Application for an environmental permit
Part A – About you

You will need to fill in this part A if you are applying for a new permit, applying to change an existing permit or surrender your permit, or want to transfer an existing permit to yourself. Please check that this is the latest version of the form available from our website.

Please read through this form and the guidance notes that came with it. Please write clearly in the answer spaces.

Note: if you believe including information on a public register would not be in the interests of national security you must tick the box in section 5 of F1 or F2 and enclose a letter telling us that you have told the Secretary of State. We will not include the information in the public register unless directed otherwise.

It will take less than one hour to fill in this part of the application form.

Where you see the term 'document reference' on the form, give the document references and send the documents with the application form when you've completed it.

Contents

1 About you

Are you applying as an individual, an organisation of individuals (for example, a partnership), a company (this includes Limited Liability Partnerships) or a public body?

- An individual ☐ Now go to section 2
- An organisation of individuals (for example, a partnership) ☐ Now go to section 3
- A public body ☐ Now go to section 4
- A registered company or other corporate body ☑ Now go to section 5

2 Applications from an individual

2a Please give us the following details

Name

Title (Mr, Mrs, Miss and so on) ______

First name ______

Last name ______

Date of birth (DD/MM/YYYY) ______

Now go to section 6

3 Applications from an organisation of individuals

3a Type of organisation

For example, a charity, a partnership, a group of individuals or a club ______

3b Details of the organisation

If you are an organisation of individuals, please give the details of the main representative below. If relevant, provide details of other members (please include their title Mr, Mrs and so on) on a separate sheet and tell us the document reference you have given this sheet. ______

Contact name

Title (Mr, Mrs, Miss and so on) ______

First name ______

3 Applications from an organisation of individuals, continued

Last name

Date of birth (DD/MM/YYYY)

Now go to section 6

4 Applications from public bodies

4a Type of public body

For example, NHS trust, local authority, English county council

4b Name of the public body

4c Please give us the following details of the executive

An officer of the public body authorised to sign on your behalf

Name

Title (Mr, Mrs, Miss and so on)

First name

Last name

Position

Now go to section 6

5 Applications from companies or corporate bodies

5a Name of the company

Gent Fairhead & Co. Limited

5b Company registration number

2392879

Date of registration (DD/MM/YYYY) 06/06/1989

If you are applying as a corporate organisation that is not a limited company, please provide evidence of your status and tell us below the reference you have given the document containing this evidence.

Document reference

Now go to section 6

6 Your address

6a Your main (registered office) address

For companies this is the address on record at Companies House.

Contact name

Title (Mr, Mrs, Miss and so on) Mrs

First name Emma

Last name Bulmer

Address Court of Noke
Pembridge
Herefordshire

Postcode HR6 9HW

Contact numbers, including the area code

Phone 01544388535

Fax 01544388332

Mobile

Email emma@edwardbulmer.co.uk

6 Your address, continued

For an organisation of individuals every partner needs to give us their details, including their title Mr, Mrs and so on. So, if necessary, continue on a separate sheet and tell us below the reference you have given the sheet.

Document reference for the extra sheet

6b Main UK business address (if different from above)

Contact name

Title (Mr, Mrs, Miss and so on)

First name

Last name

Address

Postcode

Contact numbers, including the area code

Phone

Fax

Mobile

Email

Now go to section 7

7 Contact details

7a Who can we contact about your application?

This can be someone acting as a consultant or an 'agent' for you.

Contact name

Title (Mr, Mrs, Miss and so on): Mr

First name: James

Last name: Sturman

Address: Kingsgate (Floor 3)
Wellington Road North
Stockport
Cheshire

Postcode: SK4 1LW

Contact numbers, including the area code

Phone: +44 (0)161 476 0032

Fax

Mobile: +44 7889 364179

Email: JamesSturman@fichtner.co.uk

7 Contact details, continued

7b Who can we contact about your operation (if different from question 7a)?

Contact name

Title (Mr, Mrs, Miss and so on)	Mr
First name	Ralph
Last name	Keeble
Address	Court of Noke
	Pembridge
	Herefordshire
Postcode	HR6 9HW

Contact numbers, including the area code

Phone	01206 585017
Fax	
Mobile	07798 708001
Email	rk@ralphkeeble.com

7c Who can we contact about your billing or invoice?

As in question 7a ☐

As in question 7b ☑

Please give details below if different from question 7a or 7b.

Contact name

Title (Mr, Mrs, Miss and so on)	
First name	
Last name	
Address	
Postcode	

Contact numbers, including the area code

Phone	
Fax	
Mobile	
Email	

8 How to contact us

If you need help filling in this form, please contact the person who sent it to you or contact us as shown below.

General enquiries: 03708 506 506 (Monday to Friday, 8am to 6pm)

Textphone: 03702 422 549 (Monday to Friday, 8am to 6pm)

Email: enquiries@environment-agency.gov.uk

Website: www.environment-agency.gov.uk

If you are happy with our service, please tell us. It helps us to identify good practice and encourages our staff. If you're not happy with our service, or you would like us to review a decision we have made, please let us know. More information on how to do this is available at: https://www.gov.uk/government/organisations/environment-agency/about/complaints-procedure

Please tell us if you need information in a different language or format (for example, in large print) so we can keep in touch with you more easily.

Feedback

(You don't have to answer this part of the form, but it will help us improve our forms if you do.)

We want to make our forms easy to fill in and our guidance notes easy to understand. Please use the space below to give us any comments you may have about this form or the guidance notes that came with it.

How long did it take you to fill in this form?

We will use your feedback to improve our forms and guidance notes, and to tell the Government how regulations could be made simpler.

Would you like a reply to your feedback?

Yes please ☐

No thank you ☑

Crystal Mark 19101 Clarity approved by Plain English Campaign

For Environment Agency use only

Date received (DD/MM/YYYY)

Our reference number

Payment received?

No ☐

Yes ☐ Amount received

£

Application for an environmental permit
Part B2 – General – new bespoke permit

Environment Agency

Fill in this part of the form together with parts A, F1 or F2 if you are applying for a new bespoke permit. You also need to fill in part B3, B4, B5, B6, or B7 (this depends on what activities you are applying for). Please check that this is the latest version of the form available from our website.

Please read through this form and the guidance notes that came with it. Please write clearly in the answer spaces.

It will take less than two hours to fill in this part of the application form.

Contents

1 About the permit

1a Discussions before your application

If you have had discussions with us before your application, give us the permit reference or details on a separate sheet. Tell us below the reference you have given this extra sheet.

Permit or document reference

1b Is the permit for a site or for mobile plant?

Site ☑ Now go to section 2

Mobile plant ☐ Now go to question 1c

Note: The term 'mobile plant' does not include mobile sheep dipping unit.

Mobile plant

1c Have we told you during pre-application discussions that we believe that a mobile permit is suitable for your activity?

No ☐

Yes ☐

1d Have there been any changes to your proposal since this discussion?

No ☐ Now go to section 3

Yes ☐ You should send us a description of the activity you want to carry out, highlighting the changes you have made since our pre-application discussions.

Document reference

Now go to section 3

2 About the site (but not mobile plant)

2a What is the site name, address, postcode and national grid reference?

Site name: Rivenhall Integrated Waste Management Facility

Address: Rivenhall Airfield
Woodhouse Lane
Kelvedon
Essex

Postcode: CO5 9DF

National grid reference for the site (for example, ST 12345 67890): TL 824 204

2b What type of regulated facility are you applying for?

Note: if you are applying for more than one regulated facility then go to 2c.

Installation ☐ Now tick the relevant box in question 2b1
Waste operation ☐ Now tick the relevant box in question 2b2
Mining waste operation ☐ Now tick the relevant box in question 2b3
Water discharge activity ☐ Now go to question 3d
Groundwater activity (point source) ☐ Now go to question 3d
Groundwater activity (discharge onto land) ☐ Now go to question 3d

What is the national grid reference for the regulated facility (if only one)? (See the guidance notes on part B2.)

As in 2a above ☐
Different from that in 2a ☐ Please fill in the national grid reference below

National grid reference for the regulated facility:

What is the type of activity?

2b1 Installation

Intensive farming installation ☐
Local authority (Part A (2) and Part B) ☐
Low impact installation (see question 2d below) ☐
Opra charged activity ☐
Paragraph-17 installation ☐

2b2 Waste operation

Landfill gas facility ☐
Opra charged activity ☐
Pet cemetery ☐
Tier 2 charged bespoke activity (see charging guidance for list) ☐

2b3 Mining waste operation

Non-Opra charged activity ☐
Opra charged activity ☐

Now go to question 2d

2 About the site, continued

2c If you are applying for more than one regulated facility on your site, what are their types and their grid references?

See the guidance notes on part B2.

Regulated facility 1

National grid reference: TL 824 204

What is the regulated facility type?

- Installation ☑ Now tick the relevant box in question 2c1
- Waste operation ☐ Now tick the relevant box in question 2c2
- Mining waste operation ☐ Now tick the relevant box in question 2c3
- Water discharge activity ☐ Now go to question 3d
- Groundwater activity (point source) ☐ Now go to question 3d
- Groundwater activity (discharge onto land) ☐ Now go to question 3d

What is the type of activity?

2c1 Installation

- Intensive farming installation ☐
- Local authority (part A (2) and part B) ☐
- Low impact installation (see question 2d below) ☐
- Opra charged activity ☑
- Paragraph-17 installation ☐

2c2 Waste operation

- Landfill gas facility ☐
- Opra charged activity ☐
- Pet cemetery ☐
- Tier 2 charged bespoke activity (see charging guidance for list) ☐

2c3 Mining waste operation

- Non-Opra charged activity ☐
- Opra charged activity ☐

Regulated facility 2

National grid reference: TL 824 204

What is the regulated facility type?

- Installation ☑ Now tick the relevant box in question 2c1
- Waste operation ☐ Now tick the relevant box in question 2c2
- Mining waste operation ☐ Now tick the relevant box in question 2c3
- Water discharge activity ☐ Now go to question 3d
- Groundwater activity (point source) ☐ Now go to question 3d
- Groundwater activity (discharge onto land) ☐ Now go to question 3d

What is the type of activity?

2c1 Installation

- Intensive farming installation ☐
- Local authority (part A (2) and part B) ☐
- Low impact installation (see question 2d below) ☐
- Opra charged activity ☑
- Paragraph-17 installation ☐

2c2 Waste operation

- Landfill gas facility ☐
- Opra charged activity ☐
- Pet cemetery ☐
- Tier 2 charged bespoke activity (Charging guidance for list) ☐

2c3 Mining waste operation

- Non-Opra charged activity ☐
- Opra charged activity ☐

Use several copies of this page or separate sheets if you have a long list of regulated facilities. Send them to us with your application form. Tell us below the reference you have given these extra sheets.

Document reference for the extra sheets: ______

Now go to question 2d

2 About the site, continued

2d Low impact installations (installations only)

Are any of the regulated facilities low impact installations?

No ☑

Yes ☐ If yes, tell us how you meet the conditions for a low impact installation. (See the guidance notes on part B2 – Appendix 1.)

Document reference

Tick the box to confirm you have filled in the low impact installation checklist in appendix 1 for each regulated facility. ☐

2e Treating batteries

Are you planning to treat batteries? (See the guidance notes on part B2.)

No ☑

Yes ☐ Tell us how you will do this, send us a copy of your explanation and tell us below the reference you have given this explanation.

Document reference for the explanation

2f Multi-operator installation

If the site is a multi-operator site (that is there is more than one operator of the installation) then fill in the table below the application reference for each of the other permits.

Table 1 – Other permit application references

3 Your ability as an operator

If you are only applying for a standalone water discharge or for a groundwater activity, you only have to fill in question 3d.

3a Relevant offences (applies to all except standalone surface water discharges and groundwater discharges – see the guidance notes on part B2)

Have you, or any other relevant person, been convicted of any relevant offence?

No ☑ Now go to question 3b

Yes ☐ Please give details below

Name of the relevant person

Title (Mr, Mrs, Miss and so on)

First name

Last name

Date of birth (DD/MM/YYYY)

Position at the time of the offence

Name of the court where the case was dealt with

Date of the conviction (DD/MM/YYYY)

Offence and penalty set

Date any appeal against the conviction will be heard (DD/MM/YYYY)

If necessary, use a separate sheet to give us details of other relevant offences and tell us below the reference number you have given the extra sheet.

Document reference of the extra sheet

3 Your ability as an operator, continued

3b Technical ability (for specified waste management activities and waste operations only – see the guidance notes on part B2)

Please tick the scheme you are using to show you have the suitable technical skills and knowledge to manage your facility.

CIWM/WAMITAB ☐

ESA/EU ☐

Please send in a registration letter from your scheme as above ☐

Now go to question 3c

3c Finances (for installations, waste operations and mining waste operations only)

Please note that if you knowingly or carelessly make a statement that is false or misleading to help you get an environmental permit (for yourself or anyone else), you may be committing an offence under the Environmental Permitting (England and Wales) Regulations 2010.

Do you or any relevant person have current or past bankruptcy or insolvency proceedings against you?

No ☑

Yes ☐ Please give details below, including the required set-up costs (including infrastructure), maintenance and clean up costs for the proposed facility against which a credit check may be assessed.

We may want to contact a credit reference agency for a report about your business's finances.

Landfill, Category A mining waste facilities and mining waste facilities for hazardous waste only

How do you plan to make financial provision (to operate a landfill or a mining waste facility you need to show us that you are financially capable of meeting the obligations of closure and aftercare)?

Bonds ☐

Escrow account ☐

Trust fund ☐

Lump sum ☐

Other ☐

Provide a plan of your estimated expenditure on each phase of the landfill or mining waste facility.

Give the document plan reference

Now go to question 3d

3d Management systems (all)

You can find guidance on management systems in 'How to Comply'. We have also developed environmental management toolkits for some business sectors which you can use to produce your own management system. You can get these by calling 03708 506 506 or by downloading them from our website at www.environment-agency.gov.uk.

Does your management system meet the conditions set out in our guidance?

No ☐

Yes ☑

3 Your ability as an operator, continued

What management system will you provide for your regulated facility?

EC Eco-Management and Audit Scheme (EMAS) ☐

ISO 14001 ☑

BS 8555 (Phases 1–5) ☐

Green Dragon ☐

Own management system ☐

Please make sure you send us a summary of your management system with your application.

Document reference or references

4 Consultation (fill in 4a to 4c for installations and waste operations and 4d for installations only)

Could the waste operation or installation involve releasing any substance into any of the following?

4a A sewer managed by a sewerage undertaker

No ☑

Yes ☐ Please name the sewerage undertaker

4b A harbour managed by a harbour authority

No ☑

Yes ☐ Please name the harbour authority

4c Direct into relevant territorial waters or coastal waters within the sea fisheries district of a local fisheries committee

No ☑

Yes ☐ Please name the fisheries committee

4d Is the installation on a site for which:

4d1 a nuclear site licence is needed under section 1 of the Nuclear Installations Act 1965?

No ☑

Yes ☐

4d2 a policy document for preventing major accidents is needed under regulation 5 of the Control of Major Accident Hazards Regulations 1999, or a safety report is needed under regulation 7 of those Regulations?

No ☑

Yes ☐

5 Supporting information

5a Provide a plan or plans for the site (but not any mobile plant)

Clearly mark the site boundary or discharge point, or both – see the guidance notes on part B2.

Document reference or references of the plans: See Annex 1.

5b Provide the relevant sections of a site condition/baseline report if this applies (see the guidance notes on part B2 for what needs to be marked on the plan)

Document reference of the report: See Annex 2.

If you are applying for an installation, tick the box to confirm that you have sent in a baseline report. ☐

5c Provide a non-technical summary of your application (see the guidance notes on part B2)

Document reference of the summary: See Non-Technical Summary

6 Environmental risk assessment

Provide an assessment of the risks each of your proposed regulated facilities poses to the environment. The risk assessment must use H1 or an equivalent method.

Document reference for the assessment: See Annex 4.

7 How to contact us

If you need help filling in this form, please contact the person who sent it to you or contact us as shown below.

General enquiries: 03708 506 506 (Monday to Friday, 8am to 6pm)

Textphone: 03702 422 549 (Monday to Friday, 8am to 6pm)

Email: enquiries@environment-agency.gov.uk

Website: www.environment-agency.gov.uk

If you are happy with our service, please tell us. It helps us to identify good practice and encourages our staff. If you're not happy with our service, please tell us how we can improve it.

Please tell us if you need information in a different language or format (for example, in large print) so we can keep in touch with you more easily.

Feedback

(You don't have to answer this part of the form, but it will help us improve our forms if you do.)

We want to make our forms easy to fill in and our guidance notes easy to understand. Please use the space below to give us any comments you may have about this form or the guidance notes that came with it.

How long did it take you to fill in this form? ________

We will use your feedback to improve our forms and guidance notes, and to tell the Government how regulations could be made simpler.

Would you like a reply to your feedback?

Yes please ☐

No thank you ☑

Crystal Mark 19103 Clarity approved by Plain English Campaign

For Environment Agency use only

Date received (DD/MM/YYYY)

Our reference number

Payment received?

No ☐

Yes ☐ Amount received

£

Plain English Campaign's Crystal Mark does not apply to appendix 1.

Appendix 1 – Low impact installation checklist (see the guidance notes on part B2)

Installation reference				
Condition	Response			Do you meet this?
A – Management techniques	Provide references to show how your application meets A.			Yes ☐ No ☐
	References			
B – Aqueous waste	Effluent created		m^3/day	Yes ☐ No ☐
C – Abatement systems	Provide references to show how your application meets C.			Yes ☐ No ☐
	References			
D – Groundwater	Do you plan to release any hazardous substances or non-hazardous pollutants into the ground?		Yes ☐ No ☐	Yes ☐ No ☐
E – Producing waste	Hazardous waste		Tonnes per year	Yes ☐ No ☐
	Non-hazardous waste		Tonnes per year	
F – Using energy	Peak energy consumption		MW	Yes ☐ No ☐
G – Preventing accidents	Do you have appropriate measures to prevent spills and major releases of liquids? (See 'How to comply'.)		Yes ☐ No ☐	Yes ☐ No ☐
	Provide references to show how your application meets G.			
	References			
H – Noise	Provide references to show how your application meets H.			Yes ☐ No ☐
	References			
I – Emissions of polluting substances	Provide references to show how your application meets I.			Yes ☐ No ☐
	References			
J – Odours	Provide references to show how your application meets J.			Yes ☐ No ☐
	References			
K – History of keeping to the regulations	Say here whether you have been involved in any enforcement action as described in Compliance History Appendix 1 explanatory notes.		Yes ☐ No ☐	

Application for an environmental permit
Part B3 – New bespoke installation permit

Environment Agency

If you are applying for a new bespoke permit for an installation, fill in this part of the form, together with parts A, B2 and F1. Please check that this is the latest version of the form available from our website.

Please read through this form and the guidance notes that came with it. Please write clearly in the answer spaces.

It will take less than three hours to fill in this part of the application form.

Contents

1 What activities are you applying for?

Fill in Table 1a below with details of all the activities listed in schedule 1 of the Environmental Permitting Regulations (EPR) and all directly associated activities (DAAs) (in separate rows) that you propose to carry out at the installation.

Fill in a separate table for each installation you are applying for. Use a separate sheet if you have a long list and send it to us with your application form. Tell us below the reference you have given the document.

Document reference

Table 1a – Types of activities

Schedule 1 listed activities						
Installation name	Schedule 1 references (See note 1)	Description of the Activity (See note 2)	Activity capacity (See note 3)	Annex I (D codes) and Annex II (R codes) and descriptions	Hazardous waste treatment capacity (if this applies) (See note 3)	Non-hazardous waste treatment capacity (if this applies) (See note 3)
Add extra rows if you need them. If you do not have enough room go to the line below or send a separate document and give us the document reference here	Put your main activity first			For installations that take waste only	For installations that take waste only	For installations that take waste only
Rivenhall IWMF	5.1 Part A (1) a)	CHP Plant (Line 1)				
Rivenhall IWMF	5.1 Part A (1) a)	CHP Plant (Line 2)				
Rivenhall IWMF	6.1 Part A (1) a) (A)	Pulp Plant				

Directly associated activities (See note 4)	
Name of DAA	Description of the DAA (please identify the schedule 1 activity it serves)
Add extra rows if you need them	
Material recycling facility	To identify and recover recyclates from incoming untreated wastes. It serves the CHP Plant (Lines 1 and 2).
Mechanical biological treatment plant	To remove moisture from collected municipal or commercial wastes. It serves the CHP Plant (Lines 1 and 2).
Waste Water Treatment Plant	Treats waste water produced by on-site activities. It serves all 3 Installations.
For installations that take waste	Total storage capacity (See note 5 below)
	Annual throughput (tonnes each year) 853,000.00

1 What activities are you applying for?, continued

Notes

1 Quote the section number, part A1 or A2 or B, then paragraph and sub paragraph number as shown in part 2 of schedule 1 to the regulations.

2 Use the description from schedule 1 of the regulations. Include any extra detail that you think would help to accurately describe what you want to do.

3 By 'capacity', we mean:

- the total incineration capacity (tonnes every hour) for waste incinerators;
- the total landfill capacity (cubic metres) for landfills;
- the total treatment capacity (tonnes each day) for waste treatment;
- the total storage capacity (tonnes) for waste storage operations;
- the processing and production capacity for manufacturing operations; or
- the thermal input capacity for combustion activities.

4 Fill this in as a separate line and give an accurate description of any other activities associated with your schedule 1 activities. You cannot have DAAs as part of a mobile plant application.

5 By 'total storage capacity', we mean the maximum amount of waste, in tonnes, you store on the site at any one time.

Types of waste accepted

For those installations that take waste, for each line in Table 1a (including DAAs), fill in a separate document to list those types of waste you will accept onto the site for that activity. Give the List of Wastes catalogue code and description. If you need to exclude wastes from your activity or facility by restricting the description, quantity, physical nature, hazardous properties, composition or characteristic of the waste, include these in the document. Send it to us with your application form.

Please provide the reference for each document.

You can use Table 1b as a template.

If you want to accept any waste with a code ending in 99, you must provide more information and a full description in the document.

Document reference for this extra information: Refer to section 2.2 of the Supporting Information.

Table 1b – Template example – types of waste accepted and restrictions

Waste code	Description of waste
Example 02 01 08* 06 01 02*	Example Agrochemical waste containing dangerous substances Hydrochloric acid

2 Emissions to air, water and land

Fill in Table 2 below with details of the emissions that result from the operating techniques at each of your installations.

Fill in one table for each installation.

Table 2 – Emissions (releases)

Installation name	Rivenhall IWMF			
Point source emissions to air				
Emission point reference and location	Source	Parameter	Quantity	Unit
Refer to Section 2.3.1 of the				
Supporting Information				
Point source emissions to water (other than sewers)				

2 Emissions to air, water and land, continued

Table 2 – Emissions, continued

Emission point reference and location	Source	Parameter	Quantity	Unit
Refer to Section 2.3.4 of the				
Supporting Information				
Point source emissions to sewers, effluent treatment plants or other transfers off site				
Emission point reference and location	Source	Parameter	Quantity	Unit
Refer to Section 2.3.5 of the				
Supporting Information				
Point source emissions to land				
Emission point reference and location	Source	Parameter	Quantity	Unit
Not applicable				

Supporting information

3 Operating techniques

3a Technical standards

Fill in Table 3a for each activity at the installation you have referred to in Table 1a above and list the relevant technical guidance note (TGN) or notes you are planning to use. If you are planning to use the standards set out in the TGN, there is no need to justify using them.

You must justify your decisions in a separate document if:

- there is no technical standard;
- the technical guidance provides a choice of standards; or
- you plan to use another standard.

This justification could include a reference to the Environmental Risk Assessment provided in part B2 (General Bespoke Permit) of the application form.

The documents in Table 3a should summarise the main measures you use to control the main issues identified in the H1 assessment or technical guidance. For each of the activities listed in Table 3a, describe the type of operation and the options you have chosen for controlling emissions from your process.

3 Operating techniques, continued

Table 3a – Technical standards

Note: Fill in a separate table for each activity at the installation.

Installation name	Rivenhall IWMF	
Schedule 1 activity or directly associated activity description	Relevant technical guidance note or best available techniques as described in BAT conclusions under IED (see footnote below). (You will need to refer to 'How to comply' for all permits)	Document reference (if appropriate)
	'How to comply'	
	Technical Guidance Note EPR 5.01	
	BREF Waste Incineration (August 2006)	
	Technical Guidance Notes M1, M2 and M20	
	Horizontal Guidance Note H1	
	Sector Guidance Note S5.06	

*Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)

If appropriate, use block diagrams to help describe the operation and process. Give the document references you use for each diagram and description.

Document reference

3b General requirements

Fill in a separate Table 3b for each installation.

Table 3b – General requirements

Installation name	Rivenhall IWMF
If the TGN or H1 assessment shows that emissions of substances not controlled by emission limits are an important issue, send us your plan for managing them	Document reference or references Refer to Annex 4
If the TGN or H1 assessment shows that odours are an important issue, send us your odour management plan	Document reference or references Refer to Annex 4 and Annex 7
If the TGN or H1 assessment shows that noise or vibration are important issues, send us your noise or vibration management plan (or both)	Document reference or references Refer to Annex 3

3c Types and amounts of raw materials

Fill in Table 3c for all schedule 1 activities. Fill in a separate table for each installation.

Table 3c – Types and amounts of raw materials

Installation name		Rivenhall IWMF		
Capacity (See note 1 below)				
Schedule 1 activity	Description of raw material and composition material	Maximum amount (tonnes) (See note 2 below)	Annual throughput (tonnes each year)	Description of how the raw material is used including any main hazards (include safety information sheets)
Refer to Section 2.1				
of the Supporting				
Information				

Notes

1 By 'capacity', we mean the total storage capacity (tonnes) or total treatment capacity (tonnes each day).
2 By 'maximum amount', we mean the maximum amount of raw materials on your site at any one time.

3 Operating techniques, continued

Use a separate sheet if you have a long list of raw materials, and send it to us with your application form.

Please also provide the document reference you have given the extra sheet.

Document reference: Refer to Section 2.1 of the Supporting Information

3d Information for specific sectors

For some of the sectors, we need more information to be able to set appropriate conditions in the permit.

This is as well as the information you may provide in sections 5, 6 and 7.

For those activities listed below, you must answer the questions in the related document.

Table 3d – Questions for specific sectors

Sector	Appendix
Combustion	See the questions in appendix 1
Chemicals	See the questions in appendix 2
Intensive farming	See the questions in appendix 3
Clinical waste	See the questions in appendix 4
Hazardous and non-hazardous waste recovery and disposal	See the questions in appendix 5
Incinerating waste	See the questions in appendix 6
Landfill	See the questions in appendix 7

General information

4 Monitoring

4a Describe the measures you use for monitoring emissions by referring to each emission point in Table 2 above

You should also describe any environmental monitoring. Tell us:

- how often you use these measures;
- the methods you use; and
- the procedures you follow to assess the measures.

Document reference for this information: See section 2.4.1 of the Supporting Information

4b Point source emissions to air only

Provide an assessment of the sampling locations you have used to measure point source emissions to air. The assessment must use M1 (see the guidance notes on part B3).

Document reference of the assessment: See section 2.4.1.1 to 2.4.1.5 of Supporting Information

5 Environmental impact assessment

5a Have your proposals had an environmental impact assessment under Council Directive 85/337/EEC of 27 June 1985 [Environmental Impact Assessment] (EIA)?

No ☐ Now go to section 6

Yes ☑ Please provide a copy of the environmental statement and, if the procedure has been completed:

- a copy of the planning permission; and
- the committee report and decision on the EIA.

Document reference for the copy: Refer to CD

6 Resource efficiency and climate change

If the site is a landfill, you only need to fill in this section if the application includes landfill gas engines.

6a Describe the basic measures for improving how energy efficient your activities are

Document reference of this description: See section 2.7.2 of the Supporting Information

6b Provide a breakdown of any changes to the energy your activities use and create

Document reference of the breakdown: See section 2.7.3 of the Supporting Information

6 Resource efficiency and climate change, continued

6c Have you entered into, or will you enter into, a climate change levy agreement?

No ☑ Describe the specific measures you use for improving your energy efficiency.

Document reference of this description: See section 2.7 of the Supporting Information

Yes ☐ Please give the date you entered (or the date you expect to enter) into the agreement (DD/MM/YYYY)

Please also provide documents that prove you are taking part in the agreement.

Document reference of the proof you are providing

6d Tell us about, and justify your reasons for, the raw and other materials, other substances and water you will use

Document reference of this document: See section 2.1.3 of the Supporting Information

6e Describe how you avoid producing waste in line with Council Directive 2008/98/EC on waste

If you produce waste, describe how you recover it.

If it is technically and financially impossible to recover the waste, describe how you dispose of it while avoiding or reducing any effect it has on the environment.

Document reference for your description: See section 2.8 of the Supporting Information

7 How to contact us

If you need help filling in this form, please contact the person who sent it to you or contact us as shown below.

General enquiries: 03708 506 506 (Monday to Friday, 8am to 6pm)

Textphone: 03702 422 549 (Monday to Friday, 8am to 6pm)

Email: enquiries@environment-agency.gov.uk

Website: www.environment-agency.gov.uk

If you are happy with our service, please tell us. It helps us to identify good practice and encourages our staff. If you're not happy with our service, please tell us how we can improve it.

Please tell us if you need information in a different language or format (for example, in large print) so we can keep in touch with you more easily.

Feedback

(You don't have to answer this part of the form, but it will help us improve our forms if you do.)

We want to make our forms easy to fill in and our guidance notes easy to understand. Please use the space below to give us any comments you may have about this form or the guidance notes that came with it.

How long did it take you to fill in this form?

We will use your feedback to improve our forms and guidance notes, and to tell the Government how regulations could be made simpler.

Would you like a reply to your feedback?

Yes please ☐

No thank you ☑

Crystal Mark 19104
Clarity approved by Plain English Campaign

For Environment Agency use only

Date received (DD/MM/YYYY)

Our reference number

Payment received?

No ☐

Yes ☐ Amount received

£

Plain English Campaign's Crystal Mark does not apply to appendices 1 to 7.

Appendix 1 – Specific questions for the combustion sector

1 Identify the type of fuel burned in your combustion units (including when your units are started up, shut down and run as normal). If your units are dual fuelled (that is, use two types of fuel), list both the fuels you use

Fill in a separate table for each installation.

Installation reference			
Type of fuel	When run as normal	When started up	When shut down
Coal			
Gas oil			
Heavy fuel oil			
Natural gas			
WID waste			
Biomass (see notes 1 and 2 below)			
Biomass (see notes 1 and 2 below)			
Biomass (see notes 1 and 2 below)			
Biomass (see notes 1 and 2 below)			
Biomass (see notes 1 and 2 below)			
Other			

Notes

1 Not covered by Industrial Emissions Directive 2010/75/EU.
2 'Biomass' is referred to in www.opsi.gov.uk/si/si2002/20020914.htm.

Give extra information if it helps to explain the fuel you use.

Document reference

2 Give the composition range of any fuels you are currently allowed to burn in your combustion plant

Fill in a separate table for each installation.

Fuel use and analysis					
Installation reference					
Parameter	Unit	Fuel 1	Fuel 2	Fuel 3	Fuel 4
Maximum percentage of gross thermal input	%				
Moisture	%				
Ash	% wt/wt dry				
Sulphur	% wt/wt dry				
Chlorine	% wt/wt dry				
Arsenic	% wt/wt dry				
Cadmium	% wt/wt dry				
Carbon	% wt/wt dry				
Chromium	% wt/wt dry				
Copper	% wt/wt dry				
Hydrogen	% wt/wt dry				
Lead	% wt/wt dry				
Mercury	% wt/wt dry				
Nickel	% wt/wt dry				
Nitrogen	% wt/wt dry				
Oxygen	% wt/wt dry				
Vanadium	mg/kg dry				
Zinc	mg/kg dry				
Net calorific value	MJ/kg				

Appendix 1 – Specific questions for the combustion sector, continued

3 If NOx factors are necessary for reporting purposes (that is, if you do not need to monitor emissions), please provide the factors associated with burning the relevant fuels

Fill in a separate table for each installation.

Installation reference	
Fuel	NOx factor (kgt^{-1})
Fuel 1	
Fuel 2	
Fuel 3	
Fuel 4	

Note: kgt^{-1} means kilograms of nitrogen oxides released for each tonne of fuel burned.

4 Will your combustion plant be subject to Chapter III of the Industrial Emissions Directive 2010/75/EU? (see Government guidance)

No ☐ Now fill in part F

Yes ☐

5 Is your plant

an existing plant (a plant licensed before 1 July 1987)? ☐

a new plant (a plant licensed on or after 1 July 1987 but before 27 November 2002, or a plant for which an application was made before 27 November 2002 and which was put into operation before 27 November 2003)? ☐

or

a new-new plant (a plant for which an application was made on or after 27 November 2002)? ☐

6 If you run more than one type of plant or a number of the same type of plant on your installation, please list them in the table below

Fill in a separate table for each installation.

Installation reference	
Type of plant	Number within installation
Existing	
New	
New-new	
Gas turbine (group A)	
Gas turbine (group B)	

7 If you run an existing plant, have you submitted a declaration for the 'limited life derogation' set out in Article 33 of Chapter III of the Industrial Emissions Directive?

No ☐ Now go to section 9

Yes ☐

8 Have you subsequently withdrawn your declaration?

No ☐

Yes ☐

9 List the existing large combustion plants (LCPs) which have annual mass allowances under the National Emission Reduction Plan (NERP), and those with emission limit values (ELVs) under the LCPD

Installation reference	
LCPs under NERP	LCPs with ELVs

Appendix 1 – Specific questions for the combustion sector, continued

10 Do you meet the monitoring requirements of Chapter III of the Industrial Emissions Directive?

Yes ☐

Document reference number

Appendix 2 – Specific questions for the chemical sector

1 Please provide a technical description of your activities

The description should be enough to allow us to understand:

- the process;
- the main plant and equipment used for each process;
- all reactions, including significant side reactions (that is, the chemistry of the process);
- the material mass flows (including by products and side streams) and the temperatures and pressures in major vessels;
- the all emission control systems (both hardware and management systems), for situations which could involve releasing a significant amount of emissions – particularly the main reactions and how they are controlled;
- a comparison of the indicative BATs and benchmark emission levels standards in Technical Guidance Notes (TGNs) EPR 4.01, EPR 4.02 and EPR 4.03, and chemical sector BREFs.

Document reference

2 If you are applying for a multi-purpose plant, do you have a multi-product protocol in place to control the changes?

No ☐

Yes ☐ Provide a copy of your protocol to accompany this application

Document reference

3 Does Chapter V of the Industrial Emissions Directive (IED) apply to your activities?

No ☐

Yes ☐ Fill in the following

3a List the activities which are controlled under the IED

Installation reference	
Activities	

3b Describe how the list of activities in question 3a above meets the requirements of the IED

Document reference

Appendix 3 – Specific questions for the intensive farming sector

1 For each type of livestock, tell us the number of animal places you are applying for

Installation reference	
Type of livestock	Number of places

2 Is manure or slurry exported from the site?

No ☐

Yes ☐

3 Is manure or slurry spread on the site?

No ☐

Yes ☐

Appendix 4 – Specific questions for the clinical waste sector

If you are applying for an activity covered by the Waste Incineration Directive and wish to accept clinical waste you should fill in questions 1, 2 and 3 of this appendix.

Note: If your procedures are fully in line with the standards set out in EPR5.07 then you should tick the 'yes' box and provide the procedure reference. There is no need for you to supply a copy of the procedure.

1 Are pre-acceptance procedures in place that are fully in line with the appropriate measures set out in section 2.2 of EPR 5.07 and which are used to assess a waste enquiry before it is accepted at the installation?

No ☐ Provide justification for departure from EPR 5.07 and submit a copy of the procedures

Document reference

Yes ☐ Document reference

2 Are waste acceptance procedures in place that are fully in line with the appropriate measures set out in section 2.2 of EPR 5.07, and which are used to cover issues such as loads arriving and being inspected, sampling waste, rejecting waste, and keeping records to track waste?

No ☐ Provide justification for departure from EPR 5.07 and submit a copy of the procedures

Document reference

Yes ☐ Document reference

3 Are waste storage, handling and dispatch procedures, and infrastructure in place that are fully in line with the appropriate measures set out in section 3.2 of EPR 5.07?

No ☐ Provide justification for departure from EPR 5.07 and submit a copy of the procedures

Document reference

Yes ☐ Document reference

4 Are monitoring procedures in place that are fully in line with the appropriate measures set out in section 3.3 of EPR 5.07?

No ☐ Provide justification for departure from EPR 5.07 and submit a copy of the procedures

Document reference

Yes ☐ Document reference

5 Are you proposing to either

- accept an additional waste not included in Table 2.1 of section 2.1 of EPR 5.07, or
- apply a permitted activity to a waste other than that identified for that waste in Table 2.1?

No ☐

Yes ☐ Provide justification

Document reference

6 Please provide a summary description of the treatment activities undertaken on the installation. This should cover the general principles set out in section 2.1.4 of EPR 5.07

Document reference

7 Please provide layout plans detailing the location of each treatment plant and main plant items and process flow diagrams for the treatment plant

Document reference

Appendix 5 – Specific questions for the hazardous and non-hazardous waste recovery and disposal sector

Note: If your procedures are fully in line with the standards set out in SGN 5.06 then you should tick the 'yes' box and provide the procedure reference. There is no need for you to supply a copy of the procedure.

1 Are pre-acceptance procedures in place that are fully in line with the appropriate measures set out in section 2.1.1 of SGN 5.06, and which are used to assess a waste enquiry before it is accepted at the installation?

No ☐ Provide justification for departure from SGN 5.06 and submit a copy of the procedures

Document reference

Yes ☐ Document reference

2 Are waste acceptance procedures in place that are fully in line with the appropriate measures set out in section 2.1.2 of SGN 5.06, and which are used to cover issues such as loads arriving and being inspected, sampling waste, rejecting waste, and keeping records to track waste?

No ☐ Provide justification for departure from SGN 5.06 and submit a copy of the procedures

Document reference

Yes ☐ Document reference

3 Are waste storage procedures and infrastructure in place that are fully in line with the appropriate measures set out in section 2.1.3 of SGN 5.06?

No ☐ Provide justification for departure from SGN 5.06 and submit a copy of the procedures

Document reference

Yes ☐ Document reference

4 Provide a layout plan giving details of where the installation is based, the infrastructure in place (including areas and structures for separately storing types of waste which may be dangerous to store together) and capacity of waste storage areas and structures

Document reference

5 Provide a summary of the treatment activities carried out on the installation. This should cover the general principles set out in section 2.1.4 of SGN 5.06 and the specific principles set out in sections 2.1.5 to 2.1.15 as appropriate of SGN 5.06

Document reference

6 Provide layout plans giving details of where each treatment plant is based, the main items at each plant, and process flow diagrams for the treatment plant

Document reference or references

Appendix 6 – Specific questions for the waste incineration sector

If you are proposing to accept clinical waste please also fill in questions 1, 2 and 3 of appendix 4 above.

1a Do you run incineration plants as defined by Chapter IV of the Industrial Emissions Directive (IED)?

No ☐ You do not need to answer any other questions in this appendix

Yes ☑ IED applies

1b Are you subject to IED as an incinerator or co-incinerator?

As an incinerator ☑

As a co-incinerator ☐

2 Do any of the installations contain more than one incineration line?

No ☐ Now go to section 4

Yes ☑

3 How many incineration lines are there within each installation?

Fill in a separate table for each installation

Installation reference	Rivenhall IWMF
Number of incineration lines within the installation	2
Reference identifiers for each line	CHP Plant (Line 1); CHP Plant (Line 2)

You must provide the information we ask for in questions 4, 5 and 6 below in separate documents. The information must at least include all the details set out in section 2 ('Key Issues') of TGN S5.01 (under the subheading 'European legislation and your application for an EP Permit').

4 Describe how the plant is designed, equipped and will be run to make sure it meets the requirements of IED, taking into account the categories of waste which will be incinerated

Document reference: Refer to Section 2.6 of Supporting Information

5 Describe how the heat created during the incineration and co-incineration process is recovered as far as possible (for example, through combined heat and power, creating process steam or district heating)

Document reference: Refer to Section 2.7.5.3 of Supporting Information

6 Describe how you will limit the amount and harmful effects of residues and describe how they will be recycled where this is appropriate

Document reference: Refer to Section 2.8 of Supporting Information

For each line identified in question 3, answer questions 7 to 13 below

Question 3 identifier, if necessary: CHP Plant (Line 1)

7 Do you want to take advantage of the Article 45 (1)(f) allowance (see below) if the particulates, CO or TOC continuous emission monitors (CEM) fail?

No ☐

Yes ☑ This article allows 'abnormal operation' of the incineration plant under certain circumstances when the CEM for releases to air have failed. Annex VI, Part 3(2) sets maximum half hourly average release levels for particulates (150mg/m^3), CO (normal ELV) and TOC (normal ELV) during abnormal operation.

Describe the other system you use to show you keep to the requirements of Article 13(4) (for example, using another CEM, providing a portable CEM to insert if the main CEM fails, and so on).

There will be a stand by probe and standby CEMS. Note that an abnormal condition also applies in the event of disturbances to the flue gas cleaning system.

Appendix 6 – Specific questions for the waste incineration sector, continued

8 Do you want to replace continuous HF emission monitoring with periodic hydrogen fluoride (HF) emission monitoring by relying on continuous hydrogen chloride (HCl) monitoring as allowed by IED Annex VI, Part 6 (2.3)?

Under this you do not have to continuously monitor emissions for hydrogen fluoride if you control hydrogen chloride and keep it to a level below the HCl ELVs.

No ☑

Yes ☐ Please give reasons for doing this

9 Do you want to replace continuous water vapour monitoring with pre-analysis drying of exhaust gas samples, as allowed by IED Annex VI, Part 6 (2.4)?

Under this you do not have to continuously monitor the amount of water vapour in the air released if the sampled exhaust gas is dried before the emissions are analysed.

No ☑

Yes ☐ Please give your reasons for doing this

10 Do you want to replace continuous hydrogen chloride (HCl) emission monitoring with periodic HCl emission monitoring, as allowed by IED Annex VI, Part 6 (2.5), first paragraph?

Under this you do not have to continuously monitor emissions for hydrogen chloride if you can prove that the emissions from this pollutant will never be higher than the ELVs allowed.

No ☑

Yes ☐ Please give your reasons for doing this

Appendix 6 – Specific questions for the waste incineration sector, continued

11 Do you want to replace continuous HF emission monitoring with periodic HF emission monitoring, as allowed by IED Annex VI, Part 6 (2.5), first paragraph?

Under this you do not have to continuously monitor emissions for hydrogen fluoride if you can prove that the emissions from this pollutant will never be higher than the ELVs allowed.

No ☑

Yes ☐ Please give your reasons for doing this

12 Do you want to replace continuous SO_2 emission monitoring with periodic sulphur dioxide (SO_2) emission monitoring, as allowed by IED Annex VI, Part 6 (2.5), first paragraph?

Under this you do not have to continuously monitor emissions for sulphur dioxide if you can prove that the emissions from this pollutant will never be higher than the ELVs allowed.

No ☑

Yes ☐ Please give your reasons for doing this

13 If your plant uses fluidised bed technology, do you want to apply for a derogation of the CO WID ELV to a maximum of 100 mg/m^3 as an hourly average, as allowed by IED Annex VI, Part 3?

No ☐

Does not apply ☑

Yes ☐ Please give your reasons for doing this

Appendix 7 – Specific questions for the landfill sector

1 Provide your Environmental Setting and Installation Design (ESID) report

Document reference

2 Provide your hydrogeological risk assessment (HRA) for the site

Document reference

3 Provide your stability risk assessment (SRA) for the site

Document reference

4 Provide your landfill gas risk assessment (LFGRA) for the site

Document reference

We have developed templates for these four reports which can be found within H1 – Landfill Annex.

5 Provide your proposed plan for closing the site and your procedures for looking after the site once it has closed

Document reference

FICHTNER
Consulting Engineers Limited

GENT FAIRHEAD & CO LIMITED

RIVENHALL IWMF

SUPPORTING INFORMATION

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GENT FAIRHEAD & CO LIMITED
RIVENHALL IWMF
SUPPORTING INFORMATION

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Table of Contents

1 INTRODUCTION

Gent Fairhead & Co Limited is proposing to construct and operate the Rivenhall Integrated Waste Management Facility (IWMF). The Rivenhall IWMF will be located at the former RAF Rivenhall Airfield site.

This document and its annexes contain the information for the application for the Environmental Permit (EP) for the Rivenhall IWMF. The information presented herein should be read in conjunction with the formal application form.

In section 1, we have provided an overview of the proposed installation to be developed at the installation.

In section 2, we have provided further information in response to specific questions in the application form.

The requirements of Sector Guidance Notes (SGNs) EPR 5.01, IPPC S5.06 and the sector BREF – Waste Incineration Industries - have been addressed throughout this document.

1.1 The Applicant

Gent Fairhead & Co Limited is the owner of the former RAF Rivenhall Airfield site, and is developing the Rivenhall IWMF.

1.2 The Site

The Rivenhall IWMF is located on the southeastern edge of a World War II airfield known as Rivenhall Airfield between the villages of Bradwell (northwest 2.6 km), Silver End (southwest 1.1 km), Rivenhall (south 2.3 km), Coggeshall (northeast 2.8 km) and Kelvedon (southeast 3.4 km).

Access to the site will be provided via a private access road from the existing A120.

The former airfield and its immediate surroundings are on a plateau above the River Blackwater. This plateau is currently being excavated and, therefore, under the current planning permission, half of the old airfield will become a restored 'bowl' for continued agricultural use. The airfield was open and exposed and had been used predominantly for agricultural purposes, although extensive sand and gravel extraction and restoration has been undertaken at the site.

The nearest residential properties within 1 km of the Site are: The Lodge, Allshotts Farm, Bumby Hall, Sheepcotes Farm, Green Pastures Bungalow, Goslings Cottage, Goslings Barn, Goslings Farm, Deeks Cottage, Heron's Farm, Deeks Cottage, Haywards, and Park Gate Farm Cottages.

1.3 The Application and the Listed Activities

There will be six principal activities to the Rivenhall IWMF, (1) Combined Heat and Power (CHP) Plant; (2) Materials Recycling Facility (MRF); (3) anaerobic digestion (AD) facility; (4) Mechanical Biological Treatment (MBT) facility;(5) A De-inked Paper Pulp Production Facility (Pulp plant); and (6) Wastewater treatment plant (WWTP). The capacities of the treatment processes are as follows:

(1) The CHP plant will have a maximum design capacity to process up to 595,000 tonnes per annum of non-hazardous Solid Recovered Fuel (SRF)[1] and Refuse Derived Fuel (RDF), herein referred to as RDF;

[1] The planning permissions states as an *Informative* "reference to Solid Recovered Fuel (SRF) for the purposes of this planning permission is considered to be the same as Refuse Derived Fuel (RDF)."

(2) The MRF will have a maximum design capacity to process 300,000 tonnes per annum of direct waste and treated waste materials from the MBT to recover recyclates for transfer off-site, with the residual material being transferred to the CHP facility;

(3) The AD plant will be designed to process up to 30,000 tonnes per annum of food and organic waste, with the resultant biogas being combusted in a CHP engine;

(4) The MBT Plant will have a maximum design capacity to process 170,000 tonnes per annum of waste to produce a non-hazardous RDF, which will be fed into the MRF to recover recyclates prior to treatment as a fuel within the CHP plant;

(5) The Pulp plant will have a maximum design capacity to process 170,000 tonnes per annum of waste paper to produce approximately 85,500 tonnes per annum of recycled and reusable paper pulp; and

(6) The Wastewater Treatment Plant will have a maximum design capacity of 550,000 m^3 per annum of wastewater from the installation.

These principal activities will consist of a combination of installation activities (as defined in the Environmental Permitting Regulations) and directly associated activities. In submitting this application it is regarded that the following activities are being applied for, as presented in the Table below:

Type of Activity	Schedule 1 Activity		Description of Activity
Installation	Section 5.1 Part A1, b)	CHP Facility (Line 1)	Incineration of non-hazardous waste with a capacity of greater than 3 tonnes per hour
Installation	Section 5.1 Part A1, b)	CHP Facility (Line 2)	Incineration of non-hazardous waste with a capacity of greater than 3 tonnes per hour
Installation	Section 6.1 Part A1, a)	Pulp plant	Processing of waste paper to produce a recycled paper pulp and a sludge which is suitable to be applied to land as a soil conditioner.
Waste operation		AD facility	The anaerobic digestion of organic waste to produce a biogas which is subsequently combusted in a biogas engine, and a digestate which is suitable to be applied to land as a soil conditioner.
Directly Associated Activities			
Directly Associated Activities		MRF	Processing of residual waste to recover recyclates and produce a fuel which is suitable for combustion within the CHP Plant; and the processing of treated materials from the MBT to recover recyclates and refine the fuel which is suitable for combustion within the CHP Plant

Type of Activity	Schedule 1 Activity		Description of Activity
Directly Associated Activities		MBT	The biodrying of incoming waste to reduce the moisture content of the waste to produce a fuel which is suitable for combustion within the CHP Plant. Material which has been treated within the MBT will enter the MRF for the recovery of recyclates and final refinement prior to transfer to the CHP.
Directly Associated Activities		Wastewater Treatment	The treatment and storage of process effluents from the installation prior to re-use within the installation (effluent from the Pulp plant).

As shown in the application forms (Part B1), the anaerobic digestion plant is being applied for as a separate standard rules EP, reference SR2012 No12.

1.3.1 MRF

The purpose of the MRF is to identify and recover recyclates from incoming untreated Municipal Solid Wastes (MSW) and Commercial & Industrial (C&I) wastes, from the shredded and biologically dried output from the MBT plant, and if possible and appropriate to recover further recyclates from incoming refuse derived fuel (RDF) (or solid recovered fuel (SRF)). As the predominant output by volume from the MRF will be RDF destined for the CHP plant, the MRF is deemed to be an RDF manufacturing and/or refinement process. All RDF manufactured at the installation will be transferred to the CHP plant.

The MRF is designed to both mechanically and manually sort recyclable materials from the incoming waste. The identification and separation processes are achieved initially through a mechanical process and subsequently through a manual process for final quality control.

The MRF processing facility is divided into two lines:

(1) Line 1 is for processing the material that comes from the MBT bio-drying vessels.

(2) Line 2 is for processing material that generally comes direct into the facility having undergone no or minimal pre-treatment by way of recyclate removal.

1.3.1.1 Line 1 (from MBT output)

Line 1 is for processing the material that has been pre-treated in the MBT bio-drying vessels.

Following treatment, the bio-dried wastes within the MBT vessels will be picked up by the wheeled front-end loader and tipped into a metering feed hopper at the head of Line 1. The hopper acts as both a reception point for the waste and a way of systematically feeding the waste at a steady state into the treatment process.

Once the materials have passed through the hopper, they pass by conveyor into the trommel, a rotary screening drum that separates materials of different sizes based on its settings of hole sizes. As material passes through the drum, any material that is smaller than the holes in the drum at that point will drop out, thus providing effective separation. The first holes will be set to 50mm, and any material less than 50mm will fall through and be conveyed directly to the temporary storage or holding bay at the end of the line as RDF.

The retained material continues to pass through the trommel over separation holes set at 150mm, and any material less than 150mm will fall through into a hopper feeding a transverse conveyor beneath the trommel. This fraction size of between >50mm <150mm will include the bulk of the metals and plastic bottles. The transverse conveyor will take this material to the ballistic separator shared with Line 2 (outlined in section 1.3.1.2).

The remaining materials will pass out of the end of the trommel underneath an over band magnet to remove any remaining ferrous material and the residual material will be dropped into the RDF bunker.

1.3.1.2 Line 2

Line 2 is for processing material that generally comes direct into the facility having undergone no or minimal off-site pre-treatment by way of recyclate removal. In addition, it will process the 50 mm to 150 mm fraction separated out from Line 1.

Following deposition by the delivery vehicle, a wheeled loading shovel will handle the incoming waste, either initially storing it temporarily in the daily holding bunker, or feeding it directly into the feed hopper at the head of the Line 2. Waste placed into the feed hopper drops onto a shredder that will shred the waste into 300mm particles. This ensures that the waste passes through the process in a uniformed size and that the RDF produced at the end of the line is in accordance with the fuel requirements for combustion within the CHP Plant.

All of the shredded material will then pass along a conveyor into the trommel where the initial separation holes will be set at 50mm. All of the material less than 50mm material will drop through the holes and be conveyed to the RDF bay ready for dispatch.

The remaining material will pass along the trommel to where the next separation holes are set at 150mm. All of the >50mm <150mm will fall through the trommel at this stage and onto a ballistic separator. At this point, the >50mm <150mm material from Line 1 will also be fed in parallel to this ballistic separator

The function of the ballistic separator is to separate out the principal recyclates in 2D and 3D formats. This is achieved by passing the waste materials over a series of parallel inclined rotating plates formed of angled metal paddles. This action enables the 2D flat and flexible materials such as paper and plastic film to rise up the incline but any 3D rigid or rolling materials such as plastic bottles and metal cans will roll back down the incline. Fine items fall through a sieve mesh.

From the ballistic separator, the 2D or flat >50mm<150mm material is conveyed to the RDF dispatch bay. The 3D or non-flat >50mm<150mm material will pass along a conveyor via an over-band magnet and eddy separator to an optical sorter where all of the plastic bottles can be identified. The optical sorter works by reading the different polymer types, colours and shapes. Once these have been identified, an electronic signal is sent to an air jet that expels the bottle as it passes over the jet of air. These materials will be ejected into holding cages ready for baling.

The >150 mm material that had not dropped out of the trommel for conveyance to the ballistic separator continues on to the end of the trommel where it is fed onto a conveyor under an over-band magnet for ferrous extraction and then into a picking cabin. In the picking cabin, operatives will take out the larger recyclables such as paper and rigid plastics. These will be dropped into appropriate holding cages or bunkers beneath the picking station ready for baling.

Following the end of the picking line, the remaining material continues on the conveyor and over a non-ferrous separator to extract non-ferrous metals and under a final over-band magnet to extract any remaining ferrous metals. The ferrous and non-ferrous fractions will be dropped into a holding cage or bunker ready for baling for transfer off-site to a licensed waste management facility.

All remaining materials will be fed by conveyor to drop into the RDF dispatch bay.

1.3.1.3 Recyclate dispatch

The materials that have been separated out for recycling such as paper, card, plastic bottles and metals will be mechanically transferred from each holding cage, on a separate basis, and conveyed to the baler attached to Line 2. The area between the baler and the RDF bunker will be used for the storage of bales (by clamp truck) of the various recyclates awaiting transfer off-site.

Vehicles collecting recyclates material heading for the end market (flat bed bulkers) will collect the bales during day-time operational hours.

1.3.2 MBT

The purpose of the MBT Facility is to receive collected municipal or commercial wastes that require some pre-treatment in order to remove moisture and recyclates (in combination with the adjacent MRF) and to manufacture a RDF suitable for energy recovery in the CHP plant. The MBT may also be employed when appropriate to biologically dry and moisture condition incoming RDF prior to energy recovery in the CHP plant.

The MBT process is designed to take in organic-rich materials that are treated in a series of enclosed vessels. The vessels include individual floor and roof systems that provide for air to be forced through the waste to facilitate the process of biological drying.

The MBT process is modular with each vessel being rectangle in shape. The MBT process is designed for the treatment of up to approximately 170,000 tonnes per annum of waste through the process utilising eight lines with two vessels in each line. The waste will be loaded into each vessel by a front-end loading shovel.

The waste will remain in the vessels for a minimum of 7 days enabling the biological process to occur, during which time the waste will lose up to 12% moisture content. This enables easier extraction of recyclables, particularly plastics and metals, within the mechanical processes in the MRF.

1.3.2.1 MBT Operation

Following deposition by the delivery vehicle, a wheeled loading shovel will handle the incoming waste.

In the event that the incoming waste has not undergone any initial shredding at the customer’s collection or transfer facility, there will be a mobile shredder available in the tipping hall to ensure that all material placed into the MBT vessels is shredded to an appropriate size to be determined during operations; in the order of 150 mm to 300 mm.

The wheeled loading shovel will pick up the waste from the tipping floor or holding bay, pass it through the mobile shredder as required, and place it into one of the MBT vessels as soon as possible after it has arrived at the Installation.

The design of the MBT Vessels is modular and there will be up to 16 vessels installed and in operation. The vessels are made from 3 walls of concrete with a fixed or retractable PVC roof. Approximate dimensions of each vessel are 6.5m internal width, 18m length and 4m internal height. There is a removable metal door at the front. During loading, the metal door is removed and the retractable part of the roof rolled back. The waste will be placed to a height of approximately 3m and initially compacted with the loading shovel.

Each vessel will be designed to hold up to approximately 200 tonnes of waste. When the vessel is full, the door is replaced (using the loading shovel) and, if appropriate, the roof is rolled back over the top of the vessel. The vessel will be effectively sealed at this stage. This minimises the potential for vermin, helps to maintain the heat within the vessel and contains odours or dust during the biological drying process.

A strict regime of temperature and moisture content monitoring will be undertaken for a period of seven days whilst the waste is being treated within the vessel. When the waste has achieved the appropriate moisture content, the vessel will be emptied by a wheeled loading machine and transferred directly through to the MRF feed hopper for further processing.

Depending upon the nature of the waste, and on the output from similar previous practices in the MRF, the operator may decide that there are insufficient recyclates that can be recovered by sending the MBT output through the MRF. If this is the case, the material that exits the MBT, now classified as 'RDF', will be loaded direct onto in-house dump-trucks which will transport the RDF direct to the CHP plant.

1.3.2.2 MBT Process – Temperature and Moisture Content Controls

Although very similar to an in-vessel composting system, normally sited outdoors but in the case of the Installation inside another building, there is no need or intention to create a compost output from the MBT plant. It will be used only for the manufacture of RDF for use in the CHP plant and to enhance the recovery of certain recyclates.

Within the MBT the temperature inside the waste for optimum biological drying conditions is likely to be in the region of 50 to 60°C, but there are no statutory limitations to adhere to.

In order to assist in bio-drying control, and to confirm when the wastes have reached appropriate moisture contents, a number of 2 metre long temperature probes will be inserted through the roofs of the vessels. Each vessel will have a large fan at the back to constantly blow though air and to keep the wastes aerated. Adjustments will be made in air circulation to maintain temperatures at appropriate levels.

Air within the MBT vessels is circulated for an anticipated 75% of the cycle time. A valve on the inlet air side of the fan units will control replenishment volumes of air as needed to control temperatures and moisture. The capacity of the stainless steel fan units is circa 1.5 m^3/sec which in turn is controlled by a speed reducer. The air flow is distributed at ground level through patented air rails which have proven themselves to stay clear and remain unblocked for a service interval of at least 6 months. The oxygen enriched air percolates through the waste and is then sucked back into the fan via pipework mounted on the inside of each vessel roof. There are virtually no emissions from the MBT vessels whilst in this phase of operation.

As the air used within the vessels is fed into and re-circulated on a closed (contained) loop system, the short retention time (up to a maximum of 2 weeks) mitigates the potential creation of an anaerobic environment. Temperature controls will enable the operator to ensure that such anaerobic conditions are not reached.

It is anticipated that moisture modification through the MBT process will be in the order of 10% to 12% reduction over the first week with a maximum potential moisture reduction of 15% over 2 weeks. Moisture modification results in approximately 75% leachate generation and 25% loss to air.

1.3.2.3 MBT Drainage

The enclosed MBT vessels are within the main buildings ("the Western Hangar").

The floor of the MBT area within the MBT Plant will be graded internally for appropriate wastewater control within each vessel and, separately, within the trafficked areas of the remainder of the MBT. The initial tipping area and short-term waste bunkers will be individually drained. The design allows for all surfaces to be regularly washed down and kept clean using fresh water from the Upper Lagoon.

Wastewater or leachate produced through the bio-drying process will be used as a pre-seeded source of process water to support the adjacent AD operation.

1.3.2.4 MBT Air and Dust Control

The closed loop air circulation system within each MBT vessel essentially uses the waste as a biofilter; air is drawn from within the IWMF building through the individual roof of each vessel. Hence, the MBT vessel is held at a negative pressure, which mitigates against the potential for fugitive emissions. In any case, these would not be direct to the external air and the positive ventilation system within the IWMF buildings will collect and treat air emissions arising from the MBT's operation.

The air temperature within each MBT vessel will be maintained at or around 50 to 60ºC.

Standard air changes within the MBT building will maintain a good working environment. Any emissions from the process are only released into the building when the vessel front doors are opened following treatment, i.e. as the RDF is removed using the wheeled loading shovel.

Within the MBT area, standard air changes through a positive ventilation system will be required, whereby air is drawn into the building via the front louvres in the building and sucked through dust and carbon filters in order to exhaust clean air to the surrounding atmosphere. Carbon filters will require replacement on a regular basis as required by the particular manufacturer's requirements, expected to be in the region of every 4 to 6 months.

Due to the hard-surface nature of all buildings and roads with in the IWMF, the trafficking by modern road vehicles, and the naturally damp nature of the waste materials being handled, it is not expected that dust will be created in high quantities in the MBT plant. Nevertheless, as with all operational areas of the IWMF, good operational husbandry will be instigated in accordance with the recent HSE guidance relating to the control and mitigation of dust.

1.3.3 Anaerobic Digestion (AD) Plant

The anaerobic digestion (AD) process will comprise a wet pre-treatment and anaerobic digestion system. This is considered to be a proven technology for the proposed waste feedstock, which will comprise separately collected municipal or commercial food wastes and/or other green wastes, herein referred to as mixed organic waste.

1.3.3.1 AD Waste Reception and Mechanical Pre-sorting

Mixed organic waste is delivered to the site and deposited into the AD reception area, where it is taken on a collecting screw conveyor and transferred to the pulpers.

1.3.3.2 Hydromechanical pre-treatment

The hydromechanical pre-treatment consists of two steps:

- dissolution and defibring of the digestible organics into an organic suspension and removal of coarse impurities in a waste pulper; and
- removal of fine impurities in a grit removal system.

1.3.3.3 Waste pulper

Pulping is performed to facilitate three objectives:

- disintegration of organic waste to enhance the subsequent digestion process;
- removal of non-biodegradable contaminants as a "heavy" fraction (stones, large bones, batteries and metallic objects); and
- removal of non-biodegradable contaminants as a "light" fraction (textiles, wood, plastic film, string etc.).

In the waste pulper, process water is added to the waste, which produces a suspension with a water content of approximately 90% (w/w), so that it is able to be pumped and mixed.

The waste pulper is operated in a batch-mode. The batch-mode consists of the following operation steps:

- charging of the pulper;
- dissolving process (defibration of the biowaste);
- pumping out of the biowaste suspension;
- filling with process water;
- heavy fraction discharge; and
- light fraction removal.

The charging of the waste pulper is automated. Once the optimal concentration of solids in the pulper has been reached, the charging with waste is automatically stopped.

The waste pulper is equipped with a special turbine. When it rotates, fluidic forces defibrate, suspend and partly dissolve the digestible organic fraction contained in the waste. Biologically non-degradable substances, such as plastics, textiles, metals, glass etc. are not damaged in the process. These contaminants are separated at the end of the treatment cycle.

After the dissolving process the waste-suspension is extracted through a sieve plate with a perforation limit of 10 mm at the bottom of each pulper by means of a centrifugal pump. The pulp will have a dry solids content of approximately 10 % (w/w).

Before the discharge of the contaminants the pulper is filled with process water. The contaminants retained in the pulper are now separated from the mixture of process water and contaminants on the basis of their different sedimentation characteristics.

At the bottom of the pulper the heavy fraction (glass, sand, stones, batteries, metals etc.) sediments and is removed by means of a trap system from the mixture of process water and contaminants. Before discharge it is rinsed with process water to minimize the remaining content of residual organic substances. With a dewatering screw conveyor, the purified heavy fraction is further cleaned of fine organic particles, then dewatered and transferred to a container.

The light fraction (plastics, textiles, composite materials as well as the hardly or non-digestible organic fraction, e.g. wood etc.) floats in the suspension or rises to its surface. After the separation of the heavy fraction, a gate valve is opened and the light fraction and suspension flushes into the receptacle of the LRS screw. The LRS screw removes and transports the light fraction to a light fraction press to reduce the moisture content. The dewatered light fraction is taken to a container by a conveyor belt. The resulting press water, as well as the excess water at the screw rake, is collected in a drainage system and carried back into the process with a pump.

Processing time of each batch-cycle depends very much on the type of waste and its composition. It is assumed that the cycle time is approximately 60 min for the waste pulper with screw rake.

1.3.3.4 AD Grit Removal System

The pulp withdrawn from the pulper still has a content of heavy fraction particles up to a size of the screen perforation (grit).

First the pulp is pumped into a surge tank. The pulp is withdrawn out of the coned point of the surge tank and is pumped through a grit removal system. The grit removal system mainly consists of a hydrocyclone, a classifying pipe, and a gritbox. Caused by centrifugal forces in the hydrocyclone a sludge enriched with grit is discharged as underflow into the classifying pipe and sediments downwards into the gritbox by occurring a reduction of the content of discharged organics due to a weak counterflow with upstream water. The gritbox is emptied automatically depending on demand.

The pulp is circulated through the grit removal system several times to ensure that all grit is removed from the waste. On completion of the grit removal cycle, the recirculation is stopped and the de-gritted pulp is pumped to the suspension buffer.

1.3.3.5 AD Suspension Buffer

To obtain proper mixing, air from the tank headspace is led after extraction of its condensate buffer to the air compressor suspension buffer, where it is compressed and injected back to the suspension buffer via a central gas lance system at the bottom of the tank. This induces a proper mixing of the tank contents.

Bacterial hydrolysis will commence and consume oxygen, so a certain level of oxygen must be maintained in the injected air, by permitting a very carefully controlled rate of fresh air to the compressor suction, which will suppress the formation of methane and odourous compounds.

The suspension buffer is connected to the waste air treatment system in order to avoid possible bad odours.

1.3.3.6 AD Digester

The pulp is pumped from the suspension buffer to the digesters, where the biogas production will take place. The digester is fed with the means of a digester feeding pump. The feeding process of the digester will be automatic and semi-continuous. It will be fed throughout a twenty-four hour day, seven days a week, for short periods and in frequent intervals by the use of pumps, optimal for the transport of low flowing suspensions containing solids. High liquid level in the digester outlet sump inhibits the digester feed pump.

Part of the biogas produced in the digester is led to one gas compressor per digester where it is compressed and pushed back into the digester via a central gas lance system at the bottom of the digester. The biogas creates bubbles while leaving the gas lances and it increases the water level at the top of the digester. Thus, a significant volume of liquid is displaced which creates a high velocity current in the central part of the digester up to the surface. It continues horizontally towards the perimeter of the digester, moves down close to the wall region to the bottom and then back to the digester's centre. This effect has the capability of mixing all the digester's volume. The high surface velocities avoid the formation of a 'crust' on the surface of the digester.

The temperature of the digester is monitored. The biological process operates at mesospheric temperature conditions, i.e. between 36°C and 38°C, which gives higher operating and disposal safety within the process. A constant temperature will be maintained in the digester by the external recirculation heat exchanger system provided for each digester.

The retention time for the waste will be approximately 18 days, during which the organic dry matter in the digesters will be converted to biogas.

The digested pulp (digestate) is automatically pumped from the digesters to the dewatering station under level control.

1.3.3.7 Sanitation

In accordance with the requirement of PAS 110, the following conditions will be achieved within the anaerobic digestion sanitation process:

- temperature of 70 °C;
- time during which the material is kept at this temperature of 1 hour; and
- maximum particle size of 12 mm.

To achieve the conditions, there are three isolated sanitation tanks of 30 m^3 each. While one tank is being loaded and heated up to 70°C, in the second tank the required temperature is being maintained for over 1 hour and finally the third tank is being emptied during this time. This allows for a continuous feeding of the digesters. The third requirement, the 12 mm particle size, will be maintained by the 12 mm sieve on the bottom of the pulper.

1.3.3.8 AD Biogas Cleaning and Combustion

Hydrogen sulphide (H2S) needs to be removed from the biogas produced, in order to avoid corrosion and to reduce sulphur concentrations in the emissions when the biogas is combusted. An external biological desulphurisation will be used to achieve the required values for the valorisation of the biogas in biogas units.

The outgoing biogas is conducted over a condensate trap, which is filled with gravel. In it, the water is partially separated from the biogas. In addition, the gravel heap also serves to retain possibly entrained solid components such as foam particles.

This biogas will be combusted in two biogas gas engines, with a combined electrical output of approximately 1MW.

A gas flare will be used to combust the biogas during periods of plant shutdown or excess biogas production.

1.3.3.9 AD Dewatering

The solid-liquid separation will be used to separate the digestate into a thin liquid fraction with low total solids content and a solid fraction with high total solids content.

The digestate is continuously pumped at a controlled rate from the digesters to dewatering centrifuges.

Prior to entering the centrifuges, if required, the pulp will be conditioned by the addition of polyelectrolyte solution.

The dewatering unit will be operated continuously, to ensure a constant discharge of the digester and maintain the level in the digesters.

The dewatered digestate is placed on a conveyor belt and is transported to a small storage area, which bridges the weekend production. From here it is transported with a front loader to the storage prior to transfer off-site.

The liquid fraction (centrate) is discharged into a small tank and from here it is pumped to the process water tank.

1.3.3.10 AD Digestate Storage Tanks

The remaining digestate, which has not been sent for dewatering, will be pumped to the two Digestate Storage Tanks. The tanks will be equipped with quick coupling systems for the removal of the liquid digestate for its transfer off-site.

1.3.3.11 AD Exhaust Air Collection and Treatment

The AD operating area has been compartmentalised to limit the total volume of air that requires treatment via a biofilter and/or need to be collected and changed through the building's overall ventilation system. This defines areas of 'clean' or 'dirty' air (i.e. 'clean' being air that naturally circulates around contained AD operating systems within an internal environment that requires little or no treatment prior to ventilation; and 'dirty' being areas of the building where waste and digestate, delivery or collection, requires air treatment to mitigate fugitive emissions). By controlling and containing the environment(s) within the AD area it is possible to minimise and mitigate the overall ventilation, air treatment and air changes that are required inside the building.

The AD waste reception and digestate offtake areas require 2 to 3 air changes per hour and are treated through a sealed/contained biofilter located above the 'dirty' area and fed to the CHP for treatment and discharge.

Given the enclosed and contained nature of the AD processes, the remainder of the AD area 'clean' will require 2 to 3 air changes per day. Air within the enclosed process areas of the building will be treated through standard air changes through the integrated ventilation system. Dust and carbon filters are used to exhaust clean air that can be used in other process areas – carbon filters will require replacement on a 4 to 6 month basis.

The environment within the AD halls will be held under negative pressure to control, manage and mitigate the potential for odorous emissions. Doors to the AD area shall remain closed except for those short periods of waste delivery or removal of the reject containers.

1.3.4 CHP

The CHP facility will combust waste comprising predominantly RDF from off-site satellite waste treatment facilities, some RDF produced by the on-site MRF and MBT, and some biological residues from the WWTP. The CHP plant will produce electrical power for use in the CHP plant and other on-site process with excess exported to the local distribution network. Heat will be exported as steam and hot water to on-site processes and for space heating.

The CHP facility will consist of two combustion lines. The thermal capacity of each boiler will be 92 MWth giving a total thermal capacity of the CHP facility of 184 MWth.

The CHP facility will be able to generate up to 50 MWe. With the AD plant in operation and generating 1 MWe, the CHP plant will be limited to 49 MWe as the total site generation is limited to 50 MWe. Normal export is expected to be around 28 MWe, after providing power to the other facilities on site.

The maximum capacity of the CHP facility is 595,000 tonnes per annum.

The CHP facility will be designed to accept RDF within an NCV design range of circa 7-13 MJ/kg. Fluctuations in the delivered NCV may lead to variations in the waste throughput, but this will not exceed 595,000 tonnes per annum of incoming waste.

An indicative process schematic for the CHP plant is presented within Figure 1. A larger version is included in Annex 1.

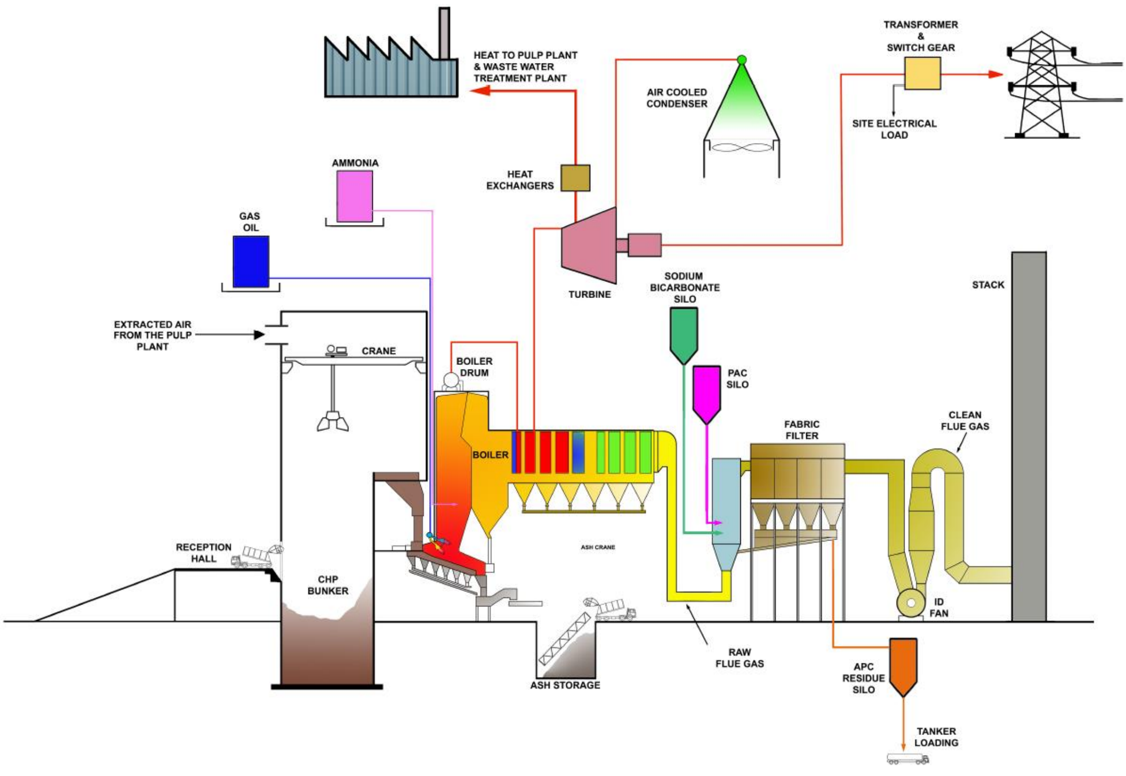


Figure 1 – Indicative CHP Plant Schematic

1.3.4.1 RDF Reception

The RDF storage bunker will have a storage capacity of approximately 8,000 tonnes, which is equivalent to up to 5 days RDF storage capacity. RDF will be stacked by the overhead crane. There will also be some additional storage within the Installation for RDF at the MRF and MBT plants.

The RDF reception area will be a fully enclosed building, maintained under slight negative pressure to minimise the risk of odours, dust or litter from escaping from the building. The vehicles will tip into the bunker from which a grab will transfer RDF to the feed hoppers for the combustion lines.

The grab will also be used to mix the RDF and remove any unsuitable or non-combustible items identified by the operations staff. These items will then be quarantined prior to transfer off-site for disposal at a suitably licensed facility.

Sludge residues from the WWTP will be transferred by site vehicle and tipped into the bunker.

1.3.4.2 Raw materials

The CHP facility will use a variety of raw materials during the combustion and processing of the RDF.

Aqueous ammonia solution will be delivered in sealed tankers and off-loaded via a standard hose connection into a tank with suitable secondary containment. Displaced air will be vented back into the tanker via a filter. In addition the tank will be fitted with an emergency pressure valve which will discharge to atmosphere via a filter.

All liquid chemicals used by the CHP facility will be stored in controlled areas, with secondary containment facilities providing containment for a volume of 110% of the biggest storage container or 25% of the total capacity, whichever is the greater.

Sodium bicarbonate and activated carbon will be delivered to the CHP facility in powder tankers and transferred to separate dedicated storage silos. Both the sodium bicarbonate and activated carbon will be transported pneumatically from the delivery vehicle to the correct storage silo.

Silos will be fitted with high level alarms. The top of the silos will be equipped with a vent fitted with a fabric filter. Cleaning of the filter will be done automatically with compressed air after the filling operation. Filters will be inspected regularly for leaks.

1.3.4.3 Combustion process

The two stream combustion unit, a moving grate design, will ensure continuous mixing of the fuel and hence promote good combustion. In each stream, as the fuel enters the furnace it will pass through a drying zone, a combustion zone and a burnout zone. Primary combustion air will be extracted from within the fuel storage bunker and fed in below the fuel through the grate to promote good combustion.

Secondary combustion air will be injected above the grate where it provides for good mixing and combustion control. Ammonia solution will be injected into the combustion chamber to react with the oxides of nitrogen, chemically reducing them to nitrogen and water.

Auxiliary burners operating on fuel oil will be fitted for start-up sequencing and to maintain temperatures above 850°C for 2 seconds. The oxygen concentration and temperature will be carefully controlled to ensure complete combustion and minimise dioxin emissions.

Bottom ash from the grate will be transported by the grate to the bottom of the hearth and into a water-filled quench pit. A conveyor will then lift the wet ash to the ash storage area in the main tipping hall. It is intended that the ash would be transferred to a suitably licensed waste management facility where it will be processed to produce a substitute aggregate material. If a suitable recovery facility is not available to accept the residue, it may be transferred for disposal in an off-site landfill.

Prior to transfer off-site, bottom ash will be periodically sampled in accordance with the Environment Agency's ash sampling protocol.

A proportion of clean flue gas downstream of the flue gas treatment plant will be recirculated back into the furnace to improve boiler efficiency, reduce NO_x and flue gas volume to the stack. The proportion of recirculated flue gas will depend on the calorific value of the waste and the thermal load at which the incinerator is operated, but is normally expected to be in the range 10 – 20%.

1.3.4.4 Energy recovery

Hot gases from the fuel combustion will pass through a series of heat exchangers and superheaters and finally through a two stage economiser. The first stage of the economiser will be used to preheat feedwater before it is supplied to the boiler and the second stage will be used to heat up condensate and will ensure that the flue gas temperature is the optimum temperature for reaction with sodium bicarbonate. The design of the boilers, following a computerised fluid dynamics assessment, will ensure that the flue gas temperature is quickly reduced through the critical temperature range to minimise the risk of dioxin reformation.

The steam will be fed to a steam turbine which will be used to generate electricity. Steam will be condensed using air cooled condensers.

Steam will be extracted from the steam turbine at various pressures. This will be used to supply heat for internal processes (e.g. deaeration and condensate preheating), plume abatement at the stack and external processes at the Pulp plant (drying, process heating and space heating) and the WWTP (evaporation, effluenct cooling and space heating). Steam pressures will be selected to optimise electrical output and overall plant efficiency. Total heat export from the CHP facility (including plume abatement but excluding internal heat uses at the CHP plant) will normally be in the range 20 – 40 MWth depending on external ambient conditions. External ambient conditions (predominatly temperature) will affect the heat demand for space heating in the Pulp plant and WWTP, and plume abatement at the CHP plant.

Most of the condensate supplied to the Pulp plant will be returned to the CHP plant for re-use in the water-steam cycle. This will minimise the consumption of potable water used for the production of demineralised water for the boiler.

1.3.4.5 Gas cleaning

Flue gases pass from the boiler to the gas cleaning equipment. The flue gases will enter a reaction chamber where sodium bicarbonate reacts with and neutralises the acid gases. Activated carbon will be injected into the duct preceding the bag filter to adsorb (primarily) dioxins, other volatile organic compounds (VOCs), mercury and other trace metals. The sodium bicarbonate injection rate will be controlled by upstream measurement of hydrogen chloride (HCl) thus optimising the efficiency of gas scrubbing and reagent usage.

Nitrogen oxides (NOx) abatement will be achieved by the use of selective non-catalytic reduction (SNCR). The SNCR is based on the injection of ammonia solution into the furnace chambers. NO_x will also be controlled using flue gas recirculation, see 1.3.4.3.

Bag filters will be used to remove the fine ash plus reacted and excess bicarbonate and carbon from the flue gases. The build-up of the latter two on the surface of the filter bags enhances the performance of the system. Reverse pulses of compressed air will be used to remove the accumulated particulate from the bags. These Air Pollution Control residues (APCr) will fall into a collection hopper. Some of the residues will be recirculated back into the process to minimise reagent consumption. The spent residues are conveyed to a dedicated APCr storage silo. The APCr will be collected by sealed tankers and taken to a licensed waste treatment facility.

The cleaned gas will then discharge to atmosphere via a stack, with an approximate height of 35 m above the surrounding ground level and a maximum elevation of 85 mAOD, at an efflux velocity of greater than 15 m/s under normal operating conditions.

1.3.4.6 Ancillary Equipment

Demineralised water is required to compensate for boiler blowdown losses.

Demineralised water will be provided from an on-site water treatment plant.

A standby generation system, which will be fired using gas oil, will be installed to provide sufficient electrical power to safely shut down the CHP facility and other site processes in the event that the electrical grid connection is lost and the turbine is off line and unable to provide electricity to site processes.

The CHP air cooled condensers will provide a source of cooling to condense the steam generated by the thermal treatment processes, and any auxiliary cooling requirements such as air compressors.

Steam from the exhaust of the steam turbine will be condensed in an air-cooled condenser and return to the water-steam cycle. Smaller forced-air coolers will provide cooling for other equipment, e.g. turbine generator and oil systems.

1.3.4.7 Liquid effluent and site drainage

The CHP facility is designed for zero discharge of wastewater. Rain water and waste water from boiler drains, blowdown and the demineralised water treatment plant will be stored and use for quenching boiler bottom ash.

1.3.4.8 Emissions monitoring

Emissions from the stack will be monitored using continuous emissions monitoring systems (CEMS) for: particulates, carbon monoxide (CO), ammonia (NH3), sulphur dioxide (SO2), hydrogen chloride (HCl), oxygen (O2), nitrogen oxides (NOx) and Volatile Organic Compounds (VOCs).

In addition to the continuous monitoring, periodic sampling and measurement will be undertaken for hydrogen fluoride (HF), nitrous oxide (N2O), cadmium (Cd), thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V), dioxins and furans and dioxins like PCBs.

Periodic measurements will be carried out four times in the first year of operation and twice per year thereafter.

The CHP Facility will include a dedicated duty CEMS for each line and a stand-by CEMS which will ensure that there is continuous monitoring data available even if there is a problem with a duty CEMS system.

1.3.5 Pulp Plant

The Pulp plant would be capable of recycling up to 170,000 tpa of recovered printing and writing paper and card, to produce 85,500 tpa of recycled paper pulp which will be transported off-site and used to predominantly manufacture printing and writing paper, white surface packaging and some tissue.

The Pulp plant has been designed and configured to produce recycled pulp suitable for use in the manufacture of writing or printing paper. To achieve this, the quality and purity of the paper and card feedstock imported to the Site must comply with a recognised specification. This would provide the Pulp plant with raw materials suitable for the washing, cleaning, bleaching, mixing and drying operations required to produce the recycled pulp.

Grades (defined by EN643) within High Grade RCP, specifically sorted office papers (SOP/SOW) and White Letter which are largely post-consumer and uncoated papers, and Multigrade (printer waste) which are largely pre-consumer, will be sourced as a feedstock for the Pulp plant.

The proposed specification of the paper and card suitable for treatment within the Pulp plant is defined by EN643.

- EN 643 Group 1: Mixed papers; OCC Packaging; Old News; and Pams.
- EN643 Group 2: Unsold News; Printed, mechanical pulp; Sorted office; Printed, colours, wood-free; Carbonless; and, PE coated.
- EN643 Group 3: Printed lightly, heavily; and, Printed white, coloured.
- EN643 Group 4: Kraft Papers; and Sacks.
- EN643 Group 5: Special Papers; and Liquid packaging board.

Based on the above feedstock, the Pulp plant would prepare a feedstock comprising 75% Sorted Office Paper (SOP), 15% Multigrade and 10% White Letter.

2.05 Sorted Office Papers

Paper, as typically generated by offices, shredded or unshredded, printed, may contain coloured papers, with a minimum 60 % wood-free paper, free of carbon and principally free from carbonless copy paper (ccp)/no carbon required (NCR), less than 10 % unbleached fibres including manila envelopes and file covers, less than 5 % newspapers and packaging.

2.13 Multigrade

A blend of coloured and white letters, coloured wood-free magazines and other wood-free papers and shavings. Free from newsprint but 10 % of other wood containing papers are permitted. May contain 2% paper with plastic layer.

3.05 White Letter

Sorted white wood-free writing papers, originating from office records, free from cash books, carbon paper and non-water soluble adhesives.

In summary, the above is the technical specification for what is generally referred to as high grade 'mixed office waste' in the industry and the Pulp plant will capable of processing this wide range of types of waste papers including high quality graphics paper, photocopying paper, printing and writing etc.

1.3.5.1 Design of waste paper de-inking plants

The four key quality parameters that influence the design of waste paper de-inking plants are:

(1) ink removal;

(2) "Stickies";

(3) brightness; and

(4) ash.

Ink Removal

The quality of ink and dirt removal is measured using a parameter called dirt or speck count: this refers to the number and size of black or coloured spots that are visible to the human eye on the finished paper.

Ink is applied to paper to create an image, either graphic or character. The type of ink and the way it is applied varies. This variability creates a problem in deciding which process should be selected to separate the ink material from the fibre and remove it from the system whilst at the same time retaining as much fibre as possible.

Laser printers produce their image using a powdered ink that is a material bound with a plastic fixative that is melted onto to the paper surface. This has been a problem for a number of earlier designs of de-inking plant because the images are very difficult to release from the cellulose fibre that forms the paper. The proposed plant incorporates equipment and technologies that will remove (or render invisible to the human eye) any residues from laser printing on the fibres.

Virgin pulp fibres do not contain ink particles.

"Stickies"

The term "Stickie" evolved from the papermaking process to describe blobs of sticky material that adhere to and contaminate the papermaking fabrics on which paper is made. If the paper making fabrics were contaminated the paper maker would have to stop the paper making machine and spend time cleaning the fabric or cut the fabric off.

The "Stickie" materials are contained in the waste paper as a variety of adhesives and plastics used in book bindings, self-seal envelopes, self-adhesive labels, and other office applications. Stringent quality control of the incoming waste paper would minimise the inclusion of the other contraries such as plastics and metal staples.

Brightness

Consumers like to have bright products because it suggests clean, sterile, healthy, modern, etc. and consequently a large amount of effort and cost is incurred to make things look "bright".

Brightness is measured using a number of techniques but generally they work on the principle of shining light onto the product and measuring the quantity of reflected rays; the higher the brightness the larger number of reflected rays.

The Pulp plant would incorporate a modern two stage brightening process incorporating oxidative and reductive chemical processes to increase the brightness of the final product in order to approach the brightness achieved with virgin pulp.

Ash

Ash is a term used by the paper makers to describe how much non-fibre material is in the product. The measurement is made from the complete combustion of a sample of the paper in a ceramic furnace by measuring the ash that is left after the paper has burned.

Ash is typically made up of minerals such as China Clays used in the production of the paper.

There are other parameters that are important to the paper makers but not largely influenced by the de-ink plant design. These parameters are the average fibre length and the ability of water to flow through the fibres which can affect the quality of the final product. These parameters are generally inherited from the waste paper fed into the de-inking plant.

1.3.5.2 Pulp plant process overview

A simplified process flow diagram for the Pulp plant is presented below.

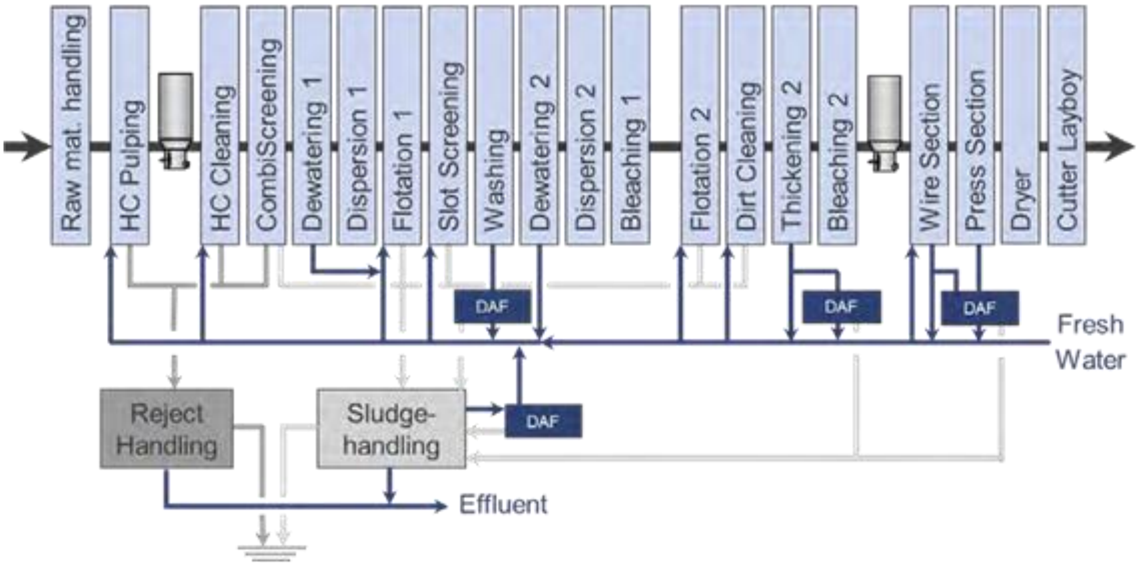


Figure 2 – Pulp Process Flow Diagram

1.3.5.3 Paper reception and pre-sorting

High grade mixed office waste paper and other high grade waste papers would be delivered to the installation and unloaded in the reception hall. Paper will typically be delivered in baled form, but the reception hall can also receive paper in loose form i.e. delivered within ejector trailers. Forklifts with debaling equipment and front end loaders would transfer the paper feedstock to a feeding hopper that would evenly distribute the paper onto a feed conveyor. At this point the paper feedstock to the Pulp plant would be joined with paper recovered from the mixed dry recyclable and/or similar pre-sorted or separated mixed commercial wastes MRF.

1.3.5.4 Pulping

Waste paper would be fed by conveyor into the pulper.

Water is heated to a temperature of approximately 80°C using a direct steam inductor and added to the pulper under flow control. The amount of water added is determined by the desired pulping consistency (i.e. ratio of water to solid matter). Typically, the likely paper feed would be approximately 90% solids whereas the ideal pulping consistency is 15% to ensure maximum fibre to fibre contact is achieved in order to loosen the ink from the paper fibres.

Additives would be applied to raise the pH to approximately 10 to create the right conditions for the fibres to swell and soften.

At the end of the pulping cycle, the fibrous mixture or 'stock' from the pulper would pass through a perforated screen. The fibrous mixture will be diluted to 5% consistency before being pumped to the high consistency cleaner.

The un-pulpable contaminants, (i.e. plastic covers, large staples and pieces of metal that have not been previously removed) are screened out and discharged on to a conveyor and fed to a standing open ro-ro container. The Ro-Ro container would be transported by the on-site truck to feed the rejected materials either into the MRF for further screening, separation and recovery or into the CHP bunker to be mixed with the incoming RDF feedstock and used within the CHP plant.

1.3.5.5 High consistency cleaner

The high consistency cleaners are designed to remove small heavy contaminants such as glass, stones, staples, paper clips etc. from the paper fibre stock using a centrifuge. These contaminants are periodically removed and discharged into a chute where any water is removed and collected for recirculation. The contaminants are sent back into the MRF for further screening, separation and recovery or mixed with the RDF feedstock and used within the CHP plant.

The remaining feedstock (pulp) within the high consistency cleaners is then fed into a coarse screening system.

1.3.5.6 Coarse screening

The coarse screening system would screen and remove from the feedstock plastic and other flat contaminants larger than 2 mm in diameter, whilst minimising the loss of the pulp fibre. Rejected materials from the coarse screening process would be recirculated and fed back into the high consistency cleaners.

Coarse screening is a three stage process comprising two primary coarse screens (one would be operational whilst the other would be on standby), one secondary coarse screen and one tertiary coarse screen.

Materials passing through the three stage coarse screening process would be fed into the pre-screening system.

1.3.5.7 Pre-screening

The pre-screening system would remove spherical and cuboid debris (i.e. glue, melted plastic and latex based sticky materials) from the pulp together with other contaminants larger than 0.18 mm in size. Rejected materials from the pre-screening process would be discharged to a sludge silo for further treatment.

Pre-screening is a three stage process comprising one primary screen, one secondary screen and one tertiary screen, all fitted with slotted screening baskets.

Materials passing through the three stage pre-screening process would be fed into the main floatation system.

1.3.5.8 Main floatation

The main floatation system removes ink, ash and other hydrophilic contaminants using surfactant and soap based chemicals whilst minimising fibre loss.

Main floatation consists of a two stage washing system comprising one primary floatation cell with six chambers and a secondary floatation cell with four chambers.

The materials from the pre-screening system are diluted down to 1.2% solids and pumped into the first (of six) chambers in the primary floatation cell through a distribution system designed to prevent turbulent flow. Each chamber would be fitted with a specially designed air distributor to liberate entrained air from the mixture in the form of bubbles.

The chemical reaction which takes place within the primary floatation cell would attract small particles of ink to the surface of the chamber in the form of bubbles. The bubbles create a foam on the surface of the primary floatation cell. Water levels within each primary floatation cell would be continuously monitored to allow the foam to overflow into a collecting chamber.

The primary floatation cells are operated on a sequence of batch processes, whereby, once the pulp has been washed in one chamber, it is pumped into the next chamber where the washing process starts again. After passing through all six chambers the cleaned pulp feedstock is fed into the low consistency primary forward cleaning system.

The foam from the primary floatation cells would contain inert materials and some pulp fibres. This would be collected in a chamber, sprayed with water and diluted into a slurry and pumped into the secondary floatation system.

The secondary floatation process is identical to that taking place in the primary floatation cells. However, the resultant foam is collected and discharged as a slurry to the sludge silo for further treatment.

1.3.5.9 Low consistency forward cleaning

The low consistency forward cleaning system uses four cone shaped centrifuges to separate cellulose fibres (paper fibres) from the de-inked pulp.

The forces that act within the centrifuge direct the materials that have a specific density higher than that of cellulous fibre to the internal wall of the centrifuge and rejected through a nozzle at the bottom. These residues would be collected and fed into the next centrifuge.

Cellulose fibres and other lightweight materials that are discharged through the top of the first centrifuge would be transferred to the fine screening system. It should be noted that materials discharged through the top of any other centrifuge would be recirculated through the system to ensure consistency and purity of the cellulose fibre recovered by the low consistency forward cleaning system.

The residues from the low consistency forward cleaning system would be collected and discharged as a slurry to the sludge silo for further treatment.

1.3.5.10 Fine screening

The fine screening system uses four filter screens to remove spherical and cuboid debris (i.e. any remaining glue, melted plastic and latex based sticky materials) from the de-inked pulp larger than 0.15 mm in size. Rejected materials from the fine screening process would be discharged to a sludge silo for further treatment.

Fine screening is a four stage process comprising two primary fine screens, one secondary fine screen and one tertiary fine screen all fitted with slotted screening baskets.

Materials passing through the four stage fine screening process would be fed into the thick washing system.

1.3.5.11 Thick washing

The thick washing system is designed to wash fillers, ash and fines from the de-inked pulp. The washed fibres would be pumped or transported by screw conveyors into the dispersing system.

The water used within the thick washer (containing the fillers, ash and fines) would be pumped to a washer filtrate storage tank. Following filtration the water collected from the storage tank would be pumped to the first loop water clarification system.

1.3.5.12 Dispersing

The dispersing system is used to develop the fibre quality. The disperser would loosen the brittle plastic based inks found on laser printed paper and resin or varnish based inks that are found on specialist publications such as quality publications, brochures and reports.

Steam is used to heat the disperser and chemicals are added to bleach colours from the fibres.

Once treated within the disperser the pulp is pumped into a post floatation system.

1.3.5.13 First loop water clarification

The first loop water clarification system would be used to aerate and clarify the water discharged from the thick washer. Aeration would cause solid particles to float to the surface, where they are collected and pumped to the sludge silo for further treatment. The clarified water resulting from the first loop water clarification system would be reused within the Pulp plant.

1.3.5.14 Post floatation

The post floatation system works in a similar manner to that of the primary floatation system to remove and loosen ink using surfactant and soap based chemicals whilst minimising fibre loss. However, the post floatation process would use one primary floatation cell with four chambers and a secondary floatation cell with three chambers.

After passing through all four chambers within the primary floatation cell, the cleaned pulp feedstock is fed into the low consistency high and low cleaning system, and foam from the secondary floatation cells would be collected and discharged as a slurry to the sludge silo for further treatment.

1.3.5.15 Low consistency high and low density cleaning

The low consistency high and low density cleaning system uses a further bank of two cone shaped centrifuges (operating in forward and reverse) to separate long and short cellulose fibres from the de-inked pulp.

Materials passing through the centrifuges would be fed into the disc thickener, whilst the residues would be collected and discharged as a slurry to the sludge silo for further treatment.

1.3.5.16 Disc thickener

The disk thickener is a multi disc filter unit which would be used to remove water from remaining pulp slurry by collecting the cellulose fibres from the solution over a very fine mesh.

Once fed into the disc thickener, the pulp slurry would rotate slowly causing the fibres to accumulate on the surface of the filter discs whilst the remaining water filters through the filter mesh. The dewatered fibres would be removed and discharged into a chute at a consistency of approximately 10% solids. The fibres are then pumped to the second stage dispersing system.

Water that filters through the disc thickener is collected and pumped to the second loop clarifier for clarification and use for dilution.

1.3.5.17 Second stage dispersing

The second stage dispersing system works in a similar manner to that of the dispersing system to further develop the quality of the fibre. The second stage disperser would loosen the remaining inks, resins and varnishes from the fibre.

Steam is used to heat the second stage disperser and additives applied to bleach the fibres.

Once treated within the second stage disperser the thickened fibrous pulp would be transported by a conveyor into reductive bleaching tower.

1.3.5.18 Second loop water clarification

The second loop water clarification system would be used to aerate and clarify the water discharged from the disc thickener. Aeration would cause solid particles to float to the surface which are collected and pumped to the sludge silo for further treatment. The clarified water resulting from the second loop water clarification system would be recirculated and reused within Pulp plant.

1.3.5.19 Reductive bleaching

The reductive bleaching system comprises a specially designed down-flow tower. The thickened fibrous pulp would be fed by the screw conveyor into a rotating distributor at the top of the bleaching tower and rotated using an electric motor. The distributor creates an even distribution of fibrous pulp within the tower to create a plug flow. As the pulp progresses down the tower bleaching chemicals are added to develop the brightness of the fibre.

As the pulp reaches the bottom of the tower the fibres are removed and fed into the final floatation system.

1.3.5.20 Final floatation

The final floatation system works in a similar manner to that of the primary and post floatation systems to remove and loosen any remaining ink. The final floatation process would use one primary floatation cell with four chambers and a secondary floatation cell with three chambers.

After passing through all four chambers within the final floatation cell the cleaned pulp feedstock is fed into the final disc thickener, and foam from secondary floatation cells would be collected and discharged as a slurry to the sludge silo for further treatment.

1.3.5.21 Final disc thickener

The final disc thickener works in a similar manner to that of the disc thickener system and comprises a multi disc filter unit which would be used to remove water from remaining fibrous pulp.

The dewatered fibres would be removed and discharged into a chute at a consistency of approximately 8% solids. The fibres are then pumped into a storage tower and fed into the pulp drying and baling system.

1.3.5.22 Final pulp drying and baling

The final stage of the process would be the dewatering, drying and baling of the recycled fibrous pulp.

The pulp drying and dewatering system will comprise a four stage process whereby the recycled pulp is fed into a headbox under pressure from the storage tower and passed through a parallel opening (slice) onto the forming section.

Within the forming section, the pulp is fed onto a continuous moving mesh belt. Here the pulp is dewatered by gravity and vacuum suction to 55% solid content. From here the web of wet pulp is conveyed via a pick up roll into the press section.

Within the press section, the web of pulp is squeezed under pressure through two rollers to further dewater and prepare the dewatered pulp (which is in a sheeted form) for the final stage of the drying process.

The web of pulp moves from the press section into the dryer section where it is dried by warm air convection as it passes through three vertical stages: intense drying at high temperature, high air speed and high air pressure; high evaporation drying at a medium temperature, medium air speed and medium air pressure; and, finally, exit drying at low temperature, low air speed and low air pressure.

At the end of the exit drying stage the web of pulp is at 87% to 90% solid content. The dried and recycled pulp sheet is passed from the exit dryer and baled either for temporary storage within the pulp store or direct to the vehicle loading bay for export from the installation.

1.3.5.23 Sludge drying

Sludge (principally China Clay and small pulp fibre) produced by the pulping process will be dried prior to export from site to be used as a soil improvement material.

The sludge will be fed through a screw press and steam-heated tube dryer to reduce its moisture content from 50% to 35%. Water arising from the sludge drying process will be fed to the WWTP for treatment, recirculation and reuse.

By reducing the moisture content of the sludge, vehicle movements associated with its collection and export from site will be minimized, and increase its reuse as a soil improvement material.

1.3.6 Wastewater Treatment Plant (WWTP)

The wastewater treatment plant (WWTP) will consist of the following seven treatment stages:

(1) course and fine screens;

(2) roughing and polishing dissolved air floatation (DAF);

(3) lime soda softening;

(4) sand filtration;

(5) membrane treatment – reverse osmosis;

(6) DAF and precipitator sludge collection; and

(7) dewatering.

1.3.6.1 Coarse and fine screens

The course and fine screens will remove larger particles including 'Stickies' that are troublesome in downstream process plant and can interfere with flotation and settlement.

Collected screenings will be removed from the screen face by a wiper screw auger and will deposited in an adjacent wheelie bin. In the event of failure of one unit, the entire flow can be accommodated and the level of treatment maintained by the remaining packaged screening unit.

1.3.6.2 Roughing and polishing dissolved air floatation (DAF)

The incoming effluent will have total suspended solids of up to 710 mg/l and a temperature of up to 50°C. The high temperature reduces the solubility of oxygen in water and therefore limits the amount of air that can be saturated in the air dissolving tube. This combined with a high incoming suspended solids leads to a less than ideal solids/air bubble ratio and less than ideal separation performance.

Therefore there is a second stage of polishing DAFs. The bulk of the suspended solids removal will take place in the roughing DAFs with the polishing DAFs operating at a much improved solids/air bubble ratio and providing an overall much improved separation performance.

The double DAF arrangement will allow for operation of each stage at differing pH which will be optimised to improve silica and organics separation.

Each stage of DAF is provided with a rapid mix weir for the addition of ferric chloride and flocculation tanks with a retention time of approx. 20 minutes and the facility for the addition of polyelectrolyte. This will encourage finer particles and colloidal organic matter to agglomerate and form larger and more easily separable floc that will be floated and removed. Depending on the precise composition of the organic matter and the percentage that is in colloidal form rather than fully dissolved, useful reductions in chemical oxygen demand (COD) can be achieved.

Therefore the design of the DAFs is optimised to achieve the maximum physiochemical separation possible which is intrinsically the lowest cost form of treatment.

1.3.6.3 Lime soda softening

After the roughing and polishing DAF plant where ferric chloride coagulant will be dosed, the effluent will be dosed with hydrated lime which will be supplemented with additional ferric chloride to further aid reduction in the de-inking solids and to improve the mobility of settled carbonate sludge.

1.3.6.4 Sand filtration

Clarified water from the lime soda softening precipitators will be subject to sand filtration to remove any solids carry-over. A bank of four pressure down-flow filters will capture any suspended solids in the sand media bed. On increase in head-loss, each filter will in turn be subject to an air, air and water, and water only backwash.

Solids removed will be returned to the calamity / balance tank where they will be pumped to the DAFs for solids separation.

The combination of double DAF, lime soda softening and filtration will remove as much of the residual ink, and greatly reduce the scaling and fouling potential of the pre-treated effluent. Only organic matter in particulate form that is able to float or settle will be removed and therefore soluble organic matter and its associated COD will be unaffected.

The pre-treatment plant will generate an effluent that has much reduced fouling potential on the membrane separation plant where bulk removal of soluble COD and dissolved salts will take place.

1.3.6.5 Membrane treatment – reverse osmosis

Four stages of reverse osmosis (RO) will be used to achieve the water quality requirements.

The product / permeate from each stage becomes the feed to the following stage, and the quality of the permeate progressively improves such that by the final fourth stage the desired treatment objectives are comfortably achieved.

The concentrate or reject from each stage is passed back to the feed of the preceding stage such that eventually all the concentrate / reject is amalgamated as a single discharge from the first stage.

Stage-one: High shear oscillating RO

The first stage is a high shear oscillating RO membrane plant.

Shear waves produced on the membrane surface keep the colloidal material in suspension, thereby minimizing fouling and prevent precipitating salts from accumulating on the membrane surface as scale. As a result, high throughput and water recoveries above that of a conventional membrane system can be achieved.

The device employs torsional oscillation at a rate of 50 times per second (50 Hertz) at the membrane surface to inhibit diffusion polarization of suspended colloids. The suspended colloids are held in suspension, where a tangential cross flow washes them away.

The high frequency oscillations impart a shear to the surface of the membrane to mitigate fouling and scaling. The membrane module houses a stack of flat membrane sheets (filter pack) in a plate and frame-type configuration.

It is possible to vary both frequency and amplitude to get the surface clean from suspended particulates and colloids. The sinusoidal shear waves of the membranes push the incoming particles from the surfaces and back into the bulk phase, resulting in a membrane surface clear for filtration.

The system consists of four components: a driving system that generates the oscillations, a membrane module, a torsion spring that transfers the oscillations to the membrane module, and an oscillation control system.

The high shear oscillating membrane system is not limited by the solubility of minerals or the presence of suspended solids. It can be used in the same applications as crystallizers or brine concentrators and is capable of high recoveries (up to 90%).

Stage two/three/four: Conventional spiral wound RO systems

The second, third and fourth stages comprise conventional RO treatment mounted horizontally in pressure vessels and arranged on skids.

1.3.6.6 Treated effluent storage and pumping

Treated permeate from the final stage of the RO system is discharge via a hydrophore vessel and official sampling point into 3 treated water tanks constructed in concrete. The total volume provides for a residence time of over 1.5 days at the design flow rate of 85 m^3/h.

Cleaned and treated water will be recirculated and reused within the Pulp plant to provide a zero liquid discharge (or closed loop) waste water treatment system.

1.3.6.7 RO reject evaporator

The reject from the RO process will be transferred to the WWTP evaporator.

Condensate or product from the system is liberated steam which has been condensed from wastewater vapour and recovered through mechanical vapour recompression.

Solid rejects/sludge arising from the evaporator will be mixed with the RDF within the CHP plant.

1.3.6.8 DAF and precipitator sludge collection & dewatering

Floated sludge from the roughing and polishing DAFs is collected in a sludge sump and is pumped to the common inlet of a filter press.

Sludge from each precipitator is pumped directly to a gravity thickening tank. The sludge settles into a hopper at the base of the gravity thickening tank. The clear supernatant will overflow and flow via gravity to the calamity / balancing tanks where it is recycled back into the main treatment plant flow.

Settled sludge that has collected at the base of the gravity thickening tank is pumped directly to a filter press. DAF sludge will be blended in line for co-pressing with the precipitator sludge.

The filter press is a conventional plate and frame type with a pneumatic power 'squeeze cycle' which will ensure a high quality and consistently dry cake is produced with approx. 30% dry solids content. If required, a polyelectrolyte will be dosed to flocculate the incoming solids and improve the filtration of the sludge.

Solid rejects/sludge arising from the WWTP process will be mixed with RDF within the CHP plant.

1.3.7 Ancillary Activities

1.3.7.1 Building Ventilation

The building ventilation system will provide abatement of odours from each of the waste treatment processes.

(1) CHP plant bunker;

(2) Pulp plant;

(3) AD plant; and

(4) MRF and MBT plant.

CHP plant

The waste bunker will be maintained at a negative pressure. In maintaining negative pressure in the bunker it will prevent odour escaping from the waste bunker area.

Air from the waste bunker will be extracted from the bunker area and fed in below the fuel through the grate in the CHP Plant to promote good combustion. The high temperatures within the combustion chamber will destroy any odours within the air.

Pulp plant

The process area within the Pulp plant which may generate odours is the sludge area. Air from the sludge area will be ventilated to the bunker within the CHP plant. On this basis, this area will be maintained at a negative pressure.

AD plant

The AD plant has been compartmentalised into 'clean' or 'dirty' air (i.e. 'clean' being air that naturally circulates around contained systems within an internal environment that requires little or no treatment prior to ventilation; or, 'dirty' being areas of the building where waste and digestate, delivery or collection, requires air treatment to mitigate fugitive emissions). Therefore, the building ventilation systems will only be required to 'manage' the odorous air from the 'dirty' areas.

Air from 'clean' areas will be treated through the building ventilation system, with carbon and dust filters removing dust and any odours from the air prior to release to atmosphere via louvres in the building.

Air from the 'dirty' areas will be extracted and treated within a biofilter. The treated air from the biofilter will then be released via the site stack.

MRF and MBT plant

The closed loop air circulation system within each MBT vessel essentially uses the waste as a biofilter; air is drawn from the building through the individual roof of each vessel. Hence, the vessel is contained at a negative pressure, which mitigates against the potential for fugitive emissions. In any case, these would not be direct to the external air and the mechanical ventilation system in the building will take care of such emissions as described below.

The air temperature within each vessel will be maintained between 50 to 60°C.

Standard air changes within the MBT building will maintain a good working environment. Any emissions from the process are only released into the waste processing area when the vessel front doors are opened following treatment – i.e. as the RDF is removed using the wheeled loading shovel.

Within the MBT area, standard air changes through a positive ventilation system will be required, whereby air is drawn into the building via the front louvres in the building and sucked through dust and carbon filters in order to exhaust clean air to the surrounding atmosphere. Carbon filters will require replacement on a regular basis as required by the particular manufacturer's requirements, expected to be in the region of every 4 to 6 months.

In terms of dust control, this is not expected to be a difficult operational concern. Due to the hard-surface nature of all buildings and roads with in the IWMF, the trafficking by modern road vehicles, and the naturally damp nature of the waste materials being handled, it is not expected that dust will be created in high quantities in the MBT plant. Nevertheless, as with all operational areas within the installation, good operational husbandry will be instigated in accordance with the recent HSE guidance relating to the control and mitigation of dust ("Construction Dust: Inspection & Enforcement Guidelines 2014" HSE).

1.3.7.2 Auxiliary Power

Back-up diesel generators will be available to safely shut down the different waste treatment facilities in case of loss of grid connection for the installation.

1.3.7.3 Water Abstraction

Abstraction of water from the River Blackwater is covered by a separate abstraction licence (AN/037/0031/001). The abstraction from the River Blackwater will be used to maintain the supply of process water within the on-site lagoon system.

1.3.7.4 Site Drainage

Water which is abstracted form the River Blackwater will be pumped into the on-site storage lagoon. The lagoon will provide a storage facility for water to be used within the process.

Uncontaminated surface water run-off from building roofs and areas of hardstanding will be discharged into the lagoon.

2 OTHER INFORMATION FOR APPLICATION FORM

2.1 Raw Materials

2.1.1 Types and Amounts of Raw Materials

The types and quantities of additional raw materials to be used within the Installation, through the implementation of this variation, are presented within Table 2.1 below. Information relating to the potential environmental impact of these raw materials is included in Table 2.2.

Table 2.1 - Types and Amounts of Raw Materials -			
Activity	**Material**	**Typical Annual Throughput (approx tonnes per annum)**	**Description including any hazard code where they are available**
Part - 6.1 A(1) (a) – Pulp Plant	Hydrogen Peroxide (50%)	5,000	
	Sodium Hydroxide	3,200	NaOH (50% solution)
	Sodium Silicate	3,000	Na_2O_3Si
	Soap	1,300	
	Tenside	50	
	Calcium chloride	100	$CaCl_2$
	FAS Hydrosulphite	1,000	
	Powder Activated Carbon	300	C
	Flocculant	400	
	Sulphuric Acid	300	H_2SO_4
	Sodium hypochlorite	600	NaClO
Part - 5.1 A(1) (b) – CHP Plant	Ammonia solution	750	NH_3
	Sodium Bicarbonate	8,000	$NaHCO_3$
	Activated Carbon	150	C
	Fuel oil	600	
	Boiler Water Treatment Chemicals		
DAA - WwTW	Ferric chloride solution 41%	300 m^3	FeCL (41% solution)
	Lime (Calcium hydroxide powder)	720 m^3	$Ca(OH)_2$
	Soda ash	288 m^3	Na_2CO_3
	Hydrochloric acid	25	HCl (32% solution)
	Magnesium chloride	<1	$MgCl_2$
	Cationic polyelectrolyte	<1	41% solution
	Anionic polyelectrolyte powder	<1	
	Chotosan powder	<1	
	Anionic polyelectrolyte	<1	
	Magnettite	40	
	Flocon(TM)	<1	40% liquid
	Sodium hypochlorite	40 m^3	NaClO
	Laboratory reagent chemicals	<1	
	Citric Acid	3	

Table 2.1 - Types and Amounts of Raw Materials -			
Activity	**Material**	**Typical Annual Throughput (approx tonnes per annum)**	**Description including any hazard code where they are available**
	STPP (sodium tripolyphosphate) Na-dodecylbenzene sulphonate	2	100% powder
	STPP (sodium tripolyphosphate)	<1	
	DBNPA 2,2-dibromo-3-nitrilopropionamide	<1	
	Hydrochlroric acid solution	320	32% wt/wt
	Sodium Hydroxide	50 m^3	
	SDS (sodium dodecylsulphate)	<1	

Table 2.2 – Raw Materials and their Impact on the Environment									
	Environmental Medium								
Activity	Product	Chemical Composition	Typical Quantity	Units	Air (%)	Land (%)	Water (%)	Impact Potential	Comments
Pulp plant	Hydrogen Peroxide (50%)		5,000	Tonnes per annum	0	0	100	Low impact	
	Sodium Hydroxide	$NaOH$ (50% solution)	3,200	Tonnes per annum	0	0	100	Low impact	Used for pH control of freshwater.
	Sodium Silicate	Na_2O_3Si	3,000	Tonnes per annum	0	0	100	Low impact	
	Soap		1,300	Tonnes per annum	0	0	100	Low impact	
	Tenside		50	Tonnes per annum	0	0	100	Low impact	
	Calcium chloride	$CaCl_2$	100	Tonnes per annum	0	0	100	Low impact	Used as a hardener.
	FAS Hydrosulphite		1,000	Tonnes per annum	0	0	100	Low impact	
	Powder Activated Carbon	C	300	Tonnes per annum	0	0	100	Low impact	Used as a coagulant
	Flocculant		400	Tonnes per annum	0	0	100	Low impact	
	Sulphuric Acid	H_2SO_4	300	Tonnes per annum	0	0	100	Low impact	Used for pH control of freshwater.

Table 2.2 – Raw Materials and their Impact on the Environment									
	Environmental Medium								
Activity	**Product**	**Chemical Composition**	**Typical Quantity**	**Units**	**Air (%)**	**Land (%)**	**Water (%)**	**Impact Potential**	**Comments**
	Sodium hypochlorite	NaClO	600	Tonnes per annum	0	0	100	Low impact	
CHP Plant	Ammonia solution	NH_3	750	Tonnes per annum	100	0	0	Low impact	Reacts with nitrogen oxides to form nitrogen, oxygen, and water vapour. Any unreacted ammonia is released to atmosphere at low concentrations, and is continuously monitored.
	Sodium Bicarbonate	$NaHCO_3$	8,000	Tonnes per annum	0	100	0	Low impact	Sodium bicarbonate is removed with the APC residues at the bag filter and disposed of as hazardous waste at a suitable licensed facility.
	Activated Carbon	C	150	Tonnes per annum	0	100	0	Low impact	Injected carbon is removed with the APC residues at the bag filter and disposed of as hazardous waste at a suitable licensed facility.
	Fuel oil		600	Tonnes per annum	100	0	0	Low impact	Used for plant start-ups and maintaining good combustion conditions in the boiler. Plant combustion products released to atmosphere after passing through the flue gas treatment plant.

Table 2.2 – Raw Materials and their Impact on the Environment									
	Environmental Medium								
Activity	**Product**	**Chemical Composition**	**Typical Quantity**	**Units**	**Air (%)**	**Land (%)**	**Water (%)**	**Impact Potential**	**Comments**
	Boiler Water Treatment Chemicals				0	0	100	Low impact	Corrosion inhibitor, scale inhibitor, biocide, ion exchange resins (sodium hydroxide, sulphuric acid).
Wastewater Treatment Plant	Ferric chloride solution 41%	FeCL (41% solution)	300 m^3	Tonnes per annum	0	0	100	Low impact	Coagulant in the water treatment process.
	Lime (Calcium hydroxide powder)	$Ca(OH)_2$	720 m^3	Tonnes per annum	0	0	100	Low impact	Used for lime softening & pH correction in the water treatment process.
	Soda ash	Na_2CO_3	288 m^3	Tonnes per annum	0	0	100	Low impact	Used for lime soda softening and pH correction in the water treatment process.
	Hydrochloric acid	HCl (32% solution)	25	Tonnes per annum	0	0	100	Low impact	Used for pH correction & membrane cleaning in the water treatment process.
	Magnesium chloride	$MgCl_2$	<1	Tonnes per annum	0	0	100	Low impact	Used for adsorptive precipitant for silica in the water treatment process.
	Cationic polyelectrolyte	41% solution	<1	Tonnes per annum	0	0	100	Low impact	Used as a coagulant aid in the water treatment process.
	Anionic polyelectrolyte powder		<1	Tonnes per annum	0	0	100	Low impact	Used as a flocculent aid in the water treatment process.
	Chotosan powder		<1	Tonnes per annum	0	0	100	Low impact	Used as a coagulant aid in the water treatment process.

Table 2.2 – Raw Materials and their Impact on the Environment

Activity	Product	Chemical Composition	Typical Quantity	Units	Air (%)	Land (%)	Water (%)	Impact Potential	Comments
					Environmental Medium				
	Anionic polyelectrolyte		<1	Tonnes per annum	0	0	100	Low impact	Used as a filtration aid in the water treatment process.
	Magnetite		40	Tonnes per annum	0	0	100	Low impact	Used as a settlement aid –ballast in the water treatment process.
	Flocon(TM)	40% liquid	<1	Tonnes per annum	0	0	100	Low impact	Used as a scale inhibitor in the water treatment process.
	Sodium hypochlorite	NaClO	40 m^3	Tonnes per annum	0	0	100	Low impact	Used as a disinfectant in the water treatment process.
	Laboratory reagent chemicals		<1	Tonnes per annum	0	0	100	Low impact	Various chemicals used in the laboratory.
	Citric Acid		3	Tonnes per annum	0	0	100	Low impact	Membrane cleaning chemical
	STPP (sodium tripolyphosphate) Na-dodecylbenzene sulphonate		2	Tonnes per annum	0	0	100	Low impact	Membrane cleaning chemical
	STPP (sodium tripolyphosphate)		<1	Tonnes per annum	0	0	100	Low impact	Membrane cleaning chemical
	DBNPA 2,2-dibromo-3-nitrilopropionamide		<1	Tonnes per annum	0	0	100	Low impact	Membrane cleaning chemical

Table 2.2 – Raw Materials and their Impact on the Environment									
	Environmental Medium								
Activity	**Product**	**Chemical Composition**	**Typical Quantity**	**Units**	**Air (%)**	**Land (%)**	**Water (%)**	**Impact Potential**	**Comments**
	Hydrochlroric acid solution	32% solution	320	m^3 per annum	0	0	100	Low impact	Membrane cleaning chemical
	Sodium Hydroxide	NaOH	50 m^3	m^3 per annum	0	0	100	Low impact	Membrane cleaning chemical
	SDS (sodium dodecylsulphate)		<1	Tonnes per annum	0	0	100	Low impact	Membrane cleaning chemical

Various other materials will be required for the operation and maintenance of the plant, including:

(1) hydraulic oils and silicone based oils;

(2) electrical switchgear;

(3) gas emptying and filling equipment;

(4) refrigerant gases for air conditioning plant;

(5) glycol/anti-freeze for cooling;

(6) oxyacetylene, TIG, MIG welding gases; and

(7) CO2 / fire-fighting foam agents.

These will be supplied to standard specifications offered by main suppliers. All chemicals will be handled in accordance with COSHH Regulations as part of the quality assurance procedures and full product data sheets will be available on-site.

Periodic reviews of all materials used will be made in the light of new products and developments. Any significant change of material, where it may have an impact on the environment, will not be made without firstly assessing the impact and seeking approval from the Environment Agency.

The Operator will maintain a detailed inventory of raw materials used on-site and have procedures for the regular review of new developments in raw materials.

2.1.2 Chemicals and Reagent Storage

In order to minimise contamination risk of process or surface water, all liquid chemicals stored on-site for the Installation will be kept inside bunded areas with whichever is the greater of 110% of stored capacity or 25% of the total capacity of the storage containers. Spillage and leakage will be contained in chemical unloading and storage areas.

Sodium bicarbonate and activated carbon will be delivered to the CHP plant for storage in silos. Both the sodium bicarbonate and the activated carbon will be transported pneumatically from the delivery vehicle to the correct storage silo.

Silos will be fitted with high level alarms. The top of the silos will be equipped with a vent fitted with a fabric filter. Cleaning of the filter will be done automatically with compressed air after the filling operation. Filters will be inspected regularly for leaks.

Sodium silicate, hydrogen peroxide, and sodium hydroxide will be delivered to the Pulp plant for storage in dedicated storage tanks. The tanks will be either stainless steel or Fibre-reinforced plastic (FRP) – this is subject to detailed design. The chemicals will be unloaded in a dedicated unloading area with the drainage from the unloading area being contained and collected in a sump to contain any spillages during unloading.

Soap, Tenside, calcium chloride, PAC, sulphuric acid and sodium hypochlorite for the Pulp plant will be delivered in IBC’s, and stored in a dedicated IBC storage area within the Pulp plant. The IBC storage facility will be bunded with 25% of the total capacity of the storage containers.

Ferric chloride and hydrochloric acid will be delivered to the wastewater treatment plant for storage in dedicated storage tanks. The tanks will be constructed of polypropylene with an integral bund. The chemicals will be unloaded in a dedicated unloading area with the drainage from the unloading area being contained and collected in a sump to contain any spillages during unloading.

Lime and soda ash will be delivered to the wastewater treatment plant for storage in silos. Both the lime and soda ash will be transported pneumatically from the delivery vehicle to the correct storage silo.

Magnesium chloride powder and magnetite will be delivered in FIBC’s. Anionic polyelectrolyte, chitosan powder will be delivered in polypropylene bags. Cationic polyelectrolyte and Flocon will be delivered in PVC drums.

Sodium hypochlorite will be delivered in IBC's. IBC's will be stored within a suitably bunded area.

2.1.3 Raw Materials Selection

2.1.3.1 Acid Gas Reagent Selection

There are several reagents available for acid gas abatement. Sodium Hydroxide (NaOH) or hydrated lime (Ca(OH)2) can be used in a wet scrubbing system. Quicklime (CaO) can be used in a semidry FGT system. Sodium bicarbonate (NaHCO3) or hydrated lime can be used in a dry FGT process.

The reagents for wet scrubbing and semi-dry abatement are not considered, since these abatement techniques have been eliminated by the BAT assessment in Annex 6 section 1. The two alternative reagents for a dry system – sodium bicarbonate and lime - are therefore considered as the only available options for abatement of acid gases.

Sodium bicarbonate has good removal rates of acid gases, and dry recycle systems are a proven technology. In addition there are much less health and safety considerations/controls required for the handling of sodium bicarbonate. Lime is a corrosive material and required strict COSHH controls for handling and transfer. Lime can also be difficult to pump. Lime can also give a greater residue volume, if in-plant recycling is not employed.

Due to the reasons stated, the use of sodium bicarbonate is considered to represent BAT for this installation.

2.1.3.2 NOx Abatement

The SNCR system can be operated with dry urea, urea solution or aqueous ammonia solution. There are advantages and disadvantages with all options:

- Urea is easier to handle than ammonia; the handling and storage of ammonia can introduce an additional risk.
- Dry urea needs big-bag handling whereas urea solution can be stored in silos and delivered in tankers.
- Ammonia emissions (or 'slip') can occur with both reagents, but good control will limit this.

The Sector Guidance on Waste Incineration considers all options as representing BAT for NOx abatement. It is proposed to use Urea solution for the SNCR system, because the climate change impacts of ammonia solution outweigh the handling and storage issues associated with the use of urea.

2.1.3.3 Auxiliary Fuel

As stated in Article 50 (3) of the Industrial Emissions Directive (IED):

The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (1) OJ L 121, 11.5.1999, p. 13., liquefied gas or natural gas.

Therefore, as identified by the requirements of the IED, the only available fuels that can be used for auxiliary firing are:

(1) natural gas;

(2) liquefied gas (LPG); or

(3) gas oil.

Natural gas can be used for auxiliary firing and is safer to handle than LPG. As stated previously, auxiliary firing will only be required intermittently. When firing this requires large volumes of gas, which would be need to be supplied from a high-pressure gas main. The installation of a high-pressure gas main to supply gas for auxiliary firing to the Installation would be very expensive.

LPG is a flammable mixture of hydrocarbon gases. It is a readily available product, and can be used for auxiliary firing. As LPG turns gaseous under ambient temperature and pressure, it is required to be stored in purpose built pressure vessels. If there was a fire within the site, there would be a significant explosion risk from the combustion of flammable gases stored under pressure.

A gas oil tank can be easily installed at the Installation. Whilst it is acknowledged that gas oil is classed as flammable, it does not pose the same type of safety risks as those associated with the storage of LPG. The combustion of gas oil will lead to emissions of sulphur dioxide, but these emissions will be minimised as far as reasonably practicable through the use of low sulphur gas oil.

Therefore, low sulphur light gas oil will be used for auxiliary firing.

2.2 Incoming Waste Management

The incoming waste will be delivered to the site from a number of waste management facilities.

The IWMF will typically accept predominantly residual municipal and commercial solid waste and mixed organic waste therefore much of the requirements of the relevant sector guidance note (S5.06) such as representative sampling and testing are considered to be adequately achieved by visual inspection and paperwork checks.

Checks will be made on the paperwork accompanying each delivery to ensure that only waste for which the plant has been designed will be accepted.

Unacceptable waste will be rejected and returned to the originator or quarantined for later disposal, as appropriate, under the control of the Integrated Management System procedures. Certain wastes will require specific action for safe storage and handling.

As restricted by the planning permission, the installation will have a maximum capacity to receive up to 853,000 tonnes of municipal and commercial waste per annum. The individual capacities of the treatment processes is presented in each of the following sections. It should be noted that some of the wastes will be transferred between the different treatment processes, therefore the maximum capacity of the installation is not equivalent to the total capacity of the different wastes treatment processes.

2.2.1.1 Wastes to be received in the MBT Facility

The MBT facility plant will have a design capacity to receive up to 170,000 tonnes of incoming MSW and C&I per annum, based on 8,256 hours operation per annum.

Table 2.3 – Waste To Be Processed in the MBT Plant

EWC Code	Description
WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED	
packaging (including separately collected municipal packaging waste)	
15 01 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 03	wooden packaging

Table 2.3 – Waste To Be Processed in the MBT Plant

EWC Code	Description
15 01 04	metallic packaging
15 01 05	composite packaging
15 01 06	mixed packaging
15 01 07	glass packaging
absorbents, filter materials, wiping cloths and protective clothing	
15 02 03	absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE	
wastes from aerobic treatment of solid wastes	
19 05 01	non-composted fraction of municipal and similar wastes
19 05 03	off-specification compost
wastes from shredding of metal-containing wastes	
19 10 01	iron and steel waste
19 10 02	non-ferrous waste
wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified	
19 12 10	combustible waste (refuse derived fuel)
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	
separately collected fractions (except 15 01)	
20 01 01	paper and cardboard
20 01 02	glass
20 01 08	biodegradable kitchen and canteen waste
20 01 10	clothes
20 01 11	textiles
20 01 38	wood other than that mentioned in 20 01 37
20 01 39	plastics
20 01 40	metals
garden and park wastes (including cemetery waste)	
20 02 01	biodegradable waste (from garden and park wastes including cemetery waste)
20 02 03	other non-compostable municipal waste

Table 2.3 – Waste To Be Processed in the MBT Plant	
EWC Code	**Description**
other municipal wastes	
20 03 01	mixed municipal waste
20 03 02	waste from markets
20 03 03	street-cleaning residues

2.2.1.2 Wastes to be received in the MRF Facility

The MRF facility plant will have a design capacity to receive up to 300,000 tonnes of incoming MSW and C&I per annum, based on 8,352 hours operation per annum.

Table 2.4 – Waste To Be Processed in the MRF Facility	
EWC Code	**Description**
WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED	
packaging (including separately collected municipal packaging waste)	
15 01 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 03	wooden packaging
15 01 04	metallic packaging
15 01 05	composite packaging
15 01 06	mixed packaging
15 01 07	glass packaging
absorbents, filter materials, wiping cloths and protective clothing	
15 02 03	absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE	
wastes from aerobic treatment of solid wastes	
19 05 01	non-composted fraction of municipal and similar wastes
19 05 03	off-specification compost
wastes from shredding of metal-containing wastes	
19 10 01	iron and steel waste
19 10 02	non-ferrous waste
wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified	
19 12 10	combustible waste (refuse derived fuel)

Table 2.4 – Waste To Be Processed in the MRF Facility	
EWC Code	**Description**
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	
separately collected fractions (except 15 01)	
20 01 01	paper and cardboard
20 01 02	glass
20 01 08	biodegradable kitchen and canteen waste
20 01 10	clothes
20 01 11	textiles
20 01 38	wood other than that mentioned in 20 01 37
20 01 39	plastics
20 01 40	metals
garden and park wastes (including cemetery waste)	
20 02 01	biodegradable waste (from garden and park wastes including cemetery waste)
20 02 03	other non-compostable municipal waste
other municipal wastes	
20 03 01	mixed municipal waste
20 03 02	waste from markets
20 03 03	street-cleaning residues

2.2.1.3 Waste to be Incinerated in the CHP Plant

The CHP plant will have two streams which will be fed waste from a single waste storage bunker.

The CHP Plant will have a maximum capacity of 595,000 tonnes per annum. This will allow for variations in the net calorific value of the RDF (as shown in the firing diagram the range will be from 7 MJ/kg to 13MJ/kg) and for the CHP Plant operating for 8,150 hours in any particular year.

The plant will be used to recover energy from MSW and C&I waste, with European Waste Catalogue Codes as follows:

Table 2.5 – Waste To Be Processed in the CHP Plant	
EWC Code	**Description of Waste**
WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE	
wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)	
19 02 03	premixed wastes composed only of non-hazardous wastes
19 02 10	combustible wastes other than those mentioned in 19 02 08 and 19 02 09
wastes from aerobic treatment of solid wastes	
19 05 01	non-composted fraction of municipal and similar wastes
19 05 02	non-composted fraction of animal and vegetable waste
19 05 03	off-specification compost
wastes from anaerobic treatment of waste	
19 06 04	digestate from anaerobic treatment of municipal waste *(a solid content greater than 50% is necessary in the digestate for it to be acceptable in the CHP Plant)*
19 06 06	digestate from anaerobic treatment of animal and vegetable waste *(a solid content greater than 50% is necessary in the digestate for it to be acceptable in the CHP Plant)*
wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified	
19 12 01	paper and cardboard
19 12 04	plastic and rubber
19 12 07	wood other than that mentioned in 19 12 06
19 12 08	Textiles
19 12 10	combustible waste (refuse derived fuel)
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	
Chapter 20	All Non-Hazardous codes to be included

2.2.1.4 Waste to be Processed in the AD Plant

The AD plant will operate a single anaerobic digestion vessel fed with organic waste collected from municipal and commercial sources.

The AD plant will have a design capacity of 30,000 tonnes per annum of organic waste, based on 8,352 hours operation per annum.

The AD plant will be process organic wastes with the following European Waste Catalogue Codes:

Table 2.6 – Organic wastes To Be Processed in the AD Facility

EWC Code	Description
WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING	
wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation	
02 03 04	biodegradable materials unsuitable for consumption or processing (other than those containing dangerous substances)
MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	
separately collected fractions (except 15 01)	
20 01 08	biodegradable kitchen and canteen waste
garden and park wastes (including cemetery waste)	
20 02 01	biodegradable waste
other municipal wastes	
20 03 01	mixed municipal waste – separately collected biowastes
20 03 02	wastes from markets

2.2.1.5 Waste to be Processed in the Pulp Plant

The Pulp Plant will have a capacity of 170,000 tonnes per annum, based on 8,352 hours operation per annum. The plant will recover paper pulp from waste paper with the following European Waste Catalogue codes:

Table 2.7 – Waste To Be Processed in the Pulp Plant

EWC Code	Description
WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED	
packaging (including separately collected municipal packaging waste)	
15 01 01	paper and cardboard packaging
WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE	
wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified	
19 12 01	paper and cardboard
MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	

Table 2.7 – Waste To Be Processed in the Pulp Plant	
EWC Code	**Description**
separately collected fractions (except 15 01)	
20 01 01	paper and cardboard

2.2.1.6 Waste Handling

The facility will develop pre-acceptance and acceptance procedures which comply with the Indicative BAT requirements in the Sector Guidance Note, including:

- Maintaining a high standard of housekeeping in all areas and provide and maintaining suitable equipment to clean up spilled materials.
- Loading and unloading of vehicles in designated areas provided with impermeable hard standing. These areas will have appropriate falls to the process water drainage system.
- Fire fighting measures will be designed by consultation with the Local Fire Officers, with particular attention paid to the waste storage area.
- Delivery and reception of waste will be controlled by a management system that will identify all risks associated with the reception of waste and shall comply with all legislative requirements, including statutory documentation.
- Incoming waste will be:
  - delivered in covered vehicles or containers; and
  - unloaded in the enclosed waste reception areas.
  - Design of equipment, buildings and handling procedures will ensure there is insignificant dispersal of litter.
- Inspection procedures will be employed to ensure that any wastes which would prevent the anaerobic digestion process from operating in compliance with its permit are segregated and placed in a designated storage area pending removal.
- Further inspection will take place by the plant operatives during vehicle tipping and waste unloading.

2.2.2 Waste Minimisation (Minimising the Use of Raw Materials)

2.2.2.1 CHP Plant

A number of specific techniques will be employed to minimise the production of residues, focussing on the following:

(1) Feedstock Homogeneity;

(2) Dioxin & Furan Reformation;

(3) Furnace Conditions;

(4) Flue Gas Treatment Control; and

(5) Waste Management.

All of these techniques meet the Indicative BAT requirements from the Sector Guidance Note on Waste Incineration.

Feedstock Homogeneity

Improving feedstock homogeneity can improve the operational stability of the plant, leading to reduced reagent use and reduced residue production. The process of both off-site fuel preparation and on-site pre-treatment of the incoming waste within the MBT and MRF; and the subsequent mixing of both fuel (RDF) streams by the cranes within the waste bunker will serve to improve the homogeneity of fuel input to the CHP Plant.

Dioxin & Furan Reformation

As identified within the sector guidance for the Incineration of Waste (EPR5.01), there are a number of BAT design considerations required for the boiler. The CHP plant boiler has been designed to minimise the formation of dioxins and furans as follows:

- Slow rates of combustion gas cooling will be avoided via boiler design to ensure the residence time is minimised in the critical cooling section and avoid slow rates of combustion gas cooling to minimise the potential for de-novo formation of dioxins and furans.
- The gas residence time in the critical temperature range will be minimised by ensuring high gas velocities exist in these sections. The residence time and temperature profile (between 450 and 200ºC) of flue gas will be considered during the detailed design phase to ensure that dioxin formation is minimised throughout the process.
- It is reported in the Environment Agency guidance note EPR5.01 that the injection of ammonia compounds into the furnace – an SNCR NOx abatement system – inhibits dioxin formation and promotes their destruction. SNCR is to be utilised in the CHP plant.
- Transfer surfaces will be above a minimum temperature of 170°C subject to other reaction considerations.
- Computational Fluidised Dynamics (CFD) will be applied to the design, where considered appropriate, to ensure gas velocities are in a range that negates the formation of stagnant pockets / low velocities. A copy of the CFD model will be supplied to the Environment Agency following detailed design and prior to commencement of commissioning.
- Minimising the volume in the critical cooling sections will ensure high gas velocities.
- Boundary layers of slow moving gas along boiler surfaces will be prevented via design and a regular maintenance schedule to remove build-up of any deposits that may have occurred.

Furnace Conditions

Furnace conditions will be optimised in order to minimise the quantity of residues arising for further disposal. Burnout in the furnace will reduce the Total Organic Carbon (TOC) content of the bottom ash to less than 3% by optimising waste feed rate and combustion air flows.

Flue Gas Treatment Control

Close control of the flue gas treatment system will minimise the use of reagents and hence minimise the APCr produced. SNCR reagent dosing will be optimised to prevent ammonia slip.

Sodium Bicarbonate usage will be minimised by trimming reagent dosing to accurately match the acid load using fast response upstream acid gas monitoring. The plant preventative maintenance regime will include regular checks and calibration of the reagent dosing system to ensure optimum operation. Back-up feed systems will be provided to ensure no interruption in sodium bicarbonate dosing. The bag filter is designed to build up a filter cake of unreacted acid gas reagent, which acts as a buffer during any minor interruptions in dosing.

Activated carbon dosing will be based on flue gas volume flow measurement. The activated carbon dosing screw speed frequency control responds automatically to the increase and decrease of flue gas volume. Maintaining a steady concentration of activated carbon in the flue gas and consequently on the filter bags will maintain the adsorption rate for gaseous metals and dioxins.

Activated carbon and sodium bicarbonate will be stored in separate silos. The feed rate for activated carbon and sodium bicarbonate dosing systems will have separate controls.

Waste Management

The arrangements for the management of residues produced by the installation are presented in section 2.8. In particular, bottom ash and APCr from the flue gas treatment system will be stored and disposed of separately.

The procedures for handling of the wastes generated by the facility will be in accordance with the Indicative BAT requirements in the Sector Guidance Note, refer to section 2.2.1.6.

RDF Charging

The CHP Plant will meet the indicative BAT requirements outlined in the Incinerator Sector Guidance Note for fuel charging and the specific requirements of the IED:

- The combustion control and feeding system will be fully in line with the requirements of the IED. The conditions within the furnace will be continually monitored to ensure that optimal conditions are maintained and that the mandatory the IED emission limits are not exceeded. Auxiliary burners fired with fuel oil will be installed and will be used to maintain the temperature in the combustion chamber;
- The RDF charging and feeding systems will be interlocked with furnace conditions so that charging cannot take place when the temperatures drop below 850°C, both during start-up and if the temperature falls below 850°C during operation;
- The RDF charging and feeding systems will also be interlocked with the continuous emissions monitoring system to prevent RDF charging if the emissions to atmosphere are in excess of an emission limit value;
- Following loading into the feeding chutes by the grab, the RDF will be transferred onto the grates by hydraulic powered feeding units;
- The backward flow of combustion gases and the premature ignition of RDF will be prevented by keeping the chute full of RDF and by keeping the furnace under negative pressure;
- A level detector will monitor the amount of RDF in the feed chute and an alarm will be sounded if the fuel falls below the safe minimum level. Secondary air will be injected from nozzles in the wall of the furnace to control flame height and the direction of air and flame flow; and
- In a breakdown scenario, operations will be reduced or closed down as soon as practicable until normal operations can be restored.

The feed rate to the furnace will be controlled by the combustion control system.

2.2.2.2 AD Plant Waste Minimisation

Feed composition

The principal aim of the pre-treatment pulping process will be to create a feedstock for the digester which is suitable for anaerobic digestion.

Feed homogeneity

Good mixing of the feed with the digestate before entering the digester ensures the waste is fully inoculated with bacteria which improves the rate of digestion and minimises sludge production.

Residence time

Control of residence time by adjusting the waste feed and sludge extraction rates will ensure the waste is fully processed leading to reduced digestate sludge production. The average retention time in the digester will be approximately 18 days to ensure that the material is mature, free from pathogenic bacteria and seeds and generate lower odour emissions.

Digester conditions

The digester is operated with a high solids content which reduces the volume of sludge produced as less water is contained in the sludge. The digester will be controlled to operate under optimal conditions for bacterial growth to ensure the waste is fully digested and therefore less sludge is produced.

2.2.3 Water Use

The following key points should be noted:

- The water systems for the installation have been designed with the key objective of the recovery and reuse of process effluents.
- Water abstracted from the River Blackwater will be fed into the site’s lagoon system and pumped into the IWMF for use within the Pulp Plant.
- All process effluents generated on-site will be treated (within the WWTP and package treatments) and/or reused and recirculated into the IWMF processes or lagoon system.
- Treated process effluents from the waste water treatment plant will be collected and fed into the lagoon system prior to re-use as process water within the installation.
- Where practicable, surface water will be separated from process effluents.
- There will be no discharges of untreated process effluent from the installation to a watercourse.

An indicative schematic of proposed water use within the facility is presented below. A larger copy is presented in Annex 1.

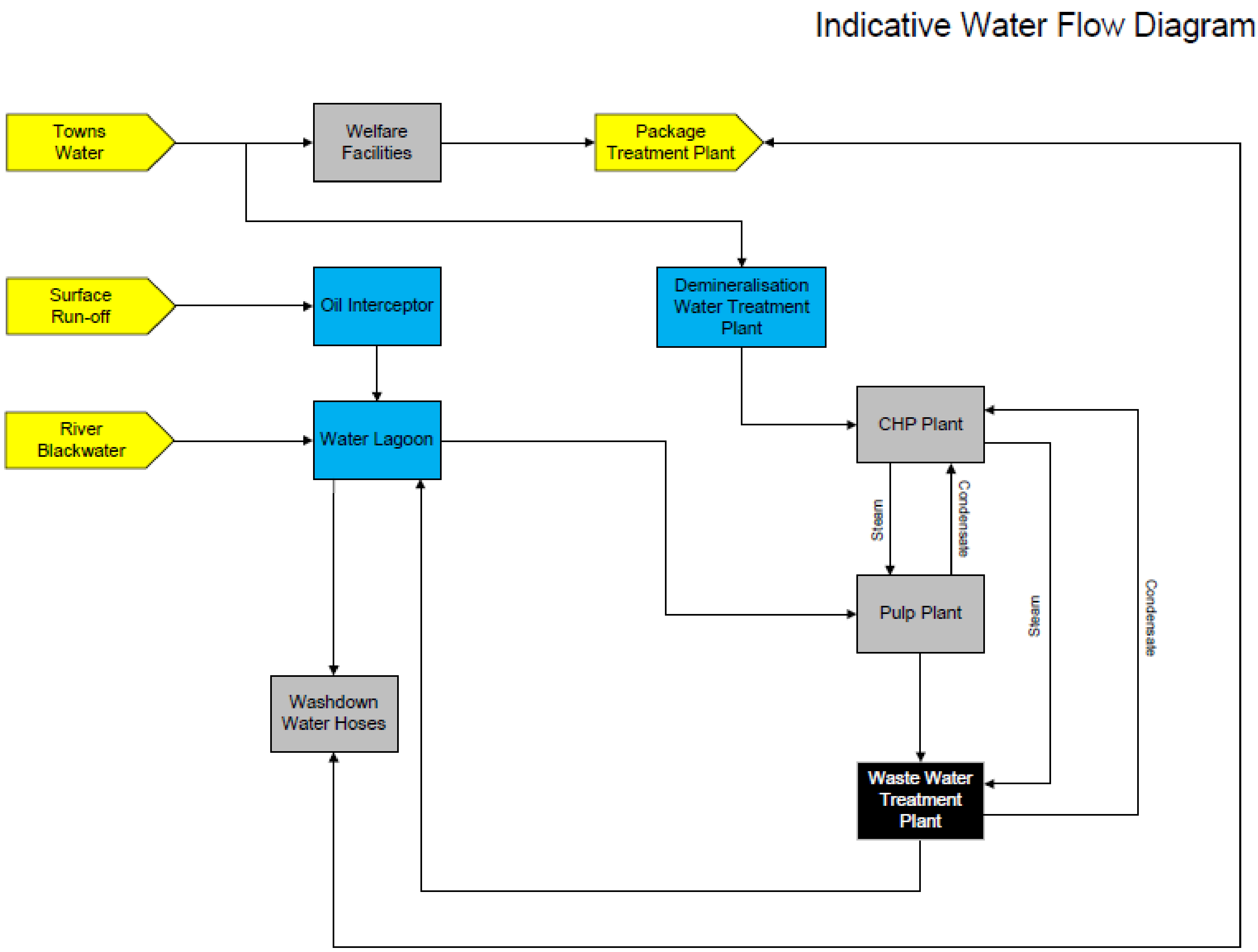


Figure 3 - Indicative Water Flow Diagram

2.2.3.1 Overview

The significant water consuming treatment processes will be the Pulp plant and CHP plant. The following key points should be noted:

(1) The water system will be designed to ensure that there are 'zero' discharges to water from the installation:

a) Water for use within the IWMF will be pumped from Upper Lagoon (which is recharged as required with water from New Field Lagoon) and fed into the Pulp Plant at a rate of 507.5 m^3 per day to support and supplement the IWMF's Zero Liquid Discharge (or Closed Loop) waste water treatment system.

b) The Pulp Plant requires a maximum of 1,750 m^3 of water per day to produce 85,500 tonnes of high grade recycled pulp per year.

c) Water from the Pulp Plant, together with water from other IWMF processes, will be cleaned and treated to an exceptionally high standard through the WWTP. Allowing for water losses associated with the various recovery, recycling and treatment processes undertaken at the installation, the maximum waste water flow into the WWTP will be 1,506 m^3 per day.

d) Allowing for water losses through the WWTP reverse osmosis and evaporation processes 1,496 m^3 of cleaned and treated water will be recirculated and reused within the Pulp Plant or the nearby lagoon network to provide a Zero Liquid Discharge (or Closed Loop) waste water treatment system.

(2) The facility will have separate process effluent and storm water systems (surface drainage).

2.2.3.2 Potable and Amenity Water

Water for supplies for the offices and mess facilities will come from the mains water supply. The quantity of this water is expected to be small compared to the other water uses on-site.

Waste water from showers, toilets and other mess facilities will be treated in on-site package treatment works.

2.2.3.3 Process Water

The process effluents generated by the installation are presented below.

IWMF Water Use and Wastewater Management

A summary of the IWMF's water usage and wastewater management systems that are either integrated or support the Zero Liquid Discharge or Closed Loop water treatment system:

Anaerobic Digestion

The AD has been designed to treat 30,000 tonnes of C&I waste. The design and general arrangement of the AD offers a Closed Loop waste water treatment process. Most of the water required by AD process will be supplied by recirculated process water, reducing the demand of fresh or industrial water to the AD.

Fresh water will be fed into the AD to support the pre-treatment, biological treatment and biogas clean up and air treatment processes at a rate of 6,350 m^3/year.

In addition, it is estimated that 1,100 m^3/year of wash down water will be required for general housekeeping and maintenance of the AD area, which will be collected and reused as a pre-seeded source of process water to support the AD operation.

Whilst the AD process offers a closed loop water management system, the maximum fresh water demand for the AD will of the order of 5,245 m^3/year or 14.5 m^3/day.

Mechanical Biological Treatment

The MBT has been designed to treat 170,000 tonnes of pre-sorted and shredded C&I wastes which will be fed into biodrying clamps. The biodrying process will produce around 15,000 m^3/year or 44 m^3/day of waste water (based on a 12% reduction in the overall weight of the C&I waste feedstock of which 75% would result in leachate and 25% moisture loss to air).

Waste water produced through the biodrying process can be used either as a pre-seeded source of process water to support the AD operation, used to quench the bottom ash from the CHP or cleaned and treated through the WWTP for reuse and recirculation within the IWMF. Based on average water flows through the Pulp Plant (rather than maximum flows), allowances have been made within the design of the WWTP to receive all MBT waste water.

CHP Plant

Boiler water for the CHP plant will be sourced from the local mains network. Arrangements are in place for Anglian Water to provide the required connection for the CHP coincidental to the water mains diversion works around the IWMF site.

The CHP will also source water from either the WWTP, or Upper Lagoon via New Field Lagoon, at a rate of 96,000 m^3/year or 288 m^3/day to quench the CHP bottom ash. No process waste water will be discharged from the CHP plant.

Pulp Plant

The Pulp Plant requires on average 1,750 m^3 of water per day to produce 85,500 tonnes of high grade recycled pulp per year. Some of this water will leave the process within the sludge or recovered and recycled pulp. Waste water from the Pulp Plant (1,506 m^3 per day) will be fed into the WWTP and treated for recirculation and reuse within the IWMF.

Water for use within the Pulp Plant will principally be sourced from the WWTP and supplemented with water from Upper Lagoon via New Field Lagoon which will require localised treatment (deionisation) prior to use.

Materials Recovery Facility

A small quantity of water (1 m^3/day) will be required within the MRF for general housekeeping purposes. Wash down water from the MRF will be collected and reused, or cleaned and treated through the WWTP for reuse and recirculation within the IWMF.

IWMF Offices, Workshops and Welfare Facilities

Mains water will be used to service the IWMF's offices, workshops and welfare facilities. Waste water arising from the various facilities will be collected and treated in a standard package treatment plant. It is estimated that wastewater arising from the various IWMF facilities will be of the order of 5 m^3/day.

2.3 Emissions

2.3.1 Point Source Emissions to Air

The full list of proposed emission limits for atmospheric emissions from the installation is shown in Table 2.8. All point source emissions to air from the installation will be discharged to atmosphere via a common windshield approximately 35 m above original ground level with a maximum elevation of 85 mAOD. Details regarding the location of the stack and the sources of the emissions to be released from the windshield are presented in Annex 5 - Dispersion Modelling Assessment.

This includes the information requested in Table 2 of Application Form Part B3. This is based on the emission limits required by the Industrial Emissions Directive.

Table 2.8 - Proposed Emission Limit Values (ELVs)

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit
CHP Plant – Emission Points A1 and A2				
Particulate matter	mg/Nm^3	30	10	-
VOCs as Total Organic Carbon (TOC)	mg/Nm^3	20	10	-
Hydrogen chloride	mg/Nm^3	60	10	-
Hydrogen fluoride	mg/Nm^3	-	-	2
Carbon monoxide	mg/Nm^3	100	50	-
Sulphur dioxide	mg/Nm^3	200	50	-
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	400	200	-
Cadmium & thallium and their compounds (total)	mg/Nm^3	-		0.05(2)
Mercury and its compounds	mg/Nm^3	-		0.05(2)
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm^3	-		0.5(2)
Dioxins & furans ITEQ	ng/Nm^3	-		0.1(3)
All expressed at 11% oxygen in dry flue gas at 0°C and 1 bar-a.				
AD Engines – Emission Points A3 and A4				
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3		-	500
Carbon monoxide	mg/Nm^3		-	1000
VOCs	mg/Nm^3		-	
All expressed at 5% oxygen in dry flue gas at 0°C and 1 bar-a.				
Pulp Plant Ventilation – Emission Point A5				
There are no proposed emission limits for the 'clean air' which is extracted from general working areas within the Pulp plant.				
AD Flare – Emission Points A6				
There are no proposed emission limits for emissions to air for the AD flare.				

Note:

(1) Periodic over a minimum 1-hour period.

(2) Periodic over a minimum 30 minute, maximum 8-hour period.

(3) Periodic over a minimum 6 hours, maximum 8 hour period.

A back-up generator will be provided which will be fired on gas oil. This has not been included as an emission point as it will only be required to operate periodically to safely shutdown the CHP facility when there is a loss of connection to the national grid.

2.3.2 Fugitive Emissions to Air

In addition to the point source emissions to air, there will be potential fugitive emissions to air from refilling of raw material storage tanks such as ammonia. These will be vented to the tanker during refilling. Storage tanks will be fitted with high level controls and alarms.

Storage silos will be fitted with filters to mitigate fugitive emissions of dusts during filling activities. The silos will be filled by bulk tanker and offloaded pneumatically into the silos with displaced air vented through a reverse pulse jet filter. Silos will be fitted with high level control and alarm. Silos will be equipped with a vent fitted at the top with a fabric filter. Filter residues will be returned to the silo. Cleaning of the filter is done automatically with compressed air after the filing operation. The filter will be inspected regularly for leaks.

All waste handling operations will be undertaken within enclosed buildings, and therefore will minimise fugitive emissions of dust from the installation.

Air from the MRF and MBT process areas will be extracted via the building ventilation system and treated via dust and carbon filter system prior to release to atmosphere via the building louvres.

2.3.3 Odour

An Odour Management Plan for the installation is presented in Annex 7. It should be noted that the Odour Management Plan will be subject to review following completion of detailed design of the installation.

2.3.4 Emissions to Water

The IWMF will give rise to surface water run-off from roads, vehicle parking areas, building roofs, hard-standings and hard landscaped areas. Surface water run-off from these areas will be discharged to the Upper Lagoon which is adjacent to the IWMF. The lagoon will be used for the storage of water to be used as process water within the installation.

There will not be any discharges of process effluent to water from the IWMF. The facility has been designed as a 'Zero liquid discharge' facility.

- Water for use within the IWMF will be pumped from Upper Lagoon (which is recharged as required with water from New Field Lagoon) and fed into the Pulp Plant at a rate of 507.5 m^3 per day to support and supplement the IWMF's Zero Liquid Discharge (or Closed Loop) waste water treatment system;
- The Pulp Plant requires a maximum of 1,750 m^3 of water per day to produce 85,500 tonnes of high grade recycled pulp per year;
- Water from the Pulp Plant, together with water from other IWMF processes, will be cleaned and treated to an exceptionally high standard through the WWTP. Allowing for water losses associated with the various recovery, recycling and treatment processes undertaken at the installation, the maximum waste water flow into the WWTP will be 1,506 m^3 per day;
- Allowing for water losses through the WWTP reverse osmosis and evaporation processes 1,496 m^3 of cleaned and treated water will be recirculated and reused within the Pulp Plant or the nearby lagoon network to provide a Zero Liquid Discharge (or Closed Loop) waste water treatment system.

2.3.5 Emissions to Sewer

There will be no discharges of process effluents to sewer from the installation.

Domestic foul effluents will be treated in a package water treatment plant.

2.3.6 Contaminated water

All chemicals will be stored in an appropriate manner incorporating the use of suitable secondary and other measures (such as acid and alkali resistant coatings) to ensure appropriate containment and tertiary abatement measures.

All storage facilities for chemicals will be designed in accordance with Environment Agency Pollution Prevention Guidance PPG 2, PPG 3 and PPG 18. The potential for accidents, and associated environmental impacts, is therefore limited.

Areas designated for storage of chemicals and liquid hazardous materials will be situated within secondary containment with provision for isolation and independent drainage.

Adequate quantities of spillage absorbent materials will be made available at easily accessible location(s), where chemicals are stored. The site drainage plan, including the location of process and surface water drainage will be updated and made available on-site following completion of detailed design.

Deliveries of all chemicals will be unloaded and transferred to suitable storage facilities which will incorporate secondary containment measures prior to its use. Secondary containment facilities will have capacity to contain 110% of the tank capacity in case of failure of the storage systems.

Tanker off-loading of chemicals will take place within areas where the drainage is contained with the appropriate capacity to contain a spill during delivery.

Any spillage that has the potential to cause environmental harm or to leave the installation will be reported to the site management and recorded in accordance with installations inspection, audit and reporting procedures. The relevant regulatory authorities (Environment Agency / Health and Safety Executive) will be informed as specified as required in accordance with the installations documented management procedures.

In the event of a fire in the CHP plant, contaminated water used for fighting fires will be collected through the wastewater drainage system which will flow into the RDF storage bunker.

The effectiveness of the Emergency Response Procedures for spillages is subject to Management Review and may be reviewed following any major spillages and revised as appropriate.

2.3.7 Noise

The facility will be designed to ensure that there are no impulsive or tonal features from its operation. An assessment of noise impacts has been completed and is presented in Annex 3.

2.4 Monitoring Methods

2.4.1 Emissions Monitoring

Sampling and analysis of all pollutants including dioxins and furans will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality.

The plant will be equipped with modern monitoring and data logging devices to enable checks to be made of process efficiency.

The purpose of monitoring has three main objectives:

(1) To provide the information necessary for efficient and safe plant operation;

(2) To warn the operator if any emissions deviate from predefined ranges; and

(3) To provide records of emissions and events for the purposes of demonstrating regulatory compliance.

2.4.1.1 Monitoring Emissions to Air – CHP Plant

The following parameters for the emissions from the CHP plant will be monitored and recorded continuously using a Continuous Emissions Monitoring System (CEMS):

(1) Oxygen;

(2) Carbon monoxide;

(3) Hydrogen chloride;

(4) Sulphur dioxide;

(5) Nitrogen oxides;

(6) Ammonia;

(7) Volatile organic compounds (VOCs); and

(8) Particulates.

In addition, the water vapour content, temperature and pressure of the flue gases will be monitored so that the emission concentrations can be reported at the reference conditions required by the Industrial Emissions Directive (IED).

The installation and functioning continuously monitored emissions concentrations will be subject to control and to periodic surveillance tests by an independent testing company at frequencies to be agreed with the EA.

The following emissions from the CHP plant will also be monitored by means of spot sampling at frequencies agreed with the Environment Agency:

(1) Metals [cadmium (Cd), thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb); Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni), Vanadium (V)];

(2) Hydrogen fluoride (HF);

(3) Nitrous Oxide;

(4) Dioxins and furans; and

(5) Dioxin like PCBs.

The methods and standards used for emissions monitoring will be in compliance with guidance note S5.01 and the IED. In particular, the CEMS equipment will be certified to the MCERTS standard and will have certified ranges which are no greater than 1.5 times the relevant daily average emission limit.

It is anticipated that

- Hydrogen chloride, carbon monoxide, sulphur dioxide, oxides of nitrogen and ammonia will be measured by an FTIR type multi-gas analyser;
- VOCs will be measured by a FID type analyser;
- Particulate matter will be measured by an opacimeter; and
- Oxygen will be monitored by a zirconium probe.

Sampling and analysis of all pollutants including dioxins and furans will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality.

The frequency of periodic measurements will comply with the IED as a minimum. The flue gas sampling techniques and the sampling platform will comply with Environment Agency Technical Guidance Notes M1 and M2.

All monitoring results shall be recorded, processed and presented in such a way as to enable the EA to verify compliance with the operating conditions and the regulatory emission limit values within the EP.

Periodic monitoring will be undertaken by MCERTS accredited stack monitoring organisations.

Reliability

IED Annex VI Part 8 allows a valid daily average to be obtained only if no more than 5 half-hourly averages during the day are discarded due to malfunction or maintenance of the continuous measurement system. IED Annex VI Part 8 also requires that no more than 10 daily averages are discarded per year.

These reliability requirements will be met primarily by selecting MCERTS certified equipment.

Calibration of the CEMS will be carried out at regular intervals as recommended by the manufacturer and by the requirements of BS EN14181 and the BS EN 15267-3. Regular servicing and maintenance will be carried out under a service contract with the equipment supplier. The CEMs will be supplied with remote access to allow service engineers to provide remote diagnostics.

There will be one dedicated CEMS per line and one stand-by CEMS which can be switched to either unit automatically. This will ensure that there is continuous monitoring data available even if there is a problem with one of the duty CEMS systems.

Start-up and Shutdown

The emission limit values under the IED do not apply during start-up and shutdown, but the abatement equipment will operate during start-up and shutdown. Therefore, a signal will be sent from the main plant control system to the CEMS package to indicate when the plant is operational and burning waste. The averages will only be calculated when this signal is sent, but raw monitoring data will be retained for inspection.

Start-up ends when all the following conditions are met:

(1) The feed chute damper is open and the feeder, flue gas cleaning plant, control systems, monitoring equipment, grate and ash extractors are all running;

(2) The temperature within the combustion chamber is greater than 850°C.

(3) Exhaust gas oxygen is less than 15% (wet measurement); and

(4) The combustion grate is fully covered with fuel.

Shutdown begins when all the following conditions are met

(1) The feed chute damper is closed;

(2) The waste remaining on the grate is burned out;

(3) The flue gas treatment systems are running

(4) The shutdown burner is in service; and

(5) Exhaust gas oxygen is equal or above 15% (wet measurement).

2.4.1.2 Monitoring Emissions to Air – AD Plant

CHP Engines

The Environment Agency Standard Rules Permit - SR2010No15 – only requires periodic monitoring of emissions from the biogas combustion plant. The periodic monitoring will monitor and record the following parameters:

- Oxygen;
- Carbon Monoxide;
- Nitrogen oxides; and

- VOC's.

The water vapour content, temperature and pressure of the flue gases will also be monitored. The emission concentrations will then be reported according to the reference conditions required by Guidance for Monitoring Landfill Gas Engine Emissions.

The flue gas sampling techniques and the sampling platform will comply with Environment Agency Technical Guidance Notes M1 and M2.

Flare

The Environment Agency Standard Rules Permit - SR2010No15 – does not include any requirements for undertaking emissions monitoring for emissions from the flare. The flare will only be used in emergency situations and will be demonstrated to meet the minimum operational standards for a landfill gas flare.

As the flare will be operating for less than 10% of the year, it has been assumed that there will be no requirement to undertake monitoring of emissions from the flare.

2.4.1.3 Monitoring Emissions to Air – Pulp Plant

There will be no monitoring of emissions of the air which has been extracted from the general operational areas within the Pulp plant.

2.4.1.4 Monitoring Emissions to Air – MBT/MRF

There will be no monitoring of emissions to air from the MBT and MRF facilities.

2.4.1.5 Monitoring Emissions to Land

Disposal of residues to land will comply with all relevant legislation.

In particular the bottom ash from the CHP plant will comply with the IED criterion of Total Organic Carbon less than 3% and/or Loss on Ignition less than 5%. Compliance with the TOC/LOI criterion will be demonstrated during commissioning and checked at periodic intervals to be agreed with the Environment Agency throughout the life of the plant, in accordance with the Environment Agency's ash sampling protocol.

Testing for TOC/LOI will be conducted by an independent laboratory.

2.4.2 Process Monitoring

2.4.2.1 CHP Plant

The CHP Plant will be controlled from a dedicated control room. A modern control system, incorporating the latest advances in control and instrumentation technology, will be used to control operations, optimising the process relative to efficient heat release, good burn-out and minimum particle carry-over. The system will control and/or monitor the main features of the plant operation including, but not limited to the following:

- Combustion air;
- Fuel feed rate;
- SNCR system;
- Flue gas oxygen concentration at the boiler exit;
- Flue gas composition at the stack;
- Combustion process;
- Boiler feed pumps and feedwater control;

- Steam flow at the boiler outlet;
- Steam outlet temperature;
- Boiler drum level control;
- Flue gas control;
- Power generation; and
- Steam turbine exhaust pressure.

The response times for instrumentation and control devices will be designed to be fast enough to ensure efficient control.

The following process variables have particular potential to influence emissions:

(1) Fuel throughput will be recorded to enable comparison with the design throughput. As a minimum, daily and annual throughput will be recorded;

(2) Combustion temperature will be monitored at a suitable position to demonstrate compliance with the requirement for a residence time of 2 seconds at a temperature of at least 850°C;

(3) The differential pressure across the bag filters will be measured, in order to optimise the performance of the cleaning system and to detect bag failures; and

(4) The concentration of HCl in the flue gases upstream of the flue gas treatment system will be measured in order to optimise the performance of the emissions abatement equipment.

Water use will be monitored and recorded regularly at various points throughout the process to help highlight any abnormal usage. This will be achieved by monitoring the incoming water supplies and the boiler water makeup.

In addition, electricity and auxiliary fuel consumption will be monitored to highlight any abnormal usage.

Validation of Combustion Conditions

The CHP Plant will be designed to provide a residence time, after the last injection of combustion air, of more than two seconds at a temperature of at least 850°C. This criterion will be demonstrated using Computational Fluid Dynamic (CFD) modelling during the design stage and confirmed by the recognized measurements and methodologies during commissioning in accordance with Guidance Note EPR5.01.

It will also be demonstrated during commissioning that the CHP plant can achieve complete combustion by measuring concentrations of carbon monoxide, VOCs and dioxins in the flue gases and TOC of the bottom ash.

During the operational phase, the temperature at the 2 seconds residence time point will be monitored to ensure that it remains above 850°C. The location of the temperature probes will be selected using the results of the CFD model. If it is not possible to locate the temperature probes at precisely the 2 seconds residence time point then a correction factor will be applied to the measured temperature. The CFD model for the design will be made available to the EA following detailed design of the boiler.

Ammonia solution will be injected into the flue gases at a temperature of between 850 and 1000°C. This narrow temperature range is needed to reduce NOx successfully and avoid unwanted secondary reactions. This means that multiple levels of injection points will be required in the radiation zone of the furnace.

Sufficient nozzles will be provided at each level to distribute the ammonia correctly across the entire cross section of the radiation zone. CFD modelling will be used to define the appropriate location and number of injection levels as well as number of nozzles to make sure the SNCR system achieves the required reduction efficiency for the whole range of operating conditions while maintaining the ammonia slip below the required emission level.

The CFD modelling will also be used to optimise the location of the secondary air inputs into the combustion chamber.

Measuring Oxygen Levels

The oxygen concentration at the boiler exit of the CHP plant will be monitored and controlled to ensure that there will always be adequate oxygen for complete combustion of combustible gases. Oxygen concentration will be controlled by regulating combustion airflows and fuel feed rate.

2.4.2.2 AD Plant

The volumetric flow through the anaerobic digestion process is monitored via a flow-meter located on the slurry feed line to the digesters.

Within the treatment stages of the anaerobic digestion process there will be monitoring of various elements of the process:

Hydrolysis Tank:

- Level transmitter on hydrolysis tank;
- Flow-meter on digesters feed line.

Anaerobic Digesters:

- Temperature transmitters on digester heat exchanger;
- Level transmitter on digester tanks;
- Pressure transmitter on digester tanks;
- Temperature transmitter on digester tanks;
- Gas flow-meter on digester off take gas pipe work;
- Gas flow-meter on gas boosters and CHP feed line;
- Gas holder standard instrumentation (level transmitter + CH_4 detector); and
- Gas flow-meter on flare stack feed line.

Bio-filter:

- Flow-meter on bio-filter water recirculation pipe work; and,
- Temperature transmitter on irrigation water delivery pipeline.

Dewatering:

- Flow-meter on dewatering feed line.

2.4.2.3 Pulp Plant

The Pulp plant will be controlled from a central control room. The Pulp process will have a high level of automation with the plant being controlled by process values. The plant will be controlled by the Distributed Control System (DCS) which will provide process control, motor control and control the operation of the plant. All process machines will also be controlled by local control panels and boxes if local control is required.

The high automation of the Pulp plant will allow for the following:

- Subsystem control by automatic group start/-stop program;
- Protection interlocking of process machines and plant equipment as far as required; and
- Manual/automatic operation of PID's, control functions and motors from the operator station of the DCS.

Process monitoring will include the following:

- pressures;
- differential pressure;
- flow;

- consistencies; and
- temperatures.

In addition, analytical monitoring of the following will be undertaken:

- Brightness;
- retention;
- pH-value; and
- turbidity.

When the CHP Plant is not available due to planned or unplanned shutdown, the control room for the CHP Plant will inform the Pulp Plant. The Pulp Plant will then switch to auxiliary mode, prior to fully shutting down.

2.4.2.4 Wastewater Treatment Plant

Process wastewaters from the Pulp plant to the wastewater treatment plant will be monitored for pH, temperature and conductivity with set points to raise alarms and/or divert flow to the Buffer tank.

The pH / temperature will be continuously monitored and used for process control (with out of range alarms) at the 1st stage DAF, second stage DAF and settled water after the Lime softening settlement tanks.

The pH will be reduced after the sand filters and prior to the 1st Stage of Reverse Osmosis and this acid addition will be governed automatically to a fixed but adjustable target pH by triple validated pH meters.

pH / conductivity / temperature will be monitored on the reject and product of each stage of RO including the final product stage for discharge to the treated water tanks.

The WWTP plant will be provided with sample points between all series process units to allow routine chemical analysis to confirm performance (i.e., Chemical Oxygen Demand removal, ammonia, nitrate, Biological Oxygen Demand, residual hardness, residual silica total dissolved solids, etc at the appropriate stage) and to calibrate the process instrumentation.

When the CHP Plant and/or the Pulp plant are not available due to planned or unplanned shutdown, the control room for the CHP Plant will inform the wastewater plant. The wastewater treatment plant will then switch to auxiliary mode, prior to fully shutting down.

2.5 Technology Selection

2.5.1 MRF & MBT

As identified in the BREF - "Waste treatment industries" - the sorting and separation techniques employed in the MRF and MBT Plant are regarded as appropriate techniques for treating and recovering recyclates and separating waste into 'high calorific' fractions and preparation of a waste fuel.

As identified in the BREF, the benefit of employing mechanical treatment is that it converts a heterogeneous mixture of waste materials, particularly from solid commercial and industrial wastes as being treated in the MRF and MBT facility, and makes the waste a more homogeneous fuel.

As identified in the BREF, the production of solid waste fuel can be divided into a number of steps such as those employed within the MRF and MBT, which are:

- Metal, wood and plastic separation;
- Classification/Sieving; and
- Bio-drying to produce a high calorific value fuel.

It is considered that the techniques employed in the MRF and MBT facilities will represent BAT for this installation.

2.5.2 Anaerobic Digestion Treatment Process

The following treatment techniques will be considered for the anaerobic digestions process:

- Digester type; and
- Digester conditions.

2.5.2.1 Digestion type

It is proposed that the organic fraction of source segregated waste will be processed using anaerobic digestion. Aerobic digestion is an alternative treatment process organic waste which is less sensitive to process conditions such as pH, temperature and sulphur compounds. However, anaerobic digestion is able to break down more complex compounds in the waste and has the significant advantage that the majority of the chemical energy in the waste is released as methane which can be combusted to generate electricity and heat.

2.5.2.2 Digester conditions

Batch or Continuous

As identified in the BREF - "Waste treatment Industries", anaerobic digestion can be undertaken as a batch or continuous process. Continuous processes do not suffer from odour problems when emptying vessels, unlike batch vessels. Bio-gas production from batch plants is inherently intermittent and it is therefore more difficult to achieve a continuous biogas supply to the electricity generating engines. Continuous processes benefit from consistent and more controllable gas production which reduces the gas storage volume required and improves the efficiency of the gas engines. Continuous processing also requires less operational input and intervention.

Wet or Dry

As identified in the BREF - "Waste Treatment Industries", anaerobic digestion can be undertaken in either dry or wet conditions. In a wet system, solid wastes is slurried and fermented by hydrolytic and fermentative bacteria to release volatile fatty acids which are then converted to biogas in a high rate industrial waste water anaerobic digester. Wet systems are favourable for the digestion of source segregated organic waste and wet organic waste from food processors.

As the anaerobic digestion process is proposed to treat residual food waste from municipal and C&I sources, it is considered that the proposed wet system will represent BAT as detailed in the BREF - "Waste Treatment Industries".

Retention Time

The minimum retention time of the digester is approximately 18 days and biogas is collected within the roof space, which is connected to the biogas system. The longer the retention time of the slurry in the digester, the greater the extent of biodegradation and subsequently a better quality digestate, the greater the production of biogas. Having an 18 day retention time will ensure that the material is mature, free from pathogenic bacteria and seeds and also the digestate will generate lower odour emissions.

The plant will operate a single continuous anaerobic digestion vessel for the reasons outlined above.

Temperature

The operating temperature of an anaerobic digester is determined by the type of microorganism to be employed to digest the waste. The two most common systems are mesophilic (37-41°C) or thermophilic (48-55°C). The anaerobic digester will be operated at between 36°C and 38°C which is in the mesophilic region.

Mesophilic systems tend to be more stable than thermophilic systems. The mechanical pretreatment of the feed and the continuous design of the digester will ensure conditions remain constant and the bacterial system remains stable. As mesophilic systems do not require any additional heating, all of the gas produced can be used to generate electricity from the biogas which is produced in the Anaerobic Digestion process.

It is considered that the proposed mesophilic process will represent BAT as detailed in the BREF - "Waste Treatment Industries".

2.5.2.3 Conclusions

The anaerobic digestion process will allow treatment of the organic fraction of food wastes. Due to the reasons detailed above the proposed operating techniques are regarded as achieving BAT as detailed in the BREF - "Waste Treatment Industries".

2.5.3 Biogas Combustion plant

2.5.3.1 Combustion technology

Gas engine

The energy from the biogas produced by the anaerobic digestion plant will be recovered as electricity by combusting it in one of two gas engines. An alternative to using a gas engine would be to use the gas to fire a steam boiler and utilise the steam produced to generate electricity in a steam turbine. At the proposed rate of gas production from the AD plant, direct use of the biogas in a gas engine is a more efficient means of generating electricity than using a boiler and steam turbine. The use a gas engine to combust the biogas to generate electricity is therefore regarded as representing BAT.

Spark Ignition

The engines will be spark ignition engines. Spark ignition engines are regarded as being a low Nitrogen Dioxide technology. The use of Spark ignition engines is therefore regarded as representing BAT.

2.5.3.2 Combustion conditions

Flare

As required by the BREF – Waste Treatment Industries, when flaring biogas, the outlet temperature of the flue-gas will be at least 900°C and the residence time 0.3 sec.

2.5.3.3 Emissions Abatement

Sulphur dioxide

The combustion sector guidance note states that for small scale plant (<20MWth), the use of low sulphur fuels (<1.2%S) is sufficient in the consideration of BAT.

Hydrogen sulphide needs to be removed from the biogas, produced in order to reduce sulphur concentration in the emissions when the biogas is combusted. An external biological desulphurisation will be used to remove hydrogen sulphide from the biogas.

NOx Reduction

NOx emissions within the gas engines will be controlled through lean burn techniques. These measures will control NOx levels in the exhaust gases to below 500 mg/Nm^3, which is in accordance with the emission limits required by the Environment Agency Landfill Gas technical guidance note (LFTGN 08).

It is not considered that SCR or SNCR techniques would represent BAT for this combustion process.

Particulates

The combustion of biogas is not considered to lead to emissions of particulates. As stated within Environment Agency Guidance Note EPR 1.01, gas fired plant will not generally require particulate control. As the engines will be new, it is not considered that additional abatement control will be required.

It is therefore considered that the technology selection is an appropriate technique for the minimisation of particulate emissions and will represent BAT.

Carbon Monoxide

As stated within Environment Agency Guidance Note EPR 1.01, it is acknowledged that when low NOx combustion techniques are applied there is a trade-off in increased CO emissions. It is therefore considered that the technique selected is an appropriate technique for the minimisation of Carbon Monoxide emissions and will represent BAT.

Volatile Organic Compounds (VOC's)

As stated within Environment Agency Guidance Note EPR 1.01, it is acknowledged that VOC emissions indicate poor controlled combustion conditions. Good combustion techniques will be employed to minimise emissions of VOC's from the installation.

It is therefore considered that the technique selected is appropriate technique for the minimisation of VOC emissions and will represent BAT.

2.5.4 Pulp Plant

2.5.4.1 Raw Material Selection

The Pulp plant will produce pulp from recovered printing and writing paper and card. This process will enable paper and card which has been recovered from off-site waste management facilities to produce a recycled pulp. The recycled pulp can subsequently be used in paper and tissue manufacturing mills and displace and/or supplement the use of virgin pulp.

The raw material selection processes are considered to represent BAT for the installation.

2.5.4.2 Preparing Recover Fibre (RCF)

The incoming RCF will be de-inked using a chemi-mechanical process to remove ink and other materials.

The preparation processes removes contaminants (e.g. of stickies, ink, filler, dyes in screens, flotation cells and bleaching); changes the physical characteristics of the materials (e.g. disperging disperses remaining ink particles); and changes the chemistry (e.g. reductive bleaching of lignin/dyes) of the fibrous mix.

The flotation de-inking process will use soaps to bind to the ink, and float it off as a scum. This is effective with the larger particles (greater than 50 μm). The floatation process is a two loop cleaning and flotation system to ensure maximum removal of contaminants and produce a high quality product.

The proposed processes are considered to represent BAT for preparing recovered fibre.

2.5.4.3 Pulping

The Pulp plant will utilise pulping techniques. The pulper will ensure the following:

- Excellent ink detachment through fibre-fibre friction;
- Flexible in regard to furnish, production, energy consumption, according to requirements;
- Low residual flake content, low fibre losses, gentle fibre treatment;
- Low residual stickies content - stickies (bindings/hot melts) remain screenable;
- Optimal mixing and dosage of chemicals; and
- Simple operation and control.

The pulping process will be designed to ensure a high consistency pulp is produced by disintegrating the paper for recycling into the separated fibres within the Pulp plant.

The proposed pulping processes are considered to represent BAT for the installation.

2.5.4.4 Bleaching

The Pulp plant will utilise reductive bleaching technique which will be used to bleach the fibrous pulp following treatment to achieve the brightness requirements of the paper and tissue manufacturing processes. The Pulp plant will use hydrogen peroxide and sodium hydrosulphate as the bleaching chemicals. Chlorine will not be used for bleaching of the de-inked pulp.

Wastewaters generated by the bleaching process will be treated within the wastewater treatment plant. All wastewaters treated in the wastewater treatment plant will be recycled within the installation.

The proposed bleaching processes are considered to represent BAT for the installation.

2.5.5 CHP Plant

2.5.5.1 Waste Incineration Technology

It is proposed that the waste incineration technology for the CHP plant will be a grate furnace. This is the leading technology in the UK and Europe for the combustion of the fuel types likely to be treated by the Facility. The moving grate comprises of inclined fixed and moving bars that will move the fuel from the feed inlet to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all fuel is exposed to the combustion process.

The Waste Incineration and Combustion BREF’s identify a number of alternative technologies for the combustion of waste fuels. The suitability of these technologies has been considered including different gasification technologies, as follows:

(1) **Grate Furnaces**

As stated in the Sector Guidance Note, these are designed to handle large volumes of waste derived fuels.

Grates are the leading technology in the UK and Europe for the combustion of biomass and waste fuels. The moving grate comprises an inclined fixed and moving bars (or rollers) or a vibrating grate that will move the fuel from the feed inlet to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all fuel is exposed to the combustion process.

(2) **Fixed Hearth**

These are not considered suitable for large volumes of waste derived fuels. They are best suited to low volumes of consistent waste. Therefore these systems are not considered practical and have not been considered any further.

(3) **Pulsed Hearth**

Pulsed hearth technology has been used for waste fuels, such as RDF, in the past, as well as other solid wastes. However, there have been difficulties in achieving reliable and effective burnout of waste and it is considered that the burnout criteria required by Article 50 (1) of the IED would be difficult to achieve. Therefore these systems are not considered practical and have not been considered any further.

(4) **Rotary and Oscillating Kilns**

Rotary kilns are used widely within the cement industry which uses a consistent fuel feedstock and they have been used widely within the healthcare sector in treating clinical waste, but they have not been used in the UK for large volumes of waste derived fuels. The energy conversion efficiency of a rotary kiln is lower than that of other waste incineration technologies due to the large areas of refractory lined combustion chamber.

An oscillating kiln is used for the incineration of municipal waste at one site in England and some sites in France. The energy conversion efficiency in these systems is lower than that of other waste incineration technologies due to the large areas of refractory lined combustion chamber.

The capacity per rotary or oscillating kiln unit is limited to 8 tonnes per hour and for this application a large number of furnaces would be required to achieve the design throughput. This is not considered practical and would lead to significant efficiency losses, therefore this option has not been considered any further.

(5) **Fluidised Bed Combustor**

Fluidised beds are designed for the combustion of relatively homogeneous fuel. Therefore fluidised beds are appropriate for untreated waste which have been pre-processed to produce an RDF, such as that proposed for the installation.

While fluidised bed combustion can lead to slightly lower NOx generation, the injection of ammonia or urea is still required to achieve the relevant emission limits specified in IED.

Fluidised beds can have elevated emissions of nitrous oxide, a potent greenhouse gas. Some have been designed to minimise the formation of nitrous oxide.

(6) **Pyrolysis /Gasification**

In pyrolysis, the waste is heated in the absence of air, leading to the production of a syngas with a higher calorific value than from gasification. However, the process normally requires some form of external heat source, which may be from the combustion of part of the syngas.

Various suppliers are developing pyrolysis and gasification systems for the disposal of waste derived fuels, however these systems are not considered proven.

Currently there are no pyrolysis or gasification systems which are of a capacity required to process the nominal design capacity. Therefore these systems are not suitable and have not been considered any further.

A quantitative BAT assessment for a grate and conventional fluidised bed has been undertaken and is presented in Annex 6 section 5. The conclusions of the assessment are summarised in the table below.

For the purposes of this application we have undertaken a quantitative assessment of the available technologies for the proposed capacity using data obtained by Fichtner from a range of different projects using the technologies identified within this assessment.

Table 2.9 - BAT Assessment Combustion Techniques

		Grate	Fluidised Bed
Global Warming Potential	t CO_2 p.a.	-254,000	-251,000
Ammonia Consumption	t.p.a.	750	500
Residues		161,000	166,270
Total Materials Costs	p.a.		£460,000
Power Revenue	p.a.	£2,190,000	£2,740,000

Both the grate and fluidised bed will produce similar quantities of ash, although the fluidised bed produces more fly ash.

The lower annualised costs associated with a grate system outweigh the additional material costs and higher ammonia consumption.

Furthermore, the grate system will be able to process the varying waste composition compared to a fluidised bed system which requires a consistent and homogenous fuel.

On this basis a grate system is considered to represent BAT for this facility.

2.5.5.2 NOx Abatement Systems

As stated within the relevant Environment Agency guidance document for Waste Incineration (EPR5.01), there are three recognised technologies available for the abatement of emissions of NOx:

(1) Flue Gas Recirculation (FGR);

(2) Selective Non-Catalytic Reduction (SNCR); and

(3) Selective Catalytic Reduction (SCR).

Flue Gas Recirculation (FGR)

The CHP will employ flue gas recirculation. This primary control measures reduces NOx generation by diluting the flame in the combustion chamber, decreasing the reaction temperature and oxygen availability.

It is important to emphasise that FGR itself does not reduce NOx emissions to the levels required by the IED and so it would not alleviate the need for further abatement.

Selective Non-catalytic Reduction

NOx levels will primarily be controlled by monitoring the combustion air. Selective non-catalytic NOx reduction (SNCR) methods will also be installed, using 25% ammonium hydroxide solution as the reagent.

Selective Catalytic Reduction

The use of Selective Catalytic Reduction (SCR) has also been considered. In this technique, the ammonia solution is injected into the flue gases immediately upstream of a reactor vessel containing layers of catalyst. The reaction is most efficient in the temperature range 200 to 350°C. The catalyst is expensive and to achieve a reasonable working life, it is necessary to install the SCR downstream of the flue gas treatment plant. This is because the flue gas treatment plant removes dust which would otherwise cause deterioration of the catalyst.

Since the other flue gas cleaning reactions take place at an optimum temperature of around 140°C, the flue gases have to be reheated before entering the SCR. This requires some thermal energy which would otherwise be converted to electrical power output, reducing the overall energy recovery efficiency of the facility. The catalytic reactor also creates additional pressure losses to be compensated by a bigger exhaust fan, reducing further the overall energy efficiency.

A quantitative BAT assessment of the available technologies has been undertaken, refer to Annex 6. This assessment uses data obtained by Fichtner from a range of different projects using the technologies proposed in this application.

Table 2.10 – BAT Assessment NOx Abatement

Parameter	Units	SNCR	SCR
NO_x emissions removed by abatement	tpa	340	720
POCP		-22,900	-8,000
Global Warming Potential	tpa CO_2 eq	5,200	14,000
Ammonia solution	tpa	750	620
Total Annualised Cost	£ p.a.	£1,263,000	£4,567,000

As can be seen from information presented in the Table 2.10, applying SCR to the Installation:

(1) increases the annualised costs by approximately £3.3 million;

(2) abates an additional 380 tonnes of NOx per annum;

(3) reduces the benefit of the facility in terms of the global warming potential by a minimum of 8,000 tonnes of CO2; and

(4) reduces ammonia consumption by a minimum of approximately 130 tonnes per annum.

This gives an effective additional annual cost of approximately £8,700 per additional tonne of NOx abated. The additional costs associated with SCR are not considered to represent BAT for the Installation. Therefore, SNCR is considered to represent BAT for the Installation.

2.5.5.3 Acid Gas Abatement System

There are currently three technologies widely available for acid gas treatment on similar plants in the UK.

(1) Wet scrubbing, involving the mixing of the flue gases with an alkaline solution of sodium hydroxide or hydrated lime. This has a good abatement performance, but it consumes large quantities of water, produces large quantities of liquid effluent which require treatment and has high capital and operating costs. It is mainly used in the UK for hazardous waste incineration plants where high and varying levels of acid gases in the flue gases require the buffering capacity and additional abatement performance of a wet scrubbing system.

(2) Semi-dry, involving the injection of quick lime as a slurry into the flue gases in the form of a spray of fine droplets. The acid gases are absorbed into the aqueous phase on the surface of the droplets and react with the quick lime. The fine droplets evaporate as the flue gases pass through the system, cooling the gas. This means that less energy can be extracted from the flue gases in the boiler, making the steam cycle less efficient. The quick lime and reaction products are collected on a bag filter, where further reaction can take place.

(3) Dry, involving the injection of solid hydrated lime or sodium bicarbonate into the flue gases as a powder. The reagent is collected on a bag filter to form a cake and most of the reaction between the acid gases and the reagent takes place as the flue gases pass through the filter cake. In its basic form, the dry system consumes more reagent than the semi-dry system. However, this can be improved by recirculating the flue gas treatment residues, which contain some unreacted hydrated lime and reinjecting this into the flue gases.

Wet scrubbing is not considered to be suitable for the CHP Plant, due to the production of a large volume of hazardous liquid effluent, a reduction in the power generating efficiency of the plant and the generation of visible plume.

Semi-dry systems will generate a visible plume in certain climatic conditions. Planning Condition 17 states:

> *No development shall commence until a management plan for the CHP plant to ensure there is no visible plume from the stack has been submitted to and approved in writing by the Waste Planning Authority. The development shall be implemented in accordance with the approved plan.*

Due to the potential formation of visible plume from the stack and the requirements of planning condition 17, a semi-dry system is not considered to be an available technique for the abatement of acid gases

A dry system can easily achieve the emission limits required by the IED and are less likely to generate a visible plume than semi-dry and wet systems. Dry systems are used on a number plants in Europe.

Taking the above into consideration a dry system is considered to be the only available technique for this Installation. Therefore, a dry system is regarded as representing BAT.

2.5.5.4 Particulate Matter Abatement

The CHP Plant will use a multi-compartment fabric filter for the control of particulates. There are a number of alternative technologies available, but none offer the performance of the fabric filter. Fabric filters represent BAT for this type of waste incineration plant for the following reasons:

(1) Fabric filters are a proven technology and are used in a wide range of applications. The use of fabric filters with multiple compartments, allows individual bag filters to be isolated in case of individual bag filter failure.

(2) Wet scrubbers are not capable of meeting the same emission limits as fabric filters.

(3) Electrostatic precipitators are also not capable of abating particulates to the same level as fabric filters. They could be used to reduce the particulate loading on the fabric filters and so increase the acid gas reaction efficiency and reduce lime residue production, but the benefit is marginal and would not justify the additional expenditure, the consequent increase in power consumption and significant increase in the carbon footprint of the Facility.

(4) Ceramic Filters have not been proven for this type of combustion plant, and are regarded as being more suited to high temperature filtration.

Fabric filters are considered to represent BAT for the removal of particulates for this Installation.

The bag filter will not require a flue gas bypass station, as the bag filters will be preheated allowing start-up without a bypass, which is considered to represent BAT.

For plants which include a bypass in their design, there is a risk that during normal operation, pollutant residues can build up in the inlet duct to a bypass station. If the bypass is then operated during start-up, as is common until the bag filter is at operating temperature, these residues will be emitted from the stack with no abatement.

2.5.5.5 Steam Condenser

There are three potential BAT solutions considered in Sector Guidance Note EPR 5.01 as representing indicative BAT for the Installation, which are:

- Air Cooled Condenser (ACC);
- Once though Cooling; and,
- Evaporative Condenser.

The CHP will operate an ACC to condense the steam output from the turbine to allow return of the condensate to the boiler.

The ACC will be designed and guaranteed by the technology supplier with enough additional capacity to maintain turbine efficiency during the summer.

Once through cooling systems require significant quantities of water. Whilst there will be an abstraction from the River Blackwater for the supply of process water for the installation, there would not be sufficient capacity in the river to supply process feedwater and water for once though cooling. Therefore once though cooling is not considered to be 'available' for the installation.

Evaporative condenser systems also require large volumes of volume and produce a significant plume. The planning permission for the facility prohibits visible plume from the installation, therefore this is not considered to be an available technique for the installation.

ACCs do not require large volumes of water and do not generate a visible plume.

Air cooled condensing is considered to represent BAT for the installation.

2.5.6 Wastewater Treatment Plant

The WWTP will enable the process waters to be treated prior to recirculation within the installation. Whilst the facility will be a significant consumer of water there will be zero discharges of process effluent discharged to the environment. As the WWTP will allow the installation to be a zero discharge facility it is considered to represent BAT for the installation.

The WWTP will employ physio-chemical treatment techniques as opposed to biological treatment. Whilst biological treatment was initially considered, this type of treatment process could not achieve the water quality requirements which are necessary for the pulp process.

The proposed WWTP will utilise the following wastewater treatment techniques:

- Coarse and fine screens;
- Roughing and polishing dissolved air floatation (DAF);
- Lime soda softening;
- Sand filtration;
- Membrane treatment – reverse osmosis;
- Treated effluent storage and pumping;
- RO reject evaporator; and
- DAF and precipitator sludge collection & dewatering.

The proposed water treatment process will employ proven techniques which are used in the wastewater treatment industry. The arrangement and combination of technologies will achieve a water quality standard which is comparable to the quality of water which is extracted from the River Blackwater as feed water for the process.

The availability of a CHP plant ensures that evaporation techniques are viable.

2.6 Specific requirements of the Industrial Emissions Directive (2010/75/EU)

This section presents information on how the CHP Plant will comply with the Waste Incineration requirements of the Industrial Emissions Directive (IED).

Chapter IV of the IED includes 'Special Provisions for Waste Incineration Plants and Waste Co-incineration Plants'. Review of provisions for waste incineration as presented in the IED has identified that the following requirements could be applicable to the CHP Plant:

- Article 46 – Control of Emissions;
- Article 47 – Breakdown;
- Article 48 – Monitoring of Emissions;
- Article 49 – Compliance with Emission Limit Values;
- Article 50 – Operating Conditions;
- Article 52 – Delivery & Reception of Waste;
- Article 53 – Residues; and
- Article 55 – Reporting & public information on waste incineration plants and waste co-incineration plants.

As the installation will be constructed as a 'new' facility, the requirements of Articles 51 (Authorising to change operating conditions) and 54 (Substantial change) will not apply to the installation. In addition, the requirements of Article 55 (Reporting & public information on waste incineration plants and waste co-incineration plants) will apply to the competent authority (the Environment Agency), not the installation.

The following table identifies the relevant Articles of the IED and explains how the CHP plant will comply with them. Many of the articles in the IED impose requirements on regulatory bodies, in terms of the permit conditions which must be set, rather than on the operator. The table below only covers those requirements which the IED imposes on operators and either explains how this is achieved or refers to a section of the application where an explanation can be found.

Table 2.11 Summary Table for IED Compliance		
Article	**Requirement**	**How met or reference**
22(2)	Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013. The baseline report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for under paragraph 3. The baseline report shall contain at least the following information: (a) information on the present use and, where available, on past uses of the site; (b) where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned. Where information produced pursuant to other national or Union law fulfils the requirements of this paragraph that information may be included in, or attached to, the submitted baseline report.	Refer to Annex 2 – Site Condition Report
44	An application for a permit for a waste incineration plant or waste co-incineration plant shall include a description of the measures which are envisaged to guarantee that the following requirements are met: (a) the plant is designed, equipped and will be maintained and operated in such a manner that the requirements of this Chapter are met taking into account the categories of waste to be incinerated or co-incinerated;	Refer to Section 2.2.1.4 of the Supporting Information
	(b) the heat generated during the incineration and co-incineration process is recovered as far as practicable through the generation of heat, steam or power;	Refer to section 2.7.3.1of the Supporting Information.
	(c) the residues will be minimised in their amount and harmfulness and recycled where appropriate;	Refer to Section 2.8 of the Supporting Information

Table 2.11 Summary Table for IED Compliance		
Article	**Requirement**	**How met or reference**
	(d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Union law.	Refer to Section 2.8 of the Supporting Information
46 (1)	Waste gases from waste incineration plants and waste co-incineration plants shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Refer to Annex 5 Dispersion Modelling Assessment
46 (2)	Emissions into air from waste incineration plants and waste co-incineration plants shall not exceed the emission limit values set out in parts 3 and 4 of Annex VI or determined in accordance with Part 4 of that Annex.	Refer to Section 2.3.1 of the Supporting Information
46 (5)	Waste incineration plant sites and waste co-incineration plant sites, including associated storage areas for waste, shall be designed and operated in such a way as to prevent the unauthorised and accidental release of any polluting substances into soil, surface water and groundwater. Storage capacity shall be provided for contaminated rainwater run-off from the waste incineration plant site or waste co-incineration plant site or for contaminated water arising from spillage or fire-fighting operations. The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.	Refer to Section 2.3.6.
46 (6)	Without prejudice to Article 50(4)(c), the waste incineration plant or waste co-incineration plant or individual furnaces being part of a waste incineration plant or waste co-incineration plant shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded. The cumulative duration of operation in such conditions over 1 year shall not exceed 60 hours. The time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device.	Refer to Annex 5 – Abnormal Emissions Assessment
47	In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.	Refer to Section 2.2.2.1 of the Supporting Information

Table 2.11 Summary Table for IED Compliance		
Article	**Requirement**	**How met or reference**
48 (2)	The installation and functioning of the automated measuring systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	Refer to Section 2.2.2.1of the Supporting Information
48 (4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Refer to Section 2.4.1.1 of the Supporting Information
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	There will be no emissions from flue gas treatment systems to water/sewer from the CHP Plant. Refer to Section 2.3 of the Supporting Information.
50 (1)	Waste incineration plants shall be operated in such a way as to achieve a level of incineration such that the total organic carbon content of slag and bottom ashes is less than 3% or their loss on ignition is less than 5% of the dry weight of the material. If necessary, waste pre-treatment techniques shall be used.	TOC/LOI. Refer to Section 2.4.1.5 of the Supporting Information
50 (2)	Waste incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the incineration of waste is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850°C for at least two seconds.	Refer to Section 2.2.2.1 of the Supporting Information
50 (3)	Each combustion chamber of a waste incineration plant shall be equipped with at least one auxiliary burner. This burner shall be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below the temperatures set out in paragraph 2. It shall also be used during plant start-up and shut-down operations in order to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber. The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (OJ L 121, 11.5.1999, p. 13.), liquefied gas or natural gas.	Refer to Section 2.2.2.1 and 2.1.3.3 of the Supporting Information.

Table 2.11 Summary Table for IED Compliance		
Article	**Requirement**	**How met or reference**
50 (4)	Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations: (a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) has been reached;	Refer to Section 2.4.1.1 of the Supporting Information
	(b) whenever the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) is not maintained;	Refer to Section 2.4.1.1 of the Supporting Information
	(c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices.	Refer to Section 2.4.1.1 of the Supporting Information
50 (5)	Any heat generated by waste incineration plants or waste co-incineration plants shall be recovered as far as practicable.	Refer to section 2.7 of the Supporting Information.
50 (6)	Infectious clinical waste shall be placed straight in the furnace, without first being mixed with other categories of waste and without direct handling.	This requirement will not apply as the CHP Plant will not receive infectious clinical waste.
52 (1)	The operator of the waste incineration plant or waste co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable the pollution of air, soil, surface water and groundwater as well as other negative effects on the environment, odours and noise, and direct risks to human health	Refer to Section 2.3 of the Supporting Information
52 (2)	The operator shall determine the mass of each type of waste, if possible according to the European Waste List established by Decision 2000/532/EC, prior to accepting the waste at the waste incineration plant or waste co-incineration plant.	Refer to Section 2.2 and 2.2.1.6 of the Supporting Information.
53 (1)	Residues shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside.	Refer to Section 2.8 of the Supporting Information
53 (2)	Transport and intermediate storage of dry residues in the form of dust shall take place in such a way as to prevent dispersal of those residues in the environment.	Refer to Annex 4 – Environmental Risk Assessment

Table 2.11 Summary Table for IED Compliance		
Article	**Requirement**	**How met or reference**
53 (3)	Prior to determining the routes for the disposal or recycling of the residues, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the residues. Those tests shall concern the total soluble fraction and heavy metals soluble fraction.	Refer to Section 2.8 of the Supporting Information.

2.7 Energy Efficiency

2.7.1 General

The CHP plant will utilise a steam boiler which will generate steam which will be used to supply steam to the Pulp Plant and a steam turbine generator to generate electricity.

The bio-gas produced in the anaerobic digestion process will be burnt in two gas engines to generate electricity. The exhaust gases will be used to raise steam to heat the digestion process.

The Installation will supply electricity to the local electricity grid via a power transformer which increases the voltage to the appropriate level.

In case of failure of the electricity supply, an emergency diesel generator will be provided to safely shut down the CHP plant and to provide an emergency supply to the rest of the installation.

In considering the energy efficiency of the Installation, due account has been taken of the requirements of the Environment Agency's Horizontal Guidance Note H2 on Energy Efficiency.

2.7.2 Basic Energy Requirements

An indicative Sankey diagram for the CHP plant is presented below.

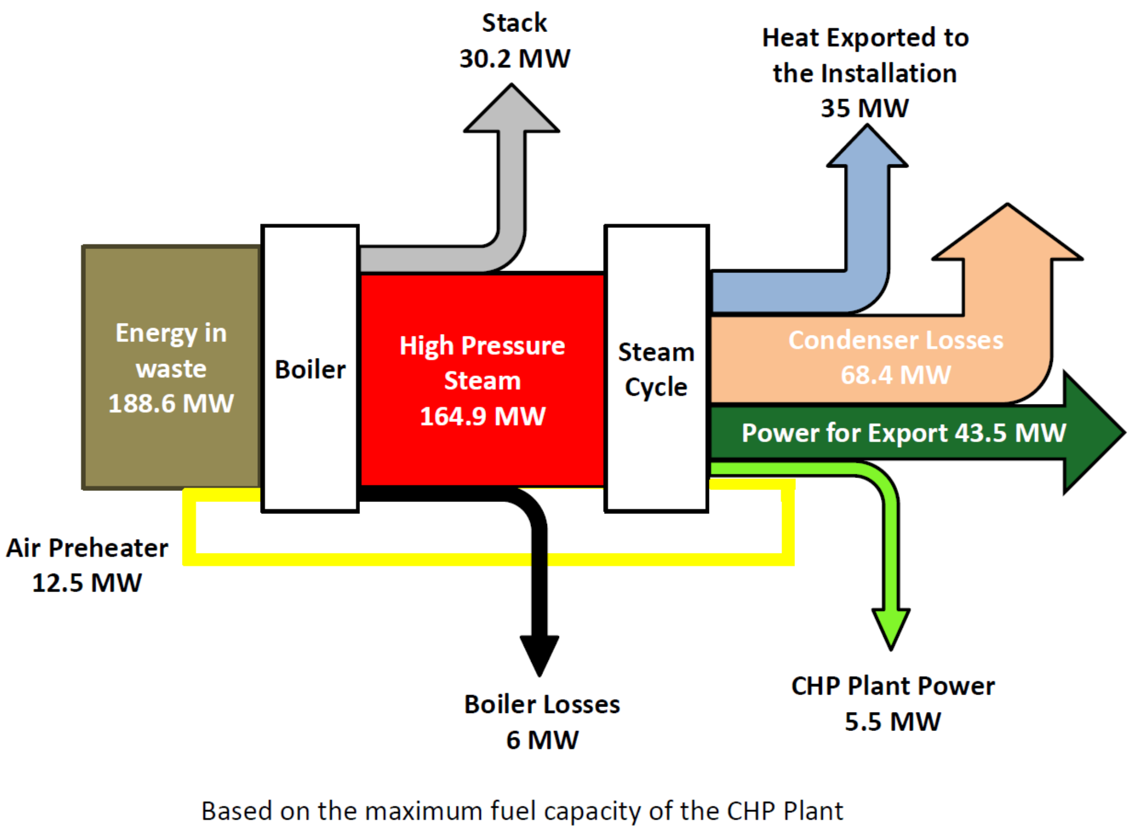


Figure 2 – CHP Indicative Sankey Diagram (assumed maximum heat and power export)

The CHP plant will be capable of generating up to 49 MWe of electricity and up to 35 MWth of heat. The maximum heat load will be during winter periods. The grate and boiler have been designed so that an output of approximately 49 MWe (depending on external ambient temperatures which affect turbine performance) should still be achieved across all heat loads.

In addition to the energy recovered within the CHP Plant the AD plant will combust biogas which is produced from the anaerobic digestion of organic waste within engines. The AD plant will be capable of generating up to 1MWe.

The assumed parasitic load for the other waste treatment processes is as follows:

- MTB- 1.5MWe;
- MRF – 0.5MWe;
- Pulp Plant – 10 MWe;
- Wastewater treatment plant – 4 MWe; and
- Site services and weigh bridge - 0.1 MWe.

The precise electrical parasitic load will be determined when detailed design has been completed and a breakdown will be supplied to the EA at that time. However, the most significant electrical consumers are anticipated to be the following:

- Conveyors;
- Combustion Air Fans;
- Induced Draft Fans;
- Boiler feedwater and cooling water pumps;
- Air compressors;
- Waste loading systems, reagents injection, ash and residue conveying systems;
- Bottom ash conveying systems;
- Pulpers;

- Screens;
- Flotation systems;
- Centrifuges;
- Trommels;
- Sludge drier; and
- Ancillary rooms.

The installation will be designed with careful attention being paid to all normal energy efficiency design features, such as high efficiency motors, high standards of cladding and insulation etc.

The CHP plant will be designed to achieve a high thermal efficiency. In particular:

- The boilers will be equipped with economisers and super-heaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste that is being burnt;
- Unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemicals and the heat contained within the steam and water;
- MP and LP steam from pass outs on the turbine will be used to the preheat combustion air;
- Steady operation will be maintained where necessary by using auxiliary fuel firing; and
- Boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat recovery.

The anaerobic digestion / bio-gas combustion plant will be designed to achieve a high thermal efficiency. In particular:

- The temperature of the digester will be maintained by recovering heat from the exhaust gases of the gas engines using a steam boiler;
- The digester will be insulated to minimise heat losses;
- Constant gas feed to the engines by the use of buffer storage and by controlling the digester feed rate will ensure optimal performance of the gas engines; and
- The gas engines generate electricity at a high efficiency compared to a steam cycle system and operating conditions will be optimised to achieve as high efficiency as possible while minimising NOx emissions.

Due consideration will be given to the recommendations given in the relevant Sector Guidance Notes.

2.7.3 Energy Efficiency Benchmarks

2.7.3.1 CHP Plant Benchmarks

The CHP Plant will generate up to 49 MWe from 595,000 tonnes per annum of waste following pre-treatment – assuming electricity only operation. As stated within the Environment Agency Guidance Note – The Incineration of Waste (EPR5.01), the benchmark for the generation of electricity from municipal waste incineration is 5-9 MW per 100,000 tonnes. Applying the criteria stated within the EA guidance, the CHP plant will generate approximately 8.23 MW per 100,000 tonnes of waste. It is therefore regarded that the CHP plant meets the EA benchmarks for recovery of electricity.

In addition, if it is assumed that the CHP plant will be available for up to 8,150 hours per annum, thus allowing for periods of start-up or shutdown, then the CHP plant will generate approximately 400,000 MWh. Thus the CHP plant will generate approximately 0.671 MWh/tonne of waste. This is higher than the benchmark range of 0.415 - 0.644 MWh/tonne of waste for electricity production per tonne of MSW, as presented in the BREF.

The CHP plant will have a parasitic load of 5.5 MW. If it is assumed that the CHP plant will be available for 8,000 hours per annum, then the CHP plant will consume 44,000 MWh.

Therefore the specific energy consumption of the CHP plant is 73.9 kWh/te. The benchmark comparison stated in the Waste Incineration BREF is 150 kWh/te. Therefore the CHP plant will compare favourably with the benchmark stated in the BREF.

2.7.3.2 AD Plant Benchmarks

The AD facility will generate up to 1MWe from the processing of 30,000 tonnes of organic wastes. The parasitic load of the AD facility will be 0.2 MWe. Assuming the AD facility operates for 8,352 hours per annum the AD Plant will generate approximately 8,352 MWh of power. The AD facility will have a parasitic load of approximately 1,670 MWh per annum. This equates to a parasitic load of 56 kWh/te. The benchmark comparison stated in the Waste Industries BREF is 50 – 55 kWh/te of MSW.

When comparing the specific energy consumption of the AD/CHP Plant with the benchmark energy consumption, it must be noted that it is not stated whether the benchmark energy consumption includes any pre-treatment or post-treatment of the waste. The calculations for the installations AD plant has included waste reception and preparation, the AD process and post-treatment activities (including dewatering).

The proposed system will require all organic materials to be prepared for biological treatment in the anaerobic digestion by pulping. This is an energy intensive processes, but creates a consistently feedstock to anaerobic digesters to aid in the generation of biogas. Following treatment in the AD plant, the digestate will be dewatered prior to transfer off-site for land spreading.

As stated in the Waste Industries BREF:

> "Estimates concerning the utilisation of electricity by the plant vary a great deal. In rural AD plants, approximately 20 % of the electricity produced in the process is required for the plant operation, while urban plants may utilise 2/3 of the electricity produced."

As stated previously the AD facility will generate 8,352 MWh of power with a parasitic load of approximately 1,670 MWh per annum. This implies that approximately 20% of the power produced in the process is consumed as parasitic load. The feedstock for the AD facility will process organic waste sourced from municipal and C&I sources. This type of feedstock is believed to be more representative of an urban AD plant. On this basis, the AD plant at the installation is therefore regarded as being significantly more efficient than the urban plants referred to within the BREF.

2.7.4 Operating and Maintenance (O&M) Procedures

The O&M procedures will include the following aspects:

- Good maintenance and housekeeping techniques and regimes across the whole plant;

- Plant Condition Monitoring carried out on a regular basis, to ensure, amongst other things, that motors are operating efficiently, insulation and cladding are not damaged and that there are no significant leaks; and
- Operators trained in energy awareness and encouraged to identify opportunities for energy efficiency improvements.

2.7.4.1 Energy Efficiency Measures

An energy efficiency plan will be built into the O&M procedures of the installation ensuring maximum, practical, sustainable, safe and controllable electricity generation. This plan will be reviewed regularly as a requirement of the ISO 14001 management systems for the installation.

During normal operation, procedures will be reviewed and amended, where necessary, to include improvements in efficiency as and when proven new equipment and operating techniques become available. These will be assessed on the implementation cost compared with the anticipated benefits

2.7.5 Further Energy Efficiency Requirements

The plant will not be subject to a Climate Change Levy agreement.

2.7.5.1 MRF and MBT plant

The mechanical treatment plant will be supplied with electricity directly from the CHP plant and therefore meets the BAT recommendation for energy supply techniques. This part of the facility is a net energy user, but in refining the input streams it ensures more efficient energy generation in the CHP Plant as well as recovering valuable recyclable materials from the incoming waste.

2.7.5.2 AD plant

The temperature of the digester will be maintained by recovering heat from the gas engine exhaust.

The biogas combustion plant generates energy derived from organic municipal and C&I waste and therefore meets the BAT requirements of the sector guidance note for energy supply techniques. The gas engines will be operated with an exhaust temperature of approximately 450°C to maximise efficiency while minimising emissions of nitrogen dioxide.

Energy will be recovered from the exhaust gases by generating steam for heating of the anaerobic digester. This will improve the energy efficiency of the anaerobic digestion and energy generation process.

2.7.5.3 CHP Plant

In accordance with the Waste Incineration requirements of the Industrial Emissions Directive, heat should be recovered as far as practicable. In order to demonstrate this, the following points should be noted:

(1) The CHP plant will normally export 20 – 40 MWth as steam and hot water (see 1.3.4.4) as steam and hot water. As the CHP plant has been designed and will normally operate in CHP mode, i.e. exporting both electricity and heat, it is considered to represent BAT for energy efficiency, and a CHP-R application is not required.

(2) The boiler will operate with superheated steam at a pressure of around 75 bar and a temperature of 440°C. Compared to other EfW plants in the UK, these are at the top end of steam conditions and have been selected to maximise the thermal and electrical efficiency of the facility.

(3) The flue gas treatment system will use dry injection of sodium bicarbonate with a flue gas exit temperature of 180°C.

2.7.5.4 Pulp Plant

The heat and steam used in the Pulp plant will have been generated by the adjacent CHP plant, which will generate heat and power from waste.

The Pulp plant will operate an energy management system which assess the plants overall energy consumption; locates, quantifies and optimises the potential for energy recover; and monitors and safeguards the optimised situation for energy consumption.

In accordance with the requirements of the BREF, the following measures will be implemented at the Pulp plant:

(1) All steam and condensate pipes will be insulated.

(2) Energy efficient vacuum systems will be employed for dewatering.

(3) High efficiency pumps, motors and agitators will be installed.

(4) Fans, compressors and pumps agitators.

(5) Plant will be designed to match steam levels with the actual pressure needs.

2.8 Waste Recovery and Disposal

The main residue streams arising from each of the treatment processes will be as follows:

(1) Bottom ash from the EfW combustion process (Residue Type RT1);

(2) APC residue and fine ash particles from the EfW process (Residue Type RT2);

(3) Recyclable materials from MRF and MBT plant (Residue Type RT3);

(4) Digestate from the anaerobic digestion plant (Residue Type RT4);

(5) Organic and inorganic material from the Pulp Plant (Residue Type RT5); and

(6) Rejects from the MRF (Residue Type RT6).

2.8.1 Introduction

As described below, the waste recovery and disposal techniques will be in accordance with the indicative BAT requirements. The wastes generated from the operation of the installation are summarised in Table 2.12.

Prior to the transfer of residues to any residues off-site, where appropriate, the residues will be tested in accordance with the requirements of the EA's Technical Guidance 'WM2: Hazardous Waste: Interpretation of the definition and classification of hazardous waste'.

Any materials which are to be transferred to landfill from the installation will be Waste Acceptance Criteria (WAC) tested - leachability tested - to ensure that they meet the WAC for the landfill that they are to be transferred to.

2.8.2 Bottom Ash

As can be seen in the process flow diagram in Annex 1, boiler ash will be mixed with bottom ash. The mixture of boiler ash and bottom ash is normally a non-hazardous waste which can be recycled. If the boiler ash were to be mixed with the APC residues, the mixture would be defined as hazardous waste and this would restrict the ability of the operator to recycle the boiler ash.

Bottom ash has been used for at least 20 years in Europe as a substitute for valuable primary aggregate materials in the construction of roads and embankments. Gent Fairhead intends to transfer bottom ash from the CHP plant to an off-site bottom ash reprocessing facility. If a suitable recovery facility will not accept the residue, it may be transferred for disposal in an off-site non-hazardous landfill.

2.8.3 Air Pollution Control Residues

APC residues are predominantly composed of calcium as hydroxide, carbonate, sulphate and chloride/hydroxide complexes. Typical major element concentration ranges for the UK residues are as follows:

- 30-36% w/w calcium;
- 12-15% w/w chlorine;
- 8-10% w/w carbonate (as C); and
- 3-4% w/w sulphate (as S).

Silicon, aluminium, iron, magnesium and fluorine are also present in addition to traces of dioxins and the following heavy metals: zinc, lead, manganese, copper, chromium, cadmium, mercury, and arsenic.

It may be possible to send the residue to an effluent treatment contractor, to be used to neutralise acids and similar materials or to be used in the production of concrete building products. Using the residues in this way avoids the use of primary materials. If this option is not practicable then it will be sent to a secure landfill for treatment and disposal as a hazardous waste.

APC Residues will be removed from site in enclosed tankers thereby minimising the chance of spillage and dust emissions. During the tanker filling operation, displaced air will vent back to the silo and any releases to atmosphere would pass through a fabric filter.

2.8.4 Digestate

The sludge residue from anaerobic digestion will be dried in the dewatering press where solids are dewatered.

The digestate cake will be transferred offsite to be spread to agricultural land as a soil enhancer.

2.8.5 Recyclables from MRF and MBT plant

Ferrous and non-ferrous metals, plastics, paper and card will be baled and exported from the facility as segregated streams for offsite recycling.

2.8.6 Sludge from the Pulp Plant

A mixture of organic and inorganic material which will be transferred off-site to be used as a soil conditioner.

2.8.7 Inert Rejects from the MRF

Waste materials which cannot be recycled will be transferred off-site for disposal.

Table 2.12 Key Residue Streams from the IWMF					
Source/ Material	**Properties of Residue**	**Storage location/ volume stored**	**Future annual quantity of residue produced (estimate)**	**Disposal Route and Transport Method**	**Frequency**
Bottom Ash	Grate ash. This ash is relatively inert, classified as non-hazardous.	Bottom ash storage bunker	145,000 tonnes	Sent to an ash recycling facility for recovery as a secondary aggregate.	Daily
Plastics	Separated plastics from incoming waste	Adjacent to the baler	30,000 tonnes	The plastics are transferred to a licensed recycling facility. Transport occurs by road vehicles.	Daily
Paper/Card	Separated paper/card from incoming waste which has been recovered within the MRF	Adjacent to the baler	15,000 tonnes	The paper/card are transferred to a licensed recycling facility. Transport occurs by road vehicles.	Daily
Wood	Separated wood from incoming waste which have been baled	Adjacent to the baler	4,000 tonnes	The wood is transferred to a licensed recycling facility. Transport occurs by road vehicles.	Daily
Metals	Separated metal from incoming waste which have been baled	Adjacent to the baler	14,000 tonnes	The metals are transferred to a licensed recycling facility. Transport occurs by road vehicles.	Daily

Fly Ash / APCR	Ash from boiler and dry flue gas treatment, may contain some unreacted sodium bicarbonate	APCR silo's	16,000 tonnes	Recycled or disposed of in a licensed site for hazardous waste. Transport occurs by road vehicle.	Daily
Sludge from the Pulp Plant	Mixture of organic and inorganic material with a moisture content of between 10% and 45%	Sludge Bunker	41,400 tonnes	Transferred off-site to be spread on land as a soil conditioner.	Daily
Digestate	Dewatered digestate from the anaerobic digestion plant	Digestate storage area within the AD plant		Transferred off-site to be spread on land as a soil conditioner.	Daily
Inert rejects from the MRF	Materials from the IWMF which cannot be recycled.	MRF	1,500	Transferred off-site for disposal	Weekly

2.9 Management

As defined in the Regulation 7 of the Environmental Permitting Regulations, the operator is 'the person who has control over the operation of a regulated facility'.

Gent Fairhead expect that the day-to-day operation of the different waste treatment processes will be subcontracted to third party organisations through operation and maintenance (O&M) contracts. Gent Fairhead will ensure that under the O&M contract Gent Fairhead retain control of the Installation and it is operated to the exact instruction of Gent Fairhead.

Gent Fairhead will require the O&M contractors to implement environmental management systems in accordance with BS EN ISO 14001:2004 Environmental Management System Standard and with the operating and maintenance instructions of the designer of the plant.

2.9.1 Management Systems

The O&M contractor will develop an EMS that clearly defines the Installation management structure as well as setting out roles and responsibilities of all staff. The development of the EMS will also include:

(1) an Environmental Policy;

(2) Health and Safety procedures; and

(3) an operational guidance manual which will include process plant operating procedures for both standard and emergency conditions.

The O&M contractors will also work to the Construction (Design and Management) Regulations during the construction and commissioning period. In addition, management will undertake inspections and reviews for quality control, performance measurements, and staff appraisals.

Gent Fairhead will undertake periodic review and audits of the different O&M contractor's performance.

2.10 Scope and Structure

The O&M contractor's environmental management systems will be required to cover the following key areas. These are:

(1) the operation of the Installation; and

(2) the handling and transfer of residues generated by the Installation.

Where applicable, documented procedures will detail specifically how each activity is to be controlled. These will be contained in an Environmental Procedures Manual and identified related documents.

The O&M contractor will be required to developed contain procedures for accident management that comply with the requirements set out in Agency guidance "How to comply with your Environmental Permit" EPR1.00. This will be in the form of an accident management plan that will be developed before the Installation is commissioned.

2.10.1.1 General Requirements

The O&M contract will require the O&M contractor to maintain their EMS in accordance with the ISO:14001 standard. The EMS objectives and scope will ensure that the O&M contractor's EMS meets these requirements by:

(1) identifying potential environmental impacts;

(2) documenting and implementing standard procedures to mitigate and control these impacts;

(3) determining a procedural hierarchy that considers the interaction of the relevant processes;

(4) ensuring adequate responsibility, authority and resources to management necessary to support the EMS;

(5) establishing performance indicators to measure the effectiveness of the procedures;

(6) monitoring, measuring and analysing the procedures for effectiveness; and

(7) implementing actions as required based on the results of auditing to ensure continual improvements of the processes.

2.10.1.2 Personnel

Operation and maintenance of the plant will be undertaken by the O&M contractor's staff. Sufficient numbers of staff, in various grades, will be required to manage, operate and maintain the plant on a continuous basis, seven days per week throughout the year. The plant will be managed, operated and maintained by experienced managers, boiler operators and maintenance staff.

The key environmental management responsibilities will be allocated as described below.

(1) The General Manager will be employed by Gent Fairhead and will have overall responsibility for management of the Installation and compliance with the operating permit. The general manager will have extensive experience relevant to his responsibilities.

(2) The Operations Managers will be employed by each O&M Contractor and will have day-to-day responsibility for the operation of the plant, to ensure that the plant is operated in accordance with the permit and that the environmental impact of the plant's operations is minimised. In this context, he or she will be responsible for designing and implementing operating procedures which incorporate environmental aspects.

(3) The Maintenance Manager will be employed by each of the O&M Contractor and will be responsible for the management of maintenance activities, for maintenance planning and for ensuring that the plant continues to operate in accordance with its design.

2.10.2 Competence, Training and Awareness

Gent Fairhead aims to ensure that any persons performing tasks for it, or on its behalf, which have the potential to cause significant environmental impact are competent on the basis of appropriate education and training or experience.

Gent Fairhead will require the O&M contractor's EMS to contain a training procedure to make employees aware of:

(1) the importance of conformity with the environment policies and procedures and with the requirements of the EMS;

(2) potentially significant environmental aspects associated with their work;

(3) their roles and responsibilities in achieving conformity with the requirements of the EMS, including emergency preparedness and response requirements;

(4) the relevance and importance of their activities and how they contribute to the achievement of the environmental and quality objectives; and

(5) the potential consequences of the departure from specified procedures.

The O&M contractor will comply with industry standards or codes of practice for training (e.g. WAMITAB), where they exist. Gent Fairhead will require the O&M contractors EMS to contain an archiving procedure to ensure all training is recorded and all associated records are retained.

2.10.2.1 Competence

The O&M contractor will identify the minimum competencies required for each role. These will then be applied to the recruitment process to ensure that key role responsibilities are satisfied. The O&M contractor will be required to pay particular attention will be paid to potential candidate's experience, qualifications, knowledge and skills.

2.10.2.2 Induction and Awareness

Staff induction programmes are location and job role specific and will include, as a minimum, the induction of:

(1) the Environmental Policy;

(2) the requirements of the Environmental Permit;

(3) the Health and Safety Policy and Procedures; and

(4) the EMS Awareness Training.

2.10.2.3 Training

The O&M contractor will be required to train staff during commissioning of the Installation and before the plant is operational. The O&M contractor's Line Managers will be required to identify and monitor staff training needs as part of the appraisal system.

The O&M contractor's training records will be required to maintained onsite. The O&M contractor will be required to comply with industry standards or codes of practice for training (e.g. WAMITAB), where they exist.

2.11 Closure

The planning permission for the Installation has no finite date for the end of operations or closure. During operations there will be a continuous programme of preventative and life cycle maintenance that will ensure the replacement of key components at appropriate stages. In this way, the plant will continue to operate to the same standards required by the Environmental Permit for many years. When the Installation reaches the end of its operational life, for whatever reason, and is proposed to be closed, it may be adapted for an alternative use, or demolished as part of a redevelopment scheme and the site cleared and left in a fit-for-use condition. These proposals would be subject to a new planning permission.

2.11.1 General

Gent Fairhead & Co Limited recognises the need to ensure that the design, the operation and the maintenance procedures facilitate decommissioning in a safe manner without risk of pollution, contamination or excessive disturbance to noise, dust, odour, ground and water courses.

To achieve this aim a Site closure plan will be prepared at the appropriate time. It is anticipated that the closure plan will include the information listed below.

2.11.2 Site Closure Plan

The following is a summary of the measures to be considered within the site closure plan to ensure the objective of safe and clean decommissioning.

2.11.2.1 General Requirements

(1) Underground tanks and pipework to be avoided except for supply and discharge utilities such as towns water, sewerage lines and gas supply;

(2) Safe removal of all chemical and hazardous materials;

(3) Adequate provision for drainage, vessel cleaning and dismantling of pipework;

(4) Disassembly and containment procedures for insulation, materials handling equipment, material extraction equipment, fabric filters and other filtration equipment without significant leakage, spillage, dust or hazard;

(5) The use of recyclable materials where possible;

(6) Methodology for the removal/decommissioning of components and structures to minimise the exposure of noise, disturbance, dust and odours and for the protection of surface and groundwater; and

(7) Soil sampling and testing of sensitive areas to ensure the minimum disturbance (sensitive areas to be selected with reference to the site condition report).

2.11.2.2 Specific Details

(1) A list of recyclable materials/components and current potential outlet sources;

(2) A list of materials/components not suitable for recycle and potential outlet sources;

(3) A list of materials to go to landfill with current recognised analysis, where appropriate;

(4) A list of all chemicals and hazardous materials, location and current containment methods; and

(5) A Bill of Materials detailing total known quantities of items throughout the installation such as:

   a) Steelwork;
   b) Plastics;
   c) Cables;
   d) Concrete and Civils Materials;
   e) Oils;
   f) Chemicals;
   g) Consumables;
   h) Incoming waste (municipal and commercial wastes);
   i) Processed wastes (digestate, recyclates, RDF);
   j) Contained Water and Effluents; and
   k) Bottom Ash and APC Residues.

2.11.2.3 Disposal Routes

Each of the items listed within the Bill of Materials will have a recognised or special route for disposal identified; e.g. Landfill by a licensed contractor; transfer for disposal by high sided, fully sheeted road vehicle or for sale to a scrap metal dealer; transfer for disposal by skip/fully enclosed container; waste contractor to collect and transfer off-site to a suitably licensed facility.

2.12 Improvement Programme

Gent Fairhead is committed to continual environmental improvement and are therefore suggesting the following improvement conditions be incorporated into the Environmental Permit.

2.12.1 Pre-operational Conditions

Prior to the commencement of operation of the installation, Gent Fairhead will:

- submit a written report to the Environment Agency on the commissioning of the installation. The report will summarise the environmental performance of the plant as installed against the design parameters set out in the Application.
- submit a written report to the Environment Agency describing the performance and optimisation of the NOx abatement system and combustion settings to minimise oxides of nitrogen (NOx) emissions within the emission limit values described in this permit with the minimisation of nitrous oxide emissions. The report will include an assessment of the level of NOx and N2O emissions that can be achieved under optimum operating conditions.
- submit a written summary report to the Agency to confirm by the results of calibration and verification testing that the performance of Continuous Emission Monitors for parameters as specified in Table S3.1 and Table S3.1(a) complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3.
- Submit a 'final' odour management plan for the installation which will reflect the odour management arrangements following detailed design of the installation.

2.12.2 Commissioning

Prior to commissioning of the installation, Gent Fairhead will:

- submit a written report to the EA, on the details of the computational fluid dynamic (CFD) modelling used in the design of the boiler. The report will demonstrate whether the BAT design stage requirements, given in the Incineration of Waste Sector Guidance note EPR 5.01, have been completed. In particular the report will demonstrate whether the residence time and temperature requirements will be met.
- submit to the Environment Agency for approval a protocol for the sampling and testing of bottom ash for the purposes of assessing its hazard status. Sampling and testing shall be carried out in accordance with the protocol as approved.
- provide a written commissioning plan, including timelines for completion, for approval by the Environment Agency. The commissioning plan shall include the expected emissions to the environment during the different stages of commissioning, the expected durations of commissioning activities and the actions to be taken to protect the environment and report to the Environment Agency in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.

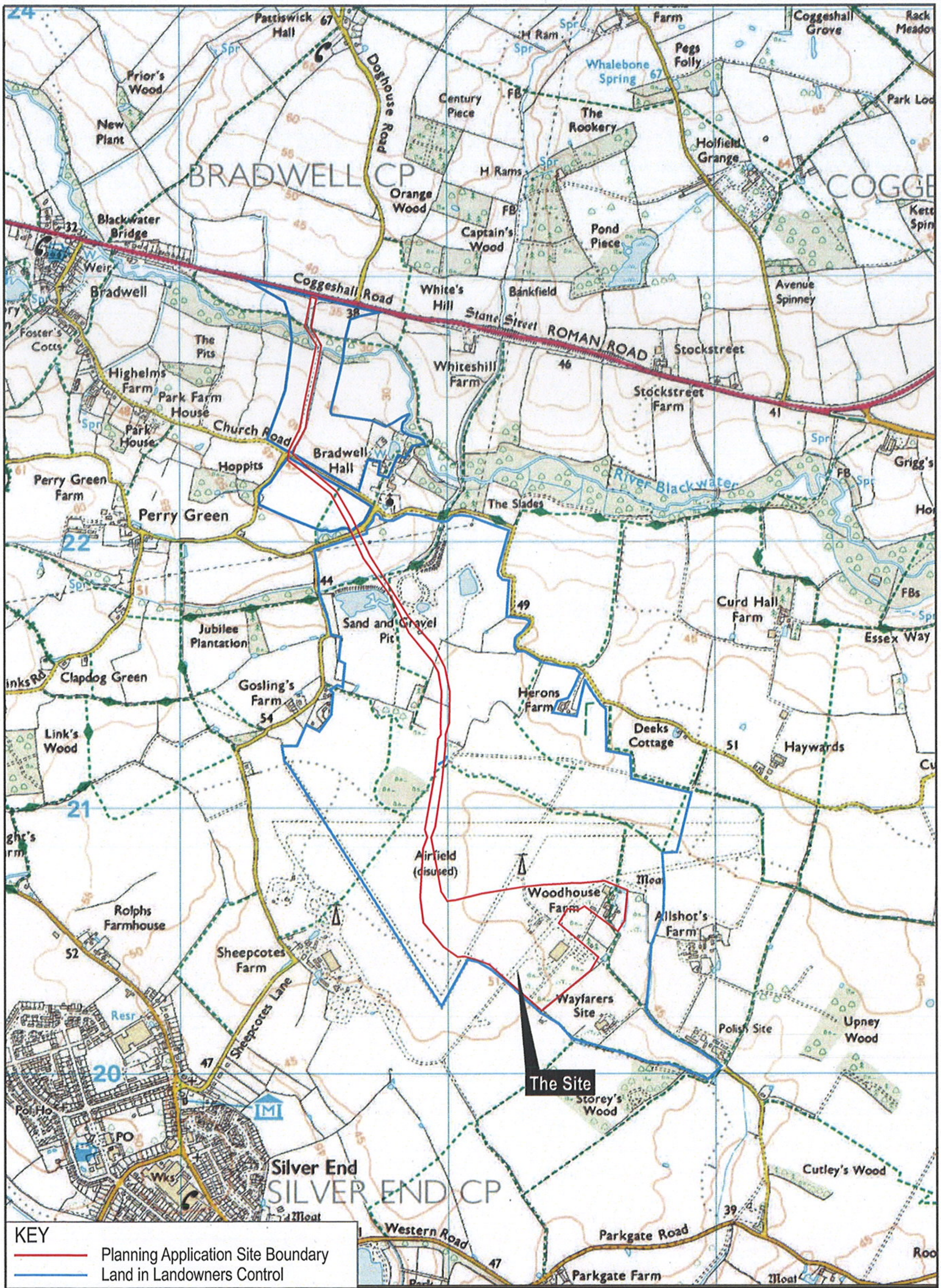
2.12.3 Post Commissioning

Post commissioning of the installation, Gent Fairhead will:

- carry out checks to verify the residence time, minimum temperature and oxygen content of the exhaust gases in the CHP plant furnace whilst operating under the anticipated most unfavourable operating conditions. Results shall be submitted to the EA.

- provide a written proposal to the EA, for carrying out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air, identifying the fractions in the PM10 and PM2.5 ranges from the CHP Plant. The report will detail a timetable for undertaking the tests and producing a report on the results.

Annex 1 – Plans and Drawings



KEY
- Planning Application Site Boundary (red line)
- Land in Landowners Control (blue line)

Golder Associates	Date 12/08/2008 Project No. 07514690074 Created by A.J File No. 561350	Title **Land Ownership & Proposed Site Plan** **Gent Fairhead & Co. Limited, Rivenhall Airfield** **Evolution of the Recycling & Composting Facility**	**Figure** **1-1**

ALL INFORMATION ON THIS DRAWING IS INDICATIVE ONLY, AND MAY BE SUBJECT TO FURTHER DESIGN DEVELOPMENT.

DO NOT SCALE

NOTES:

INSTALLATION BOUNDARY

REV.	DETAILS OF REVISION	DRAWN	CHKD	DATE
R2	PRELIMINARY	DTW	JRS	14.09.15
R1	PRELIMINARY	DTW	JRS	11.09.15

FICHTNER
CONSULTING ENGINEERS LIMITED
Kingsgate, Wellington Road North, Stockport, Cheshire, SK4 1LW, UK
Tel: 0161 476 0032
Website: www.fichtner.co.uk

CLIENT: GENT FAIRHEAD

SITE: RIVENHALL IWMF

PROJECT: EP APPLICATION

TITLE: INSTALLATION BOUNDARY

DRAWING STATUS:	PRELIMINARY		
DRAWN BY:	DTW	DATE: 04.09.15	
CHECKED BY:	JRS	DATE: 04.09.15	
FILENAME:	1552-007-R2.DWG		
OFFICE OF ISSUE:	STOCKPORT		
SHEET SIZE:	A1	SCALE: 1:1000	
DRAWING No.:	1552-007	Sheet 1 of 1	REVISION: R2

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DO NOT SCALE

NOTES:

INSTALLATION BOUNDARY

R2	PRELIMINARY	DTW	JRS	14.09.15
R1	PRELIMINARY	DTW	JRS	11.09.15
REV.	DETAILS OF REVISION	DRAWN	CHKD	DATE

FICHTNER
CONSULTING ENGINEERS LIMITED
Kingsgate, Wellington Road North,
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CLIENT: GENT FAIRHEAD

SITE: RIVENHALL IWMF

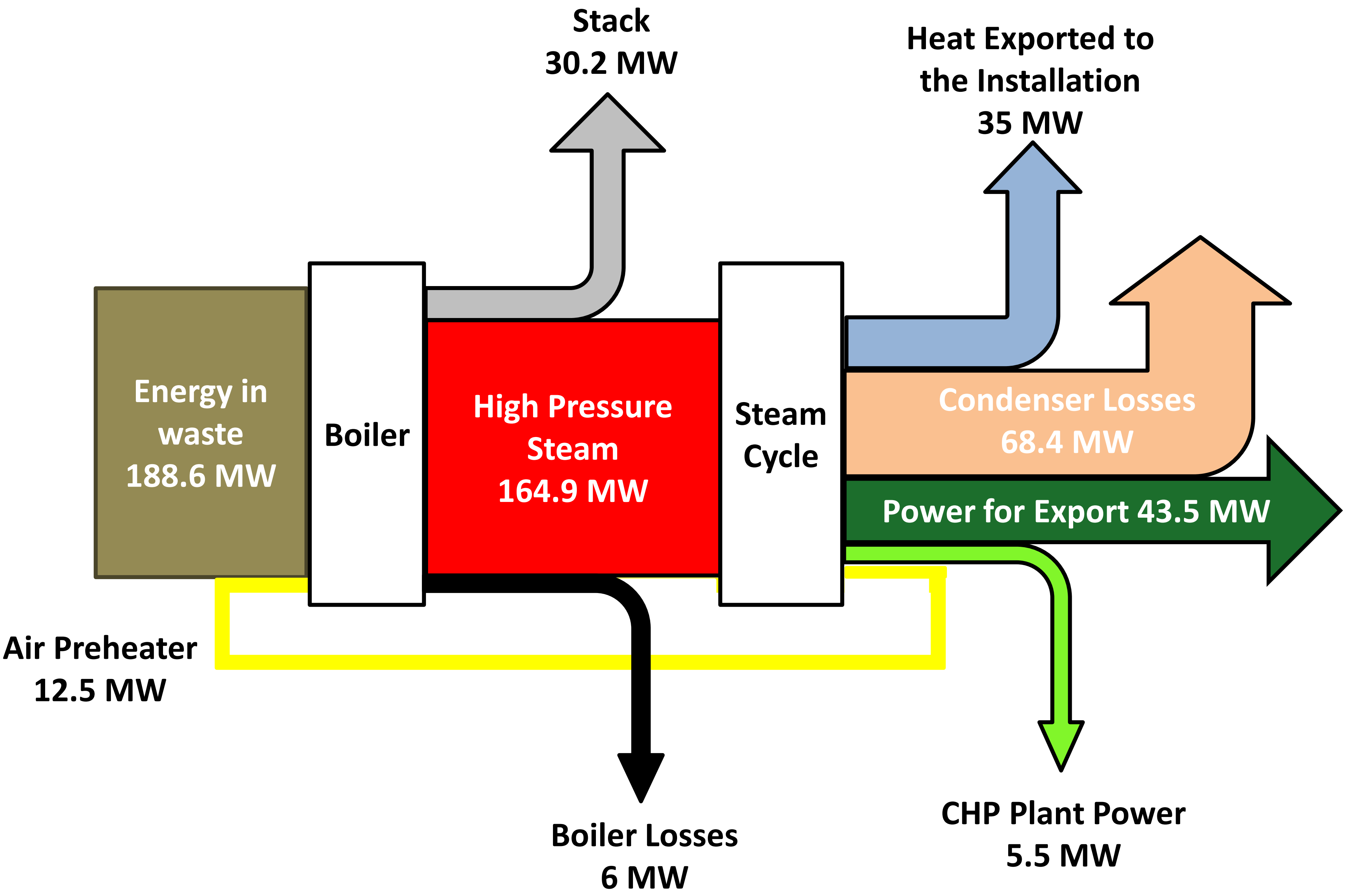
PROJECT: EP APPLICATION

TITLE: EMISSION POINTS

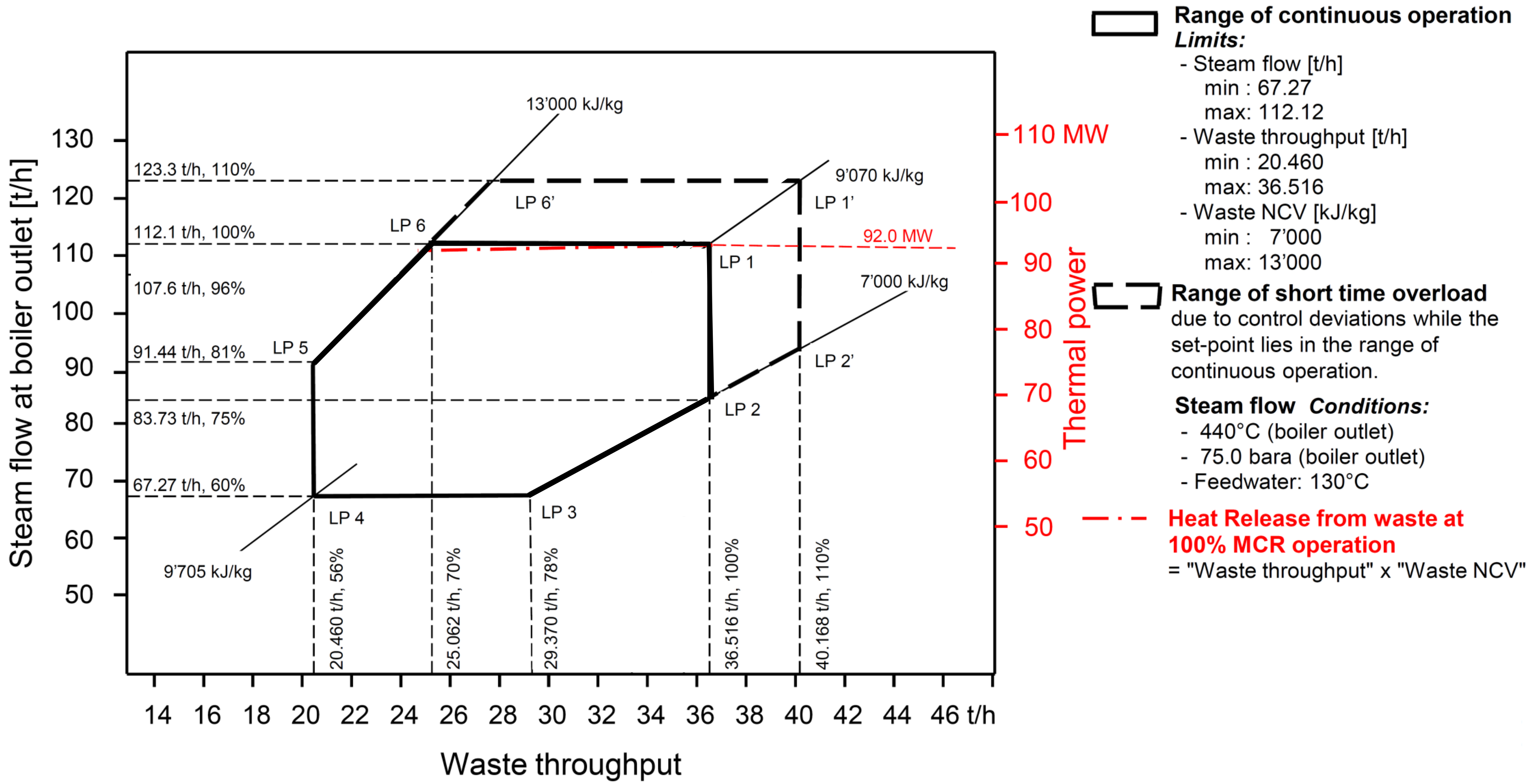
DRAWING STATUS:	PRELIMINARY	
DRAWN BY:	DTW	DATE: 04.09.15
CHECKED BY:	JRS	DATE: 04.09.15
FILENAME:	1552-008-R2.DWG	
OFFICE OF ISSUE:	STOCKPORT	
SHEET SIZE:	A1	SCALE: 1:1000

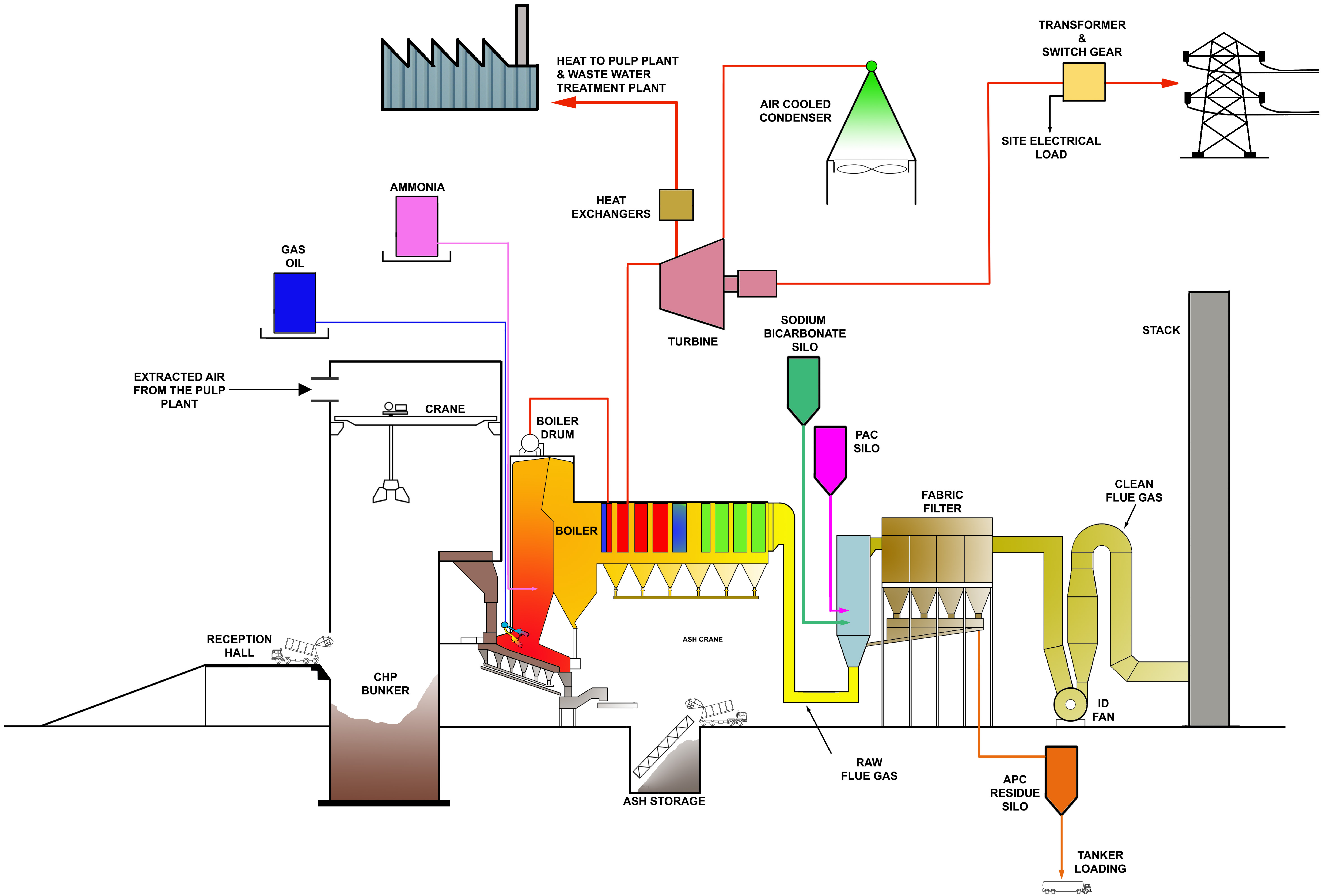
DRAWING No.: 1552-008 Sheet 1 Of 1

REVISION: R2

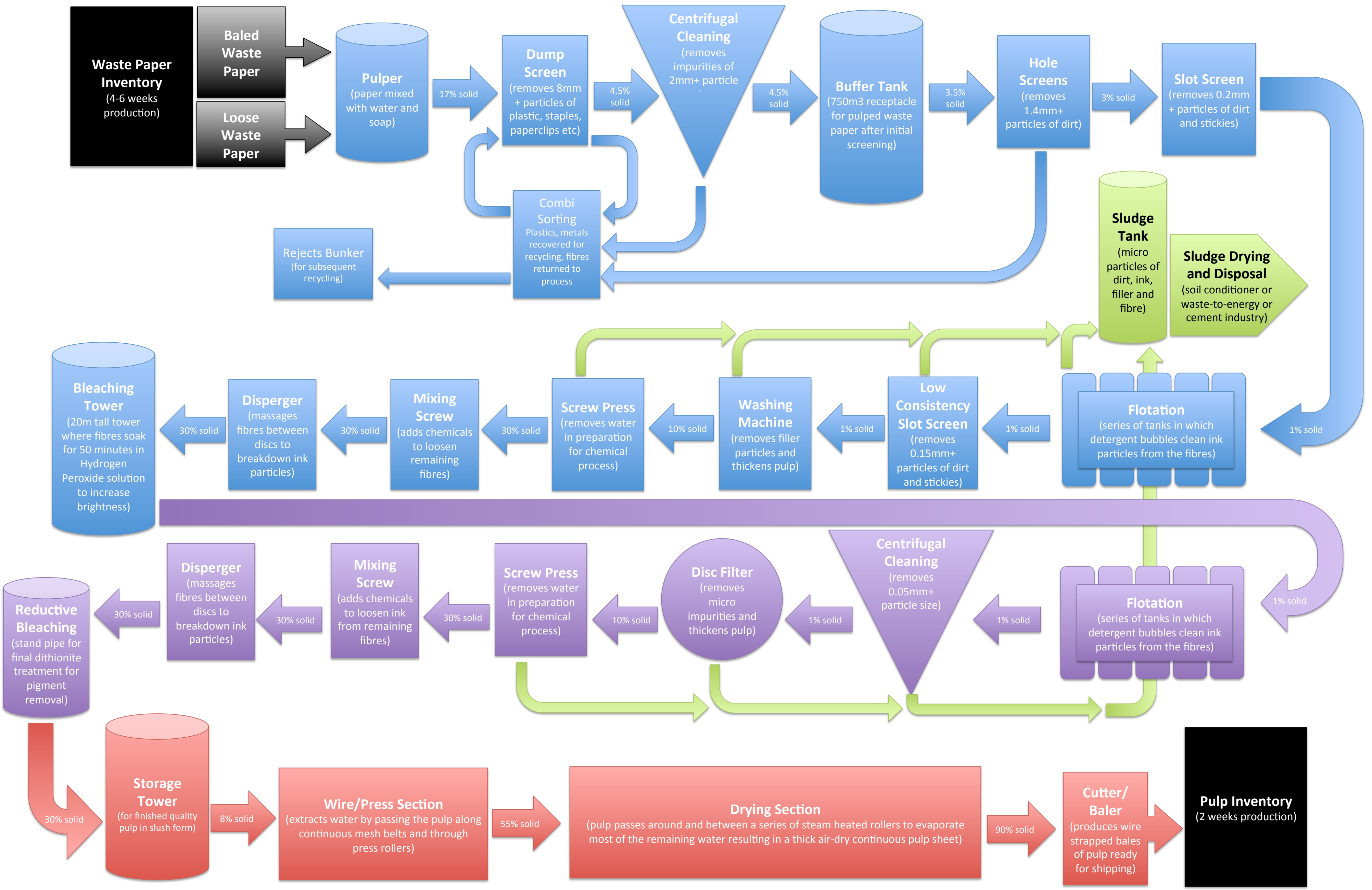


Based on the maximum fuel capacity of the CHP Plant


Range of continuous operation
Limits:
- Steam flow [t/h]
min : 67.27
max: 112.12
- Waste throughput [t/h]
min : 20.460
max: 36.516
- Waste NCV [kJ/kg]
min : 7'000
max: 13'000
Range of short time overload
due to control deviations while the set-point lies in the range of continuous operation.
Steam flow Conditions:
- 440°C (boiler outlet)
- 75.0 bara (boiler outlet)
- Feedwater: 130°C
Heat Release from waste at 100% MCR operation
= "Waste throughput" x "Waste NCV"
Steam flow at boiler outlet [t/h]
Waste throughput
Thermal power
110 MW
92.0 MW
13'000 kJ/kg
9'070 kJ/kg
7'000 kJ/kg
9'705 kJ/kg
123.3 t/h, 110%
112.1 t/h, 100%
107.6 t/h, 96%
91.44 t/h, 81%
83.73 t/h, 75%
67.27 t/h, 60%
LP 1
LP 1'
LP 2
LP 2'
LP 3
LP 4
LP 5
LP 6
LP 6'
20.460 t/h, 56%
25.062 t/h, 70%
29.370 t/h, 78%
36.516 t/h, 100%
40.168 t/h, 110%
14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 t/h
50 60 70 80 90 100 110 120 130

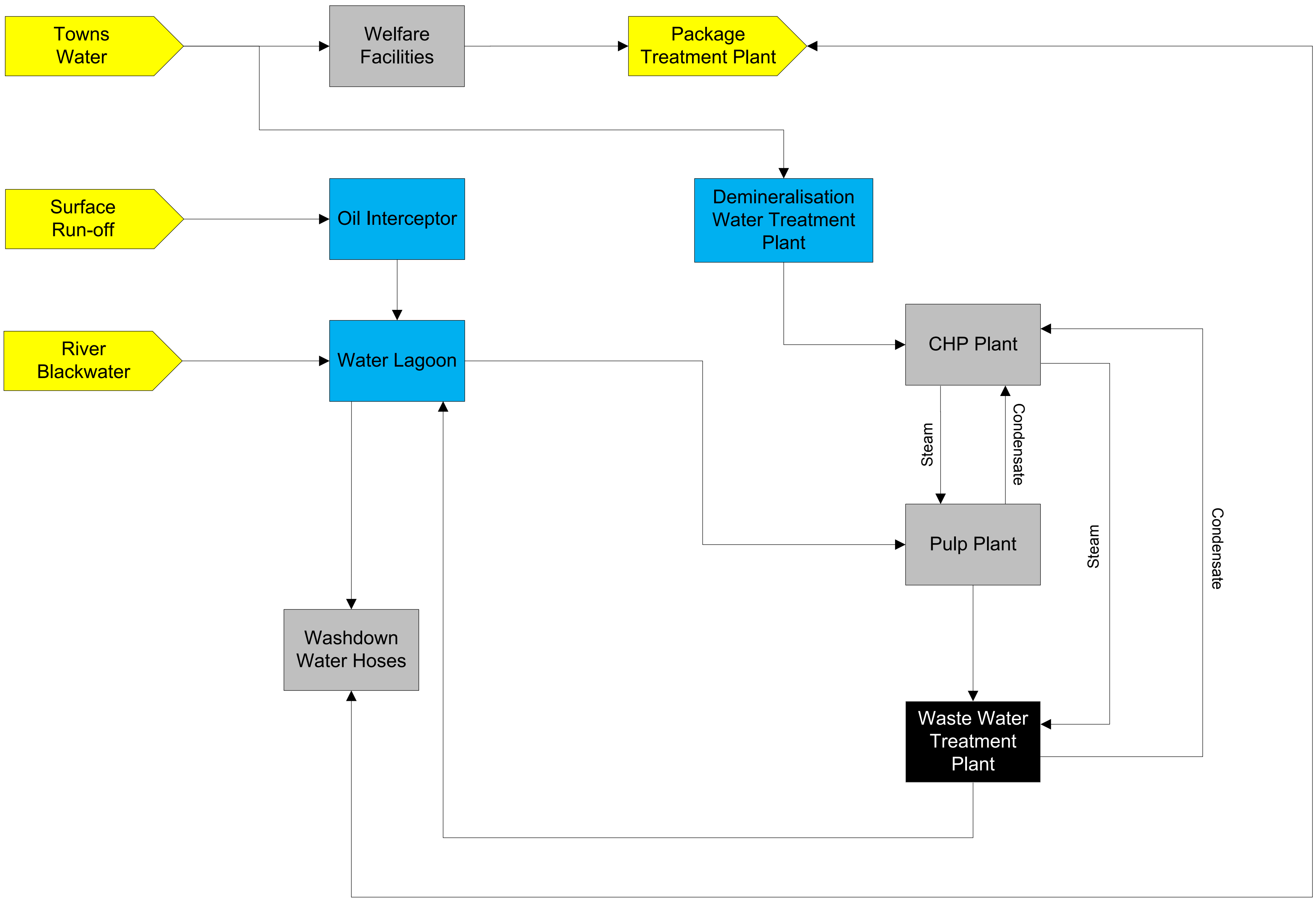


S:\PICTURE_LIBRARY\schematics\Rivenhall CHP Plant Schematic)



Waste Paper Inventory (4-6 weeks production)
Baled Waste Paper
Loose Waste Paper
Pulper (paper mixed with water and soap)
17% solid
Dump Screen (removes 8mm + particles of plastic, staples, paperclips etc)
4.5% solid
Centrifugal Cleaning (removes impurities of 2mm+ particle
4.5% solid
Buffer Tank (750m3 receptacle for pulped waste paper after initial screening)
3.5% solid
Hole Screens (removes 1.4mm+ particles of dirt)
3% solid
Slot Screen (removes 0.2mm + particles of dirt and stickies)
Combi Sorting
Plastics, metals recovered for recycling, fibres returned to process
Rejects Bunker (for subsequent recycling)
Sludge Tank (micro particles of dirt, ink, filler and fibre)
Sludge Drying and Disposal (soil conditioner or waste-to-energy or cement industry)
Bleaching Tower (20m tall tower where fibres soak for 50 minutes in Hydrogen Peroxide solution to increase brightness)
30% solid
Disperger (massages fibres between discs to breakdown ink particles)
30% solid
Mixing Screw (adds chemicals to loosen remaining fibres)
30% solid
Screw Press (removes water in preparation for chemical process)
10% solid
Washing Machine (removes filler particles and thickens pulp)
1% solid
Low Consistency Slot Screen (removes 0.15mm+ particles of dirt and stickies)
1% solid
Flotation (series of tanks in which detergent bubbles clean ink particles from the fibres)
1% solid
Reductive Bleaching (stand pipe for final dithionite treatment for pigment removal)
30% solid
Disperger (massages fibres between discs to breakdown ink particles)
30% solid
Mixing Screw (adds chemicals to loosen ink from remaining fibres)
30% solid
Screw Press (removes water in preparation for chemical process)
10% solid
Disc Filter (removes micro impurities and thickens pulp)
1% solid
Centrifugal Cleaning (removes 0.05mm+ particle size)
1% solid
Flotation (series of tanks in which detergent bubbles clean ink particles from the fibres)
1% solid
30% solid
Storage Tower (for finished quality pulp in slush form)
8% solid
Wire/Press Section (extracts water by passing the pulp along continuous mesh belts and through press rollers)
55% solid
Drying Section (pulp passes around and between a series of steam heated rollers to evaporate most of the remaining water resulting in a thick air-dry continuous pulp sheet)
90% solid
Cutter/ Baler (produces wire strapped bales of pulp ready for shipping)
Pulp Inventory (2 weeks production)

Indicative Water Flow Diagram



Annex 2 - Site Condition Report

see separate file

Annex 3 - Noise Assessment

CadnaA Noise Model Data

Rivenhall Airfield Integrated Waste Management Facility

B3749 20150915 N

Broadway, Bourn, Cambridge CB23 2TA 01954 718344 info@acoustical.co.uk www.acoustical.co.uk

Sources

Sound Power Spectra

Name	ID	Type	Oktave Spectrum (dB)												Source
			Weight.	31.5	63	125	250	500	1000	2000	4000	8000	A	lin	
accin	accin	Lw		0.0	102.6	102.6	97.6	94.6	92.6	84.6	79.6	75.6	97.0	106.7	
accout	accout	Lw		0.0	101.6	101.6	96.6	93.6	91.6	83.6	78.6	74.6	96.0	105.7	
acside	acside	Lw		0.0	94.8	94.8	90.8	84.8	81.8	79.8	74.8	72.8	88.6	98.9	
actop	actop	Lw		0.0	93.4	93.4	89.4	83.4	80.4	78.4	73.4	71.4	87.2	97.5	
bms1	bms1	Lw		0.0	105.6	98.1	95.6	84.4	77.5	76.0	75.4	75.6	90.2	106.7	
bms2	bms2	Lw		0.0	109.1	101.6	99.1	87.9	81.0	79.5	78.9	79.1	93.7	110.2	
bms3	bms3	Lw		0.0	105.6	98.1	95.6	84.4	77.5	76.0	75.4	75.6	90.2	106.7	
bms4	bms4	Lw		0.0	109.1	101.6	99.1	87.9	81.0	79.5	78.9	79.1	93.7	110.2	
bmt	bmt	Lw		0.0	110.0	102.5	100.0	88.8	81.9	80.4	79.8	80.0	94.6	111.1	
bhw1	bhw1	Lw		0.0	92.6	85.6	74.6	68.6	59.6	51.6	42.6	37.6	73.4	93.5	
bhw2	bhw2	Lw		0.0	99.3	92.3	81.3	75.3	66.3	58.3	49.3	44.3	80.1	100.2	
bhr	bhr	Lw		0.0	100.7	93.7	82.7	76.7	67.7	59.7	50.7	45.7	81.5	101.6	
bhw3	bhw3	Lw		0.0	89.7	82.7	71.7	65.7	56.7	48.7	39.7	34.7	70.5	90.6	
bhrv1	bhrv1	Lw		0.0	97.5	96.5	88.5	87.5	86.5	86.5	84.5	80.5	92.9	101.0	
bhrv2	bhrv2	Lw		0.0	97.5	96.5	88.5	87.5	86.5	86.5	84.5	80.5	92.9	101.0	
bhv1	bhv1	Lw		0.0	86.5	85.5	78.5	76.5	72.5	74.5	75.5	74.5	82.1	90.1	
bhv2	bhv2	Lw		0.0	86.4	85.4	78.4	76.4	72.4	74.4	75.4	74.4	82.0	90.0	
bhv3	bhv3	Lw		0.0	86.4	85.4	78.4	76.4	72.4	74.4	75.4	74.4	82.0	90.0	
bhv4	bhv4	Lw		0.0	86.4	85.4	78.4	76.4	72.4	74.4	75.4	74.4	82.0	90.0	
bhv5	bhv5	Lw		0.0	86.5	85.5	78.5	76.5	72.5	74.5	75.5	74.5	82.1	90.1	
bunkr	bunkr	Lw		0.0	105.1	92.1	83.1	73.1	65.1	48.1	39.1	35.1	82.0	105.3	
bunkrv	bunkrv	Lw		0.0	100.6	93.6	87.6	82.6	82.6	73.6	71.6	68.6	86.9	101.7	
rcs1	rcs1	Lw		0.0	90.2	86.2	86.2	82.2	80.2	76.2	70.2	64.2	85.1	93.4	
rcs2	rcs2	Lw		0.0	85.4	81.4	81.4	77.4	75.4	71.4	65.4	59.4	80.3	88.6	
rcs3	rcs3	Lw		0.0	90.2	86.2	86.2	82.2	80.2	76.2	70.2	64.2	85.1	93.4	
rcs4	rcs4	Lw		0.0	85.4	81.4	81.4	77.4	75.4	71.4	65.4	59.4	80.3	88.6	
rct	rct	Lw		0.0	90.5	86.5	86.5	82.5	80.5	76.5	70.5	64.5	85.4	93.7	
emods1	emods1	Lw		0.0	103.6	98.5	80.3	73.0	64.7	65.0	55.3	45.3	84.2	104.8	
emods2	emods2	Lw		0.0	102.6	97.5	79.3	72.0	63.7	64.0	54.3	44.3	83.2	103.8	
emods3	emods3	Lw		0.0	103.6	98.5	80.3	73.0	64.7	65.0	55.3	45.3	84.2	104.8	
emods4	emods4	Lw		0.0	102.6	97.5	79.3	72.0	63.7	64.0	54.3	44.3	83.2	103.8	
emodt	emodt	Lw		0.0	103.3	98.2	80.0	72.7	64.4	64.7	55.0	45.0	83.9	104.5	
meap1	meap1	Lw		0.0	72.7	79.2	86.7	78.7	66.7	43.7	30.7	18.7	80.3	88.1	

meap2	meap2	Lw		0.0	71.0	76.4	82.8	73.6	61.3	37.8	24.2	11.4	76.0	84.3	
meap3	meap3	Lw		0.0	72.5	77.9	84.3	75.1	62.8	39.3	25.7	12.9	77.5	85.8	
meap4	meap4	Lw		0.0	70.1	74.5	79.9	69.7	57.4	33.9	20.3	7.5	72.8	81.6	
meap5	meap5	Lw		0.0	72.1	76.5	81.9	71.7	59.4	35.9	22.3	9.5	74.8	83.6	
meap6	meap6	Lw		0.0	77.9	84.4	91.9	83.9	71.9	48.9	35.9	23.9	85.5	93.3	
ffs1	ffs1	Lw		0.0	58.3	65.9	79.7	79.6	83.5	90.4	77.6	75.6	92.6	92.1	
ffs2	ffs2	Lw		0.0	55.6	63.2	77.0	76.9	80.8	87.7	74.9	72.9	89.9	89.4	
ffs3	ffs3	Lw		0.0	58.3	65.9	79.7	79.6	83.5	90.4	77.6	75.6	92.6	92.1	
ffs4	ffs4	Lw		0.0	55.6	63.2	77.0	76.9	80.8	87.7	74.9	72.9	89.9	89.4	
fft	fft	Lw		0.0	56.1	63.7	77.5	77.4	81.3	88.2	75.4	73.4	90.4	89.9	
ids1	ids1	Lw		0.0	93.9	93.9	95.9	91.9	87.9	83.9	81.9	73.9	94.0	100.6	
ids2	ids2	Lw		0.0	92.7	92.7	94.7	90.7	86.7	82.7	80.7	72.7	92.8	99.4	
ids3	ids3	Lw		0.0	93.9	93.9	95.9	91.9	87.9	83.9	81.9	73.9	94.0	100.6	
ids4	ids4	Lw		0.0	92.7	92.7	94.7	90.7	86.7	82.7	80.7	72.7	92.8	99.4	
idt	idt	Lw		0.0	92.5	92.5	94.5	90.5	86.5	82.5	80.5	72.5	92.6	99.2	
idip1	idip1	Lw		0.0	62.8	69.8	74.8	76.8	76.8	60.8	40.8	18.8	78.9	81.4	
idip2	idip2	Lw		0.0	66.2	72.2	77.2	79.2	79.2	63.2	43.2	21.2	81.3	83.8	
idip3	idip3	Lw		0.0	80.2	82.2	78.2	71.2	62.2	37.2	8.2		73.3	85.5	
idip4	idip4	Lw		0.0	62.8	69.8	74.8	76.8	76.8	60.8	40.8	18.8	78.9	81.4	
idip5	idip5	Lw		0.0	64.2	70.2	75.2	77.2	77.2	61.2	41.2	19.2	79.3	81.8	
idip6	idip6	Lw		0.0	80.3	82.3	78.3	71.3	62.3	37.3	8.3		73.4	85.6	
idop1	idop1	Lw		0.0	80.1	85.1	88.1	79.1	68.1	43.1	14.1		81.5	90.6	
idop2	idop2	Lw		0.0	72.5	74.5	76.5	65.5	53.5	33.5	13.5	6.5	69.5	79.8	
idop3	idop3	Lw		0.0	69.5	71.5	73.5	62.5	50.5	30.5	10.5	3.5	66.5	76.8	
idop4	idop4	Lw		0.0	64.0	66.0	68.0	57.0	45.0	25.0	5.0		61.0	71.3	
idop5	idop5	Lw		0.0	64.0	66.0	68.0	57.0	45.0	25.0	5.0		61.0	71.3	
idop6	idop6	Lw		0.0	69.5	71.5	73.5	62.5	50.5	30.5	10.5	3.5	66.5	76.8	
idop7	idop7	Lw		0.0	69.0	71.0	73.0	62.0	50.0	30.0	10.0	3.0	66.0	76.3	
idop8	idop8	Lw		0.0	80.0	85.0	88.0	79.0	68.0	43.0	14.0		81.4	90.5	
stbw1	stbw1	Lw		0.0	101.9	94.9	81.9	74.9	68.9	58.9	54.9	43.9	82.0	102.7	
stbw2	stbw2	Lw		0.0	98.3	91.3	78.3	71.3	65.3	55.3	51.3	40.3	78.4	99.1	
stbr1	stbr1	Lw		0.0	104.9	97.9	84.9	77.9	71.9	61.9	57.9	46.9	85.0	105.7	
stbw3	stbw3	Lw		0.0	95.9	88.9	75.9	68.9	62.9	52.9	48.9	37.9	76.0	96.7	
stbw4	stbw4	Lw		0.0	97.2	90.2	77.2	70.2	64.2	54.2	50.2	39.2	77.3	98.0	
stbw5	stbw5	Lw		0.0	98.1	91.1	78.1	71.1	65.1	55.1	51.1	40.1	78.2	98.9	
stbr2	stbr2	Lw		0.0	100.0	93.0	80.0	73.0	67.0	57.0	53.0	42.0	80.1	100.8	
stbw6	stbw6	Lw		0.0	94.4	87.4	74.4	67.4	61.4	51.4	47.4	36.4	74.5	95.2	
stbw7	stbw7	Lw		0.0	100.4	93.4	80.4	73.4	67.4	57.4	53.4	42.4	80.5	101.2	

stbg	stbg	Lw		0.0	94.9	90.9	82.9	74.9	72.9	67.9	67.9	64.9	80.7	96.6	
stbrv	stbrv	Lw		0.0	103.0	103.0	95.0	88.0	84.0	78.0	87.0	79.0	93.6	106.5	
stbv1	stbv1	Lw		0.0	96.8	96.8	88.8	81.8	77.8	71.8	80.8	72.8	87.4	100.3	
stbv2	stbv2	Lw		0.0	101.1	101.1	93.1	86.1	82.1	76.1	85.1	77.1	91.7	104.6	
stbv3	stbv3	Lw		0.0	98.3	97.3	88.3	85.3	84.3	84.3	90.3	83.3	94.1	101.8	
ventf	ventf	Lw		0.0	98.8	97.7	96.2	94.8	86.6	83.4	81.6	71.7	94.9	103.3	
stack1	stack1	Lw		0.0	110.6	100.5	85.4	56.2	27.9	11.4	8.0	16.0	87.8	111.0	
stack2	stack2	Lw		0.0	110.6	100.5	85.4	56.2	27.9	11.4	8.0	16.0	87.8	111.0	
stackas	stackas	Lw		0.0	71.6	69.6	68.6	67.6	66.6	64.6	60.6	54.6	71.5	76.6	
stackshell	stackshell	Lw		0.0	80.5	75.4	71.3	55.1	37.8	18.3			65.0	82.1	
accsdo1	accsdo1	Lw		0.0	92.5	93.0	86.8	85.6	80.4	78.5	69.4	66.0	87.1	96.8	
accsdo2	accsdo2	Lw		0.0	87.9	88.4	82.2	81.0	75.8	73.9	64.8	61.4	82.5	92.2	
accsdo3	accsdo3	Lw		0.0	87.9	88.4	82.2	81.0	75.8	73.9	64.8	61.4	82.5	92.2	
accsdo4	accsdo4	Lw		0.0	92.1	92.6	86.4	85.2	80.0	78.1	69.0	65.6	86.7	96.4	
accsdo5	accsdo5	Lw		0.0	92.1	92.6	86.4	85.2	80.0	78.1	69.0	65.6	86.7	96.4	
tbw1	tbw1	Lw		0.0	97.0	92.0	81.0	76.0	59.0	45.0	31.0	19.0	79.5	98.3	
tbw2	tbw2	Lw		0.0	92.7	87.7	76.7	71.7	54.7	40.7	26.7	14.7	75.2	94.0	
tbw3	tbw3	Lw		0.0	97.0	92.0	81.0	76.0	59.0	45.0	31.0	19.0	79.5	98.3	
tbw4	tbw4	Lw		0.0	92.7	87.7	76.7	71.7	54.7	40.7	26.7	14.7	75.2	94.0	
tbr	tbr	Lw		0.0	96.7	91.7	80.7	75.7	58.7	44.7	30.7	18.7	79.2	98.0	
cokes1	cokes1	Lw		0.0	92.3	88.3	86.3	85.3	87.3	86.3	84.3	79.3	92.4	96.5	
cokes2	cokes2	Lw		0.0	91.2	87.2	85.2	84.2	86.2	85.2	83.2	78.2	91.3	95.4	
cokes3	cokes3	Lw		0.0	92.3	88.3	86.3	85.3	87.3	86.3	84.3	79.3	92.4	96.5	
cokes4	cokes4	Lw		0.0	91.2	87.2	85.2	84.2	86.2	85.2	83.2	78.2	91.3	95.4	
coket	coket	Lw		0.0	88.9	84.9	82.9	81.9	83.9	82.9	80.9	75.9	89.0	93.1	
MRF Roof	mrfr	Lw	A	0.0	0.0	0.0	0.0	109.6	0.0	0.0	0.0	0.0	109.6	112.8	
MBT Roof	mbtr	Lw	A	0.0	0.0	0.0	0.0	110.9	0.0	0.0	0.0	0.0	110.9	114.1	
AD Roof	adr	Lw	A	0.0	0.0	0.0	0.0	115.7	0.0	0.0	0.0	0.0	115.7	118.9	
WWTP Roof	wwtpr	Lw	A	0.0	0.0	0.0	0.0	115.0	0.0	0.0	0.0	0.0	115.0	118.2	
PPP Roof	pppr	Lw	A	0.0	0.0	0.0	0.0	117.5	0.0	0.0	0.0	0.0	117.5	120.7	
MDP Storage Roof	mdpsr	Lw	A	0.0	0.0	0.0	0.0	108.5	0.0	0.0	0.0	0.0	108.5	111.7	
RCP Storage Roof	rcpsr	Lw	A	0.0	0.0	0.0	0.0	105.9	0.0	0.0	0.0	0.0	105.9	109.1	
Veh Circ Roof	vcr	Lw	A	0.0	0.0	0.0	0.0	115.0	0.0	0.0	0.0	0.0	115.0	118.2	
Ash Hall Roof	ahr	Lw	A	0.0	0.0	0.0	0.0	104.5	0.0	0.0	0.0	0.0	104.5	107.7	
MRF Wall	mrfw1	Lw	A	0.0	0.0	0.0	0.0	107.4	0.0	0.0	0.0	0.0	107.4	110.6	
MRF Wall	mrfw2	Lw	A	0.0	0.0	0.0	0.0	104.2	0.0	0.0	0.0	0.0	104.2	107.4	
MBT Wall	mbtw	Lw	A	0.0	0.0	0.0	0.0	105.4	0.0	0.0	0.0	0.0	105.4	108.6	
AD Wall	adw	Lw	A	0.0	0.0	0.0	0.0	110.3	0.0	0.0	0.0	0.0	110.3	113.5	

WWTP Wall	wwtpw1	Lw	A	0.0	0.0	0.0	0.0	108.7	0.0	0.0	0.0	0.0	108.7	111.9	
WWTP Wall	wwtpw2	Lw	A	0.0	0.0	0.0	0.0	109.6	0.0	0.0	0.0	0.0	109.6	112.8	
WWTP Wall	wwtpw3	Lw	A	0.0	0.0	0.0	0.0	108.3	0.0	0.0	0.0	0.0	108.3	111.5	
MDP Storage Wall	mdpsw	Lw	A	0.0	0.0	0.0	0.0	104.5	0.0	0.0	0.0	0.0	104.5	107.7	
PPP Wall	pppw1	Lw	A	0.0	0.0	0.0	0.0	108.0	0.0	0.0	0.0	0.0	108.0	111.2	
PPP Wall	pppw2	Lw	A	0.0	0.0	0.0	0.0	114.7	0.0	0.0	0.0	0.0	114.7	117.9	
PPP Wall	pppw3	Lw	A	0.0	0.0	0.0	0.0	104.4	0.0	0.0	0.0	0.0	104.4	107.6	
Ash Hall Wall	ahw	Lw	A	0.0	0.0	0.0	0.0	98.6	0.0	0.0	0.0	0.0	98.6	101.8	
Veh Circ Wall	vcw1	Lw	A	0.0	0.0	0.0	0.0	101.8	0.0	0.0	0.0	0.0	101.8	105.0	
Veh Circ Wall	vcw2	Lw	A	0.0	0.0	0.0	0.0	101.8	0.0	0.0	0.0	0.0	101.8	105.0	
Veh Circ Wall	vcw3	Lw	A	0.0	0.0	0.0	0.0	103.9	0.0	0.0	0.0	0.0	103.9	107.1	
Veh Circ Wall	vcw4	Lw	A	0.0	0.0	0.0	0.0	102.3	0.0	0.0	0.0	0.0	102.3	105.5	
Veh Circ Wall	vcw5	Lw	A	0.0	0.0	0.0	0.0	99.6	0.0	0.0	0.0	0.0	99.6	102.8	
Veh Circ Door	vcd	Lw	A	0.0	0.0	0.0	0.0	92.9	0.0	0.0	0.0	0.0	92.9	96.1	
MRF Door	mrfd	Lw	A	0.0	0.0	0.0	0.0	92.9	0.0	0.0	0.0	0.0	92.9	96.1	
PPP Doors	pppd	Lw	A	0.0	0.0	0.0	0.0	100.8	0.0	0.0	0.0	0.0	100.8	104.0	
MRF FV	mrffv	Lw	A	0.0	0.0	0.0	0.0	98.1	0.0	0.0	0.0	0.0	98.1	101.3	
MBT FV	mbtfv	Lw	A	0.0	0.0	0.0	0.0	94.4	0.0	0.0	0.0	0.0	94.4	97.6	
AD FV	adfv	Lw	A	0.0	0.0	0.0	0.0	99.3	0.0	0.0	0.0	0.0	99.3	102.5	
Veh Cir FV	vcfv1	Lw	A	0.0	0.0	0.0	0.0	93.4	0.0	0.0	0.0	0.0	93.4	96.6	
WWTP FV	wwtpfv	Lw	A	0.0	0.0	0.0	0.0	102.7	0.0	0.0	0.0	0.0	102.7	105.9	
Veh Cir FV	vcfv2	Lw	A	0.0	0.0	0.0	0.0	93.0	0.0	0.0	0.0	0.0	93.0	96.2	
MDIP FV	mdipfv	Lw	A	0.0	0.0	0.0	0.0	93.5	0.0	0.0	0.0	0.0	93.5	96.7	
PPP FV	pppfv	Lw	A	0.0	0.0	0.0	0.0	104.9	0.0	0.0	0.0	0.0	104.9	108.1	
Veh Cir FV	vcfv3	Lw	A	0.0	0.0	0.0	0.0	93.0	0.0	0.0	0.0	0.0	93.0	96.2	

Directivity

Name	Angle	Directivity (dB)								
	(°)	31.5	63	125	250	500	1000	2000	4000	8000
ACC Inlet	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	90	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
	105	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
	120	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
	135	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0
	150	-14.0	-14.0	-14.0	-14.0	-14.0	-14.0	-14.0	-14.0	-14.0
	165	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0
	180	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
ACC Outlet	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	90	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
	105	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
	120	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
	135	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0
	150	-14.0	-14.0	-14.0	-14.0	-14.0	-14.0	-14.0	-14.0	-14.0
	165	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0
	180	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0

Point Sources

Name	ID	Result. PWL			Lw / Li			Correction			K0	Freq.	Direct.	Height		Coordinates		
		Day	Evening	Night	Type	Value	norm.	Day	Evening	Night						X	Y	Z
		(dBA)	(dBA)	(dBA)			dB(A)	dB(A)	dB(A)	dB(A)	(dB)	(Hz)		(m)		(m)	(m)	(m)
Vent Fan	ventf	94.9	94.9	94.9	Lw	ventf		0.0	0.0	0.0	0.0		(none)	22.20	r	582360.66	220409.12	52.20
Stack Outlet 2	stack2	87.8	87.8	87.8	Lw	stack2		0.0	0.0	0.0	0.0		Chimney (VDI 3733)	55.00	r	582444.35	220419.27	85.00
Stack Outlet Air	stackas	71.5	71.5	71.5	Lw	stackas		0.0	0.0	0.0	0.0		Chimney (VDI 3733)	55.00	r	582443.73	220421.93	85.00
Stack Outlet 1	stack1	87.8	87.8	87.8	Lw	stack1		0.0	0.0	0.0	0.0		Chimney (VDI 3733)	55.00	r	582446.34	220421.56	85.00

ACOUSTICAL CONTROL Engineers & Consultants

Line Sources

Name	ID	Result. PWL			Result. PWL'			Lw / Li			K0	Freq.	Direct.
		Day	Evening	Night	Day	Evening	Night	Type	Value	norm.			
		(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(dB)	(Hz)	
Exhaust Pipe 1	meap1	80.3	80.3	80.3	66.1	66.1	66.1	Lw	meap1		0.0		(none)
Exhaust Pipe 2	meap2	76.0	76.0	76.0	63.1	63.1	63.1	Lw	meap2		0.0		(none)
Exhaust Pipe 3	meap3	77.5	77.5	77.5	63.2	63.2	63.2	Lw	meap3		0.0		(none)
Exhaust Pipe 4	meap4	72.8	72.8	72.8	60.9	60.9	60.9	Lw	meap4		0.0		(none)
Exhaust Pipe 5	meap5	74.8	74.8	74.8	60.9	60.9	60.9	Lw	meap5		0.0		(none)
Exhaust Pipe 6	meap6	85.5	85.5	85.5	66.0	66.0	66.0	Lw	meap6		0.0		(none)
Inlet Pipe 1	idip1	78.9	78.9	78.9	72.0	72.0	72.0	Lw	idip1		0.0		(none)
Inlet Pipe 2	idip2	81.3	81.3	81.3	75.1	75.1	75.1	Lw	idip2		0.0		(none)
Inlet Pipe 3	idip3	73.3	73.3	73.3	63.1	63.1	63.1	Lw	idip3		0.0		(none)
Inlet Pipe 4	idip4	78.9	78.9	78.9	72.1	72.1	72.1	Lw	idip4		0.0		(none)
Inlet Pipe 5	idip5	79.3	79.3	79.3	75.2	75.2	75.2	Lw	idip5		0.0		(none)
Inlet Pipe 6	idip6	73.4	73.4	73.4	63.2	63.2	63.2	Lw	idip6		0.0		(none)
Out Pipe 1	idop1	81.5	81.5	81.5	71.6	71.6	71.6	Lw	idop1		0.0		(none)
Out Pipe 2	idop2	69.5	69.5	69.5	57.2	57.2	57.2	Lw	idop2		0.0		(none)
Out Pipe 3	idop3	66.5	66.5	66.5	57.2	57.2	57.2	Lw	idop3		0.0		(none)
Out Pipe 4	idop4	61.0	61.0	61.0	57.2	57.2	57.2	Lw	idop4		0.0		(none)
Out Pipe 5	idop5	61.0	61.0	61.0	57.2	57.2	57.2	Lw	idop5		0.0		(none)
Out Pipe 6	idop6	66.5	66.5	66.5	57.2	57.2	57.2	Lw	idop6		0.0		(none)
Out Pipe 7	idop7	66.0	66.0	66.0	57.2	57.2	57.2	Lw	idop7		0.0		(none)
Out Pipe 8	idop8	81.4	81.4	81.4	71.6	71.6	71.6	Lw	idop8		0.0		(none)
Stack Shell	stackshell	65.0	65.0	65.0	48.1	48.1	48.1	Lw	stackshell		0.0		(none)
ACC Steam Duct	accsdo1	87.1	87.1	87.1	76.3	76.3	76.3	Lw	accsdo1		0.0		(none)
ACC Steam Duct	accsdo2	82.5	82.5	82.5	72.5	72.5	72.5	Lw	accsdo2		0.0		(none)
ACC Steam Duct	accsdo3	82.5	82.5	82.5	72.5	72.5	72.5	Lw	accsdo3		0.0		(none)
ACC Steam Duct	accsdo4	86.7	86.7	86.7	70.3	70.3	70.3	Lw	accsdo4		0.0		(none)
ACC Steam Duct	accsdo5	86.7	86.7	86.7	70.3	70.3	70.3	Lw	accsdo5		0.0		(none)

Line Source Geometry

Name	Height				Coordinates			
	Begin		End		x	y	z	Ground
	(m)		(m)		(m)	(m)	(m)	(m)
Exhaust Pipe 1	19.50	r			582366.49	220537.00	54.50	35.00
					582386.58	220519.68	54.50	35.00
Exhaust Pipe 2	24.50	r			582453.97	220462.96	54.50	30.00
					582441.90	220447.91	54.50	30.00
Exhaust Pipe 3	24.50	r	5.50	r	582441.79	220448.10	54.50	30.00
					582429.80	220433.36	35.50	30.00
Exhaust Pipe 4	5.50	r	5.50	r	582429.70	220433.45	35.50	30.00
					582441.55	220423.53	35.50	30.00
Exhaust Pipe 5	5.50	r	30.00	r	582441.45	220423.62	35.50	30.00
					582442.69	220422.68	60.00	30.00
Exhaust Pipe 6	19.50	r	24.50	r	582385.52	220518.83	54.50	35.00
					582453.78	220462.65	54.50	30.00
Inlet Pipe 1	13.50	r			582435.99	220410.28	43.50	30.00
					582439.73	220407.27	43.50	30.00
Inlet Pipe 2	13.50	r			582439.62	220407.36	43.50	30.00
					582442.27	220410.48	43.50	30.00
Inlet Pipe 3	13.50	r	3.50	r	582442.27	220410.48	43.50	30.00
					582440.58	220408.30	33.50	30.00
Inlet Pipe 4	13.50	r			582454.25	220431.62	43.50	30.00
					582457.89	220428.59	43.50	30.00
Inlet Pipe 5	13.50	r			582457.88	220428.79	43.50	30.00
					582459.48	220430.77	43.50	30.00
Inlet Pipe 6	13.50	r	3.50	r	582459.48	220430.87	43.50	30.00
					582457.31	220428.07	33.50	30.00
Out Pipe 1	13.00	r	3.50	r	582438.14	220402.70	43.00	30.00
					582439.65	220404.57	33.50	30.00
Out Pipe 2	13.50	r	13.50	r	582438.14	220402.70	43.50	30.00
					582448.51	220415.77	43.50	30.00
Out Pipe 3	13.50	r	5.00	r	582448.41	220415.76	43.50	30.00
					582448.51	220415.77	35.00	30.00
Out Pipe 4	5.00	r	5.00	r	582446.64	220417.28	35.00	30.00
					582448.51	220415.77	35.00	30.00
Out Pipe 5	5.00	r	5.00	r	582448.81	220419.98	35.00	30.00
					582450.68	220418.47	35.00	30.00

Out Pipe 6	13.50	r	5.00	r	582450.68	220418.47	43.50	30.00
					582450.68	220418.47	35.00	30.00
Out Pipe 7	13.50	r	13.50	r	582450.68	220418.47	43.50	30.00
					582455.39	220424.38	43.50	30.00
Out Pipe 8	13.00	r	3.50	r	582455.39	220424.38	43.00	30.00
					582456.05	220425.21	33.50	30.00
Stack Shell	5.00	r	54.00	r	582445.39	220420.51	35.00	30.00
					582445.39	220420.51	84.00	30.00
ACC Steam Duct	0.00	r	12.00	r	582379.07	220385.03	35.00	35.00
					582379.07	220385.03	47.00	35.00
ACC Steam Duct	12.00	r	19.50	r	582379.07	220385.03	47.00	35.00
					582382.13	220379.38	54.50	35.00
ACC Steam Duct	12.00	r	19.50	r	582379.07	220385.03	47.00	35.00
					582372.96	220387.53	54.50	35.00
ACC Steam Duct	19.50	r	19.50	r	582345.41	220353.58	54.50	35.00
					582372.96	220387.53	54.50	35.00
ACC Steam Duct	19.50	r	19.50	r	582354.47	220345.62	54.50	35.00
					582382.03	220379.47	54.50	35.00

Area Sources

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			K0	Freq.	Direct.
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.			
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(dB)	(Hz)	
ACC Inlet	+	accin	97.0	97.0	97.0	66.2	66.2	66.2	Lw	accin		1.5		ACC Inlet
ACC Outlet	+	accout	96.0	96.0	96.0	65.2	65.2	65.2	Lw	accout		0.0		ACC Outlet
Air Comp 1 Top	+	actop	87.2	87.2	87.2	80.4	80.4	80.4	Lw	actop		0.0		(none)
Air Comp 2 Top	+	actop	87.2	87.2	87.2	80.4	80.4	80.4	Lw	actop		0.0		(none)
Bicarb Top	+	bmt	94.6	94.6	94.6	77.9	77.9	77.9	Lw	bmt		0.0		(none)
Boiler Hall Roof	+	bhr	81.5	81.5	81.5	47.4	47.4	47.4	Lw	bhr		0.0		(none)
Recooler 1 Top	+	rct	85.4	85.4	85.4	73.1	73.1	73.1	Lw	rct		0.0		(none)
Recooler 1 Top	+	rct	85.4	85.4	85.4	73.1	73.1	73.1	Lw	rct		0.0		(none)
Recooler 3 Top	+	rct	85.4	85.4	85.4	73.0	73.0	73.0	Lw	rct		0.0		(none)
Recooler 4 Top	+	rct	85.4	85.4	85.4	73.1	73.1	73.1	Lw	rct		0.0		(none)
E Mod Top	+	emodt	83.9	83.9	83.9	62.7	62.7	62.7	Lw	emodt		0.0		(none)
FF1 Top	+	fft	90.4	90.4	90.4	68.4	68.4	68.4	Lw	fft		0.0		(none)
FF2 Top	+	fft	90.4	90.4	90.4	68.4	68.4	68.4	Lw	fft		0.0		(none)
ID Fan 1 Top	+	idt	92.6	92.6	92.6	81.3	81.3	81.3	Lw	idt		0.0		(none)
ID Fan 2 Top	+	idt	92.6	92.6	92.6	81.4	81.4	81.4	Lw	idt		0.0		(none)
Transformer Top	+	tbr	79.2	79.2	79.2	57.1	57.1	57.1	Lw	tbr		0.0		(none)
Coke Top	+	coket	89.0	89.0	89.0	83.2	83.2	83.2	Lw	coket		0.0		(none)
Steam Turbine Roof 1	+	stbr1	85.0	85.0	85.0	56.1	56.1	56.1	Lw	stbr1		0.0		(none)
Steam Turbine Roof 2	+	stbr2	80.1	80.1	80.1	56.0	56.0	56.0	Lw	stbr2		0.0		(none)
Steam Turbine Roof Vent	+	stbrv	93.6	93.6	93.6	72.6	72.6	72.6	Lw	stbrv		0.0		(none)
Bunker Roof	+	bunkr	82.0	82.0	82.0	49.7	49.7	49.7	Lw	bunkr		0.0		(none)
Bunker Roof Vent	+	bunkrv	86.9	86.9	86.9	68.8	68.8	68.8	Lw	bunkrv		0.0		(none)
Boiler Roof Vent 1	+	bhrv1	92.9	92.9	92.9	72.0	72.0	72.0	Lw	bhrv1		0.0		(none)
Boiler Roof Vent 2	+	bhrv2	92.9	92.9	92.9	72.0	72.0	72.0	Lw	bhrv2		0.0		(none)
MRF Roof	+		86.6	86.6	86.6	51.0	51.0	51.0	Lw	mrfr		0.0	500	(none)
MBT Roof	+		87.9	87.9	87.9	51.0	51.0	51.0	Lw	mbtr		0.0	500	(none)
AD Roof	+		92.7	92.7	92.7	56.0	56.0	56.0	Lw	adr		0.0	500	(none)
WWTP Roof	+		92.0	92.0	92.0	56.0	56.0	56.0	Lw	wwtpr		0.0	500	(none)
PPP Roof	+		94.5	94.5	94.5	56.0	56.0	56.0	Lw	pppr		0.0	500	(none)
MDP Storage Roof	+		85.5	85.5	85.5	51.0	51.0	51.0	Lw	mdpsr		0.0	500	(none)
RCP Storage Roof	+		82.9	82.9	82.9	51.0	51.0	51.0	Lw	rcpsr		0.0	500	(none)
Vehicle Circulation / RDF Reception Roof	+		92.0	92.0	92.0	51.0	51.0	51.0	Lw	vcr		0.0	500	(none)
Ash Hall Roof	+		81.5	81.5	81.5	51.0	51.0	51.0	Lw	ahr		0.0	500	(none)

Area Source Geometry

Name	Height				Coordinates			
	Begin		End		x	y	z	Ground
	(m)		(m)		(m)	(m)	(m)	(m)
ACC Inlet	6.50	r			582336.59	220353.01	41.50	35.00
					582355.48	220337.28	41.50	35.00
					582386.68	220374.77	41.50	35.00
					582367.81	220390.49	41.50	35.00
ACC Outlet	19.00	r			582336.59	220353.01	54.00	35.00
					582355.48	220337.28	54.00	35.00
					582386.68	220374.77	54.00	35.00
					582367.81	220390.49	54.00	35.00
Air Comp 1 Top	2.50	r			582447.10	220426.59	32.50	30.00
					582448.76	220425.17	32.50	30.00
					582450.18	220426.83	32.50	30.00
					582448.52	220428.25	32.50	30.00
Air Comp 2 Top	2.50	r			582438.29	220416.38	32.50	30.00
					582439.95	220414.97	32.50	30.00
					582441.38	220416.63	32.50	30.00
					582439.71	220418.05	32.50	30.00
Bicarb Top	3.50	r			582453.16	220416.79	33.50	30.00
					582456.12	220413.24	33.50	30.00
					582463.89	220419.69	33.50	30.00
					582460.94	220423.34	33.50	30.00
Boiler Hall Roof	30.00	r			582375.86	220436.00	60.00	30.00
					582407.75	220409.95	60.00	30.00
					582448.71	220459.83	60.00	30.00
					582419.57	220483.76	60.00	30.00
Recooler 1 Top	23.20	r			582385.88	220416.10	53.20	30.00
					582387.66	220414.49	53.20	30.00
					582392.50	220419.81	53.20	30.00
					582390.73	220421.42	53.20	30.00
Recooler 1 Top	23.20	r			582383.70	220418.10	53.20	30.00
					582385.47	220416.49	53.20	30.00
					582390.31	220421.81	53.20	30.00
					582388.54	220423.42	53.20	30.00
Recooler 3 Top	23.20	r			582381.10	220420.48	53.20	30.00
					582382.86	220418.86	53.20	30.00

					582387.79	220424.16	53.20	30.00
					582385.93	220425.79	53.20	30.00
Recooler 4 Top	23.20	r			582378.91	220422.47	53.20	30.00
					582380.66	220420.87	53.20	30.00
					582385.50	220426.17	53.20	30.00
					582383.70	220427.78	53.20	30.00
E Mod Top	10.50	r			582400.72	220385.45	40.50	30.00
					582408.82	220395.52	40.50	30.00
					582401.04	220401.83	40.50	30.00
					582392.95	220391.77	40.50	30.00
FF1 Top	15.00	r			582419.76	220417.81	45.00	30.00
					582433.06	220406.76	45.00	30.00
					582438.91	220413.82	45.00	30.00
					582425.61	220424.86	45.00	30.00
FF2 Top	15.00	r			582437.85	220438.83	45.00	30.00
					582451.13	220427.80	45.00	30.00
					582456.97	220434.84	45.00	30.00
					582443.69	220445.86	45.00	30.00
ID Fan 1 Top	4.00	r			582438.09	220406.09	34.00	30.00
					582441.30	220403.45	34.00	30.00
					582443.38	220405.84	34.00	30.00
					582440.16	220408.57	34.00	30.00
ID Fan 2 Top	4.00	r			582454.61	220426.25	34.00	30.00
					582457.73	220423.51	34.00	30.00
					582459.79	220425.98	34.00	30.00
					582456.59	220428.62	34.00	30.00
Transformer Top	8.00	r			582381.54	220360.68	43.00	35.00
					582386.49	220354.84	43.00	35.00
					582402.39	220368.16	43.00	35.00
					582397.46	220374.08	43.00	35.00
Coke Top	3.00	r			582452.57	220412.45	33.00	30.00
					582451.15	220410.80	33.00	30.00
					582452.49	220409.67	33.00	30.00
					582453.89	220411.33	33.00	30.00
Steam Turbine Roof 1					582357.61	220408.08	51.20	35.00
					582375.98	220393.07	51.20	35.00
					582396.77	220418.54	51.20	30.00
					582378.35	220433.56	51.20	30.00

Steam Turbine Roof 2					582375.99	220393.07	42.50	35.00
					582386.03	220384.84	42.50	35.00
					582398.50	220400.07	42.50	30.00
					582388.46	220408.29	42.50	30.00
Steam Turbine Roof Vent	21.20	r			582376.97	220401.90	51.20	30.00
					582387.08	220414.06	51.20	30.00
					582381.16	220419.40	51.20	30.00
					582371.10	220407.18	51.20	30.00
Bunker Roof	30.00	r			582355.46	220460.74	60.00	30.00
					582379.81	220441.08	60.00	30.00
					582414.63	220479.54	60.00	30.00
					582388.57	220500.79	60.00	30.00
Bunker Roof Vent	30.00	r			582381.60	220462.43	60.00	30.00
					582391.71	220474.49	60.00	30.00
					582388.70	220477.28	60.00	30.00
					582378.60	220465.17	60.00	30.00
Boiler Roof Vent 1	30.00	r			582400.10	220428.14	60.00	30.00
					582410.39	220439.95	60.00	30.00
					582404.41	220445.15	60.00	30.00
					582394.13	220433.33	60.00	30.00
Boiler Roof Vent 2	30.00	r			582418.68	220448.73	60.00	30.00
					582428.30	220460.57	60.00	30.00
					582422.05	220465.64	60.00	30.00
					582412.43	220453.80	60.00	30.00
MRF Roof	60.00	a			582127.20	220485.02	60.00	35.00
					582183.74	220552.19	60.00	35.00
					582215.86	220525.52	60.00	35.00
					582159.59	220458.37	60.00	35.00
MBT Roof	60.00	a			582159.60	220458.36	60.00	35.00
					582215.89	220525.49	60.00	35.00
					582259.04	220489.80	60.00	35.00
					582202.65	220423.38	60.00	35.00
AD Roof	60.00	a			582202.76	220423.31	60.00	35.00
					582259.28	220489.67	60.00	35.00
					582299.64	220456.14	60.00	35.00
					582244.33	220388.93	60.00	35.00
WWTP Roof	60.00	a			582302.24	220341.06	60.00	30.00
					582357.38	220408.34	60.00	30.00

					582314.87	220443.74	60.00	35.00
					582281.66	220403.22	60.00	35.00
					582300.33	220387.99	60.00	30.00
					582278.04	220360.90	60.00	30.00
PPP Roof	60.00	a			582258.00	220641.99	60.00	35.00
					582373.70	220546.60	60.00	35.00
					582324.52	220486.84	60.00	35.00
					582314.04	220495.41	60.00	35.00
					582327.79	220512.10	60.00	35.00
					582271.00	220558.67	60.00	35.00
					582286.65	220577.38	60.00	35.00
					582237.80	220617.73	60.00	35.00
MDP Storage Roof	60.00	a			582237.76	220617.60	60.00	35.00
					582286.29	220577.40	60.00	35.00
					582257.52	220542.64	60.00	35.00
					582208.85	220582.95	60.00	35.00
RCP Storage Roof	60.00	a			582257.66	220542.46	60.00	35.00
					582270.91	220558.56	60.00	35.00
					582327.34	220512.10	60.00	35.00
					582313.80	220495.65	60.00	35.00
Vehicle Circulation / RDF Reception Roof	60.00	a			582183.82	220552.28	60.00	35.00
					582299.87	220456.15	60.00	35.00
					582244.46	220388.84	60.00	35.00
					582277.97	220361.10	60.00	30.00
					582300.18	220388.00	60.00	30.00
					582281.31	220403.17	60.00	35.00
					582314.82	220444.01	60.00	35.00
					582330.72	220430.84	60.00	30.00
					582395.60	220509.79	60.00	30.00
					582365.01	220535.30	60.00	35.00
					582324.50	220486.49	60.00	35.00
					582208.79	220582.71	60.00	35.00
Ash Hall Roof	60.00	a			582378.25	220433.75	60.00	30.00
					582357.49	220408.41	60.00	30.00
					582330.95	220430.63	60.00	30.00
					582351.82	220455.75	60.00	30.00

Vertical Area Sources

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			K0	Freq.	Direct.
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.			
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(dB)	(Hz)	
Air Comp 1 Side 1	+	acside	88.6	88.6	88.6	81.2	81.2	81.2	Lw	acside		3.0		(none)
Air Comp 1 Side 2	+	acside	88.6	88.6	88.6	81.2	81.2	81.2	Lw	acside		3.0		(none)
Air Comp 1 Side 3	+	acside	88.6	88.6	88.6	81.2	81.2	81.2	Lw	acside		3.0		(none)
Air Comp 1 Side 4	+	acside	88.6	88.6	88.6	81.2	81.2	81.2	Lw	acside		3.0		(none)
Air Comp 2 Side 1	+	acside	88.6	88.6	88.6	81.2	81.2	81.2	Lw	acside		3.0		(none)
Air Comp 2 Side 2	+	acside	88.6	88.6	88.6	81.2	81.2	81.2	Lw	acside		3.0		(none)
Air Comp 2 Side 3	+	acside	88.6	88.6	88.6	81.2	81.2	81.2	Lw	acside		3.0		(none)
Air Comp 2 Side 4	+	acside	88.6	88.6	88.6	81.2	81.2	81.2	Lw	acside		3.0		(none)
Bicarb Sid 1	+	bms1	90.2	90.2	90.2	78.2	78.2	78.2	Lw	bms1		3.0		(none)
Bicarb Side 2	+	bms2	93.7	93.7	93.7	78.3	78.3	78.3	Lw	bms2		3.0		(none)
Bicarb Side 3	+	bms3	90.2	90.2	90.2	78.1	78.1	78.1	Lw	bms3		3.0		(none)
Bicarb Side 4	+	bms4	93.7	93.7	93.7	78.2	78.2	78.2	Lw	bms4		3.0		(none)
Boiler Hall Wall 1	+	bhw1	73.4	73.4	73.4	47.2	47.2	47.2	Lw	bhw1		3.0		(none)
Boiler Hall Wall 2	+	bhw2	80.1	80.1	80.1	47.2	47.2	47.2	Lw	bhw2		3.0		(none)
Boiler Hall Wall 3	+	bhw3	70.5	70.5	70.5	50.3	50.3	50.3	Lw	bhw3		3.0		(none)
Boiler Louvre 1	+	bhv1	82.1	82.1	82.1	69.0	69.0	69.0	Lw	bhv1		3.0		(none)
Boiler Louvre 2	+	bhv2	82.0	82.0	82.0	69.0	69.0	69.0	Lw	bhv2		3.0		(none)
Boiler Louvre 3	+	bhv3	82.0	82.0	82.0	69.0	69.0	69.0	Lw	bhv3		3.0		(none)
Boiler Louvre 4	+	bhv4	82.0	82.0	82.0	69.0	69.0	69.0	Lw	bhv4		3.0		(none)
Boiler Louvre 5	+	bhv5	82.1	82.1	82.1	69.1	69.1	69.1	Lw	bhv5		3.0		(none)
Recooler 1 Side 1	+	rcs1	85.1	85.1	85.1	73.5	73.5	73.5	Lw	rcs1		3.0		(none)
Recooler 1 Side 2	+	rcs2	80.3	80.3	80.3	73.5	73.5	73.5	Lw	rcs2		3.0		(none)
Recooler 1 Side 3	+	rcs3	85.1	85.1	85.1	73.5	73.5	73.5	Lw	rcs3		3.0		(none)
Recooler 1 Side 4	+	rcs4	80.3	80.3	80.3	73.5	73.5	73.5	Lw	rcs4		3.0		(none)
Recooler 2 Side 1	+	rcs1	85.1	85.1	85.1	73.5	73.5	73.5	Lw	rcs1		3.0		(none)
Recooler 2 Side 2	+	rcs2	80.3	80.3	80.3	73.5	73.5	73.5	Lw	rcs2		3.0		(none)
Recooler 2 Side 3	+	rcs3	85.1	85.1	85.1	73.5	73.5	73.5	Lw	rcs3		3.0		(none)
Recooler 2 Side 4	+	rcs4	80.3	80.3	80.3	73.5	73.5	73.5	Lw	rcs4		3.0		(none)
Recooler 3 Side 1	+	rcs1	85.1	85.1	85.1	73.5	73.5	73.5	Lw	rcs1		3.0		(none)
Recooler 3 Side 2	+	rcs2	80.3	80.3	80.3	73.5	73.5	73.5	Lw	rcs2		3.0		(none)
Recooler 3 Side 3	+	rcs3	85.1	85.1	85.1	73.5	73.5	73.5	Lw	rcs3		3.0		(none)
Recooler 3 Side 4	+	rcs4	80.3	80.3	80.3	73.4	73.4	73.4	Lw	rcs4		3.0		(none)
Recooler 4 Side 1	+	rcs1	85.1	85.1	85.1	73.6	73.6	73.6	Lw	rcs1		3.0		(none)
Recooler 4 Side 2	+	rcs2	80.3	80.3	80.3	73.5	73.5	73.5	Lw	rcs2		3.0		(none)

Recooler 4 Side 3	+	rcs3	85.1	85.1	85.1	73.5	73.5	73.5	Lw	rcs3		3.0		(none)
Recooler 4 Side 4	+	rcs4	80.3	80.3	80.3	73.5	73.5	73.5	Lw	rcs4		3.0		(none)
E Mod Side 1	+	emods1	84.2	84.2	84.2	62.8	62.8	62.8	Lw	emods1		3.0		(none)
E Mod Side 2	+	emods2	83.2	83.2	83.2	62.9	62.9	62.9	Lw	emods2		3.0		(none)
E Mod Side 3	+	emods3	84.2	84.2	84.2	62.8	62.8	62.8	Lw	emods3		3.0		(none)
E Mod Side 4	+	emods4	83.2	83.2	83.2	62.9	62.9	62.9	Lw	emods4		3.0		(none)
FF1 Side 1	+	ffs1	92.6	92.6	92.6	68.5	68.5	68.5	Lw	ffs1		3.0		(none)
FF1 Side 2	+	ffs2	89.9	89.9	89.9	68.5	68.5	68.5	Lw	ffs2		3.0		(none)
FF1 Side 3	+	ffs3	92.6	92.6	92.6	68.5	68.5	68.5	Lw	ffs3		3.0		(none)
FF1 Side 4	+	ffs4	89.9	89.9	89.9	68.5	68.5	68.5	Lw	ffs4		3.0		(none)
FF2 Side 1	+	ffs1	92.6	92.6	92.6	68.5	68.5	68.5	Lw	ffs1		3.0		(none)
FF2 Side 2	+	ffs2	89.9	89.9	89.9	68.5	68.5	68.5	Lw	ffs2		3.0		(none)
FF2 Side 3	+	ffs3	92.6	92.6	92.6	68.5	68.5	68.5	Lw	ffs3		3.0		(none)
FF2 Side 4	+	ffs4	89.9	89.9	89.9	68.5	68.5	68.5	Lw	ffs4		3.0		(none)
ID Fan 1 Side 1	+	ids1	94.0	94.0	94.0	81.8	81.8	81.8	Lw	ids1		3.0		(none)
ID Fan 1 Side 2	+	ids2	92.8	92.8	92.8	81.7	81.7	81.7	Lw	ids2		3.0		(none)
ID Fan 1 Side 3	+	ids3	94.0	94.0	94.0	81.7	81.7	81.7	Lw	ids3		3.0		(none)
ID Fan 1 Side 4	+	ids4	92.8	92.8	92.8	81.6	81.6	81.6	Lw	ids4		3.0		(none)
ID Fan 2 Side 1	+	ids1	94.0	94.0	94.0	81.8	81.8	81.8	Lw	ids1		3.0		(none)
ID Fan 2 Side 2	+	ids2	92.8	92.8	92.8	81.6	81.6	81.6	Lw	ids2		3.0		(none)
ID Fan 2 Side 3	+	ids3	94.0	94.0	94.0	81.8	81.8	81.8	Lw	ids3		3.0		(none)
ID Fan 2 Side 4	+	ids4	92.8	92.8	92.8	81.8	81.8	81.8	Lw	ids4		3.0		(none)
Tranformer Side 1	+	tbw1	79.5	79.5	79.5	57.2	57.2	57.2	Lw	tbw1		3.0		(none)
Tranformer Side 2	+	tbw2	75.2	75.2	75.2	57.2	57.2	57.2	Lw	tbw2		3.0		(none)
Tranformer Side 3	+	tbw3	79.5	79.5	79.5	57.2	57.2	57.2	Lw	tbw3		3.0		(none)
Tranformer Side 4	+	tbw4	75.2	75.2	75.2	57.3	57.3	57.3	Lw	tbw4		3.0		(none)
Coke Side 1	+	cokes1	92.4	92.4	92.4	84.2	84.2	84.2	Lw	cokes1		3.0		(none)
Coke Side 2	+	cokes2	91.3	91.3	91.3	84.1	84.1	84.1	Lw	cokes2		3.0		(none)
Coke Side 3	+	cokes3	92.4	92.4	92.4	84.2	84.2	84.2	Lw	cokes3		3.0		(none)
Coke Side 4	+	cokes4	91.3	91.3	91.3	84.1	84.1	84.1	Lw	cokes4		3.0		(none)
Steam Turbine Wall 1	+	stbw1	82.0	82.0	82.0	56.1	56.1	56.1	Lw	stbw1		3.0		(none)
Steam Turbine Wall 2	+	stbw2	78.4	78.4	78.4	56.1	56.1	56.1	Lw	stbw2		3.0		(none)
Steam Turbine Wall 3	+	stbw3	76.0	76.0	76.0	56.0	56.0	56.0	Lw	stbw3		3.0		(none)
Steam Turbine Wall 4	+	stbw4	77.3	77.3	77.3	56.1	56.1	56.1	Lw	stbw4		3.0		(none)
Steam Turbine Wall 5	+	stbw5	78.2	78.2	78.2	56.0	56.0	56.0	Lw	stbw5		3.0		(none)
Steam Turbine Wall 6	+	stbw6	74.5	74.5	74.5	56.1	56.1	56.1	Lw	stbw6		3.0		(none)
Steam Turbine Wall 7	+	stbw7	80.5	80.5	80.5	56.0	56.0	56.0	Lw	stbw7		3.0		(none)
Steam Turbine Gate	+	stbg	80.7	80.7	80.7	66.8	66.8	66.8	Lw	stbg		3.0		(none)

Steam Turbine Vent 1	+	stbv1	87.4	87.4	87.4	72.6	72.6	72.6	Lw	stbv1		3.0		(none)
Steam Turbine Vent 2	+	stbv2	91.7	91.7	91.7	72.6	72.6	72.6	Lw	stbv2		3.0		(none)
Steam Turbine Vent 3	+	stbv3	94.1	94.1	94.1	78.7	78.7	78.7	Lw	stbv3		3.0		(none)
MRF Wall	+		84.4	84.4	84.4	51.0	51.0	51.0	Lw	mrfw1		3.0	500	(none)
MRF Wall	+		81.2	81.2	81.2	51.0	51.0	51.0	Lw	mrfw2		3.0	500	(none)
MBT Wall	+		82.4	82.4	82.4	51.0	51.0	51.0	Lw	mbtw		3.0	500	(none)
AD Wall	+		87.3	87.3	87.3	56.0	56.0	56.0	Lw	adw		3.0	500	(none)
WWTP Wall	+		85.7	85.7	85.7	56.0	56.0	56.0	Lw	wwtpw1		3.0	500	(none)
WWTP Wall	+		86.6	86.6	86.6	56.1	56.1	56.1	Lw	wwtpw2		3.0	500	(none)
WWTP Wall	+		85.3	85.3	85.3	55.9	55.9	55.9	Lw	wwtpw3		3.0	500	(none)
MDP Storage Wall	+		81.5	81.5	81.5	51.0	51.0	51.0	Lw	mdpsw		3.0	500	(none)
PPP Wall	+		85.0	85.0	85.0	56.0	56.0	56.0	Lw	pppw1		3.0	500	(none)
PPP Wall	+		91.7	91.7	91.7	55.9	55.9	55.9	Lw	pppw2		3.0	500	(none)
PPP Wall	+		81.4	81.4	81.4	55.9	55.9	55.9	Lw	pppw3		3.0	500	(none)
Ash Hall Wall	+		75.6	75.6	75.6	51.0	51.0	51.0	Lw	ahw		3.0	500	(none)
Vechicle Circ Wall	+		78.8	78.8	78.8	51.1	51.1	51.1	Lw	vcw1		3.0	500	(none)
Vechicle Circ Wall	+		78.8	78.8	78.8	51.0	51.0	51.0	Lw	vcw2		3.0	500	(none)
Vechicle Circ Wall	+		80.9	80.9	80.9	51.0	51.0	51.0	Lw	vcw3		3.0	500	(none)
Vechicle Circ Wall	+		79.3	79.3	79.3	51.1	51.1	51.1	Lw	vcw4		3.0	500	(none)
Vechicle Circ Wall	+		76.6	76.6	76.6	50.9	50.9	50.9	Lw	vcw5		3.0	500	(none)
Vechicle Circ Door	+		82.9	82.9	82.9	64.1	64.1	64.1	Lw	vcd		3.0	500	(none)
Vechicle Circ Door	+		82.9	82.9	82.9	64.1	64.1	64.1	Lw	vcd		3.0	500	(none)
MRF Door	+		82.9	82.9	82.9	64.2	64.2	64.2	Lw	mrfd		3.0	500	(none)
MRF Door	+		82.9	82.9	82.9	64.2	64.2	64.2	Lw	mrfd		3.0	500	(none)
Vehicle Circ Door	+		82.9	82.9	82.9	64.1	64.1	64.1	Lw	vcd		3.0	500	(none)
PPP Doors	+		90.8	90.8	90.8	69.0	69.0	69.0	Lw	pppd		3.0	500	(none)
MRF Free Vent	+		93.1	93.1	93.1	68.9	68.9	68.9	Lw	mrffv		3.0	500	(none)
MBT Free Vent	+		89.4	89.4	89.4	69.0	69.0	69.0	Lw	mbtfv		3.0	500	(none)
AD Free Vent	+		94.3	94.3	94.3	73.9	73.9	73.9	Lw	adfv		3.0	500	(none)
Vehicle Circ Free Vent	+		88.4	88.4	88.4	69.0	69.0	69.0	Lw	vcfv1		3.0	500	(none)
WWTP Circ Free Vent	+		97.7	97.7	97.7	74.0	74.0	74.0	Lw	wwtpfv		3.0	500	(none)
Vehicle Circ Free Vent	+		88.0	88.0	88.0	69.0	69.0	69.0	Lw	vcfv2		3.0	500	(none)
MDIP Free Vent	+		88.5	88.5	88.5	68.9	68.9	68.9	Lw	mdipfv		3.0	500	(none)
PPP Free Vent	+		99.9	99.9	99.9	74.0	74.0	74.0	Lw	pppfv		3.0	500	(none)
Vehicle Circ Free Vent	+		88.0	88.0	88.0	69.0	69.0	69.0	Lw	vcfv3		3.0	500	(none)

Vertical Area Source Geometry

Name	Height				Coordinates			
	Begin		End		x	y	z	Ground
	(m)		(m)		(m)	(m)	(m)	(m)
Air Comp 1 Side 1	2.50	r			582448.76	220425.17	32.50	30.00
					582450.18	220426.83	32.50	30.00
Air Comp 1 Side 2	2.50	r			582450.18	220426.83	32.50	30.00
					582448.52	220428.25	32.50	30.00
Air Comp 1 Side 3	2.50	r			582448.52	220428.25	32.50	30.00
					582447.10	220426.59	32.50	30.00
Air Comp 1 Side 4	2.50	r			582447.10	220426.59	32.50	30.00
					582448.76	220425.17	32.50	30.00
Air Comp 2 Side 1	2.50	r			582439.96	220414.97	32.50	30.00
					582441.38	220416.63	32.50	30.00
Air Comp 2 Side 2	2.50	r			582441.38	220416.63	32.50	30.00
					582439.72	220418.05	32.50	30.00
Air Comp 2 Side 3	2.50	r			582439.71	220418.05	32.50	30.00
					582438.30	220416.38	32.50	30.00
Air Comp 2 Side 4	2.50	r			582438.29	220416.38	32.50	30.00
					582439.96	220414.97	32.50	30.00
Bicarb Sid 1	3.50	r			582453.15	220416.79	33.50	30.00
					582456.12	220413.23	33.50	30.00
Bicarb Side 2	3.50	r			582456.12	220413.23	33.50	30.00
					582463.90	220419.69	33.50	30.00
Bicarb Side 3	3.50	r			582463.90	220419.69	33.50	30.00
					582460.93	220423.35	33.50	30.00
Bicarb Side 4	3.50	r			582460.93	220423.34	33.50	30.00
					582453.15	220416.79	33.50	30.00
Boiler Hall Wall 1	30.00	r			582396.86	220418.52	60.00	30.00
					582407.66	220409.74	60.00	30.00
Boiler Hall Wall 2	30.00	r			582407.76	220409.75	60.00	30.00
					582449.01	220460.13	60.00	30.00
Boiler Hall Wall 3	30.00	r			582378.37	220433.52	60.00	30.00
					582387.53	220426.09	60.00	30.00
Boiler Louvre 1	4.00	r			582398.83	220416.91	34.00	30.00
					582406.72	220410.50	34.00	30.00
Boiler Louvre 2	6.00	r			582408.42	220410.48	36.00	30.00
					582414.65	220418.16	36.00	30.00

Boiler Louvre 3	6.00	r			582442.31	220451.82	36.00	30.00
					582448.54	220459.50	36.00	30.00
Boiler Louvre 4	10.00	r			582426.07	220432.08	40.00	30.00
					582432.40	220439.77	40.00	30.00
Boiler Louvre 5	6.00	r			582426.07	220432.08	36.00	30.00
					582432.40	220439.77	36.00	30.00
Recooler 1 Side 1	23.20	r			582390.73	220421.42	53.20	30.00
					582385.89	220416.10	53.20	30.00
Recooler 1 Side 2	23.20	r			582385.89	220416.10	53.20	30.00
					582387.66	220414.49	53.20	30.00
Recooler 1 Side 3	23.20	r			582387.66	220414.49	53.20	30.00
					582392.50	220419.81	53.20	30.00
Recooler 1 Side 4	23.20	r			582392.50	220419.81	53.20	30.00
					582390.73	220421.44	53.20	30.00
Recooler 2 Side 1	23.20	r			582388.54	220423.42	53.20	30.00
					582383.70	220418.10	53.20	30.00
Recooler 2 Side 2	23.20	r			582383.70	220418.10	53.20	30.00
					582385.47	220416.48	53.20	30.00
Recooler 2 Side 3	23.20	r			582385.47	220416.48	53.20	30.00
					582390.31	220421.80	53.20	30.00
Recooler 2 Side 4	23.20	r			582390.31	220421.81	53.20	30.00
					582388.54	220423.42	53.20	30.00
Recooler 3 Side 1	23.20	r			582385.93	220425.79	53.20	30.00
					582381.09	220420.47	53.20	30.00
Recooler 3 Side 2	23.20	r			582381.09	220420.47	53.20	30.00
					582382.86	220418.86	53.20	30.00
Recooler 3 Side 3	23.20	r			582382.86	220418.86	53.20	30.00
					582387.80	220424.16	53.20	30.00
Recooler 3 Side 4	23.20	r			582387.79	220424.16	53.20	30.00
					582385.93	220425.79	53.20	30.00
Recooler 4 Side 1	23.20	r			582383.67	220427.78	53.20	30.00
					582378.90	220422.46	53.20	30.00
Recooler 4 Side 2	23.20	r			582378.90	220422.46	53.20	30.00
					582380.67	220420.85	53.20	30.00
Recooler 4 Side 3	23.20	r			582380.67	220420.85	53.20	30.00
					582385.51	220426.17	53.20	30.00
Recooler 4 Side 4	23.20	r			582385.51	220426.17	53.20	30.00
					582383.74	220427.78	53.20	30.00

E Mod Side 1	10.50	r			582400.72	220385.45	40.50	30.00
					582408.83	220395.52	40.50	30.00
E Mod Side 2	10.50	r			582408.83	220395.52	40.50	30.00
					582401.04	220401.84	40.50	30.00
E Mod Side 3	10.50	r			582401.04	220401.84	40.50	30.00
					582392.93	220391.77	40.50	30.00
E Mod Side 4	10.50	r			582392.93	220391.77	40.50	30.00
					582400.72	220385.45	40.50	30.00
FF1 Side 1	15.00	r			582419.76	220417.80	45.00	30.00
					582433.06	220406.75	45.00	30.00
FF1 Side 2	15.00	r			582433.06	220406.75	45.00	30.00
					582438.92	220413.82	45.00	30.00
FF1 Side 3	15.00	r			582438.92	220413.82	45.00	30.00
					582425.61	220424.87	45.00	30.00
FF1 Side 4	15.00	r			582425.61	220424.87	45.00	30.00
					582419.76	220417.80	45.00	30.00
FF2 Side 1	15.00	r			582437.83	220438.83	45.00	30.00
					582451.14	220427.78	45.00	30.00
FF2 Side 2	15.00	r			582451.14	220427.78	45.00	30.00
					582456.99	220434.84	45.00	30.00
FF2 Side 3	15.00	r			582457.00	220434.84	45.00	30.00
					582443.69	220445.90	45.00	30.00
FF2 Side 4	15.00	r			582443.69	220445.90	45.00	30.00
					582437.83	220438.83	45.00	30.00
ID Fan 1 Side 1	4.00	r			582438.08	220406.09	34.00	30.00
					582441.30	220403.45	34.00	30.00
ID Fan 1 Side 2	4.00	r			582441.30	220403.45	34.00	30.00
					582443.39	220405.84	34.00	30.00
ID Fan 1 Side 3	4.00	r			582443.39	220405.84	34.00	30.00
					582440.16	220408.58	34.00	30.00
ID Fan 1 Side 4	4.00	r			582440.16	220408.58	34.00	30.00
					582438.09	220406.09	34.00	30.00
ID Fan 2 Side 1	4.00	r			582454.60	220426.25	34.00	30.00
					582457.73	220423.49	34.00	30.00
ID Fan 2 Side 2	4.00	r			582457.73	220423.49	34.00	30.00
					582459.81	220425.99	34.00	30.00
ID Fan 2 Side 3	4.00	r			582459.81	220425.98	34.00	30.00
					582456.59	220428.63	34.00	30.00

ID Fan 2 Side 4	4.00	r			582456.59	220428.63	34.00	30.00
					582454.60	220426.25	34.00	30.00
Tranformer Side 1	8.00	r			582386.49	220354.82	43.00	35.00
					582402.43	220368.16	43.00	35.00
Tranformer Side 2	8.00	r			582402.43	220368.16	43.00	35.00
					582397.46	220374.11	43.00	35.00
Tranformer Side 3	8.00	r			582397.46	220374.11	43.00	35.00
					582381.52	220360.68	43.00	35.00
Tranformer Side 4	8.00	r			582381.52	220360.68	43.00	35.00
					582386.49	220354.82	43.00	35.00
Coke Side 1	3.00	r			582452.56	220412.47	33.00	30.00
					582451.14	220410.80	33.00	30.00
Coke Side 2	3.00	r			582451.14	220410.80	33.00	30.00
					582452.49	220409.67	33.00	30.00
Coke Side 3	3.00	r			582452.49	220409.67	33.00	30.00
					582453.91	220411.33	33.00	30.00
Coke Side 4	3.00	r			582453.91	220411.33	33.00	30.00
					582452.56	220412.47	33.00	30.00
Steam Turbine Wall 1	16.20	r			582357.41	220408.07	51.20	35.00
					582376.00	220392.97	51.20	35.00
Steam Turbine Wall 2	21.20	r			582376.19	220393.18	51.20	30.00
					582388.46	220408.24	51.20	30.00
Steam Turbine Wall 3	7.50	r			582375.79	220393.06	42.50	35.00
					582386.08	220384.66	42.50	35.00
Steam Turbine Wall 4	12.50	r			582391.92	220391.92	42.50	30.00
					582398.63	220400.03	42.50	30.00
Steam Turbine Wall 5	12.50	r			582398.63	220400.03	42.50	30.00
					582388.45	220408.44	42.50	30.00
Steam Turbine Wall 6	7.50	r			582386.07	220384.76	42.50	35.00
					582391.82	220391.92	42.50	35.00
Steam Turbine Wall 7	21.20	r			582388.56	220408.24	51.20	30.00
					582396.86	220418.52	51.20	30.00
Steam Turbine Gate	5.00	r			582393.65	220414.57	35.00	30.00
					582396.76	220418.41	35.00	30.00
Steam Turbine Vent 1	8.00	r			582388.65	220408.44	38.00	30.00
					582393.46	220414.26	38.00	30.00
Steam Turbine Vent 2	18.00	r			582376.75	220393.90	48.00	30.00
					582388.18	220407.82	48.00	30.00

ACOUSTICAL CONTROL Engineers & Consultants

Steam Turbine Vent 3	6.00	r			582366.44	220400.80	41.00	35.00
					582375.27	220393.53	41.00	35.00
MRF Wall	60.00	a			582126.98	220485.00	60.00	35.00
					582183.30	220552.69	60.00	35.00
MRF Wall	60.00	a			582126.98	220485.00	60.00	35.00
					582159.47	220458.21	60.00	35.00
MBT Wall	60.00	a			582159.48	220458.21	60.00	35.00
					582202.07	220422.88	60.00	35.00
AD Wall	60.00	a			582202.10	220422.85	60.00	35.00
					582244.10	220388.52	60.00	35.00
WWTP Wall	60.00	a			582278.02	220360.87	60.00	30.00
					582302.25	220340.94	60.00	30.00
WWTP Wall	60.00	a			582302.25	220340.94	60.00	30.00
					582326.21	220370.13	60.00	32.90
WWTP Wall	60.00	a			582326.21	220370.14	60.00	32.90
					582357.45	220408.17	60.00	35.00
MDP Storage Wall	60.00	a			582208.70	220583.06	60.00	35.00
					582237.69	220617.73	60.00	35.00
PPP Wall	60.00	a			582237.74	220617.80	60.00	35.00
					582258.00	220642.01	60.00	35.00
PPP Wall	60.00	a			582258.00	220642.01	60.00	35.00
					582374.20	220546.55	60.00	35.00
PPP Wall	60.00	a			582374.21	220546.55	60.00	35.00
					582365.27	220535.41	60.00	35.00
Ash Hall Wall	60.00	a			582357.58	220408.30	60.00	30.00
					582378.37	220433.65	60.00	30.00
Vechicle Circ Wall	60.00	a			582244.22	220388.64	60.00	35.00
					582262.45	220373.64	60.00	35.00
Vechicle Circ Wall	60.00	a			582262.52	220373.61	60.00	34.66
					582277.95	220360.92	60.00	30.00
Vechicle Circ Wall	60.00	a			582208.66	220583.02	60.00	35.00
					582183.33	220552.72	60.00	35.00
Vechicle Circ Wall	60.00	a			582365.27	220535.41	60.00	35.00
					582385.68	220518.42	60.00	35.00
Vechicle Circ Wall	60.00	a			582386.22	220517.96	60.00	30.00
					582395.71	220509.95	60.00	30.00
Vechicle Circ Door	41.00	a			582244.71	220388.15	41.00	35.00
					582254.38	220380.17	41.00	35.00

Vechicle Circ Door	41.00	a			582365.78	220535.01	41.00	35.00
					582375.42	220527.01	41.00	35.00
MRF Door	41.00	a			582133.14	220479.91	41.00	35.00
					582142.74	220471.95	41.00	35.00
MRF Door	41.00	a			582164.80	220530.55	41.00	35.00
					582172.60	220540.09	41.00	35.00
Vehicle Circ Door	41.00	a			582192.06	220563.22	41.00	35.00
					582200.18	220573.03	41.00	35.00
PPP Doors	40.00	a			582306.64	220602.11	40.00	35.00
					582329.87	220583.11	40.00	35.00
MRF Free Vent	50.00	a			582183.23	220552.73	50.00	35.00
					582126.94	220485.00	50.00	35.00
					582159.43	220458.18	50.00	35.00
MBT Free Vent	50.00	a			582159.43	220458.18	50.00	35.00
					582202.02	220422.85	50.00	35.00
AD Free Vent	50.00	a			582202.08	220422.81	50.00	35.00
					582244.01	220388.45	50.00	35.00
Vehicle Circ Free Vent	50.00	a			582244.14	220388.50	50.00	35.00
					582277.84	220360.89	50.00	30.00
WWTP Circ Free Vent	50.00	a			582278.00	220360.84	50.00	30.00
					582302.24	220340.88	50.00	30.00
					582357.47	220408.15	50.00	35.00
Vehicle Circ Free Vent	50.00	a			582183.25	220552.75	50.00	35.00
					582208.63	220583.03	50.00	35.00
MDIP Free Vent	50.00	a			582208.69	220583.07	50.00	35.00
					582237.68	220617.73	50.00	35.00
PPP Free Vent	50.00	a			582237.73	220617.80	50.00	35.00
					582257.99	220642.01	50.00	35.00
					582374.28	220546.60	50.00	35.00
					582365.30	220535.42	50.00	35.00
Vehicle Circ Free Vent	50.00	a			582365.29	220535.42	50.00	35.00
					582395.78	220510.00	50.00	30.00

Roads

Road Data

Name	M.	ID	L10			exact Count Data						Traffic Speed	SCS	Surface	Gradient
			Day	Evening	Night	q			p (%)				Dist.	Type	
			(dBA)	(dBA)	(dBA)	Day	Evening	Night	Day	Evening	Night	(km/h)			(%)
Quarry Entrance Road	+		65.3	65.3	0.0	40.0	40.0	0.0	95.0	95.0	95.0	64	0.0	3	0.0
IWMF Entrance Road	+		65.2	65.2	0.0	40.0	40.0	0.0	95.0	95.0	95.0	24	0.0	3	0.0
IWMF Entrance Road	+		65.2	65.2	0.0	40.0	40.0	0.0	95.0	95.0	95.0	24	0.0	3	0.0
IWMF Entrance Road	+		65.2	65.2	0.0	40.0	40.0	0.0	95.0	95.0	95.0	24	0.0	3	0.0

Road Geometry

Name	Height				Coordinates				Dist	LSlope
	Begin		End		x	y	z	Ground	(m)	(%)
	(m)		(m)		(m)	(m)	(m)	(m)		
Quarry Entrance Road	0.00	r			581501.37	222909.83	48.00	48.00		
					581484.86	222828.32	48.00	48.00		
					581483.83	222800.46	48.00	48.00		
					581498.27	222780.85	48.00	48.00		
					581513.75	222743.71	48.00	48.00		
					581514.78	222693.15	48.00	48.00		
					581429.14	222306.22	48.00	48.00		
					581442.55	222284.56	48.00	48.00		
					581558.12	222193.76	48.00	48.00		
					581626.57	222078.86	48.00	48.00		
					581673.01	221968.85	48.00	48.00		
					581756.13	221853.95	48.00	48.00		
					581787.39	221798.64	48.00	48.00		
IWMF Entrance Road	0.00	r			581787.39	221798.64	48.00	48.00		
					581819.69	221741.50	48.00	48.00		
					581861.25	221663.27	48.00	48.00		
					581902.81	221615.68	48.00	48.00		
					581951.53	221556.68	48.00	48.00		
					581992.85	221471.16	48.00	48.00		
					582006.11	221382.49	48.00	48.00		
					581993.18	221236.13	48.00	48.00		
					581941.82	220875.52	48.00	48.00		
					581939.75	220822.78	48.00	48.00		
					581949.80	220716.19	48.00	48.00		
					581969.19	220603.32	44.12	44.12		
					581989.73	220566.66	38.60	38.60		
					582046.78	220513.40	35.00	35.00		
					582117.22	220485.72	35.00	35.00		
IWMF Entrance Road	0.00	r			582119.28	220486.87	35.00	35.00		
					582259.50	220651.05	35.00	35.00		
					582383.18	220546.10	35.00	35.00		
					582374.47	220532.16	35.00	35.00		
IWMF Entrance Road	0.00	r			582117.37	220484.20	35.00	35.00		
					582149.16	220463.74	35.00	35.00		

					582247.67	220380.78	35.00	35.00		
					582250.13	220383.84	35.00	35.00		

Buildings

Name	M.	ID	RB	Residents	Absorption	Height	
						Begin	
						(m)	
IWMF	+			0	0.15		
Compressor 1	+			0	0.15	2.50	r
Compressor 2	+			0	0.15	2.50	r
ID Fan	+			0	0.15	4.00	r
Re-Cooler 1	+			0	0.15		
Re-Cooler 2	+			0	0.15		
Re-Cooler 3	+			0	0.15		
Re-Cooler 4	+			0	0.15		
Fabric Filter 1	+			0	0.15	15.00	r
Fabric Filter 2	+			0	0.15	15.00	r
Annex to T Building	+			0	0.15	3.50	r
Emergency Diesel	+			0	0.15	3.50	r
GIS Building	+			0	0.15	10.00	r
Transformer Building	+			0	0.15	8.00	r
ST Building 1	+			0	0.15	12.50	r
ST Building 2	+			0	0.15		
Annex	+			0	0.15		
E-Mod 1	+			0	0.15	3.50	r
E-Mod 2	+			0	0.15	3.50	r
ID Fan 2	+			0	0.15	4.00	r
E-Mod 3	+			0	0.15	4.00	r
E-Mod 4	+			0	0.15	4.00	r
E-Mod ST	+			0	0.15	10.50	r
Coke Blower	+			0	0.15	3.00	r
Bicard Silo Crush	+			0	0.15	3.50	r

Building Geometry

Name	M.	ID	RB	Residents	Absorption	Height		Coordinates			
						Begin		x	y	z	Ground
						(m)		(m)	(m)	(m)	(m)
IWMF	+			0	0.15			582127.00	220485.00	60.00	30.00
								582258.00	220642.00	60.00	30.00
								582373.94	220546.60	60.00	30.00
								582365.13	220535.43	60.00	30.00
								582451.47	220463.25	60.00	30.00
								582407.71	220409.86	60.00	30.00
								582378.38	220433.69	60.00	30.00
								582302.25	220340.99	60.00	30.00
Compressor 1	+			0	0.15	2.50	r	582447.17	220426.60	32.50	30.00
								582448.47	220428.13	32.50	30.00
								582450.01	220426.83	32.50	30.00
								582448.71	220425.29	32.50	30.00
Compressor 2	+			0	0.15	2.50	r	582438.47	220416.36	32.50	30.00
								582439.76	220417.90	32.50	30.00
								582441.30	220416.60	32.50	30.00
								582440.00	220415.06	32.50	30.00
ID Fan	+			0	0.15	4.00	r	582440.21	220408.45	34.00	30.00
								582443.27	220405.86	34.00	30.00
								582441.32	220403.56	34.00	30.00
								582438.26	220406.15	34.00	30.00
Re-Cooler 1	+			0	0.15			582392.37	220419.78	53.20	51.20
								582387.67	220414.60	53.20	51.20
								582386.03	220416.09	53.20	51.20
								582390.74	220421.27	53.20	51.20
Re-Cooler 2	+			0	0.15			582390.16	220421.80	53.20	51.20
								582385.44	220416.61	53.20	51.20
								582383.81	220418.10	53.20	51.20
								582388.52	220423.29	53.20	51.20
Re-Cooler 3	+			0	0.15			582387.77	220424.15	53.20	51.20
								582382.87	220418.97	53.20	51.20
								582381.23	220420.46	53.20	51.20
								582385.94	220425.63	53.20	51.20
Re-Cooler 4	+			0	0.15			582385.36	220426.15	53.20	51.20
								582380.65	220420.98	53.20	51.20

								582379.02	220422.47	53.20	51.20
								582383.72	220427.64	53.20	51.20
Fabric Filter 1	+			0	0.15	15.00	r	582425.63	220424.77	45.00	30.00
								582438.82	220413.83	45.00	30.00
								582433.07	220406.91	45.00	30.00
								582419.88	220417.85	45.00	30.00
Fabric Filter 2	+			0	0.15	15.00	r	582443.69	220445.77	45.00	30.00
								582456.87	220434.83	45.00	30.00
								582451.13	220427.90	45.00	30.00
								582437.94	220438.84	45.00	30.00
Annex to T Building	+			0	0.15	3.50	r	582375.61	220352.34	38.50	35.00
								582378.61	220348.58	38.50	35.00
								582386.47	220354.87	38.50	35.00
								582383.42	220358.52	38.50	35.00
Emergency Diesel	+			0	0.15	3.50	r	582386.27	220379.37	38.50	35.00
								582393.72	220388.17	38.50	35.00
								582391.50	220390.24	38.50	35.00
								582384.26	220381.13	38.50	35.00
GIS Building	+			0	0.15	10.00	r	582403.46	220383.63	40.00	30.00
								582409.84	220390.78	40.00	30.00
								582419.97	220382.25	40.00	30.00
								582413.98	220375.05	40.00	30.00
Transformer Building	+			0	0.15	8.00	r	582381.63	220360.71	43.00	35.00
								582397.49	220373.99	43.00	35.00
								582402.33	220368.20	43.00	35.00
								582386.47	220354.93	43.00	35.00
ST Building 1	+			0	0.15	12.50	r	582388.45	220408.31	42.50	30.00
								582398.51	220400.06	42.50	30.00
								582386.03	220384.84	42.50	35.00
								582375.97	220393.08	42.50	35.00
ST Building 2	+			0	0.15			582378.35	220433.58	51.20	30.00
								582396.79	220418.54	51.20	30.00
								582375.98	220393.07	51.20	30.00
								582357.56	220408.11	51.20	30.00
Annex	+			0	0.15			582326.44	220370.01	42.50	30.00
								582334.13	220363.34	42.50	30.00
								582365.89	220400.96	42.50	30.00
								582357.43	220408.05	42.50	30.00

E-Mod 1	+			0	0.15	3.50	r	582421.85	220410.76	33.50	30.00
								582423.47	220412.93	33.50	30.00
								582429.85	220407.85	33.50	30.00
								582428.03	220405.57	33.50	30.00
E-Mod 2	+			0	0.15	3.50	r	582448.95	220443.44	33.50	30.00
								582450.57	220445.60	33.50	30.00
								582456.96	220440.51	33.50	30.00
								582455.14	220438.25	33.50	30.00
ID Fan 2	+			0	0.15	4.00	r	582456.62	220428.54	34.00	30.00
								582459.68	220425.95	34.00	30.00
								582457.73	220423.65	34.00	30.00
								582454.67	220426.25	34.00	30.00
E-Mod 3	+			0	0.15	4.00	r	582428.19	220427.22	34.00	30.00
								582437.43	220419.65	34.00	30.00
								582439.11	220421.71	34.00	30.00
								582430.10	220429.19	34.00	30.00
E-Mod 4	+			0	0.15	4.00	r	582433.94	220433.99	34.00	30.00
								582443.18	220426.43	34.00	30.00
								582444.86	220428.49	34.00	30.00
								582435.85	220435.96	34.00	30.00
E-Mod ST	+			0	0.15	10.50	r	582393.04	220391.77	40.50	30.00
								582401.05	220401.71	40.50	30.00
								582408.74	220395.51	40.50	30.00
								582400.73	220385.57	40.50	30.00
Coke Blower	+			0	0.15	3.00	r	582453.75	220411.35	33.00	30.00
								582452.45	220409.82	33.00	30.00
								582451.29	220410.81	33.00	30.00
								582452.60	220412.34	33.00	30.00
Bicard Silo Crush	+			0	0.15	3.50	r	582460.96	220423.17	33.50	30.00
								582463.79	220419.74	33.50	30.00
								582456.08	220413.38	33.50	30.00
								582453.25	220416.82	33.50	30.00
								582460.96	220423.17	33.50	30.00

Building Element Sound Reduction Index Spectra

Name	ID	Oktave Spectrum (dB)										Source
		31.5	63	125	250	500	1000	2000	4000	8000	Rw	
IWMF Walls	W1	22.0	22.0	22.0	22.0	23.0	22.0	22.0	22.0	22.0	23	
Free Vents	FV1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6	
Doors	D1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11	

Barriers

Name	M.	ID	Absorption		Z-Ext.	Cantilever		Height			
			left	right		horz.	vert.	Begin		End	
					(m)	(m)	(m)	(m)		(m)	
ACC Windwall	+		0.1	0.1	11.00			20.00	r		
Admin Appendix	+		0.1	0.1	12.50			24.00	r		
Silo 1	+		0.1	0.1	18.00			60.00	a		
Silo 2	+		0.1	0.1	18.00			60.00	a		

Barrier Geometry

Name	M.	ID	Absorption		Z-Ext.	Cantilever		Height				Coordinates			
			left	right		horz.	vert.	Begin		End		x	y	z	Ground
					(m)	(m)	(m)	(m)		(m)		(m)	(m)	(m)	(m)
ACC Windwall	+		0.1	0.1	11.00			20.00	r			582336.59	220353.01	55.00	35.00
												582355.49	220337.28	55.00	35.00
												582386.70	220374.77	55.00	35.00
												582367.81	220390.50	55.00	35.00
												582336.59	220353.01	55.00	35.00
Admin Appendix	+		0.1	0.1	12.50			24.00	r			582451.52	220463.28	54.00	30.00
												582453.81	220466.18	54.00	30.00
												582411.09	220501.20	54.00	30.00
												582409.03	220498.72	54.00	30.00
Silo 1	+		0.1	0.1	18.00			60.00	a			582454.31	220406.24	60.00	30.00
												582454.72	220406.73	60.00	30.00
												582454.86	220407.06	60.00	30.00
												582454.95	220407.43	60.00	30.00
												582454.95	220407.81	60.00	30.00
												582454.88	220408.17	60.00	30.00
												582454.74	220408.51	60.00	30.00
												582454.54	220408.81	60.00	30.00
												582454.29	220409.07	60.00	30.00
												582454.00	220409.28	60.00	30.00
												582453.66	220409.43	60.00	30.00
												582453.30	220409.50	60.00	30.00
												582452.93	220409.52	60.00	30.00
												582452.55	220409.45	60.00	30.00
												582452.21	220409.30	60.00	30.00
												582451.91	220409.11	60.00	30.00
												582451.65	220408.86	60.00	30.00
												582451.45	220408.57	60.00	30.00
												582451.30	220408.23	60.00	30.00
												582451.22	220407.87	60.00	30.00
												582451.22	220407.49	60.00	30.00
												582451.29	220407.12	60.00	30.00
												582451.42	220406.78	60.00	30.00
												582451.62	220406.48	60.00	30.00
												582451.87	220406.22	60.00	30.00

												582452.17	220406.02	60.00	30.00
												582452.49	220405.86	60.00	30.00
												582452.87	220405.79	60.00	30.00
												582453.23	220405.78	60.00	30.00
												582453.60	220405.84	60.00	30.00
												582453.94	220405.99	60.00	30.00
												582454.26	220406.19	60.00	30.00
												582454.31	220406.24	60.00	30.00
Silo 2	+		0.1	0.1	18.00			60.00	a			582457.58	220409.88	60.00	30.00
												582457.98	220410.37	60.00	30.00
												582458.13	220410.70	60.00	30.00
												582458.21	220411.06	60.00	30.00
												582458.22	220411.44	60.00	30.00
												582458.15	220411.81	60.00	30.00
												582458.01	220412.15	60.00	30.00
												582457.81	220412.46	60.00	30.00
												582457.56	220412.72	60.00	30.00
												582457.26	220412.92	60.00	30.00
												582456.94	220413.07	60.00	30.00
												582456.57	220413.14	60.00	30.00
												582456.20	220413.16	60.00	30.00
												582455.83	220413.09	60.00	30.00
												582455.48	220412.95	60.00	30.00
												582455.17	220412.75	60.00	30.00
												582454.93	220412.50	60.00	30.00
												582454.72	220412.21	60.00	30.00
												582454.57	220411.87	60.00	30.00
												582454.49	220411.51	60.00	30.00
												582454.48	220411.13	60.00	30.00
												582454.55	220410.76	60.00	30.00
												582454.68	220410.42	60.00	30.00
												582454.89	220410.12	60.00	30.00
												582455.14	220409.86	60.00	30.00
												582455.43	220409.66	60.00	30.00
												582455.77	220409.50	60.00	30.00
												582456.13	220409.43	60.00	30.00
												582456.50	220409.42	60.00	30.00
												582456.88	220409.48	60.00	30.00

												582457.22	220409.63	60.00	30.00
												582457.52	220409.82	60.00	30.00
												582457.58	220409.88	60.00	30.00

ACOUSTICAL CONTROL Engineers & Consultants

Contours

Name	M.	ID	OnlyPts	Height		Coordinates		
				Begin	End	x	y	z
				(m)	(m)	(m)	(m)	(m)
C1	+					582447.26	220520.35	48.00
						582491.82	220488.11	48.00
						582512.06	220471.79	48.00
						582539.39	220447.03	48.00
						582571.95	220421.61	48.00
						582506.12	220360.88	48.00
						582428.31	220300.28	48.00
						582351.17	220242.22	48.00
						582314.71	220269.95	48.00
						582282.58	220290.60	48.00
						582268.99	220303.63	48.00
						582261.48	220314.56	48.00
						582243.69	220327.50	48.00
						582231.33	220346.09	48.00
						582204.08	220369.26	48.00
						582201.86	220373.85	48.00
						582184.17	220386.89	48.00
						582173.43	220402.96	48.00
						582152.41	220414.55	48.00
						582109.16	220457.14	48.00
						582081.96	220432.49	48.00
						582055.52	220432.13	48.00
						582021.30	220454.68	48.00
						581976.41	220491.90	48.00
						581951.31	220520.17	48.00
						581929.95	220551.51	48.00
						581920.61	220573.93	48.00
						581910.52	220628.87	48.00
						581986.62	220641.26	48.00
						582000.72	220653.41	48.00
						582014.39	220645.17	48.00
						582033.44	220643.47	48.00
						582092.00	220655.23	48.00
						582226.57	220685.36	48.00

						582294.59	220697.66	48.00
						582311.77	220695.48	48.00
						582375.56	220651.36	48.00
						582412.95	220625.17	48.00
						582430.52	220612.42	48.00
						582412.11	220587.99	48.00
						582410.13	220564.43	48.00
						582419.24	220544.79	48.00
						582430.71	220534.65	48.00
						582433.83	220519.32	48.00
C5	+					582413.73	220374.28	30.00
						582416.60	220370.43	30.00
						582377.92	220339.64	35.00
						582374.95	220343.39	35.00
						582413.73	220374.28	30.00
C4	+					582258.34	220368.33	35.00
						582147.94	220460.57	35.00
						582123.40	220472.69	35.00
						582106.33	220481.07	35.00
						582114.16	220494.92	35.00
						582261.23	220657.84	35.00
						582385.28	220555.67	35.00
						582391.95	220545.50	35.00
						582394.61	220535.64	35.00
						582394.82	220529.06	35.00
						582258.13	220368.52	35.00
C6	+					582353.10	220319.69	35.00
						582361.67	220326.49	35.00
						582377.82	220339.63	35.00
						582374.85	220343.39	35.00
						582405.15	220367.79	35.00
						582394.93	220376.89	35.00
						582401.16	220384.57	35.00
						582382.18	220399.55	35.00
						582376.20	220392.98	35.00
						582376.02	220393.12	35.00
C6	+					582376.02	220393.12	35.00
						582357.61	220408.18	35.00

C6	+					582357.61	220408.18	35.00
						582357.50	220408.27	35.00
						582328.99	220373.47	35.00
						582307.46	220345.29	35.00
						582302.52	220339.97	35.00
						582312.07	220332.23	35.00
						582328.51	220320.23	35.00
						582336.04	220317.39	35.00
						582341.06	220316.73	35.00
						582347.50	220317.73	35.00
						582353.10	220319.79	35.00
C3	+					582307.25	220345.38	30.00
						582328.76	220374.06	30.00
						582357.50	220408.37	30.00
						582357.66	220408.24	30.00
C3	+					582357.66	220408.24	30.00
						582365.80	220401.67	30.00
						582376.07	220393.18	30.00
C3	+					582376.07	220393.18	30.00
						582376.19	220393.08	30.00
						582382.17	220399.75	30.00
						582391.92	220391.92	30.00
						582401.23	220384.60	30.00
						582395.13	220376.90	30.00
						582405.30	220367.78	30.00
						582413.72	220374.38	30.00
						582416.64	220370.44	30.00
						582450.55	220397.89	30.00
						582466.33	220410.52	30.00
						582476.15	220418.27	30.00
						582482.04	220424.74	30.00
						582485.32	220431.29	30.00
						582485.89	220440.40	30.00
						582483.41	220450.57	30.00
						582479.33	220456.57	30.00
						582472.39	220461.93	30.00
						582456.58	220475.26	30.00
						582434.55	220493.49	30.00

						582431.16	220489.14	30.00
						582391.08	220523.69	30.00
						582262.91	220373.04	30.00
						582302.40	220340.26	30.00
						582307.16	220345.28	30.00
C2	+					582487.53	220452.06	30.00
						582489.93	220435.10	38.00
						582486.83	220420.58	38.00
						582446.70	220386.53	38.00
						582361.90	220319.51	38.00
						582348.53	220310.79	38.00
						582338.51	220307.32	38.00
						582328.87	220308.46	38.00
						582309.48	220321.43	38.00
						582295.81	220331.86	38.00
						582275.37	220350.27	41.00
						582226.14	220390.48	44.00
						582171.90	220437.44	44.00
						582148.35	220456.09	40.00
						582130.70	220466.04	40.00
						582103.20	220479.72	35.00
						582042.78	220503.12	35.00
						582056.31	220520.94	35.00
						582021.51	220553.74	35.00
						582011.25	220574.43	35.00
						582008.43	220595.96	35.00
						582020.45	220612.01	35.00
						582048.07	220621.40	35.00
						582115.23	220634.96	35.00
						582169.67	220644.92	35.00
						582202.73	220646.98	35.00
						582227.55	220641.57	35.00
						582242.06	220653.44	35.00
						582253.91	220658.49	35.00
						582269.94	220663.54	35.00
						582291.21	220653.07	35.00
						582361.39	220598.47	35.00
						582386.49	220574.40	35.00

							582396.46	220555.80	35.00
							582401.57	220542.76	35.00
							582404.72	220530.92	30.00
							582440.76	220499.48	30.00
							582463.19	220481.27	30.00
							582480.91	220465.33	30.00
							582487.72	220452.27	30.00

Receptors

Results Table (1.5m Receptor Height)

Receiver		Land Use	Limiting Value		rel. Axis			Lr w/o Noise Control		dL req.		Lr w/ Noise Control		Exceeding		passive NC
Name	ID		Day	Night	Station	Distance	Height	Day	Night	Day	Night	Day	Night	Day	Night	
			dB(A)	dB(A)	m	m	m	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
Herons Farm			0	0	1732	424.57	1.50	41.6	32.8	41.6	32.8	0.0	0.0	-	-	-
Deeks Cottage			0	0	1532	865.31	14.50	37.3	31.9	37.3	31.9	0.0	0.0	-	-	-
Haywards			0	0	1632	968.25	14.50	35.3	31.3	35.3	31.3	0.0	0.0	-	-	-
Allshots Farm			0	0	0	515.09	6.00	38.6	37.1	38.6	37.1	0.0	0.0	-	-	-
The Lodge			0	0	3	458.75	6.00	39.4	38.2	39.4	38.2	0.0	0.0	-	-	-
Sheepcotes Farm			0	0	2518	531.06	5.38	38.9	32.7	38.9	32.7	0.0	0.0	-	-	-
Greenpastures Bungalow			0	0	2056	740.54	1.50	38.7	28.4	38.7	28.4	0.0	0.0	-	-	-
Goslings Cottage			0	0	1408	389.70	1.50	42.7	28.7	42.7	28.7	0.0	0.0	-	-	-
Goslings Farm			0	0	1408	470.67	1.50	41.6	28.7	41.6	28.7	0.0	0.0	-	-	-
Goslings Barn			0	0	1408	530.46	1.50	40.9	28.5	40.9	28.5	0.0	0.0	-	-	-
Bumby Hall			0	0	1	866.12	16.00	34.1	33.0	34.1	33.0	0.0	0.0	-	-	-
Parkgate Farm Cottages			0	0	0	1085.77	-5.00	32.9	31.2	32.9	31.2	0.0	0.0	-	-	-

ACOUSTICAL CONTROL Engineers & Consultants

Partial Levels (1.5m Receptor Height)

Source			Partial Level																									
Name	M.	ID	Herons Farm		Deeks Cottage		Haywards		Allshots Farm		The Lodge		Sheepcotes Farm		Greenpastures Bungalow		Goslings Cottage		Goslings Farm		Goslings Barn		Bumby Hall		Parkgate Farm Cottages	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Vent Fan	+	ventf	-3.3	-3.3	1.4	1.4	10.1	10.1	18.2	18.2	24.8	24.8	-2.1	-2.1	-6.8	-6.8	-6.6	-6.6	-6.6	-6.6	-6.7	-6.7	18.9	18.9	17.2	17.2
Stack Outlet 2	+	stack2	20.0	20.0	20.1	20.1	16.6	16.6	23.0	23.0	24.1	24.1	18.2	18.2	14.4	14.4	14.6	14.6	14.6	14.6	14.6	14.6	18.8	18.8	17.1	17.1
Stack Outlet Air	+	stackas	0.5	0.5	0.7	0.7	-0.7	-0.7	4.7	4.7	5.4	5.4	-0.1	-0.1	-4.7	-4.7	-4.0	-4.0	-4.1	-4.1	-3.6	-3.6	0.6	0.6	-7.1	-7.1
Stack Outlet 1	+	stack1	18.6	18.6	18.8	18.8	18.3	18.3	23.9	23.9	24.9	24.9	19.3	19.3	14.1	14.1	14.7	14.7	14.6	14.6	14.5	14.5	18.9	18.9	15.9	15.9
Exhaust Pipe 1	+	meap1	6.8	6.8	8.2	8.2	7.3	7.3	13.2	13.2	14.1	14.1	-16.0	-16.0	-13.5	-13.5	-6.6	-6.6	-9.0	-9.0	-9.3	-9.3	6.8	6.8	-18.1	-18.1
Exhaust Pipe 2	+	meap2	-7.7	-7.7	-1.1	-1.1	0.2	0.2	8.4	8.4	9.5	9.5	-20.7	-20.7	-23.5	-23.5	-15.4	-15.4	-18.6	-18.6	-15.6	-15.6	3.6	3.6	-3.6	-3.6
Exhaust Pipe 3	+	meap3	-15.8	-15.8	-6.2	-6.2	1.2	1.2	5.9	5.9	7.2	7.2	-22.0	-22.0	-24.6	-24.6	-24.2	-24.2	-24.3	-24.3	-24.4	-24.4	2.0	2.0	-0.3	-0.3
Exhaust Pipe 4	+	meap4	-22.8	-22.8	-15.0	-15.0	-13.8	-13.8	-5.1	-5.1	-3.5	-3.5	-26.5	-26.5	-30.4	-30.4	-30.0	-30.0	-30.1	-30.1	-30.2	-30.2	-12.6	-12.6	-12.4	-12.4
Exhaust Pipe 5	+	meap5	-9.5	-9.5	-1.0	-1.0	-3.3	-3.3	3.1	3.1	2.7	2.7	-10.4	-10.4	-14.8	-14.8	-14.5	-14.5	-14.6	-14.6	-14.6	-14.6	-12.4	-12.4	-4.4	-4.4
Exhaust Pipe 6	+	meap6	11.5	11.5	11.4	11.4	10.6	10.6	15.3	15.3	16.3	16.3	-12.7	-12.7	-12.6	-12.6	4.7	4.7	4.5	4.5	1.8	1.8	7.2	7.2	-7.5	-7.5
Inlet Pipe 1	+	idip1	-17.1	-17.1	-5.0	-5.0	-4.9	-4.9	5.8	5.8	4.0	4.0	-18.3	-18.3	-22.6	-22.6	-22.5	-22.5	-22.5	-22.5	-22.6	-22.6	3.8	3.8	1.1	1.1
Inlet Pipe 2	+	idip2	-12.9	-12.9	-6.4	-6.4	1.7	1.7	8.4	8.4	9.2	9.2	-14.9	-14.9	-19.2	-19.2	-19.1	-19.1	-19.2	-19.2	-19.3	-19.3	3.2	3.2	3.9	3.9
Inlet Pipe 3	+	idip3	-16.5	-16.5	-10.9	-10.9	-6.9	-6.9	0.3	0.3	0.6	0.6	-22.6	-22.6	-26.6	-26.6	-26.6	-26.6	-26.7	-26.7	-26.5	-26.5	-6.6	-6.6	-5.7	-5.7
Inlet Pipe 4	+	idip4	-1.7	-1.7	1.1	1.1	0.3	0.3	9.4	9.4	10.3	10.3	-19.9	-19.9	-22.3	-22.3	-21.4	-21.4	-21.6	-21.6	-21.7	-21.7	3.9	3.9	-5.9	-5.9
Inlet Pipe 5	+	idip5	1.2	1.2	1.6	1.6	0.7	0.7	8.1	8.1	10.2	10.2	-18.4	-18.4	-21.2	-21.2	-20.7	-20.7	-20.9	-20.9	-21.0	-21.0	4.6	4.6	-2.1	-2.1
Inlet Pipe 6	+	idip6	-6.0	-6.0	-6.2	-6.2	-6.6	-6.6	-0.5	-0.5	1.9	1.9	-23.5	-23.5	-26.9	-26.9	-26.5	-26.5	-26.6	-26.6	-26.7	-26.7	-2.9	-2.9	-10.4	-10.4
Out Pipe 1	+	idop1	-11.1	-11.1	-2.1	-2.1	0.7	0.7	8.3	8.3	9.5	9.5	-8.8	-8.8	-20.7	-20.7	-20.3	-20.3	-20.4	-20.4	-20.5	-20.5	4.9	4.9	3.7	3.7
Out Pipe 2	+	idop2	-20.8	-20.8	-11.4	-11.4	-11.0	-11.0	-4.5	-4.5	-3.3	-3.3	-19.4	-19.4	-26.9	-26.9	-27.2	-27.2	-27.1	-27.1	-27.1	-27.1	-8.2	-8.2	-8.7	-8.7
Out Pipe 3	+	idop3	-21.5	-21.5	-13.4	-13.4	-13.8	-13.8	-11.5	-11.5	-10.6	-10.6	-29.1	-29.1	-36.9	-36.9	-36.4	-36.4	-36.4	-36.4	-36.5	-36.5	-11.3	-11.3	-14.6	-14.6
Out Pipe 4	+	idop4	-29.3	-29.3	-22.7	-22.7	-20.7	-20.7	-19.8	-19.8	-19.0	-19.0	-37.8	-37.8	-43.1	-43.1	-42.6	-42.6	-42.6	-42.6	-42.7	-42.7	-18.1	-18.1	-21.2	-21.2
Out Pipe 5	+	idop5	-28.3	-28.3	-20.2	-20.2	-19.3	-19.3	-19.4	-19.4	-18.4	-18.4	-35.9	-35.9	-43.0	-43.0	-42.1	-42.1	-42.6	-42.6	-42.7	-42.7	-20.5	-20.5	-20.3	-20.3
Out Pipe 6	+	idop6	-20.9	-20.9	-13.3	-13.3	-12.9	-12.9	-10.8	-10.8	-10.0	-10.0	-32.7	-32.7	-36.8	-36.8	-35.0	-35.0	-35.1	-35.1	-35.1	-35.1	-13.6	-13.6	-14.3	-14.3
Out Pipe 7	+	idop7	-15.3	-15.3	-13.0	-13.0	-13.4	-13.4	-5.5	-5.5	-5.1	-5.1	-31.8	-31.8	-31.5	-31.5	-29.7	-29.7	-30.3	-30.3	-30.4	-30.4	-11.7	-11.7	-21.3	-21.3
Out Pipe 8	+	idop8	-1.6	-1.6	1.6	1.6	1.4	1.4	9.2	9.2	9.5	9.5	-15.7	-15.7	-18.3	-18.3	-19.4	-19.4	-19.5	-19.5	-19.6	-19.6	2.9	2.9	-14.6	-14.6
Stack Shell	+	stackshell	-14.0	-14.0	-13.7	-13.7	-26.8	-26.8	-4.9	-4.9	-1.7	-1.7	-13.9	-13.9	-29.6	-29.6	-29.3	-29.3	-29.4	-29.4	-29.4	-29.4	-9.0	-9.0	-10.6	-10.6
ACC Steam Duct	+	accsdo1	-6.2	-6.2	-4.7	-4.7	-3.7	-3.7	14.0	14.0	15.1	15.1	-8.3	-8.3	-10.5	-10.5	-10.3	-10.3	-10.4	-10.4	-10.4	-10.4	8.3	8.3	6.5	6.5
ACC Steam Duct	+	accsdo2	0.8	0.8	-1.0	-1.0	7.8	7.8	14.4	14.4	16.1	16.1	-11.6	-11.6	-6.1	-6.1	-4.0	-4.0	-4.7	-4.7	-6.6	-6.6	9.4	9.4	-7.8	-7.8
ACC Steam Duct	+	accsdo3	0.3	0.3	-0.4	-0.4	-1.1	-1.1	14.2	14.2	16.2	16.2	-11.4	-11.4	-7.8	-7.8	-6.4	-6.4	-7.7	-7.7	-7.7	-7.7	10.1	10.1	-7.9	-7.9
ACC Steam Duct	+	accsdo4	4.3	4.3	5.3	5.3	6.7	6.7	15.3	15.3	16.6	16.6	3.6	3.6	-0.0	-0.0	0.2	0.2	0.1	0.1	0.1	0.1	11.5	11.5	10.1	10.1
ACC Steam Duct	+	accsdo5	5.5	5.5	5.5	5.5	7.8	7.8	14.3	14.3	15.9	15.9	5.7	5.7	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	11.3	11.3	9.3	9.3
ACC Inlet	+	accin	3.0	3.0	5.3	5.3	12.4	12.4	21.9	21.9	23.5	23.5	2.2	2.2	-2.1	-2.1	-1.8	-1.8	-1.9	-1.9	-2.0	-2.0	19.7	19.7	17.6	17.6
ACC Outlet	+	accout	11.0	11.0	11.1	11.1	12.0	12.0	19.3	19.3	20.7	20.7	10.4	10.4	6.6	6.6	6.9	6.9	6.9	6.9	6.8	6.8	15.9	15.9	14.1	14.1
Air Comp 1 Top	+	actop	-5.2	-5.2	-1.2	-1.2	1.2	1.2	6.6	6.6	6.4	6.4	-9.4	-9.4	-15.7	-15.7	-15.0	-15.0	-15.2	-15.2	-15.3	-15.3	2.3	2.3	-0.8	-0.8
Air Comp 2 Top	+	actop	-6.2	-6.2	-3.5	-3.5	-4.6	-4.6	5.6	5.6	6.9	6.9	-11.3	-11.3	-15.5	-15.5	-15.3	-15.3	-15.4	-15.4	-15.4	-15.4	3.6	3.6	-1.9	-1.9
Bicarb Top	+	bmt	15.0	15.0	15.5	15.5	15.1	15.1	20.4	20.4	21.4	21.4	0.2	0.2	-1.0	-1.0	-0.7	-0.7	-0.7	-0.7	-0.8	-0.8	15.6	15.6	12.7	12.7
Boiler Hall Roof	+	bhr	9.3	9.3	8.7	8.7	8.3	8.3	14.4	14.4	15.4	15.4	9.3	9.3	6.5	6.5	6.9	6.9	6.8	6.8	6.8	6.8	9.5	9.5	8.1	8.1
Recooler 1 Top	+	rct	-9.7	-9.7	-10.2	-10.2	-11.2	-11.2	-1.5	-1.5	-0.1	-0.1	-0.7	-0.7	-6.4	-6.4	-6.6	-6.6	-6.4	-6.4	-6.3	-6.3	13.1	13.1	12.0	12.0
Recooler 1 Top	+	rct	-9.9	-9.9	-10.4	-10.4	-11.3	-11.3	4.8	4.8	-2.8	-2.8	-1.9	-1.9	-7.7	-7.7	-7.7	-7.7	-7.6	-7.6	-7.6	-7.6	7.6	7.6	8.8	8.8

Recooler 3 Top	+	rct	-10.0	-10.0	-10.5	-10.5	-11.4	-11.4	10.2	10.2	-4.4	-4.4	-3.6	-3.6	-9.5	-9.5	-9.4	-9.4	-9.3	-9.3	-9.4	-9.4	7.4	7.4	7.6	7.6
Recooler 4 Top	+	rct	-10.2	-10.2	-10.7	-10.7	-11.5	-11.5	10.9	10.9	-0.5	-0.5	-5.8	-5.8	-11.2	-11.2	-11.0	-11.0	-11.1	-11.1	-11.1	-11.1	7.1	7.1	7.6	7.6
E Mod Top	+	emodt	-2.5	-2.5	3.6	3.6	7.4	7.4	13.9	13.9	15.2	15.2	2.1	2.1	-4.1	-4.1	-3.9	-3.9	-3.9	-3.9	-4.0	-4.0	12.7	12.7	10.4	10.4
FF1 Top	+	fft	-9.3	-9.3	7.2	7.2	6.3	6.3	16.4	16.4	18.1	18.1	-11.7	-11.7	-17.7	-17.7	-17.1	-17.1	-17.2	-17.2	-17.3	-17.3	10.9	10.9	7.6	7.6
FF2 Top	+	fft	1.8	1.8	8.9	8.9	7.9	7.9	18.8	18.8	20.0	20.0	-12.4	-12.4	-17.4	-17.4	-16.4	-16.4	-16.6	-16.6	-16.8	-16.8	11.6	11.6	5.2	5.2
ID Fan 1 Top	+	idt	-2.7	-2.7	8.5	8.5	9.2	9.2	12.6	12.6	15.3	15.3	-4.0	-4.0	-11.5	-11.5	-11.3	-11.3	-11.3	-11.3	-11.4	-11.4	11.4	11.4	9.7	9.7
ID Fan 2 Top	+	idt	9.4	9.4	9.9	9.9	9.6	9.6	16.2	16.2	16.6	16.6	-7.2	-7.2	-11.4	-11.4	-10.7	-10.7	-10.8	-10.8	-10.9	-10.9	12.5	12.5	0.6	0.6
Transformer Top	+	tbr	-3.2	-3.2	-0.3	-0.3	-3.6	-3.6	8.2	8.2	10.3	10.3	-1.6	-1.6	-5.2	-5.2	-5.0	-5.0	-5.1	-5.1	-5.1	-5.1	5.6	5.6	3.8	3.8
Coke Top	+	coket	-8.8	-8.8	-1.3	-1.3	-5.6	-5.6	8.2	8.2	3.6	3.6	-11.1	-11.1	-16.3	-16.3	-16.5	-16.5	-16.7	-16.7	-16.8	-16.8	-0.8	-0.8	3.8	3.8
Steam Turbine Roof 1	+	stbr1	1.9	1.9	3.2	3.2	4.9	4.9	16.9	16.9	17.9	17.9	2.5	2.5	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	14.4	14.4	12.6	12.6
Steam Turbine Roof 2	+	stbr2	-6.1	-6.1	-4.6	-4.6	-2.2	-2.2	10.3	10.3	12.1	12.1	-4.5	-4.5	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.9	-9.9	8.2	8.2	6.4	6.4
Steam Turbine Roof Vent	+	stbrv	4.8	4.8	4.2	4.2	7.5	7.5	20.1	20.1	20.8	20.8	4.4	4.4	0.9	0.9	1.2	1.2	1.1	1.1	1.0	1.0	18.4	18.4	15.7	15.7
Bunker Roof	+	bunkr	12.5	12.5	12.0	12.0	10.8	10.8	15.2	15.2	16.5	16.5	12.2	12.2	9.7	9.7	10.0	10.0	10.0	10.0	9.9	9.9	11.7	11.7	8.7	8.7
Bunker Roof Vent	+	bunkrv	13.5	13.5	13.1	13.1	11.9	11.9	17.4	17.4	18.5	18.5	13.1	13.1	9.5	9.5	10.0	10.0	9.9	9.9	9.8	9.8	10.9	10.9	9.1	9.1
Boiler Roof Vent 1	+	bhrv1	16.6	16.6	16.2	16.2	15.3	15.3	23.0	23.0	23.1	23.1	16.4	16.4	12.0	12.0	12.5	12.5	12.4	12.4	12.3	12.3	15.7	15.7	14.7	14.7
Boiler Roof Vent 2	+	bhrv2	16.8	16.8	16.7	16.7	15.8	15.8	22.5	22.5	24.9	24.9	16.2	16.2	12.0	12.0	12.5	12.5	12.4	12.4	12.3	12.3	15.1	15.1	12.6	12.6
MRF Roof	+		11.9	11.9	10.5	10.5	9.3	9.3	10.8	10.8	12.1	12.1	14.1	14.1	9.5	9.5	9.6	9.6	9.6	9.6	9.6	9.6	7.9	7.9	8.4	8.4
MBT Roof	+		13.0	13.0	11.8	11.8	10.7	10.7	13.0	13.0	15.0	15.0	14.9	14.9	10.3	10.3	10.5	10.5	10.5	10.5	10.5	10.5	9.6	9.6	10.0	10.0
AD Roof	+		17.5	17.5	16.6	16.6	15.6	15.6	19.7	19.7	20.6	20.6	19.1	19.1	14.7	14.7	14.8	14.8	14.8	14.8	14.8	14.8	15.4	15.4	15.4	15.4
WWTP Roof	+		16.4	16.4	15.8	15.8	14.9	14.9	19.7	19.7	20.9	20.9	17.6	17.6	13.3	13.3	13.5	13.5	13.4	13.4	13.4	13.4	16.4	16.4	16.0	16.0
PPP Roof	+		20.8	20.8	19.8	19.8	18.6	18.6	22.8	22.8	23.4	23.4	20.2	20.2	16.6	16.6	17.2	17.2	17.1	17.1	17.0	17.0	17.8	17.8	15.0	15.0
MDP Storage Roof	+		11.8	11.8	10.5	10.5	9.1	9.1	12.8	12.8	13.3	13.3	11.9	11.9	8.1	8.1	8.7	8.7	8.6	8.6	8.5	8.5	7.9	7.9	6.8	6.8
RCP Storage Roof	+		8.7	8.7	7.8	7.8	6.6	6.6	10.9	10.9	11.6	11.6	8.8	8.8	5.0	5.0	5.4	5.4	5.4	5.4	5.3	5.3	3.8	3.8	4.6	4.6
Vehicle Circulation / RDF Reception Roof	+		17.3	17.3	16.5	16.5	15.4	15.4	20.0	20.0	20.4	20.4	18.0	18.0	13.9	13.9	14.3	14.3	14.2	14.2	14.2	14.2	15.7	15.7	14.2	14.2
Ash Hall Roof	+		6.3	6.3	5.8	5.8	5.0	5.0	10.3	10.3	10.6	10.6	6.7	6.7	2.6	2.6	3.0	3.0	2.9	2.9	2.9	2.9	6.1	6.1	5.3	5.3
Quarry Entrance Road	+		33.5	-31.8	29.7	-35.5	26.4	-38.9	23.9	-41.4	23.6	-41.7	28.4	-36.9	34.3	-31.0	37.7	-27.6	36.7	-28.6	36.1	-29.2				
IWMF Entrance Road	+		40.1	-25.2	34.3	-30.9	31.7	-33.5	32.1	-33.2	32.4	-32.8	36.6	-28.7	35.9	-29.4	40.7	-24.5	39.5	-25.8	38.7	-26.6	27.2	-38.1	27.8	-37.4
IWMF Entrance Road	+		24.8	-40.4	21.6	-43.7	20.2	-45.0	22.7	-42.5	22.7	-42.5	27.6	-37.7	22.7	-42.6	22.3	-42.9	22.3	-42.9	23.6	-41.7	16.6	-48.7	7.0	-58.2
IWMF Entrance Road	+		11.2	-54.0	3.5	-61.7	2.3	-62.9	6.0	-59.3	6.6	-58.6	20.1	-45.1	13.3	-52.0	10.6	-54.6	10.9	-54.4	11.0	-54.2	3.1	-62.2	13.5	-51.7
Air Comp 1 Side 1	+	acside	0.2	0.2	1.8	1.8	6.9	6.9	9.6	9.6	9.5	9.5	-7.2	-7.2	-13.7	-13.7	-12.9	-12.9	-13.0	-13.0	-13.1	-13.1	0.6	0.6	3.0	3.0
Air Comp 1 Side 2	+	acside	-2.1	-2.1	1.3	1.3	0.8	0.8	8.3	8.3	9.4	9.4	-6.7	-6.7	-12.7	-12.7	-12.4	-12.4	-12.0	-12.0	-12.1	-12.1	2.3	2.3	1.0	1.0
Air Comp 1 Side 3	+	acside	-4.5	-4.5	1.0	1.0	-4.5	-4.5	6.5	6.5	7.9	7.9	-6.1	-6.1	-12.5	-12.5	-11.8	-11.8	-11.9	-11.9	-12.0	-12.0	2.0	2.0	-2.5	-2.5
Air Comp 1 Side 4	+	acside	-2.4	-2.4	0.3	0.3	4.4	4.4	8.9	8.9	10.0	10.0	-6.3	-6.3	-12.3	-12.3	-12.1	-12.1	-12.2	-12.2	-11.9	-11.9	2.9	2.9	-3.8	-3.8
Air Comp 2 Side 1	+	acside	-4.0	-4.0	-0.9	-0.9	5.4	5.4	8.5	8.5	9.6	9.6	-9.1	-9.1	-13.5	-13.5	-13.1	-13.1	-13.1	-13.1	-13.2	-13.2	2.6	2.6	0.5	0.5
Air Comp 2 Side 2	+	acside	-3.1	-3.1	-1.4	-1.4	-10.2	-10.2	8.7	8.7	9.7	9.7	-8.2	-8.2	-12.4	-12.4	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	5.3	5.3	-0.5	-0.5
Air Comp 2 Side 3	+	acside	-3.1	-3.1	-0.6	-0.6	-9.0	-9.0	5.8	5.8	8.1	8.1	-8.0	-8.0	-12.3	-12.3	-12.1	-12.1	-12.1	-12.1	-12.1	-12.1	5.2	5.2	-3.8	-3.8
Air Comp 2 Side 4	+	acside	-3.6	-3.6	-0.5	-0.5	-7.6	-7.6	7.9	7.9	9.1	9.1	-8.6	-8.6	-12.4	-12.4	-12.1	-12.1	-12.2	-12.2	-12.2	-12.2	7.6	7.6	-0.2	-0.2
Bicarb Sid 1	+	bms1	5.2	5.2	9.6	9.6	1.3	1.3	14.3	14.3	14.3	14.3	1.1	1.1	-5.3	-5.3	-5.1	-5.1	-5.3	-5.3	-5.3	-5.3	7.8	7.8	10.0	10.0
Bicarb Side 2	+	bms2	12.5	12.5	13.2	13.2	11.8	11.8	19.1	19.1	19.2	19.2	-0.7	-0.7	-3.5	-3.5	-2.6	-2.6	-3.0	-3.0	-3.1	-3.1	13.6	13.6	12.5	12.5
Bicarb Side 3	+	bms3	13.8	13.8	13.3	13.3	12.9	12.9	15.7	15.7	19.9	19.9	-6.1	-6.1	-5.7	-5.7	-3.8	-3.8	-4.2	-4.2	-4.9	-4.9	10.2	10.2	1.5	1.5
Bicarb Side 4	+	bms4	14.9	14.9	16.1	16.1	16.3	16.3	18.6	18.6	19.3	19.3	1.3	1.3	0.7	0.7	1.2	1.2	1.3	1.3	1.2	1.2	14.3	14.3	4.5	4.5
Boiler Hall Wall 1	+	bhw1	-12.5	-12.5	-9.7	-9.7	-6.9	-6.9	-0.9	-0.9	0.3	0.3	-5.0	-5.0	-7.8	-7.8	-14.8	-14.8	-14.5	-14.5	-14.0	-14.0	0.2	0.2	2.6	2.6
Boiler Hall Wall 2	+	bhw2	-1.4	-1.4	3.9	3.9	8.9	8.9	13.6	13.6	14.5	14.5	-6.8	-6.8	-9.4	-9.4	-9.1	-9.1	-9.2	-9.2	-9.2	-9.2	9.2	9.2	6.5	6.5

ACOUSTICAL CONTROL Engineers & Consultants

Boiler Hall Wall 3	+	bhw3	-12.4	-12.4	-12.4	-12.4	-12.9	-12.9	-4.2	-4.2	-6.6	-6.6	-7.2	-7.2	-9.9	-9.9	-13.5	-13.5	-13.0	-13.0	-12.4	-12.4	-3.1	-3.1	-1.2	-1.2
Boiler Louvre 1	+	bhv1	-16.2	-16.2	-14.8	-14.8	-16.3	-16.3	4.5	4.5	4.6	4.6	-15.9	-15.9	-20.5	-20.5	-21.3	-21.3	-21.4	-21.4	-21.4	-21.4	-4.4	-4.4	-7.5	-7.5
Boiler Louvre 2	+	bhv2	-14.2	-14.2	-7.7	-7.7	-0.4	-0.4	6.2	6.2	6.9	6.9	-16.6	-16.6	-21.6	-21.6	-21.2	-21.2	-21.3	-21.3	-21.3	-21.3	2.5	2.5	0.5	0.5
Boiler Louvre 3	+	bhv3	-9.4	-9.4	-5.9	-5.9	-1.9	-1.9	7.6	7.6	9.0	9.0	-17.2	-17.2	-21.7	-21.7	-21.0	-21.0	-21.2	-21.2	-21.3	-21.3	2.0	2.0	-17.8	-17.8
Boiler Louvre 4	+	bhv4	-12.0	-12.0	-5.2	-5.2	1.9	1.9	3.4	3.4	5.3	5.3	-16.6	-16.6	-21.0	-21.0	-20.6	-20.6	-20.6	-20.6	-20.7	-20.7	0.5	0.5	-1.2	-1.2
Boiler Louvre 5	+	bhv5	-12.5	-12.5	-5.7	-5.7	0.4	0.4	2.1	2.1	3.9	3.9	-16.8	-16.8	-21.4	-21.4	-20.9	-20.9	-21.0	-21.0	-21.0	-21.0	-1.3	-1.3	-2.8	-2.8
Recooler 1 Side 1	+	rcs1	-8.2	-8.2	-8.7	-8.7	-9.3	-9.3	-3.0	-3.0	-0.2	-0.2	-3.3	-3.3	-9.9	-9.9	-10.0	-10.0	-9.9	-9.9	-10.0	-10.0	6.1	6.1	6.7	6.7
Recooler 1 Side 2	+	rcs2	-13.4	-13.4	-14.0	-14.0	-14.5	-14.5	-4.3	-4.3	-1.4	-1.4	-5.8	-5.8	-10.0	-10.0	-14.5	-14.5	-12.6	-12.6	-11.1	-11.1	6.0	6.0	6.2	6.2
Recooler 1 Side 3	+	rcs3	-9.5	-9.5	-9.8	-9.8	-9.3	-9.3	1.6	1.6	2.6	2.6	-4.1	-4.1	-10.6	-10.6	-10.5	-10.5	-10.4	-10.4	-10.5	-10.5	12.5	12.5	12.1	12.1
Recooler 1 Side 4	+	rcs4	-14.5	-14.5	-14.5	-14.5	-15.7	-15.7	-5.0	-5.0	-6.1	-6.1	-6.0	-6.0	-13.0	-13.0	-14.2	-14.2	-12.0	-12.0	-9.7	-9.7	4.1	4.1	4.4	4.4
Recooler 2 Side 1	+	rcs1	-8.0	-8.0	-8.6	-8.6	-9.8	-9.8	2.2	2.2	-1.6	-1.6	-1.9	-1.9	-8.0	-8.0	-7.8	-7.8	-7.9	-7.9	-7.9	-7.9	6.8	6.8	6.1	6.1
Recooler 2 Side 2	+	rcs2	-13.3	-13.3	-14.0	-14.0	-14.5	-14.5	9.3	9.3	-3.2	-3.2	-6.8	-6.8	-11.3	-11.3	-13.8	-13.8	-13.4	-13.4	-12.0	-12.0	4.3	4.3	4.8	4.8
Recooler 2 Side 3	+	rcs3	-8.5	-8.5	-9.2	-9.2	-9.4	-9.4	-3.1	-3.1	-1.0	-1.0	-2.3	-2.3	-6.7	-6.7	-6.7	-6.7	-6.6	-6.6	-6.6	-6.6	4.4	4.4	5.9	5.9
Recooler 2 Side 4	+	rcs4	-14.6	-14.6	-14.6	-14.6	-15.8	-15.8	-5.6	-5.6	-6.6	-6.6	-6.9	-6.9	-13.2	-13.2	-14.6	-14.6	-12.6	-12.6	-11.0	-11.0	3.4	3.4	1.1	1.1
Recooler 3 Side 1	+	rcs1	-8.7	-8.7	-8.6	-8.6	-9.5	-9.5	2.7	2.7	-3.2	-3.2	-5.1	-5.1	-11.5	-11.5	-11.3	-11.3	-11.3	-11.3	-11.4	-11.4	5.1	5.1	5.2	5.2
Recooler 3 Side 2	+	rcs2	-13.4	-13.4	-14.0	-14.0	-14.6	-14.6	9.8	9.8	-3.0	-3.0	-8.9	-8.9	-13.0	-13.0	-15.6	-15.6	-13.3	-13.3	-12.3	-12.3	3.5	3.5	4.2	4.2
Recooler 3 Side 3	+	rcs3	-9.6	-9.6	-10.0	-10.0	-9.5	-9.5	8.7	8.7	-2.7	-2.7	-4.5	-4.5	-10.4	-10.4	-10.1	-10.1	-10.2	-10.2	-10.2	-10.2	4.2	4.2	6.5	6.5
Recooler 3 Side 4	+	rcs4	-14.7	-14.7	-14.7	-14.7	-15.8	-15.8	-6.2	-6.2	-7.1	-7.1	-8.2	-8.2	-14.6	-14.6	-15.3	-15.3	-13.4	-13.4	-12.7	-12.7	2.5	2.5	0.4	0.4
Recooler 4 Side 1	+	rcs1	-8.4	-8.4	-8.8	-8.8	-9.6	-9.6	4.4	4.4	-0.3	-0.3	-5.2	-5.2	-10.4	-10.4	-10.2	-10.2	-10.2	-10.2	-10.3	-10.3	6.6	6.6	6.3	6.3
Recooler 4 Side 2	+	rcs2	-13.3	-13.3	-14.1	-14.1	-14.6	-14.6	9.7	9.7	6.6	6.6	-11.2	-11.2	-14.6	-14.6	-16.3	-16.3	-14.4	-14.4	-14.5	-14.5	4.3	4.3	4.1	4.1
Recooler 4 Side 3	+	rcs3	-8.6	-8.6	-9.2	-9.2	-9.6	-9.6	9.4	9.4	-3.8	-3.8	-4.2	-4.2	-8.9	-8.9	-8.6	-8.6	-8.6	-8.6	-8.7	-8.7	2.9	2.9	4.2	4.2
Recooler 4 Side 4	+	rcs4	-14.7	-14.7	-14.8	-14.8	-15.9	-15.9	-3.5	-3.5	-7.4	-7.4	-9.3	-9.3	-15.0	-15.0	-15.7	-15.7	-14.2	-14.2	-14.3	-14.3	1.9	1.9	0.2	0.2
E Mod Side 1	+	emods1	-2.9	-2.9	0.8	0.8	7.9	7.9	15.3	15.3	16.0	16.0	2.5	2.5	-2.9	-2.9	-2.7	-2.7	-2.7	-2.7	-2.8	-2.8	11.2	11.2	7.2	7.2
E Mod Side 2	+	emods2	-1.7	-1.7	4.6	4.6	6.3	6.3	14.9	14.9	15.8	15.8	0.6	0.6	-6.6	-6.6	-3.8	-3.8	-3.9	-3.9	-3.9	-3.9	13.6	13.6	3.7	3.7
E Mod Side 3	+	emods3	-2.1	-2.1	2.0	2.0	1.9	1.9	9.8	9.8	13.7	13.7	0.0	0.0	-6.1	-6.1	-5.6	-5.6	-5.6	-5.6	-5.6	-5.6	10.5	10.5	6.1	6.1
E Mod Side 4	+	emods4	-4.2	-4.2	-2.7	-2.7	-0.3	-0.3	9.5	9.5	11.5	11.5	0.6	0.6	-5.0	-5.0	-6.2	-6.2	-6.7	-6.7	-6.7	-6.7	9.8	9.8	7.6	7.6
FF1 Side 1	+	ffs1	-6.6	-6.6	-0.6	-0.6	-0.9	-0.9	5.6	5.6	7.4	7.4	-6.8	-6.8	-13.1	-13.1	-12.5	-12.5	-12.6	-12.6	-12.7	-12.7	7.6	7.6	11.4	11.4
FF1 Side 2	+	ffs2	-9.0	-9.0	-4.2	-4.2	5.1	5.1	14.1	14.1	14.1	14.1	-9.2	-9.2	-15.5	-15.5	-14.8	-14.8	-14.9	-14.9	-15.0	-15.0	8.5	8.5	7.0	7.0
FF1 Side 3	+	ffs3	-5.9	-5.9	5.3	5.3	5.8	5.8	16.5	16.5	17.7	17.7	-6.6	-6.6	-12.7	-12.7	-12.1	-12.1	-12.2	-12.2	-12.2	-12.2	14.9	14.9	3.2	3.2
FF1 Side 4	+	ffs4	-7.9	-7.9	0.6	0.6	7.8	7.8	12.8	12.8	14.0	14.0	-9.6	-9.6	-15.7	-15.7	-15.1	-15.1	-15.2	-15.2	-15.3	-15.3	3.8	3.8	5.3	5.3
FF2 Side 1	+	ffs1	-1.8	-1.8	5.6	5.6	6.6	6.6	10.9	10.9	11.9	11.9	-7.1	-7.1	-12.7	-12.7	-11.7	-11.7	-11.9	-11.9	-12.0	-12.0	4.9	4.9	7.8	7.8
FF2 Side 2	+	ffs2	1.6	1.6	4.4	4.4	8.4	8.4	16.1	16.1	16.5	16.5	-10.3	-10.3	-15.6	-15.6	-14.5	-14.5	-14.7	-14.7	-14.8	-14.8	9.3	9.3	3.2	3.2
FF2 Side 3	+	ffs3	7.3	7.3	10.7	10.7	10.0	10.0	21.0	21.0	22.2	22.2	-7.5	-7.5	-13.1	-13.1	-12.2	-12.2	-12.4	-12.4	-12.5	-12.5	15.5	15.5	-5.5	-5.5
FF2 Side 4	+	ffs4	-5.8	-5.8	5.6	5.6	1.4	1.4	15.4	15.4	15.2	15.2	-9.9	-9.9	-15.8	-15.8	-15.0	-15.0	-15.1	-15.1	-15.3	-15.3	2.6	2.6	2.2	2.2
ID Fan 1 Side 1	+	ids1	-2.3	-2.3	7.8	7.8	-1.9	-1.9	11.4	11.4	11.8	11.8	-0.7	-0.7	-8.7	-8.7	-8.4	-8.4	-8.4	-8.4	-8.4	-8.4	8.0	8.0	10.7	10.7
ID Fan 1 Side 2	+	ids2	-1.9	-1.9	5.1	5.1	-5.7	-5.7	12.3	12.3	12.7	12.7	-4.6	-4.6	-9.9	-9.9	-9.7	-9.7	-9.7	-9.7	-9.8	-9.8	4.7	4.7	4.8	4.8
ID Fan 1 Side 3	+	ids3	0.2	0.2	9.4	9.4	12.6	12.6	12.6	12.6	12.9	12.9	-3.6	-3.6	-8.3	-8.3	-8.0	-8.0	-8.1	-8.1	-8.1	-8.1	7.7	7.7	2.2	2.2
ID Fan 1 Side 4	+	ids4	-2.1	-2.1	7.9	7.9	8.6	8.6	14.4	14.4	16.1	16.1	-4.1	-4.1	-9.7	-9.7	-9.5	-9.5	-9.6	-9.6	-9.5	-9.5	9.6	9.6	6.8	6.8
ID Fan 2 Side 1	+	ids1	4.0	4.0	6.2	6.2	7.6	7.6	13.6	13.6	13.6	13.6	-4.0	-4.0	-7.9	-7.9	-7.7	-7.7	-7.7	-7.7	-7.8	-7.8	8.2	8.2	-1.2	-1.2
ID Fan 2 Side 2	+	ids2	7.5	7.5	6.5	6.5	9.6	9.6	13.8	13.8	14.4	14.4	-5.6	-5.6	-9.3	-9.3	-8.6	-8.6	-8.7	-8.7	-8.8	-8.8	7.7	7.7	-6.1	-6.1
ID Fan 2 Side 3	+	ids3	11.7	11.7	10.8	10.8	10.4	10.4	16.4	16.4	18.0	18.0	-4.8	-4.8	-8.7	-8.7	-7.9	-7.9	-8.0	-8.0	-8.1	-8.1	13.6	13.6	-1.7	-1.7
ID Fan 2 Side 4	+	ids4	5.0	5.0	9.8	9.8	7.9	7.9	15.7	15.7	16.1	16.1	-5.8	-5.8	-9.9	-9.9	-9.0	-9.0	-9.2	-9.2	-9.4	-9.4	8.8	8.8	0.0	0.0
Tranformer Side 1	+	tbw1	-8.0	-8.0	-6.3	-6.3	-2.0	-2.0	10.0	10.0	11.1	11.1	-5.8	-5.8	-10.8	-10.8	-10.5	-10.5	-10.6	-10.6	-10.7	-10.7	6.3	6.3	4.5	4.5
Tranformer Side 2	+	tbw2	-7.5	-7.5	-2.3	-2.3	-4.4	-4.4	6.0	6.0	7.5	7.5	-9.2	-9.2	-14.6	-14.6	-8.3	-8.3	-12.7	-12.7	-13.8	-13.8	3.0	3.0	-5.9	-5.9

Tranformer Side 3	+	tbw3	-2.0	-2.0	-0.4	-0.4	-5.1	-5.1	8.5	8.5	10.6	10.6	-1.0	-1.0	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	5.9	5.9	3.8	3.8
Tranformer Side 4	+	tbw4	-12.0	-12.0	-12.0	-12.0	-15.3	-15.3	2.6	2.6	3.6	3.6	-4.4	-4.4	-8.5	-8.5	-10.6	-10.6	-8.4	-8.4	-8.2	-8.2	3.1	3.1	2.4	2.4
Coke Side 1	+	cokes1	-4.4	-4.4	4.0	4.0	-1.3	-1.3	7.9	7.9	5.8	5.8	-5.7	-5.7	-10.9	-10.9	-11.0	-11.0	-11.1	-11.1	-11.4	-11.4	1.3	1.3	8.4	8.4
Coke Side 2	+	cokes2	-5.6	-5.6	2.6	2.6	-7.2	-7.2	5.4	5.4	4.4	4.4	-7.4	-7.4	-11.9	-11.9	-12.2	-12.2	-12.4	-12.4	-12.5	-12.5	-0.8	-0.8	4.2	4.2
Coke Side 3	+	cokes3	-3.9	-3.9	-0.8	-0.8	-5.2	-5.2	7.3	7.3	7.5	7.5	-6.2	-6.2	-11.8	-11.8	-11.5	-11.5	-11.7	-11.7	-11.7	-11.7	0.1	0.1	0.4	0.4
Coke Side 4	+	cokes4	-3.9	-3.9	0.3	0.3	-2.3	-2.3	10.8	10.8	6.6	6.6	-5.1	-5.1	-12.8	-12.8	-12.1	-12.1	-12.1	-12.1	-12.4	-12.4	1.2	1.2	-0.2	-0.2
Steam Turbine Wall 1	+	stbw1	-4.3	-4.3	-2.3	-2.3	-1.2	-1.2	10.7	10.7	12.4	12.4	1.0	1.0	-5.0	-5.0	-7.5	-7.5	-7.4	-7.4	-7.3	-7.3	9.4	9.4	9.4	9.4
Steam Turbine Wall 2	+	stbw2	-6.3	-6.3	-3.1	-3.1	3.0	3.0	13.4	13.4	13.6	13.6	-5.6	-5.6	-9.4	-9.4	-9.1	-9.1	-9.2	-9.2	-9.2	-9.2	8.0	8.0	5.0	5.0
Steam Turbine Wall 3	+	stbw3	-10.3	-10.3	-10.7	-10.7	-8.3	-8.3	3.5	3.5	4.6	4.6	-6.1	-6.1	-9.6	-9.6	-13.8	-13.8	-13.5	-13.5	-13.5	-13.5	2.3	2.3	4.5	4.5
Steam Turbine Wall 4	+	stbw4	-7.7	-7.7	-3.6	-3.6	2.2	2.2	4.3	4.3	7.1	7.1	-5.8	-5.8	-11.0	-11.0	-10.7	-10.7	-10.7	-10.7	-10.8	-10.8	2.9	2.9	-0.1	-0.1
Steam Turbine Wall 5	+	stbw5	-7.7	-7.7	-4.8	-4.8	-3.8	-3.8	9.2	9.2	11.3	11.3	-6.2	-6.2	-12.4	-12.4	-9.5	-9.5	-9.5	-9.5	-9.8	-9.8	7.9	7.9	0.5	0.5
Steam Turbine Wall 6	+	stbw6	-10.7	-10.7	-12.3	-12.3	-0.3	-0.3	4.5	4.5	6.2	6.2	-9.2	-9.2	-14.9	-14.9	-14.6	-14.6	-14.7	-14.7	-14.7	-14.7	1.9	1.9	-0.0	-0.0
Steam Turbine Wall 7	+	stbw7	-6.8	-6.8	-5.2	-5.2	1.0	1.0	9.2	9.2	11.9	11.9	-3.5	-3.5	-9.2	-9.2	-9.3	-9.3	-9.2	-9.2	-9.1	-9.1	9.2	9.2	8.8	8.8
Steam Turbine Gate	+	stbg	-12.5	-12.5	-11.2	-11.2	-14.4	-14.4	1.3	1.3	2.4	2.4	-10.5	-10.5	-16.6	-16.6	-16.8	-16.8	-16.7	-16.7	-16.7	-16.7	4.8	4.8	-1.1	-1.1
Steam Turbine Vent 1	+	stbv1	-8.0	-8.0	-6.6	-6.6	-6.5	-6.5	11.0	11.0	16.3	16.3	-6.0	-6.0	-12.3	-12.3	-12.0	-12.0	-12.0	-12.0	-12.1	-12.1	10.3	10.3	6.0	6.0
Steam Turbine Vent 2	+	stbv2	-1.5	-1.5	1.6	1.6	9.4	9.4	21.0	21.0	21.7	21.7	-0.7	-0.7	-4.9	-4.9	-4.6	-4.6	-4.7	-4.7	-4.7	-4.7	15.1	15.1	11.1	11.1
Steam Turbine Vent 3	+	stbv3	-5.2	-5.2	-5.9	-5.9	-6.6	-6.6	5.3	5.3	7.3	7.3	-2.7	-2.7	-7.5	-7.5	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	9.5	9.5	14.6	14.6
MRF Wall	+		10.8	10.8	-5.2	-5.2	-12.4	-12.4	-9.5	-9.5	-9.0	-9.0	13.1	13.1	8.4	8.4	8.6	8.6	8.6	8.6	8.6	8.6	-13.1	-13.1	-13.7	-13.7
MRF Wall	+		-11.1	-11.1	-15.5	-15.5	-16.6	-16.6	-13.0	-13.0	-12.3	-12.3	10.0	10.0	5.1	5.1	-15.2	-15.2	-15.0	-15.0	-14.8	-14.8	-15.5	-15.5	4.0	4.0
MBT Wall	+		-12.2	-12.2	-13.8	-13.8	-14.8	-14.8	-10.7	-10.7	-10.4	-10.4	11.8	11.8	7.3	7.3	-12.9	-12.9	-12.2	-12.2	-11.6	-11.6	-11.4	-11.4	6.8	6.8
AD Wall	+		-7.6	-7.6	-8.8	-8.8	-9.6	-9.6	-5.3	-5.3	-4.1	-4.1	17.3	17.3	12.9	12.9	-7.6	-7.6	-6.9	-6.9	-6.3	-6.3	-5.4	-5.4	13.3	13.3
WWTP Wall	+		-10.9	-10.9	-11.4	-11.4	-12.1	-12.1	-4.2	-4.2	-2.4	-2.4	11.5	11.5	7.5	7.5	-13.2	-13.2	-13.1	-13.1	-13.0	-13.0	2.4	2.4	9.2	9.2
WWTP Wall	+		-4.2	-4.2	-10.0	-10.0	5.0	5.0	11.4	11.4	12.5	12.5	-4.8	-4.8	-12.0	-12.0	-11.2	-11.2	-11.3	-11.3	-11.5	-11.5	10.7	10.7	10.8	10.8
WWTP Wall	+		-6.2	-6.2	-9.8	-9.8	4.4	4.4	13.4	13.4	14.5	14.5	-4.8	-4.8	-8.8	-8.8	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	9.3	9.3	8.8	8.8
MDP Storage Wall	+		9.0	9.0	1.1	1.1	-14.6	-14.6	-11.0	-11.0	-10.7	-10.7	9.2	9.2	5.4	5.4	5.9	5.9	5.9	5.9	5.8	5.8	-16.1	-16.1	-17.3	-17.3
PPP Wall	+		12.8	12.8	6.6	6.6	-10.3	-10.3	-4.5	-4.5	-4.5	-4.5	12.4	12.4	8.8	8.8	9.5	9.5	9.4	9.4	9.3	9.3	-12.5	-12.5	-14.2	-14.2
PPP Wall	+		19.3	19.3	18.3	18.3	17.0	17.0	20.8	20.8	21.4	21.4	-0.8	-0.8	-5.0	-5.0	15.5	15.5	15.4	15.4	15.3	15.3	16.2	16.2	-7.0	-7.0
PPP Wall	+		-2.9	-2.9	4.0	4.0	10.2	10.2	14.8	14.8	15.6	15.6	-13.2	-13.2	-16.6	-16.6	-16.0	-16.0	-16.1	-16.1	-16.3	-16.3	8.0	8.0	-5.8	-5.8
Ash Hall Wall	+		-17.8	-17.8	-17.2	-17.2	-6.4	-6.4	1.7	1.7	4.4	4.4	-17.6	-17.6	-21.2	-21.2	-20.9	-20.9	-21.0	-21.0	-21.0	-21.0	2.4	2.4	1.5	1.5
Vechicle Circ Wall	+		-17.3	-17.3	-18.0	-18.0	-18.8	-18.8	-13.8	-13.8	-12.8	-12.8	5.8	5.8	1.4	1.4	-19.3	-19.3	-19.2	-19.2	-19.1	-19.1	-17.0	-17.0	2.5	2.5
Vechicle Circ Wall	+		-17.9	-17.9	-18.5	-18.5	-19.3	-19.3	-13.7	-13.7	-12.7	-12.7	4.8	4.8	0.6	0.6	-20.1	-20.1	-20.0	-20.0	-19.9	-19.9	-11.1	-11.1	1.9	1.9
Vechicle Circ Wall	+		8.0	8.0	-1.1	-1.1	-15.1	-15.1	-12.2	-12.2	-11.8	-11.8	9.0	9.0	4.9	4.9	5.3	5.3	5.2	5.2	5.2	5.2	-16.4	-16.4	-17.5	-17.5
Vechicle Circ Wall	+		5.1	5.1	5.6	5.6	5.0	5.0	11.8	11.8	12.6	12.6	-15.6	-15.6	-17.4	-17.4	-8.6	-8.6	-8.8	-8.8	-8.9	-8.9	3.7	3.7	-18.6	-18.6
Vechicle Circ Wall	+		2.7	2.7	2.0	2.0	1.0	1.0	6.3	6.3	9.0	9.0	-18.8	-18.8	-20.8	-20.8	-9.3	-9.3	-9.5	-9.5	-9.5	-9.5	-0.1	-0.1	-21.6	-21.6
Vechicle Circ Door	+		-15.4	-15.4	-16.5	-16.5	-17.4	-17.4	-11.9	-11.9	-10.8	-10.8	-0.7	-0.7	1.8	1.8	-18.3	-18.3	-18.3	-18.3	-18.3	-18.3	-16.0	-16.0	-2.2	-2.2
Vechicle Circ Door	+		3.7	3.7	5.0	5.0	3.9	3.9	10.2	10.2	11.5	11.5	-14.6	-14.6	-18.6	-18.6	-17.9	-17.9	-18.0	-18.0	-18.1	-18.1	6.4	6.4	-18.3	-18.3
MRF Door	+		-11.6	-11.6	-16.5	-16.5	-17.8	-17.8	-13.5	-13.5	-12.8	-12.8	8.3	8.3	3.2	3.2	-17.1	-17.1	-17.0	-17.0	-17.0	-17.0	-17.3	-17.3	0.6	0.6
MRF Door	+		7.4	7.4	-15.9	-15.9	-17.2	-17.2	-12.8	-12.8	-12.3	-12.3	9.4	9.4	4.8	4.8	5.0	5.0	5.0	5.0	5.0	5.0	-17.4	-17.4	-18.5	-18.5
Vehicle Circ Door	+		6.3	6.3	-0.2	-0.2	-16.8	-16.8	-12.3	-12.3	-11.9	-11.9	7.5	7.5	3.2	3.2	3.6	3.6	3.5	3.5	3.5	3.5	-17.3	-17.3	-18.8	-18.8
PPP Doors	+		14.1	14.1	12.9	12.9	11.9	11.9	15.5	15.5	16.1	16.1	-5.2	-5.2	-10.3	-10.3	10.6	10.6	10.5	10.5	10.4	10.4	11.3	11.3	-11.3	-11.3
MRF Free Vent	+		18.8	18.8	0.7	0.7	-6.2	-6.2	-2.2	-2.2	-1.6	-1.6	22.7	22.7	17.9	17.9	16.5	16.5	16.5	16.5	16.5	16.5	-6.0	-6.0	11.7	11.7
MBT Free Vent	+		-6.7	-6.7	-8.9	-8.9	-10.0	-10.0	-5.5	-5.5	-4.7	-4.7	20.4	20.4	15.4	15.4	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.2	-9.2	15.4	15.4
AD Free Vent	+		-2.6	-2.6	-4.0	-4.0	-4.9	-4.9	0.1	0.1	1.0	1.0	25.3	25.3	20.4	20.4	-5.5	-5.5	-5.4	-5.4	-5.5	-5.5	-3.8	-3.8	21.2	21.2
Vehicle Circ Free Vent	+		-9.2	-9.2	-10.0	-10.0	-10.8	-10.8	-5.1	-5.1	-4.0	-4.0	16.1	16.1	11.4	11.4	-11.8	-11.8	-11.8	-11.8	-11.8	-11.8	-3.7	-3.7	12.9	12.9

WWTP Circ Free Vent	+		11.5	11.5	-0.4	-0.4	15.1	15.1	20.0	20.0	20.9	20.9	19.6	19.6	15.0	15.0	5.7	5.7	5.6	5.6	5.5	5.5	19.5	19.5	21.8	21.8
Vehicle Circ Free Vent	+		16.4	16.4	6.1	6.1	-10.6	-10.6	-6.2	-6.2	-5.8	-5.8	17.5	17.5	13.3	13.3	13.7	13.7	13.6	13.6	13.6	13.6	-11.1	-11.1	-12.5	-12.5
MDIP Free Vent	+		16.5	16.5	8.5	8.5	-9.7	-9.7	-4.9	-4.9	-4.6	-4.6	16.7	16.7	12.9	12.9	13.4	13.4	13.4	13.4	13.3	13.3	-10.5	-10.5	-12.2	-12.2
PPP Free Vent	+		28.0	28.0	26.6	26.6	25.6	25.6	29.7	29.7	30.3	30.3	20.0	20.0	16.4	16.4	24.2	24.2	24.1	24.1	23.8	23.8	24.3	24.3	-0.1	-0.1
Vehicle Circ Free Vent	+		14.2	14.2	14.9	14.9	14.2	14.2	20.5	20.5	21.7	21.7	-8.7	-8.7	-12.4	-12.4	-4.3	-4.3	-4.7	-4.7	-4.7	-4.7	12.8	12.8	-12.0	-12.0

Results Table (4m Receptor Height)

Receiver Name	ID	Land Use	Limiting Value Day	Limiting Value Night	rel. Axis Station	rel. Axis Distance	rel. Axis Height	Lr w/o Noise Control Day	Lr w/o Noise Control Night	dL req. Day	dL req. Night	Lr w/ Noise Control Day	Lr w/ Noise Control Night	Exceeding Day	Exceeding Night	passive NC
			dB(A)	dB(A)	m	m	m	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
Herons Farm			0	0	1732	424.58	4.00	43.3	34.8	43.3	34.8	0.0	0.0	-	-	-
Deeks Cottage			0	0	1532	865.31	17.00	38.9	33.9	38.9	33.9	0.0	0.0	-	-	-
Haywards			0	0	1632	968.25	17.00	37.0	33.3	37.0	33.3	0.0	0.0	-	-	-
Allshots Farm			0	0	0	515.09	8.50	40.3	39.0	40.3	39.0	0.0	0.0	-	-	-
The Lodge			0	0	3	458.75	8.50	41.1	40.0	41.1	40.0	0.0	0.0	-	-	-
Sheepcotes Farm			0	0	2518	531.06	7.88	40.5	34.8	40.5	34.8	0.0	0.0	-	-	-
Greenpastures Bungalow			0	0	2056	740.54	4.00	40.4	30.4	40.4	30.4	0.0	0.0	-	-	-
Goslings Cottage			0	0	1408	389.70	4.00	44.3	30.8	44.3	30.8	0.0	0.0	-	-	-
Goslings Farm			0	0	1408	470.67	4.00	43.3	30.7	43.3	30.7	0.0	0.0	-	-	-
Goslings Barn			0	0	1408	530.46	4.00	42.6	30.6	42.6	30.6	0.0	0.0	-	-	-
Bumby Hall			0	0	1	866.12	18.50	35.7	34.8	35.7	34.8	0.0	0.0	-	-	-
Parkgate Farm Cottages			0	0	0	1085.77	-2.50	34.5	33.2	34.5	33.2	0.0	0.0	-	-	-

Partial Levels (4m Receptor Height)

Source			Partial Level																							
Name	M.	ID	Herons Farm		Deeks Cottage		Haywards		Allshots Farm		The Lodge		Sheepcotes Farm		Greenpastures Bungalow		Goslings Cottage		Goslings Farm		Goslings Barn		Bumby Hall		Parkgate Farm Cottages	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Vent Fan	+	ventf	-1.0	-1.0	3.9	3.9	12.9	12.9	21.0	21.0	27.6	27.6	0.2	0.2	-4.5	-4.5	-4.3	-4.3	-4.3	-4.3	-4.4	-4.4	21.6	21.6	20.0	20.0
Stack Outlet 2	+	stack2	20.3	20.3	20.4	20.4	16.9	16.9	23.1	23.1	24.1	24.1	18.7	18.7	14.9	14.9	15.0	15.0	15.0	15.0	15.0	15.0	19.2	19.2	17.5	17.5
Stack Outlet Air	+	stackas	1.9	1.9	2.2	2.2	0.9	0.9	6.0	6.0	6.7	6.7	1.4	1.4	-2.9	-2.9	-2.3	-2.3	-2.4	-2.4	-1.9	-1.9	1.9	1.9	-5.5	-5.5
Stack Outlet 1	+	stack1	19.1	19.1	19.3	19.3	18.8	18.8	24.1	24.1	25.0	25.0	19.6	19.6	14.6	14.6	15.2	15.2	15.1	15.1	15.0	15.0	19.4	19.4	16.3	16.3
Exhaust Pipe 1	+	meap1	10.3	10.3	11.6	11.6	10.8	10.8	16.7	16.7	17.6	17.6	-12.6	-12.6	-10.0	-10.0	-3.1	-3.1	-5.4	-5.4	-5.7	-5.7	10.3	10.3	-14.7	-14.7
Exhaust Pipe 2	+	meap2	-4.2	-4.2	2.3	2.3	3.7	3.7	11.9	11.9	12.9	12.9	-17.3	-17.3	-20.2	-20.2	-12.0	-12.0	-15.1	-15.1	-12.1	-12.1	7.0	7.0	-0.1	-0.1
Exhaust Pipe 3	+	meap3	-12.4	-12.4	-2.8	-2.8	4.7	4.7	8.7	8.7	10.0	10.0	-18.6	-18.6	-21.2	-21.2	-20.8	-20.8	-20.9	-20.9	-20.9	-20.9	4.6	4.6	2.3	2.3
Exhaust Pipe 4	+	meap4	-19.5	-19.5	-11.5	-11.5	-10.3	-10.3	-1.5	-1.5	0.2	0.2	-23.1	-23.1	-27.0	-27.0	-26.6	-26.6	-26.7	-26.7	-26.8	-26.8	-9.1	-9.1	-8.9	-8.9
Exhaust Pipe 5	+	meap5	-6.1	-6.1	1.5	1.5	-0.9	-0.9	5.2	5.2	6.2	6.2	-8.4	-8.4	-11.3	-11.3	-11.0	-11.0	-11.1	-11.1	-11.1	-11.1	-9.2	-9.2	-1.2	-1.2
Exhaust Pipe 6	+	meap6	15.0	15.0	14.9	14.9	14.0	14.0	18.8	18.8	19.7	19.7	-9.3	-9.3	-9.1	-9.1	8.2	8.2	8.0	8.0	5.3	5.3	10.6	10.6	-4.0	-4.0
Inlet Pipe 1	+	idip1	-8.7	-8.7	-11.7	-11.7	-3.3	-3.3	7.5	7.5	6.2	6.2	-16.4	-16.4	-20.3	-20.3	-20.3	-20.3	-20.4	-20.4	-20.4	-20.4	5.4	5.4	2.1	2.1
Inlet Pipe 2	+	idip2	-4.5	-4.5	-4.6	-4.6	3.3	3.3	10.0	10.0	11.1	11.1	-12.7	-12.7	-16.9	-16.9	-16.8	-16.8	-16.9	-16.9	-17.0	-17.0	5.0	5.0	4.4	4.4
Inlet Pipe 3	+	idip3	-14.9	-14.9	-8.7	-8.7	-4.2	-4.2	2.8	2.8	3.0	3.0	-20.5	-20.5	-24.5	-24.5	-24.6	-24.6	-24.7	-24.7	-24.4	-24.4	-4.0	-4.0	-2.8	-2.8
Inlet Pipe 4	+	idip4	0.0	0.0	2.6	2.6	1.9	1.9	10.8	10.8	11.8	11.8	-17.9	-17.9	-20.0	-20.0	-19.2	-19.2	-19.3	-19.3	-19.4	-19.4	5.5	5.5	-3.9	-3.9
Inlet Pipe 5	+	idip5	2.7	2.7	3.1	3.1	2.2	2.2	9.6	9.6	11.8	11.8	-16.1	-16.1	-18.9	-18.9	-18.5	-18.5	-18.6	-18.6	-18.7	-18.7	6.2	6.2	-0.2	-0.2
Inlet Pipe 6	+	idip6	-3.3	-3.3	-3.5	-3.5	-3.8	-3.8	2.1	2.1	4.3	4.3	-21.5	-21.5	-25.0	-25.0	-24.5	-24.5	-24.6	-24.6	-24.7	-24.7	-0.2	-0.2	-9.7	-9.7
Out Pipe 1	+	idop1	-8.0	-8.0	1.3	1.3	4.1	4.1	11.7	11.7	12.9	12.9	-5.5	-5.5	-17.6	-17.6	-17.2	-17.2	-17.3	-17.3	-17.4	-17.4	8.3	8.3	7.3	7.3
Out Pipe 2	+	idop2	-12.8	-12.8	-8.2	-8.2	-7.8	-7.8	-1.3	-1.3	-0.1	-0.1	-16.2	-16.2	-24.0	-24.0	-24.3	-24.3	-24.2	-24.2	-24.2	-24.2	-4.9	-4.9	-6.7	-6.7
Out Pipe 3	+	idop3	-18.7	-18.7	-10.2	-10.2	-10.6	-10.6	-8.3	-8.3	-7.5	-7.5	-26.2	-26.2	-33.9	-33.9	-33.4	-33.4	-33.5	-33.5	-33.5	-33.5	-8.0	-8.0	-11.4	-11.4
Out Pipe 4	+	idop4	-26.5	-26.5	-19.4	-19.4	-17.3	-17.3	-16.7	-16.7	-15.9	-15.9	-34.9	-34.9	-40.1	-40.1	-39.5	-39.5	-39.6	-39.6	-39.7	-39.7	-14.7	-14.7	-17.9	-17.9
Out Pipe 5	+	idop5	-25.4	-25.4	-16.9	-16.9	-16.0	-16.0	-16.2	-16.2	-15.3	-15.3	-32.8	-32.8	-40.0	-40.0	-39.0	-39.0	-39.5	-39.5	-39.6	-39.6	-17.3	-17.3	-16.9	-16.9
Out Pipe 6	+	idop6	-18.0	-18.0	-10.0	-10.0	-9.6	-9.6	-7.7	-7.7	-7.1	-7.1	-29.7	-29.7	-33.8	-33.8	-31.8	-31.8	-31.9	-31.9	-32.0	-32.0	-10.4	-10.4	-11.0	-11.0
Out Pipe 7	+	idop7	-12.1	-12.1	-9.8	-9.8	-10.2	-10.2	-2.3	-2.3	-1.8	-1.8	-28.8	-28.8	-28.6	-28.6	-26.7	-26.7	-27.2	-27.2	-27.4	-27.4	-8.4	-8.4	-18.0	-18.0
Out Pipe 8	+	idop8	1.8	1.8	5.0	5.0	4.7	4.7	12.6	12.6	12.9	12.9	-12.5	-12.5	-15.1	-15.1	-16.1	-16.1	-16.2	-16.2	-16.3	-16.3	6.3	6.3	-11.0	-11.0
Stack Shell	+	stackshell	-11.7	-11.7	-12.3	-12.3	-25.5	-25.5	-3.3	-3.3	-0.0	-0.0	-11.6	-11.6	-28.6	-28.6	-28.3	-28.3	-28.4	-28.4	-28.4	-28.4	-6.9	-6.9	-8.6	-8.6
ACC Steam Duct	+	accsdo1	-4.5	-4.5	-3.0	-3.0	-2.1	-2.1	15.9	15.9	16.9	16.9	-6.6	-6.6	-8.8	-8.8	-8.5	-8.5	-8.6	-8.6	-8.7	-8.7	10.8	10.8	8.8	8.8
ACC Steam Duct	+	accsdo2	3.2	3.2	1.2	1.2	8.6	8.6	16.4	16.4	17.1	17.1	-9.8	-9.8	-3.8	-3.8	-1.4	-1.4	-2.3	-2.3	-4.4	-4.4	11.3	11.3	-6.2	-6.2
ACC Steam Duct	+	accsdo3	2.6	2.6	1.9	1.9	1.1	1.1	16.1	16.1	16.8	16.8	-9.6	-9.6	-5.7	-5.7	-4.0	-4.0	-5.6	-5.6	-5.5	-5.5	11.7	11.7	-6.2	-6.2
ACC Steam Duct	+	accsdo4	6.7	6.7	7.6	7.6	8.9	8.9	17.3	17.3	18.5	18.5	6.0	6.0	2.4	2.4	2.6	2.6	2.5	2.5	2.5	2.5	13.6	13.6	12.3	12.3
ACC Steam Duct	+	accsdo5	7.8	7.8	7.7	7.7	10.0	10.0	16.3	16.3	17.8	17.8	8.1	8.1	4.3	4.3	4.4	4.4	4.4	4.4	4.4	4.4	13.5	13.5	11.5	11.5
ACC Inlet	+	accin	4.8	4.8	7.2	7.2	14.3	14.3	23.8	23.8	25.4	25.4	3.8	3.8	-0.4	-0.4	-0.1	-0.1	-0.2	-0.2	-0.3	-0.3	21.6	21.6	19.5	19.5
ACC Outlet	+	accout	13.0	13.0	13.1	13.1	13.9	13.9	21.1	21.1	22.5	22.5	12.5	12.5	8.8	8.8	9.0	9.0	9.0	9.0	9.0	9.0	17.8	17.8	16.1	16.1
Air Comp 1 Top	+	actop	-4.3	-4.3	-0.0	-0.0	3.0	3.0	8.3	8.3	7.9	7.9	-8.1	-8.1	-14.3	-14.3	-13.6	-13.6	-13.8	-13.8	-13.9	-13.9	4.1	4.1	1.0	1.0
Air Comp 2 Top	+	actop	-5.3	-5.3	-2.4	-2.4	-2.9	-2.9	7.1	7.1	8.3	8.3	-9.9	-9.9	-14.1	-14.1	-13.9	-13.9	-14.0	-14.0	-14.0	-14.0	5.4	5.4	-0.0	-0.0
Bicarb Top	+	bmt	16.2	16.2	16.7	16.7	16.5	16.5	21.8	21.8	22.8	22.8	0.8	0.8	-0.6	-0.6	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	16.9	16.9	13.8	13.8
Boiler Hall Roof	+	bhr	10.4	10.4	9.9	9.9	9.3	9.3	15.3	15.3	16.2	16.2	10.3	10.3	7.3	7.3	7.7	7.7	7.6	7.6	7.6	7.6	10.5	10.5	9.0	9.0
Recooler 1 Top	+	rct	-7.8	-7.8	-8.4	-8.4	-9.3	-9.3	0.5	0.5	1.7	1.7	1.6	1.6	-4.1	-4.1	-4.4	-4.4	-4.1	-4.1	-4.1	-4.1	15.1	15.1	14.0	14.0
Recooler 1 Top	+	rct	-8.0	-8.0	-8.5	-8.5	-9.5	-9.5	6.7	6.7	-1.0	-1.0	0.3	0.3	-5.5	-5.5	-5.6	-5.6	-5.5	-5.5	-5.5	-5.5	9.6	9.6	10.8	10.8

Recooler 3 Top	+	rct	-8.1	-8.1	-8.7	-8.7	-9.6	-9.6	12.1	12.1	-2.7	-2.7	-1.5	-1.5	-7.4	-7.4	-7.3	-7.3	-7.3	-7.3	-7.3	-7.3	9.3	9.3	9.6	9.6
Recooler 4 Top	+	rct	-8.4	-8.4	-8.9	-8.9	-9.7	-9.7	12.8	12.8	1.2	1.2	-3.7	-3.7	-9.2	-9.2	-9.0	-9.0	-9.0	-9.0	-9.1	-9.1	9.1	9.1	9.6	9.6
E Mod Top	+	emodt	-2.4	-2.4	3.7	3.7	7.8	7.8	13.9	13.9	15.1	15.1	2.2	2.2	-3.9	-3.9	-3.7	-3.7	-3.8	-3.8	-3.8	-3.8	13.0	13.0	10.8	10.8
FF1 Top	+	fft	-8.5	-8.5	7.8	7.8	6.7	6.7	16.7	16.7	18.5	18.5	-11.1	-11.1	-16.8	-16.8	-16.3	-16.3	-16.4	-16.4	-16.4	-16.4	11.3	11.3	8.2	8.2
FF2 Top	+	fft	2.3	2.3	9.3	9.3	8.3	8.3	19.0	19.0	20.3	20.3	-11.8	-11.8	-16.5	-16.5	-15.5	-15.5	-15.8	-15.8	-15.9	-15.9	12.0	12.0	5.8	5.8
ID Fan 1 Top	+	idt	-0.5	-0.5	11.4	11.4	11.8	11.8	15.3	15.3	18.1	18.1	-1.5	-1.5	-9.2	-9.2	-9.0	-9.0	-9.0	-9.0	-9.1	-9.1	14.0	14.0	13.1	13.1
ID Fan 2 Top	+	idt	12.0	12.0	12.6	12.6	12.3	12.3	19.0	19.0	19.4	19.4	-5.0	-5.0	-9.0	-9.0	-8.3	-8.3	-8.5	-8.5	-8.6	-8.6	15.2	15.2	3.1	3.1
Transformer Top	+	tbr	-2.8	-2.8	0.2	0.2	-2.8	-2.8	9.0	9.0	11.0	11.0	-1.1	-1.1	-4.7	-4.7	-4.5	-4.5	-4.6	-4.6	-4.6	-4.6	6.7	6.7	4.8	4.8
Coke Top	+	coket	-7.8	-7.8	-0.1	-0.1	-4.2	-4.2	9.6	9.6	4.8	4.8	-10.2	-10.2	-15.3	-15.3	-15.5	-15.5	-15.6	-15.6	-15.7	-15.7	0.6	0.6	5.1	5.1
Steam Turbine Roof 1	+	stbr1	2.0	2.0	3.4	3.4	5.2	5.2	15.6	15.6	16.1	16.1	2.7	2.7	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	12.7	12.7	12.0	12.0
Steam Turbine Roof 2	+	stbr2	-6.1	-6.1	-4.5	-4.5	-1.9	-1.9	10.5	10.5	12.3	12.3	-4.4	-4.4	-9.7	-9.7	-9.6	-9.6	-9.7	-9.7	-9.8	-9.8	8.7	8.7	6.9	6.9
Steam Turbine Roof Vent	+	stbrv	6.0	6.0	5.4	5.4	9.0	9.0	21.9	21.9	22.6	22.6	5.6	5.6	2.2	2.2	2.4	2.4	2.3	2.3	2.2	2.2	18.7	18.7	17.2	17.2
Bunker Roof	+	bunkr	13.0	13.0	12.4	12.4	11.2	11.2	15.9	15.9	17.0	17.0	12.7	12.7	9.9	9.9	10.2	10.2	10.2	10.2	10.1	10.1	12.1	12.1	9.1	9.1
Bunker Roof Vent	+	bunkrv	14.9	14.9	14.5	14.5	13.4	13.4	18.9	18.9	19.8	19.8	14.5	14.5	10.9	10.9	11.3	11.3	11.2	11.2	11.2	11.2	12.3	12.3	10.6	10.6
Boiler Roof Vent 1	+	bhrv1	18.0	18.0	17.7	17.7	16.8	16.8	24.2	24.2	24.2	24.2	17.8	17.8	13.6	13.6	14.0	14.0	14.0	14.0	13.9	13.9	17.2	17.2	16.2	16.2
Boiler Roof Vent 2	+	bhrv2	18.3	18.3	18.1	18.1	17.3	17.3	23.6	23.6	26.0	26.0	17.6	17.6	13.5	13.5	14.1	14.1	14.0	14.0	13.9	13.9	16.5	16.5	14.2	14.2
MRF Roof	+		15.5	15.5	14.2	14.2	13.0	13.0	14.9	14.9	16.0	16.0	17.8	17.8	13.1	13.1	13.3	13.3	13.3	13.3	13.3	13.3	11.7	11.7	12.1	12.1
MBT Roof	+		16.6	16.6	15.5	15.5	14.4	14.4	17.2	17.2	18.8	18.8	18.6	18.6	14.0	14.0	14.2	14.2	14.2	14.2	14.1	14.1	13.5	13.5	13.7	13.7
AD Roof	+		21.2	21.2	20.3	20.3	19.3	19.3	23.6	23.6	24.3	24.3	22.9	22.9	18.3	18.3	18.5	18.5	18.5	18.5	18.5	18.5	19.6	19.6	19.1	19.1
WWTP Roof	+		20.0	20.0	19.5	19.5	18.7	18.7	23.5	23.5	24.6	24.6	21.3	21.3	16.9	16.9	17.1	17.1	17.1	17.1	17.1	17.1	20.1	20.1	19.7	19.7
PPP Roof	+		24.5	24.5	23.5	23.5	22.2	22.2	26.5	26.5	27.1	27.1	23.9	23.9	20.3	20.3	20.9	20.9	20.8	20.8	20.7	20.7	21.6	21.6	18.8	18.8
MDP Storage Roof	+		15.5	15.5	14.2	14.2	12.8	12.8	16.5	16.5	17.1	17.1	15.6	15.6	11.8	11.8	12.3	12.3	12.3	12.3	12.2	12.2	11.6	11.6	10.5	10.5
RCP Storage Roof	+		12.4	12.4	11.4	11.4	10.3	10.3	14.6	14.6	15.3	15.3	12.5	12.5	8.7	8.7	9.1	9.1	9.0	9.0	9.0	9.0	7.5	7.5	8.3	8.3
Vehicle Circulation / RDF Reception Roof	+		21.0	21.0	20.2	20.2	19.1	19.1	23.8	23.8	24.4	24.4	21.7	21.7	17.6	17.6	17.9	17.9	17.9	17.9	17.8	17.8	19.3	19.3	18.0	18.0
Ash Hall Roof	+		10.0	10.0	9.5	9.5	8.7	8.7	14.0	14.0	14.3	14.3	10.4	10.4	6.3	6.3	6.7	6.7	6.6	6.6	6.6	6.6	9.8	9.8	9.0	9.0
Quarry Entrance Road	+		35.1	-30.2	31.4	-33.9	28.0	-37.2	25.5	-39.7	25.2	-40.0	30.0	-35.3	36.0	-29.3	39.3	-26.0	38.4	-26.9	37.8	-27.5				
IWMF Entrance Road	+		41.7	-23.5	35.9	-29.4	33.3	-32.0	33.5	-31.7	33.8	-31.5	38.1	-27.1	37.5	-27.7	42.4	-22.9	41.1	-24.1	40.3	-24.9	28.4	-36.8	28.6	-36.7
IWMF Entrance Road	+		25.1	-40.2	21.7	-43.5	20.3	-44.9	23.0	-42.2	23.0	-42.2	28.1	-37.1	22.9	-42.4	22.5	-42.8	22.5	-42.8	24.6	-40.6	17.2	-48.1	7.1	-58.2
IWMF Entrance Road	+		11.5	-53.8	3.6	-61.7	2.3	-62.9	6.0	-59.3	6.6	-58.6	20.3	-44.9	14.0	-51.3	10.9	-54.4	11.2	-54.1	11.3	-53.9	3.1	-62.2	13.6	-51.7
Air Comp 1 Side 1	+	acside	0.8	0.8	2.8	2.8	8.4	8.4	10.8	10.8	10.3	10.3	-6.2	-6.2	-12.5	-12.5	-11.7	-11.7	-11.7	-11.7	-11.8	-11.8	1.5	1.5	4.4	4.4
Air Comp 1 Side 2	+	acside	-1.5	-1.5	2.2	2.2	2.0	2.0	9.2	9.2	10.2	10.2	-5.7	-5.7	-11.7	-11.7	-11.3	-11.3	-11.0	-11.0	-11.1	-11.1	3.3	3.3	2.3	2.3
Air Comp 1 Side 3	+	acside	-3.8	-3.8	1.9	1.9	-3.8	-3.8	7.0	7.0	8.3	8.3	-5.1	-5.1	-11.5	-11.5	-10.8	-10.8	-10.9	-10.9	-11.0	-11.0	3.1	3.1	-1.6	-1.6
Air Comp 1 Side 4	+	acside	-1.8	-1.8	0.9	0.9	5.8	5.8	10.0	10.0	11.0	11.0	-5.4	-5.4	-11.3	-11.3	-10.9	-10.9	-11.0	-11.0	-10.9	-10.9	4.2	4.2	-2.9	-2.9
Air Comp 2 Side 1	+	acside	-3.2	-3.2	-0.2	-0.2	6.7	6.7	9.4	9.4	10.4	10.4	-7.9	-7.9	-12.3	-12.3	-11.9	-11.9	-11.9	-11.9	-12.0	-12.0	3.8	3.8	2.0	2.0
Air Comp 2 Side 2	+	acside	-2.5	-2.5	-0.7	-0.7	-9.1	-9.1	9.6	9.6	10.5	10.5	-7.2	-7.2	-11.3	-11.3	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	6.8	6.8	0.7	0.7
Air Comp 2 Side 3	+	acside	-2.5	-2.5	0.2	0.2	-7.9	-7.9	6.3	6.3	8.5	8.5	-7.0	-7.0	-11.2	-11.2	-11.1	-11.1	-11.0	-11.0	-11.1	-11.1	6.6	6.6	-2.8	-2.8
Air Comp 2 Side 4	+	acside	-2.9	-2.9	0.2	0.2	-6.6	-6.6	8.7	8.7	9.9	9.9	-7.5	-7.5	-11.4	-11.4	-11.1	-11.1	-11.2	-11.2	-11.2	-11.2	9.0	9.0	0.9	0.9
Bicarb Sid 1	+	bms1	5.3	5.3	9.8	9.8	2.9	2.9	14.6	14.6	14.5	14.5	1.4	1.4	-5.0	-5.0	-4.8	-4.8	-4.9	-4.9	-4.9	-4.9	8.4	8.4	10.9	10.9
Bicarb Side 2	+	bms2	12.8	12.8	13.6	13.6	12.3	12.3	19.5	19.5	19.3	19.3	-0.1	-0.1	-3.1	-3.1	-2.2	-2.2	-2.5	-2.5	-2.6	-2.6	13.9	13.9	13.0	13.0
Bicarb Side 3	+	bms3	14.6	14.6	13.9	13.9	13.5	13.5	16.1	16.1	20.5	20.5	-5.2	-5.2	-5.3	-5.3	-3.5	-3.5	-3.9	-3.9	-4.6	-4.6	10.8	10.8	1.7	1.7
Bicarb Side 4	+	bms4	15.3	15.3	16.8	16.8	17.1	17.1	19.3	19.3	20.0	20.0	1.8	1.8	1.0	1.0	1.5	1.5	1.6	1.6	1.5	1.5	15.0	15.0	5.3	5.3
Boiler Hall Wall 1	+	bhw1	-12.2	-12.2	-9.0	-9.0	-6.0	-6.0	-0.3	-0.3	0.5	0.5	-4.4	-4.4	-7.2	-7.2	-14.5	-14.5	-14.1	-14.1	-13.5	-13.5	0.7	0.7	2.8	2.8
Boiler Hall Wall 2	+	bhw2	-1.3	-1.3	4.2	4.2	9.2	9.2	13.9	13.9	14.8	14.8	-6.4	-6.4	-9.0	-9.0	-8.8	-8.8	-8.8	-8.8	-8.9	-8.9	9.6	9.6	6.7	6.7

Boiler Hall Wall 3	+	bhw3	-12.0	-12.0	-12.1	-12.1	-12.7	-12.7	-3.3	-3.3	-6.4	-6.4	-6.5	-6.5	-9.4	-9.4	-13.1	-13.1	-12.6	-12.6	-11.9	-11.9	-2.6	-2.6	-0.2	-0.2
Boiler Louvre 1	+	bhv1	-14.9	-14.9	-13.6	-13.6	-14.6	-14.6	6.6	6.6	6.5	6.5	-14.7	-14.7	-19.2	-19.2	-19.7	-19.7	-19.8	-19.8	-19.8	-19.8	-2.8	-2.8	-6.0	-6.0
Boiler Louvre 2	+	bhv2	-12.9	-12.9	-6.4	-6.4	1.6	1.6	8.0	8.0	8.8	8.8	-15.1	-15.1	-19.8	-19.8	-19.5	-19.5	-19.5	-19.5	-19.6	-19.6	4.3	4.3	2.4	2.4
Boiler Louvre 3	+	bhv3	-8.2	-8.2	-4.4	-4.4	0.0	0.0	9.5	9.5	11.0	11.0	-15.6	-15.6	-19.9	-19.9	-19.3	-19.3	-19.5	-19.5	-19.6	-19.6	3.9	3.9	-16.6	-16.6
Boiler Louvre 4	+	bhv4	-10.8	-10.8	-3.8	-3.8	3.7	3.7	4.7	4.7	6.7	6.7	-15.0	-15.0	-19.3	-19.3	-18.8	-18.8	-18.9	-18.9	-19.0	-19.0	2.4	2.4	0.6	0.6
Boiler Louvre 5	+	bhv5	-11.2	-11.2	-4.3	-4.3	2.4	2.4	3.5	3.5	5.6	5.6	-15.2	-15.2	-19.6	-19.6	-19.1	-19.1	-19.2	-19.2	-19.3	-19.3	0.5	0.5	-1.0	-1.0
Recooler 1 Side 1	+	rcs1	-6.3	-6.3	-6.9	-6.9	-7.5	-7.5	-1.3	-1.3	1.7	1.7	-1.3	-1.3	-7.9	-7.9	-8.0	-8.0	-7.9	-7.9	-8.0	-8.0	8.4	8.4	9.0	9.0
Recooler 1 Side 2	+	rcs2	-11.6	-11.6	-12.2	-12.2	-12.7	-12.7	-2.6	-2.6	0.5	0.5	-3.6	-3.6	-7.8	-7.8	-12.6	-12.6	-10.5	-10.5	-8.9	-8.9	8.1	8.1	8.3	8.3
Recooler 1 Side 3	+	rcs3	-7.7	-7.7	-8.2	-8.2	-7.5	-7.5	3.5	3.5	4.4	4.4	-2.1	-2.1	-8.7	-8.7	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5	14.3	14.3	14.1	14.1
Recooler 1 Side 4	+	rcs4	-12.8	-12.8	-12.8	-12.8	-14.1	-14.1	-3.2	-3.2	-4.4	-4.4	-3.9	-3.9	-11.4	-11.4	-12.2	-12.2	-9.9	-9.9	-7.6	-7.6	6.1	6.1	6.5	6.5
Recooler 2 Side 1	+	rcs1	-6.2	-6.2	-6.8	-6.8	-8.0	-8.0	4.2	4.2	0.1	0.1	0.2	0.2	-6.0	-6.0	-5.7	-5.7	-5.8	-5.8	-5.9	-5.9	9.1	9.1	8.3	8.3
Recooler 2 Side 2	+	rcs2	-11.4	-11.4	-12.2	-12.2	-12.7	-12.7	11.1	11.1	-1.4	-1.4	-4.7	-4.7	-9.2	-9.2	-11.5	-11.5	-11.3	-11.3	-9.9	-9.9	6.5	6.5	6.8	6.8
Recooler 2 Side 3	+	rcs3	-6.5	-6.5	-7.4	-7.4	-7.6	-7.6	-1.5	-1.5	0.7	0.7	0.1	0.1	-4.2	-4.2	-4.2	-4.2	-4.1	-4.1	-4.1	-4.1	6.7	6.7	8.2	8.2
Recooler 2 Side 4	+	rcs4	-12.9	-12.9	-12.9	-12.9	-14.1	-14.1	-3.8	-3.8	-4.9	-4.9	-4.8	-4.8	-11.4	-11.4	-12.7	-12.7	-10.5	-10.5	-8.9	-8.9	5.4	5.4	3.3	3.3
Recooler 3 Side 1	+	rcs1	-7.0	-7.0	-6.8	-6.8	-7.7	-7.7	5.1	5.1	-1.5	-1.5	-3.1	-3.1	-9.6	-9.6	-9.3	-9.3	-9.4	-9.4	-9.5	-9.5	7.4	7.4	7.5	7.5
Recooler 3 Side 2	+	rcs2	-11.6	-11.6	-12.3	-12.3	-12.8	-12.8	11.7	11.7	-1.2	-1.2	-6.8	-6.8	-10.9	-10.9	-13.7	-13.7	-11.2	-11.2	-10.2	-10.2	5.7	5.7	6.2	6.2
Recooler 3 Side 3	+	rcs3	-7.8	-7.8	-8.4	-8.4	-7.7	-7.7	10.7	10.7	-1.0	-1.0	-2.5	-2.5	-8.2	-8.2	-7.9	-7.9	-7.9	-7.9	-8.0	-8.0	6.5	6.5	8.7	8.7
Recooler 3 Side 4	+	rcs4	-13.0	-13.0	-13.1	-13.1	-14.2	-14.2	-4.4	-4.4	-5.4	-5.4	-6.1	-6.1	-12.5	-12.5	-13.3	-13.3	-11.4	-11.4	-10.6	-10.6	4.6	4.6	2.6	2.6
Recooler 4 Side 1	+	rcs1	-6.5	-6.5	-7.0	-7.0	-7.8	-7.8	6.6	6.6	1.6	1.6	-3.2	-3.2	-8.5	-8.5	-8.2	-8.2	-8.3	-8.3	-8.3	-8.3	8.5	8.5	8.3	8.3
Recooler 4 Side 2	+	rcs2	-11.5	-11.5	-12.3	-12.3	-12.8	-12.8	11.4	11.4	8.3	8.3	-9.2	-9.2	-12.6	-12.6	-14.3	-14.3	-12.3	-12.3	-12.5	-12.5	6.4	6.4	6.2	6.2
Recooler 4 Side 3	+	rcs3	-6.6	-6.6	-7.4	-7.4	-7.8	-7.8	11.4	11.4	-2.1	-2.1	-1.9	-1.9	-6.6	-6.6	-6.3	-6.3	-6.3	-6.3	-6.4	-6.4	5.0	5.0	6.4	6.4
Recooler 4 Side 4	+	rcs4	-13.1	-13.1	-13.2	-13.2	-14.2	-14.2	-1.3	-1.3	-5.7	-5.7	-7.4	-7.4	-13.0	-13.0	-13.8	-13.8	-12.2	-12.2	-12.3	-12.3	4.0	4.0	2.3	2.3
E Mod Side 1	+	emods1	-2.9	-2.9	0.8	0.8	8.1	8.1	15.3	15.3	15.9	15.9	2.6	2.6	-2.8	-2.8	-2.6	-2.6	-2.7	-2.7	-2.7	-2.7	11.4	11.4	7.5	7.5
E Mod Side 2	+	emods2	-1.7	-1.7	4.6	4.6	6.6	6.6	14.8	14.8	15.7	15.7	0.6	0.6	-6.5	-6.5	-3.7	-3.7	-3.8	-3.8	-3.8	-3.8	13.8	13.8	4.0	4.0
E Mod Side 3	+	emods3	-2.1	-2.1	2.0	2.0	2.0	2.0	9.7	9.7	13.4	13.4	0.0	0.0	-6.0	-6.0	-5.6	-5.6	-5.5	-5.5	-5.6	-5.6	10.6	10.6	6.3	6.3
E Mod Side 4	+	emods4	-4.2	-4.2	-2.7	-2.7	-0.3	-0.3	9.3	9.3	11.2	11.2	0.7	0.7	-4.9	-4.9	-6.1	-6.1	-6.7	-6.7	-6.6	-6.6	10.1	10.1	7.9	7.9
FF1 Side 1	+	ffs1	-6.2	-6.2	-0.3	-0.3	-0.3	-0.3	6.0	6.0	7.9	7.9	-6.4	-6.4	-12.4	-12.4	-11.9	-11.9	-12.0	-12.0	-12.1	-12.1	8.4	8.4	12.1	12.1
FF1 Side 2	+	ffs2	-8.5	-8.5	-3.8	-3.8	5.5	5.5	14.7	14.7	14.9	14.9	-8.8	-8.8	-14.9	-14.9	-14.2	-14.2	-14.3	-14.3	-14.4	-14.4	9.0	9.0	7.5	7.5
FF1 Side 3	+	ffs3	-5.4	-5.4	6.0	6.0	6.4	6.4	17.2	17.2	18.4	18.4	-6.2	-6.2	-12.1	-12.1	-11.5	-11.5	-11.6	-11.6	-11.6	-11.6	15.2	15.2	3.7	3.7
FF1 Side 4	+	ffs4	-7.4	-7.4	1.5	1.5	8.2	8.2	13.3	13.3	14.5	14.5	-9.2	-9.2	-15.1	-15.1	-14.5	-14.5	-14.6	-14.6	-14.7	-14.7	4.4	4.4	5.9	5.9
FF2 Side 1	+	ffs1	-1.4	-1.4	6.4	6.4	7.2	7.2	11.3	11.3	12.4	12.4	-6.7	-6.7	-12.0	-12.0	-11.1	-11.1	-11.3	-11.3	-11.4	-11.4	5.8	5.8	8.4	8.4
FF2 Side 2	+	ffs2	2.1	2.1	5.0	5.0	9.0	9.0	16.6	16.6	17.1	17.1	-9.9	-9.9	-15.0	-15.0	-14.0	-14.0	-14.1	-14.1	-14.2	-14.2	9.8	9.8	3.8	3.8
FF2 Side 3	+	ffs3	7.9	7.9	11.3	11.3	10.6	10.6	21.5	21.5	22.7	22.7	-7.1	-7.1	-12.5	-12.5	-11.6	-11.6	-11.8	-11.8	-11.9	-11.9	16.0	16.0	-4.8	-4.8
FF2 Side 4	+	ffs4	-5.1	-5.1	6.3	6.3	2.4	2.4	15.9	15.9	15.8	15.8	-9.5	-9.5	-15.2	-15.2	-14.4	-14.4	-14.5	-14.5	-14.7	-14.7	3.3	3.3	2.9	2.9
ID Fan 1 Side 1	+	ids1	-0.5	-0.5	10.6	10.6	0.3	0.3	13.8	13.8	14.1	14.1	1.5	1.5	-6.8	-6.8	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	10.5	10.5	14.0	14.0
ID Fan 1 Side 2	+	ids2	0.1	0.1	7.6	7.6	-4.0	-4.0	14.8	14.8	15.2	15.2	-2.7	-2.7	-7.9	-7.9	-7.7	-7.7	-7.8	-7.8	-7.9	-7.9	7.1	7.1	7.4	7.4
ID Fan 1 Side 3	+	ids3	2.1	2.1	11.8	11.8	15.0	15.0	15.0	15.0	15.2	15.2	-1.8	-1.8	-6.3	-6.3	-6.0	-6.0	-6.1	-6.1	-6.1	-6.1	10.0	10.0	4.5	4.5
ID Fan 1 Side 4	+	ids4	-0.4	-0.4	10.6	10.6	11.0	11.0	16.8	16.8	18.5	18.5	-2.2	-2.2	-7.7	-7.7	-7.6	-7.6	-7.7	-7.7	-7.6	-7.6	12.1	12.1	10.1	10.1
ID Fan 2 Side 1	+	ids1	6.3	6.3	8.6	8.6	9.9	9.9	15.9	15.9	15.7	15.7	-2.2	-2.2	-5.9	-5.9	-5.6	-5.6	-5.7	-5.7	-5.8	-5.8	10.6	10.6	0.4	0.4
ID Fan 2 Side 2	+	ids2	10.0	10.0	9.0	9.0	12.1	12.1	16.1	16.1	16.7	16.7	-3.8	-3.8	-7.2	-7.2	-6.6	-6.6	-6.7	-6.7	-6.8	-6.8	10.2	10.2	-4.0	-4.0
ID Fan 2 Side 3	+	ids3	14.1	14.1	13.3	13.3	12.9	12.9	18.8	18.8	20.4	20.4	-2.9	-2.9	-6.7	-6.7	-6.0	-6.0	-6.1	-6.1	-6.2	-6.2	16.1	16.1	0.4	0.4
ID Fan 2 Side 4	+	ids4	7.5	7.5	12.3	12.3	10.3	10.3	18.3	18.3	18.5	18.5	-4.0	-4.0	-7.9	-7.9	-7.0	-7.0	-7.2	-7.2	-7.5	-7.5	11.3	11.3	2.3	2.3
Tranformer Side 1	+	tbw1	-7.8	-7.8	-6.1	-6.1	-1.4	-1.4	10.7	10.7	11.7	11.7	-5.6	-5.6	-10.6	-10.6	-10.3	-10.3	-10.4	-10.4	-10.4	-10.4	7.0	7.0	5.3	5.3
Tranformer Side 2	+	tbw2	-7.3	-7.3	-1.9	-1.9	-3.7	-3.7	6.8	6.8	8.3	8.3	-8.3	-8.3	-14.3	-14.3	-8.0	-8.0	-12.4	-12.4	-13.5	-13.5	3.9	3.9	-5.3	-5.3

Tranformer Side 3	+	tbw3	-1.8	-1.8	-0.2	-0.2	-5.0	-5.0	9.2	9.2	11.1	11.1	-0.7	-0.7	-4.2	-4.2	-4.2	-4.2	-4.3	-4.3	-4.3	-4.3	6.9	6.9	4.7	4.7
Tranformer Side 4	+	tbw4	-11.8	-11.8	-11.8	-11.8	-15.0	-15.0	2.7	2.7	3.6	3.6	-4.2	-4.2	-8.2	-8.2	-10.3	-10.3	-8.1	-8.1	-7.9	-7.9	3.9	3.9	3.2	3.2
Coke Side 1	+	cokes1	-3.8	-3.8	5.0	5.0	-0.2	-0.2	8.9	8.9	6.6	6.6	-5.1	-5.1	-10.1	-10.1	-10.2	-10.2	-10.4	-10.4	-10.6	-10.6	2.5	2.5	9.4	9.4
Coke Side 2	+	cokes2	-5.0	-5.0	3.5	3.5	-6.3	-6.3	6.3	6.3	5.3	5.3	-6.7	-6.7	-11.2	-11.2	-11.5	-11.5	-11.6	-11.6	-11.7	-11.7	0.2	0.2	5.2	5.2
Coke Side 3	+	cokes3	-3.3	-3.3	-0.2	-0.2	-4.4	-4.4	8.1	8.1	8.2	8.2	-5.5	-5.5	-11.0	-11.0	-10.7	-10.7	-10.8	-10.8	-10.8	-10.8	1.0	1.0	1.5	1.5
Coke Side 4	+	cokes4	-3.2	-3.2	1.2	1.2	-1.2	-1.2	11.9	11.9	7.4	7.4	-4.4	-4.4	-12.0	-12.0	-11.3	-11.3	-11.4	-11.4	-11.6	-11.6	2.4	2.4	0.9	0.9
Steam Turbine Wall 1	+	stbw1	-4.2	-4.2	-2.1	-2.1	-0.7	-0.7	10.1	10.1	11.9	11.9	1.5	1.5	-4.9	-4.9	-7.4	-7.4	-7.3	-7.3	-7.2	-7.2	10.0	10.0	9.7	9.7
Steam Turbine Wall 2	+	stbw2	-6.2	-6.2	-3.0	-3.0	3.4	3.4	13.0	13.0	12.7	12.7	-5.5	-5.5	-9.2	-9.2	-9.0	-9.0	-9.0	-9.0	-9.1	-9.1	7.4	7.4	4.8	4.8
Steam Turbine Wall 3	+	stbw3	-10.3	-10.3	-10.7	-10.7	-8.2	-8.2	3.4	3.4	4.5	4.5	-6.1	-6.1	-9.5	-9.5	-13.8	-13.8	-13.5	-13.5	-13.4	-13.4	2.7	2.7	4.9	4.9
Steam Turbine Wall 4	+	stbw4	-7.7	-7.7	-3.6	-3.6	2.5	2.5	4.4	4.4	7.1	7.1	-5.7	-5.7	-11.0	-11.0	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	3.2	3.2	0.2	0.2
Steam Turbine Wall 5	+	stbw5	-7.7	-7.7	-4.9	-4.9	-3.5	-3.5	9.2	9.2	11.4	11.4	-6.1	-6.1	-12.3	-12.3	-9.4	-9.4	-9.5	-9.5	-9.7	-9.7	8.1	8.1	1.3	1.3
Steam Turbine Wall 6	+	stbw6	-10.7	-10.7	-12.3	-12.3	0.0	0.0	4.6	4.6	6.2	6.2	-9.2	-9.2	-14.8	-14.8	-14.6	-14.6	-14.7	-14.7	-14.7	-14.7	2.3	2.3	0.2	0.2
Steam Turbine Wall 7	+	stbw7	-6.7	-6.7	-5.2	-5.2	1.4	1.4	9.2	9.2	12.2	12.2	-3.4	-3.4	-9.0	-9.0	-9.1	-9.1	-9.0	-9.0	-9.0	-9.0	9.0	9.0	8.4	8.4
Steam Turbine Gate	+	stbg	-12.1	-12.1	-10.8	-10.8	-13.8	-13.8	2.2	2.2	2.5	2.5	-10.0	-10.0	-16.1	-16.1	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	5.7	5.7	-0.7	-0.7
Steam Turbine Vent 1	+	stbv1	-6.7	-6.7	-5.4	-5.4	-5.4	-5.4	12.1	12.1	17.9	17.9	-4.6	-4.6	-11.0	-11.0	-10.7	-10.7	-10.7	-10.7	-10.8	-10.8	12.1	12.1	7.8	7.8
Steam Turbine Vent 2	+	stbv2	-0.4	-0.4	2.6	2.6	10.8	10.8	23.0	23.0	23.2	23.2	0.3	0.3	-3.8	-3.8	-3.5	-3.5	-3.6	-3.6	-3.6	-3.6	16.9	16.9	12.8	12.8
Steam Turbine Vent 3	+	stbv3	-4.3	-4.3	-4.9	-4.9	-5.6	-5.6	6.0	6.0	8.0	8.0	-2.0	-2.0	-6.6	-6.6	-8.1	-8.1	-8.1	-8.1	-8.1	-8.1	10.9	10.9	16.0	16.0
MRF Wall	+		14.0	14.0	-1.5	-1.5	-8.7	-8.7	-5.8	-5.8	-5.3	-5.3	16.4	16.4	11.6	11.6	11.8	11.8	11.8	11.8	11.8	11.8	-9.4	-9.4	-10.0	-10.0
MRF Wall	+		-7.4	-7.4	-11.9	-11.9	-12.9	-12.9	-9.3	-9.3	-8.6	-8.6	13.3	13.3	8.2	8.2	-11.5	-11.5	-11.3	-11.3	-11.1	-11.1	-11.8	-11.8	7.4	7.4
MBT Wall	+		-8.5	-8.5	-10.1	-10.1	-11.1	-11.1	-6.9	-6.9	-6.6	-6.6	15.0	15.0	10.5	10.5	-9.1	-9.1	-8.5	-8.5	-7.9	-7.9	-7.6	-7.6	10.3	10.3
AD Wall	+		-3.9	-3.9	-5.0	-5.0	-5.9	-5.9	-1.6	-1.6	-0.3	-0.3	20.7	20.7	16.1	16.1	-3.9	-3.9	-3.2	-3.2	-2.6	-2.6	-1.6	-1.6	16.7	16.7
WWTP Wall	+		-7.2	-7.2	-7.7	-7.7	-8.4	-8.4	-0.3	-0.3	1.4	1.4	14.9	14.9	10.7	10.7	-9.5	-9.5	-9.4	-9.4	-9.3	-9.3	6.1	6.1	12.6	12.6
WWTP Wall	+		0.2	0.2	-6.3	-6.3	8.7	8.7	15.4	15.4	16.4	16.4	-1.1	-1.1	-8.3	-8.3	-7.4	-7.4	-7.6	-7.6	-7.8	-7.8	14.1	14.1	14.2	14.2
WWTP Wall	+		-2.4	-2.4	-6.1	-6.1	8.1	8.1	17.1	17.1	18.3	18.3	-1.1	-1.1	-5.0	-5.0	-5.1	-5.1	-5.1	-5.1	-5.1	-5.1	12.9	12.9	12.4	12.4
MDP Storage Wall	+		12.4	12.4	4.8	4.8	-10.9	-10.9	-7.3	-7.3	-7.0	-7.0	12.4	12.4	8.7	8.7	9.3	9.3	9.2	9.2	9.1	9.1	-12.4	-12.4	-13.6	-13.6
PPP Wall	+		16.3	16.3	10.3	10.3	-6.7	-6.7	-0.8	-0.8	-0.8	-0.8	15.5	15.5	12.2	12.2	12.9	12.9	12.8	12.8	12.7	12.7	-8.8	-8.8	-10.5	-10.5
PPP Wall	+		22.7	22.7	21.7	21.7	20.4	20.4	24.2	24.2	24.7	24.7	2.9	2.9	-1.3	-1.3	18.8	18.8	18.7	18.7	18.6	18.6	19.4	19.4	-3.3	-3.3
PPP Wall	+		0.7	0.7	7.7	7.7	13.7	13.7	18.3	18.3	18.8	18.8	-9.5	-9.5	-12.9	-12.9	-12.3	-12.3	-12.4	-12.4	-12.6	-12.6	11.2	11.2	-2.1	-2.1
Ash Hall Wall	+		-14.1	-14.1	-13.5	-13.5	-2.6	-2.6	5.5	5.5	8.0	8.0	-13.9	-13.9	-17.5	-17.5	-17.2	-17.2	-17.3	-17.3	-17.3	-17.3	6.1	6.1	5.2	5.2
Vechicle Circ Wall	+		-13.6	-13.6	-14.3	-14.3	-15.1	-15.1	-10.1	-10.1	-9.1	-9.1	9.2	9.2	4.6	4.6	-15.6	-15.6	-15.5	-15.5	-15.4	-15.4	-13.3	-13.3	5.9	5.9
Vechicle Circ Wall	+		-14.2	-14.2	-14.8	-14.8	-15.6	-15.6	-10.0	-10.0	-8.9	-8.9	8.2	8.2	3.8	3.8	-16.4	-16.4	-16.3	-16.3	-16.2	-16.2	-7.4	-7.4	5.3	5.3
Vechicle Circ Wall	+		11.3	11.3	2.6	2.6	-11.4	-11.4	-8.5	-8.5	-8.1	-8.1	12.2	12.2	8.1	8.1	8.5	8.5	8.5	8.5	8.4	8.4	-12.7	-12.7	-13.8	-13.8
Vechicle Circ Wall	+		8.4	8.4	9.0	9.0	8.5	8.5	15.2	15.2	15.9	15.9	-11.9	-11.9	-13.7	-13.7	-4.9	-4.9	-5.1	-5.1	-5.1	-5.1	7.5	7.5	-14.9	-14.9
Vechicle Circ Wall	+		6.1	6.1	5.5	5.5	4.5	4.5	9.8	9.8	12.4	12.4	-15.1	-15.1	-17.1	-17.1	-5.5	-5.5	-5.7	-5.7	-5.8	-5.8	3.7	3.7	-17.9	-17.9
Vechicle Circ Door	+		-11.8	-11.8	-12.9	-12.9	-13.8	-13.8	-8.2	-8.2	-7.2	-7.2	3.2	3.2	5.5	5.5	-14.6	-14.6	-14.6	-14.6	-14.6	-14.6	-12.3	-12.3	1.7	1.7
Vechicle Circ Door	+		7.4	7.4	8.7	8.7	7.6	7.6	14.0	14.0	15.3	15.3	-10.9	-10.9	-14.9	-14.9	-14.3	-14.3	-14.4	-14.4	-14.5	-14.5	10.1	10.1	-14.6	-14.6
MRF Door	+		-7.9	-7.9	-12.8	-12.8	-14.1	-14.1	-9.8	-9.8	-9.1	-9.1	12.0	12.0	6.8	6.8	-13.4	-13.4	-13.3	-13.3	-13.4	-13.4	-13.7	-13.7	4.3	4.3
MRF Door	+		11.1	11.1	-12.2	-12.2	-13.5	-13.5	-9.2	-9.2	-8.7	-8.7	13.1	13.1	8.5	8.5	8.7	8.7	8.7	8.7	8.7	8.7	-13.7	-13.7	-14.9	-14.9
Vehicle Circ Door	+		10.0	10.0	3.5	3.5	-13.2	-13.2	-8.7	-8.7	-8.2	-8.2	11.1	11.1	6.9	6.9	7.2	7.2	7.2	7.2	7.2	7.2	-13.6	-13.6	-15.1	-15.1
PPP Doors	+		17.8	17.8	16.7	16.7	15.6	15.6	19.3	19.3	19.9	19.9	-1.6	-1.6	-6.6	-6.6	14.3	14.3	14.2	14.2	14.1	14.1	15.0	15.0	-7.6	-7.6
MRF Free Vent	+		19.9	19.9	4.4	4.4	-2.5	-2.5	1.4	1.4	2.0	2.0	23.9	23.9	18.9	18.9	17.6	17.6	17.6	17.6	17.6	17.6	-2.3	-2.3	13.0	13.0
MBT Free Vent	+		-3.0	-3.0	-5.2	-5.2	-6.3	-6.3	-1.8	-1.8	-1.0	-1.0	21.5	21.5	16.4	16.4	-6.2	-6.2	-6.2	-6.2	-6.2	-6.2	-5.5	-5.5	16.7	16.7
AD Free Vent	+		1.1	1.1	-0.3	-0.3	-1.3	-1.3	3.7	3.7	4.6	4.6	26.6	26.6	21.4	21.4	-1.8	-1.8	-1.8	-1.8	-1.8	-1.8	-0.1	-0.1	22.4	22.4
Vehicle Circ Free Vent	+		-5.6	-5.6	-6.3	-6.3	-7.1	-7.1	-1.5	-1.5	-0.4	-0.4	17.4	17.4	12.3	12.3	-8.1	-8.1	-8.1	-8.1	-8.1	-8.1	-0.0	-0.0	14.1	14.1

WWTP Circ Free Vent	+		15.3	15.3	3.3	3.3	18.9	18.9	23.6	23.6	24.6	24.6	21.2	21.2	16.4	16.4	9.5	9.5	9.4	9.4	9.3	9.3	21.7	21.7	23.3	23.3
Vehicle Circ Free Vent	+		17.5	17.5	9.7	9.7	-6.9	-6.9	-2.6	-2.6	-2.2	-2.2	18.7	18.7	14.3	14.3	14.7	14.7	14.7	14.7	14.6	14.6	-7.4	-7.4	-8.8	-8.8
MDIP Free Vent	+		17.8	17.8	12.1	12.1	-6.0	-6.0	-1.2	-1.2	-0.9	-0.9	17.9	17.9	14.0	14.0	14.6	14.6	14.5	14.5	14.4	14.4	-6.9	-6.9	-8.5	-8.5
PPP Free Vent	+		29.3	29.3	28.1	28.1	26.9	26.9	31.1	31.1	31.6	31.6	21.4	21.4	17.6	17.6	25.3	25.3	25.2	25.2	24.9	24.9	25.4	25.4	3.6	3.6
Vehicle Circ Free Vent	+		15.4	15.4	16.3	16.3	15.7	15.7	21.9	21.9	23.1	23.1	-5.0	-5.0	-8.8	-8.8	-0.5	-0.5	-0.9	-0.9	-1.0	-1.0	16.5	16.5	-8.3	-8.3

Calculation Parameters

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0
Max. Search Radius (m)	2000
Min. Dist Src to Rcvr	0
Partition	
Raster Factor	0.5
Max. Length of Section (m)	10
Min. Length of Section (m)	1
Min. Length of Section (%)	0
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960
Reference Time Night (min)	480
Daytime Penalty (dB)	0
Recr. Time Penalty (dB)	6
Night-time Penalty (dB)	10
DTM	
Standard Height (m)	0
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	1
Search Radius Src	100

Search Radius Rcvr	100
Max. Distance Source - Rcvr	3000.00 3000.00
Min. Distance Rvcr - Reflector	0.20 1.00
Min. Distance Source - Reflector	0.2
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Incl. Ground Att. over Barrier
	De,o with limit
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (°C)	10
rel. Humidity (%)	70
Ground Absorption G	0.75
Wind Speed for Dir. (m/s)	5
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03 (1990))	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

Acoustic Assessment in Support of Environmental Permit Application

at

Rivenhall Airfield Integrated Waste Management Facility, Braintree, Essex

Report Prepared by:

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Acoustic Consultant

21 September 2015

Contents

1.0 Introduction

1.1 Belair Research Limited (BRL) trading as Acoustical Control Consultants (ACC) is an independent acoustic consultancy company. All of our acoustic consultants are qualified and experienced practitioners and are either Associate or Corporate members of the Institute of Acoustics. Acoustical Control Engineers Limited is our associated company specialising in engineered solutions to acoustic problems.

1.2 Belair Research Limited (BRL) has been appointed by Gent Fairhead & Co Limited to undertake an acoustic assessment of the proposals. This assessment provides evidence in support of the Environmental Permit application for the Integrated Waste Management Facility (IWMF) on Rivenhall Airfield, Braintree, Essex.

1.3 The author also undertook and supported the 2008 Acoustic Impact assessment and has been involved with acoustic monitoring at the adjacent Bradwell Quarry since 2004 therefore has a good understanding of factors affecting the acoustic environment surrounding the site.

1.4 The IWMF has evolved since 2008 and more detailed information has become available upon which this assessment is based.

1.5 This assessment benefits from detailed design of elements of the IWMF as set out in text and an updated computer model

2.0 Site Description

2.1 The site is approximately 7km to the southeast of Braintree, approximately 4km to the southwest of Coggeshall and 5km to the north of Witham, these making up the largest settlements in the area. Closer settlements are Silver End, 1km and Bradwell, 3km are situated to the south west and north-north west respectively. Other single or small groups of properties are situated within 450m to 1000m from the site.

2.2 The site is located on the disused Rivenhall Airfield, which is in the process of being removed through systematic quarrying activity at the adjacent Bradwell Quarry.

2.3 To the north of the site is the A120, which runs in an approximately west-east direction. The dedicated access road runs in an approximate southerly direction from the A120 to Bradwell Quarry and will be extended in a southerly direction across the restored airfield to provide access to the IWMF.

2.4 With the exception of the active quarry, the area is predominantly rural in nature comprising mainly arable crops, the terrain is approximately flat at a height of approximately 50mAOD. Figures 2.1 and 2.2 show the relative location of the site, surrounding areas and closest potentially sensitive receptors.

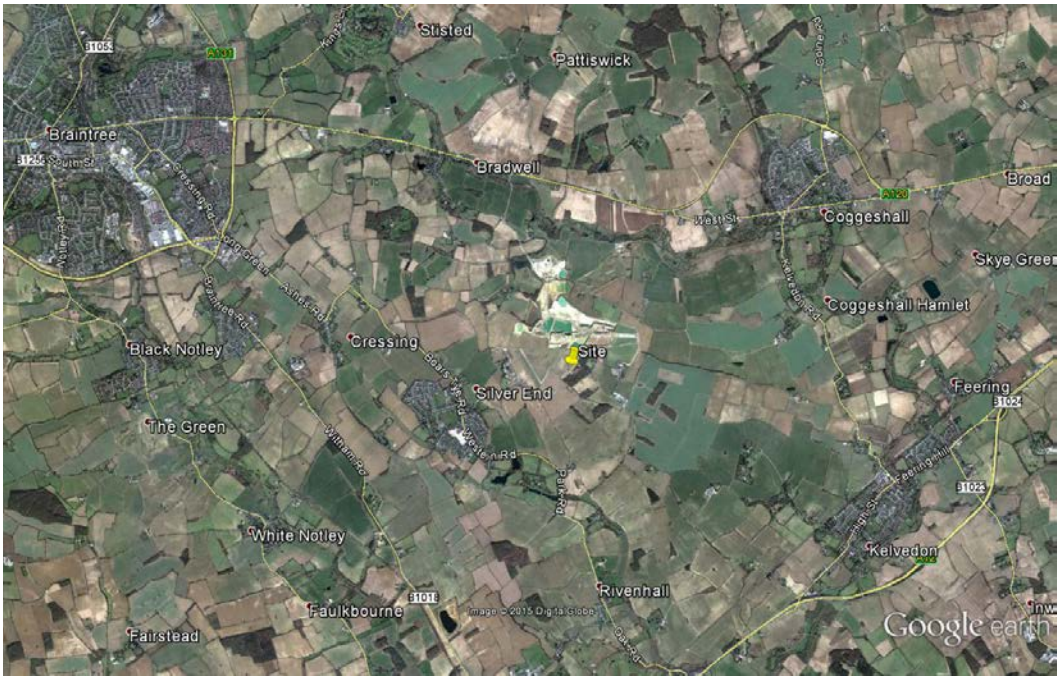


Figure 2.1 Location of site in context of surrounding area

Figure 2.2 Site and closest potentially sensitive receptors

2.5 The IWMF will be constructed at 35mAOD, with some elements down to 30mAOD, this is at least 13m below surrounding ground level, the excavations will provide a good degree of acoustic screening to many of the processes and operations.

3.0 Proposals

3.1 The IWMF comprises a number of operations, which are detailed elsewhere within the submissions, however in broad terms they comprise a materials recycling facility, mechanical biological treatment plant, a paper pulp plant, a waste water treatment plant, an anaerobic digestion plant and a combined heat and power plant. These processes are contained within the building along with vehicle circulation areas. Outside the building are vehicle routes, the access road, air cooled condensers, switchgear, the stack and various fans and filters.

3.2 A planning application for the Integrated Waste Management Facility (IWMF) was submitted in August 2008 and was accompanied by an Environmental Statement. The application was "called-in" for determination by the Secretary of State (SoS). The Call-In Public Inquiry was held in Sept/Oct 2009 and the Secretary of State issued the Inspectors report and decision on 2 March 2010, granting planning permission subject to 63 conditions and a legal agreement.

3.3 Following a number of modifications since that date, the extant planning permission is reference number ESS/55/14/BTE. The previous noise assessment, for the purposes of the Environmental Impact Assessment, made a number of assumptions regarding the sound emissions from the facility due to the fact that the details of the development were not know at that time. These assumptions were considered reasonable at the time and were based on the experience of the project team. The basis of the noise impact assessment has remained consistent throughout and has been accepted by Essex County Council.

3.4 The IWMF involves several different operators, each specialising in a different technology. Considering the overall integration associated with the IWMF's waste recovery, recycling and treatment operations, the noise attenuation measures applied at the site will be implemented through a strategic review of the cumulative operations. This will optimise the various interfaces between each operator to ensure that the cumulative effect of their operations will comply with the planning condition limits. In practice this means that they will work together with a specialist acoustic advisor to devise the most efficient, sustainable and cost effective approach to controlling noise emissions from the site as a whole.

3.5 Gent Fairhead & Co Limited are the applicants and retain overall responsibility for the site including ensuring any permit conditions are properly implemented.

4.0 Planning Conditions

4.1 Planning conditions reference ESS/55/14/BTE and numbered 38 to 42 inclusive set out the noise limits for the operation of the site during construction and operation.

4.2 The planning conditions relating to noise are numbered 38-42. Numbers 38 to 40 relate to the maximum permitted noise emissions from the IWMF and numbers 41 and 42 relate to the monitoring for compliance. Numbers 38 to 40 are duplicated below.

38. Except for temporary operations, as defined in Condition 42, between the hours of 07:00 and 19:00 the free field Equivalent Continuous Noise Level (LAeq 1 hour) at noise sensitive properties adjoining the Site, due to operations in the Site, shall not exceed the LAeq 1 hour levels set out in the following table:

Location	**Location Criterion dB$L_{Aeq,1hr}$**
Herons Farm	45
Deeks Cottage	45
Haywards	45
Allshots Farm	47
The Lodge	49
Sheepcotes Farm	45
Greenpastures Bungalow	45
Goslings Cottage	47
Goslings Farm	47
Goslings Barn	47
Bumby Hall	45
Parkgate Farm Cottages	45

Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface facing the site and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.
Reason: In the interests of residential and local amenity and to comply with MLP policy MLP13, WLP policy W10E and BDLPR policy RLP62.

39. The free field Equivalent Continuous Noise Level (LAeq 1 hour) shall not exceed 42 dB(A) LAeq 1hour between the hours of 19:00 and 23:00, as measured or predicted at noise sensitive properties, listed in Condition 38, adjoining the site. Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface facing the site and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

Reason: In the interests of residential and local amenity and to comply with MLP policy MLP13, WLP policy W10E and BDLPR policy RLP62.

40. The free field Equivalent Continuous Noise Level (LAeq 1 hour) shall not exceed 40 dB(A) LAeq 5min between the hours of 23:00 and 07:00, as measured and/or predicted at 1 metre from the façade facing the site at noise sensitive properties, listed in Condition 38, adjoining the site.

Reason: In the interests of residential and local amenity and to comply with MLP policy MLP13, WLP policy W10E and BDLPR policy RLP62.

5.0 Relevant Guidance

Integrated Pollution Prevention and Control (IPPC) Horizontal Guidance for Noise Part 2 – Noise Assessment and Control

5.1 The Integrated Pollution Prevention and Control (IPPC) system employs an integrated approach to controlling the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single Permitting process. To gain a Permit, Operators will have to show that they have systematically developed proposals to apply the Best Available Techniques (BATs) and meet certain other requirements, taking account of relevant local factors.

5.2 The Regulators implement IPPC to:

- protect the environment as a whole
- promote the use of "clean technology" to minimise waste at source
- encourage innovation, by leaving significant responsibility for developing satisfactory solutions to environmental issues with industrial Operators
- provide a "one-stop shop" for administering applications for Permits to operate.

5.3 Once a Permit has been issued, other parts of IPPC are applicable. These include compliance monitoring, periodic Permit reviews, variation of Permit conditions and transfers of Permits between Operators. IPPC also provides for the restoration of industrial sites when the Permitted activities cease to operate.

Noise impact assessment – information requirements (for applications which include computer modelling or spreadsheet calculations) Version 2 June 2015

5.4 This brief document sets out the basic reporting requirements to be presented as part of any assessment that is reliant on some form of computer modelling. In general terms the data that is necessary to be reported includes the source locations, sizes, noise emissions receptor positions and any factors that might influence the propagation of sound from source to receiver.

BS4142:2014 Methods for rating industrial and commercial sound

5.5 The original assessment noted that BS4142:1997 may not be the most appropriate assessment methodology and that other guidance for example from the World Health Organisation (WHO) and BS8233:1999 Sound Insulation and Noise Reduction for Buildings offered more appropriate means of assessing internal sound levels as a result of external sound at night. The majority of the updates are associated with noise incidence during the night.

5.6 Both BS4142:1997 and BS8233:1999 were revised in 2014. One of the significant differences between BS4142:2014 and previous editions of the Standard is the explicit requirement to consider context as part of the assessment. It is no longer adequate to simply compare the Rating Level and the Background Sound Level without due regard to the context of the acoustic environment and the sound source. This is consistent with the original assessment's approach to also consider other more appropriate guidance.

5.7 Under BS4142:2014 the context of the acoustic environment and the sound source can significantly affect the outcome of the Initial Estimate, which is based solely on the difference between the Rating and Background Sound Levels. The Background Sound Level (L_{A90}) specifically excludes acoustic events occurring for less than 90% of the time, such as passing vehicles or activity occurring for much but not all of the time. This means that the difference between Rating and Background Sound Levels can be identical for two locations with very different acoustic characteristics and corresponding sensitivities to noise.

Rating Level - Background Sound Level	Initial Estimate
Around 10dB or more	Likely to be an indication of a significant adverse impact, depending on the context.
Around 5dB	Likely to be an indication of an adverse impact, depending on the context.
Similar levels	An indication of the specific sound source having a low impact, depending on the context.

5.8 In addition to comparing the level and character of the specific and residual sound, the context also includes careful consideration of other factors such as the character of the locale e.g. quiet rural or predominantly industrial; noise sensitive receptors e.g. outdoor amenity space or indoors; and duration and time of specific sound e.g. 24/7 operation or one event per week.

5.9 Depending upon the context, other guidance may be more appropriate, such as considering the potential impact of sound on residents during the night when the primary concern is to ensure that they are not disturbed whilst sleeping, possibly with open bedroom windows. In this case the difference between Background Sound Level and Rating Level outdoors is likely to be of little significance to the residents indoors.

BS8233:2014 Guidance on sound insulation and noise reduction for buildings

5.10 For dwellings the main considerations are to protect sleep in bedrooms and to protect resting, listening and communicating in other rooms. For noise without a specific character it is desirable that the overall average levels during the 8 hour night or 16 hour day time periods do not exceed 30dBA or 35dBA respectively.

5.11 For amenity space, such as gardens and patios, it is desirable that the average level does not exceed 50dBA, with an upper guideline value of 55dBA which would be acceptable in noisier environments. For dwellings with conventional windows, an internal target of 35dBA during the day equates to around 50dBA (possibly slightly lower) outside noise sensitive rooms with openable windows

National Planning Policy Framework, Noise Policy Statement for England and National Planning Practice Guidance

5.12 The National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE) and National Planning Practice Guidance (NPPG) were issued in 2012, 2010 and 2012 respectively.

5.13 These documents note that there is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking. Assessments should be proportionate to the proposed development. Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations.

5.14 Below the No Observed Effect Level (NOEL) sound is unnoticeable and of no significance. Below the Lowest Observed Adverse Effect Level (LOAEL) sound can be heard but does not cause any changes in behaviour or attitude, although the acoustic character of the area may be slightly changed. Below the Significant Observed Adverse Effect Level (SOAEL) sound may cause slight changes in behaviour or attitude e.g. turning up volume of a television or closing windows. There is potential for some sleep disturbance and a perceived change in the acoustic character of the area and quality of life.

5.15 Areas of Tranquillity should be protected, but in general cases it may be inappropriate to achieve a level below the LOAEL as this provides no benefit but may require additional resources such as energy, materials, space, time and money, adversely affecting the sustainability of doing so. Noise above the LOAEL should be mitigated and reduced to a minimum, although it may be appropriate to exceed the LOAEL and create an adverse acoustic impact, if this provides other sustainability benefits that are of greater significance. Noise above the SOAEL should be avoided.

5.16 The World Health Organisation: Night Noise Guidelines for Europe provides an update to the WHO - Guidelines for Community Noise document. These documents note that a steady level of 30dBA within bedrooms is suitable to protect vulnerable people from sleep disturbance and that occasional maximum levels of up to around 42dBA to 45dBA are also consistent with this. The difference between a sound level outdoors and the resultant level indoors with open windows varies through Europe due to differing building characteristics and particularly window type. An average difference of around 15dBA is often used, although this is also dependent upon other factors such as the frequency spectrum of the incident sound.

6.0 Sound Level Predictions

6.1 Acoustic modelling of the site has been undertaken using DataKustik's CadnaA version 4.5.151. The modelling package implements ISO 9613-1 and 2: Acoustics – Attenuation of sound during propagation outdoors and VDI 3733 Noise at pipes.

6.2 An Engineering Procurement Contractor (EPC) will operate the CHP element of the IWMF, including the stack, air cooled condensers and various other items of external plant. The EPC have separately commissioned consultants to produce an acoustic model of their process and to predict sound levels at the closest sensitive receptors. The model was reproduced with the support of EPC's acoustic consultants, to include this aspect in to the wider IWMF acoustic model. The two models show very good correlation which provides confidence in the calculations.

6.3 Other operations within the IWMF are at similar stages of advanced design and the acoustic environment associated with the operation of plant and equipment within the IWMF buildings is understood. Where appropriate assumptions relating to the likely internal reverberant sound levels based on experience of similar operations to understand the noise levels associated with the integrated operation of the materials recycling facility, mechanical biological treatment plant, paper pulp plant, wastewater treatment plant and anaerobic digestion plant within the IWMF's buildings. The building dimensions and attenuation performance of the structural elements are then used to calculate sound power levels for these individual (wall, roof, louvre) elements that are modelled as area sources.

6.4 To account for environmental conditions the model assumes down wind conditions with a wind speed of $3ms^{-1}$, $10^{o}C$ ambient temperature, 70% humidity, mixed ground cover and one order of reflection.

6.5 The acoustic model input and output tables are shown separately in *B3749 20150915 Cadna Data*, due to the amount of information. Where available octave band source data has been included in the model, sources have been modelled as either point, line or area sources as appropriate, the model is three dimensional and so the height and geometry of the sources is included in the model. Where spectral data is not available reasonable worst case assumptions have been made based on experience of similar plant and equipment. The model assumes flat ground between the site boundary and the closest sensitive properties, including the IWMF site access road. This simplification will lead to higher predicted sound levels than would occur in reality when the intervening ground profile is taken into account and represents a worst case situation. The assessment includes all operational vehicle movements to and from the A120 and within the site boundary.

6.6 Plant and equipment will be selected, located orientated and if required attenuated to avoid any tonal, impulsive or other characteristics that might otherwise attract an acoustic feature correction. Vents located across the roof of the building, these are operable in emergency situations only and at all other times will be closed with a mechanical damper system which will provide the same level of attenuation as the roof structure.

6.7 Models of the operations during the daytime and night-time operations have been produced. It is assumed that the daytime operations will cease before the start of the evening period as referenced in the planning conditions, therefore it is only necessary to consider the daytime and night-time operational conditions, in reality there will not be a transition period during the evening.

6.8 The models assume a height of 1.5m and 4m above ground height at the receptor locations to allow for ground and first floor receptors. Some of the properties around the site, for example The Lodge and Green Pastures bungalow are single storey properties. Where this is the case the 1.5m receptor height is considered appropriate for both day and night periods.

6.9 Table 6.1 shows the results of the prediction exercise, the sound levels are Rating Levels. Contour plots are shown in Appendix 1.

Location	Daytime (1.5m) dBA	Night-time (4m) dBA	Night-time (1.5m) dBA
Herons Farm	42	35	
Deeks Cottage	37	34	
Haywards	35	33	
Allshots Farm	39	39	
The Lodge	39	n/a	38
Sheepcotes Farm	39	35	
Greenpastures Bungalow	39	n/a	28
Goslings Cottage	43	31	
Goslings Farm	42	31	
Goslings Barn	41	31	
Bumby Hall	34	35	
Parkgate Farm Cottages	33	33	

Table 6.1 Predicted sound levels

6.10 Tables showing the partial sound levels corresponding to each source are shown in *B3749 20150915 Cadna Data*.

7.0 Analysis

7.1 Baseline surveys were originally undertaken in October 2005 and are routinely reviewed for the adjacent quarrying operations; with the most recent targeted baseline monitoring being completed in January and February 2014; this has confirmed that the acoustic environment has remained consistent. In consideration of the context of the area there has been no significant development or changes in the area that we would expect to alter the acoustic environment. The baseline noise data was presented in the original assessment report in tabular format. Presenting the data in a graphical format provides a visual representation of the variation in sound levels at the four locations. These are presented in Appendix 2.

7.2 Referring to the graphs in Appendix 2, the residual sound level generally fluctuated around 35dB$L_{Aeq,15min}$ to 50dB$L_{Aeq,15min}$, during the daytime with occasional peaks due to localised events such as road traffic and farm activity. At night the residual sound level fell as would be expected and generally fluctuated between just below 30dB$L_{Aeq,15min}$ and around 35dB$L_{Aeq,15min}$.

7.3 The background (L_{A90}) sound level was generally around 35dB$L_{A90,15min}$ to 40dB$L_{A90,15min}$ at Goslings Cottage, Herons Farm and Sheepcotes Farm during the day. At The Lodge background sound levels was generally in the region of 30dB$L_{A90,15min}$ to 40dB$L_{A90,15min}$.

7.4 At night the background sound level was around 25dB$L_{A90,15min}$ to 40dB$L_{A90,15min}$ at Goslings Cottage, just below 30dB$L_{A90,15min}$ to around 35dB$L_{A90,15min}$ at Herons Farm, approximately 30dB$L_{A90,15min}$ to 40dB$L_{A90,15min}$ at The Lodge, and approximately mid-way between 30dB$L_{A90,15min}$ and 35dB$L_{A90,15min}$ at Sheepcotes Farm.

7.5 It is important to note that the standards and guidance note that the crucial times in terms of protecting residents from sleep disturbance are around those times when residents are preparing to sleep or are awakening. In the UK this is generally around 2300 to midnight and 0600 to 0700 respectively.

7.6 The representative night-time background sound level in this case is reasonably consistent across locations at these more crucial times and is approximately 30dB$L_{A90,15min}$ at the beginning of the night and around 35dB$L_{A90,15min}$ at the end of the night.

7.7 Table 7.1 below shows a comparison of the range of predicted sound levels at the sensitive properties and representative background and residual sound levels across the area. It is designed to provide an Initial Estimate according to BS4142:2014.

Result	Daytime	Night-time
Residual sound level	35dB$L_{Aeq,T}$ to 50dB$L_{Aeq,T}$	30dB$L_{Aeq,T}$ to 35dB$L_{Aeq,T}$
Background sound level	30dB$L_{A90,T}$ to 40dB$L_{A90,T}$	30dB$L_{A90,T}$ to 35dB$L_{A90,T}$
Specific sound level	33dB$L_{Aeq,T}$ to 43dB$L_{Aeq,T}$	28dB$L_{Aeq,T}$ to 38dB$L_{Aeq,T}$
Acoustic feature correction	0dB	0dB
Rating Level	33dB$L_{Aeq,T}$ to 43dB$L_{Aeq,T}$	28dB$L_{Aeq,T}$ to 38dB$L_{Aeq,T}$
Excess over background sound level	+3 to +13	-2 to +8
Initial Estimate	Likely to be an indication of the source having between a low impact and significant adverse impact, depending on the context	Likely to be an indication of the source having between a low impact and an adverse impact, depending on the context

Table 7.1 Initial Estimate of Likely Significance of Impact

7.8 Table 7.2 shows a comparison of the predicted Rating Sound Levels against the planning condition noise limits. In all cases the Rating Sound Levels are below the planning condition limits.

Location	Predicted Rating sound level dBA	Planning condition limit dBA	Difference dBA
Herons Farm	42	45	-3
Deeks Cottage	37	45	-8
Haywards	35	45	-10
Allshots Farm	39	47	-8
The Lodge	39	49	-10
Sheepcotes Farm	39	45	-6
Greenpastures Bungalow	39	45	-6
Goslings Cottage	43	47	-4
Goslings Farm	42	47	-5
Goslings Barn	41	47	-6
Bumby Hall	34	45	-11
Parkgate Farm Cottages	33	45	-12

Table 7.2 Comparison with Planning Condition Noise Limits – Daytime

7.9 When considering the context of the assessment during the daytime the acoustic environment is influenced by road traffic in the vicinity of most of the receptors and more distant sources for example the A120 and aircraft movements. Farming and quarry activity are also established activities in the area which have the potential to influence the acoustic environment.

7.10 The predicted rating sound levels are elevated by the access road traffic, which in this model is at the same ground level as surrounding receptors, in reality this is not the case and the access road is reasonably well screened along most of its length, this means that the contribution from this source is an overestimate and sound levels during the daytime will be lower than those shown in the tables. Screening that just intersects the line of sight between the source and the receiver will reduce sound levels at the receiver by 5dBA.

7.11 During the day, the residual sound level will vary significantly depending upon factors such as activity in the immediate area, together with more distant sources and traffic density. The Background Sound Level will be somewhat higher than at night. This means that a Rating Level of up to 43dBA at the nearest noise sensitive receptors, due to the IWMF, will be towards the middle of the range of variation of the residual acoustic environment. This is also consistent with levels recommended in BS8233 and by the World Health Organisation.

7.12 During the night operations will be contained to within the IWMF building. At night, the primary concern is to ensure that residents will not be disturbed by the level or character of sound from plant at the site, whilst avoiding the potential adverse sustainability consequences of trying to achieve an unnecessarily low level that provides no additional benefit. Authoritative guidance such as BS8233 and the World Health Organisation indicates that a Rating Level of up to around 40dBA outside the nearest dwellings will be consistent with these objectives.

Table 7.3 shows a comparison of the predicted Rating Sound Levels against the planning condition noise limits. In all cases the Rating Sound Levels are below the planning condition limits.

Location	**Predicted Rating sound level dBA**	**Planning condition limit dBA**	**Difference dBA**
Herons Farm	35	40	-5
Deeks Cottage	34		-6
Haywards	33		-7
Allshots Farm	39		-1
The Lodge	38		-2
Sheepcotes Farm	35		-5
Greenpastures Bungalow	28		-12
Goslings Cottage	31		-9
Goslings Farm	31		-9
Goslings Barn	31		-9
Bumby Hall	35		-5
Parkgate Farm Cottages	33		-7

Table 7.3 Comparison with Planning Condition Noise Limit – Night-time

7.14 When considering the context of this assessment and the acoustic environment during the night-time period, a Rating Level of between 28dBA and 38dBA due to the IWMF will not disturb neighbouring residents who may be sleeping with open bedroom windows. This equates to internal sound levels of less than 20dBA to around 25dBA and will be consistent with National Planning Policy and with relevant authoritative guidance. There is therefore likely to be negligible acoustic impact associated with the operations at night.

8.0 Conclusion

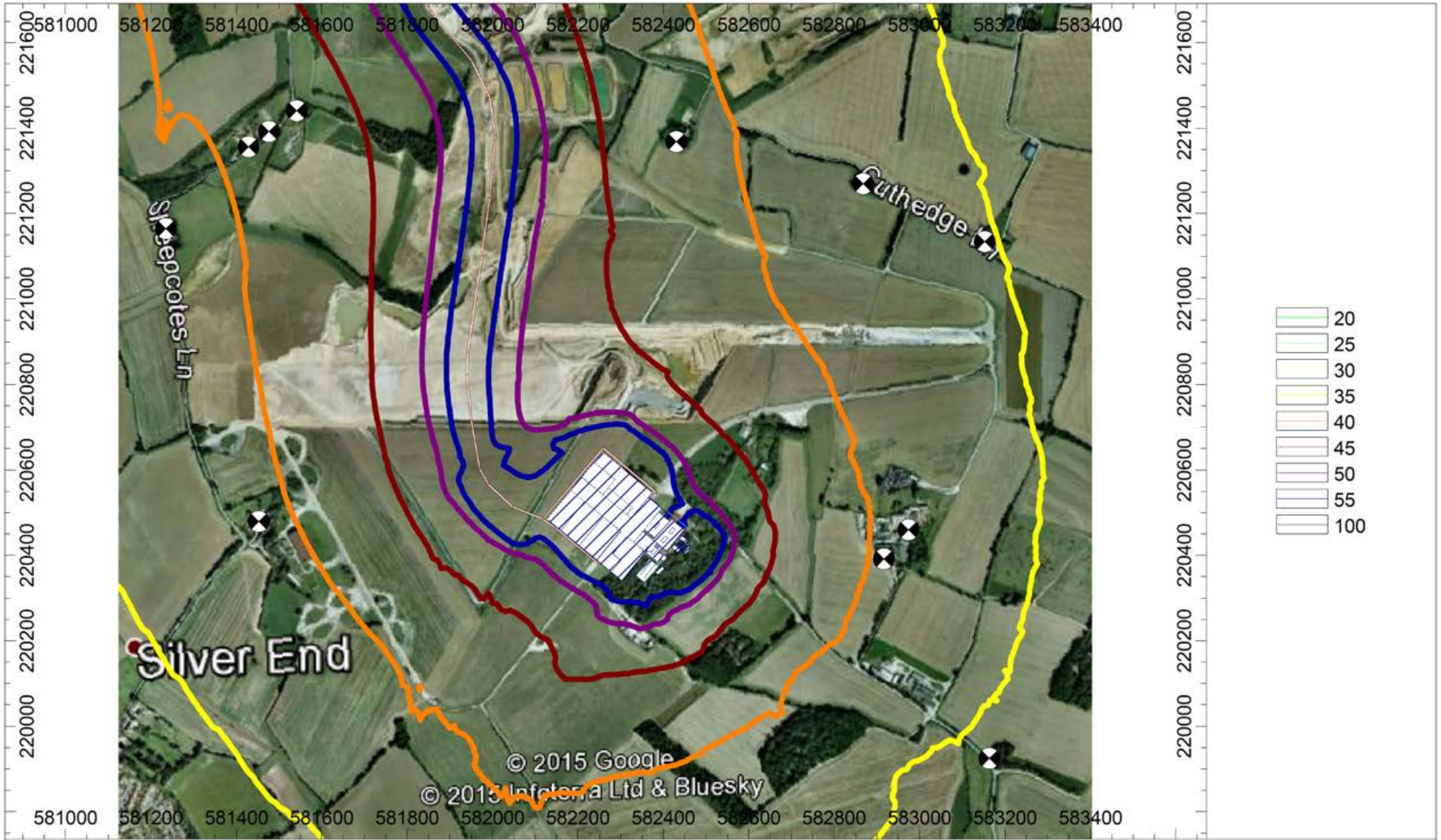
8.1 A three dimensional computer model of the site and surrounding area has been constructed. All of the processing plant associated with the IWMF has been built into the model, where specific information is not available reasonable worst case assumptions have been made.

8.2 The assessment has demonstrated that the IWMF will produce sound levels at the closest sensitive receptors that comply with the planning condition noise limits.

8.3 This assessment has also considered a range of authoritative guidance and has demonstrated that the predicted sound levels will comply with recommendations set out in these documents.

8.4 Operation of the site will follow IPPC/EP guidance with regard to noise and vibration and will utilise appropriate control measures and monitoring to ensure that the noise and vibration from the installation complies with the relevant criteria and does not give rise to cause for annoyance.

Appendix 1 Sound Contour Plots



PROJECT: IWMF Rivenhall - Daytime 1.5m Grid Height	DATE: 16/09/2015
REF: B3749	AUTHOR: TSL

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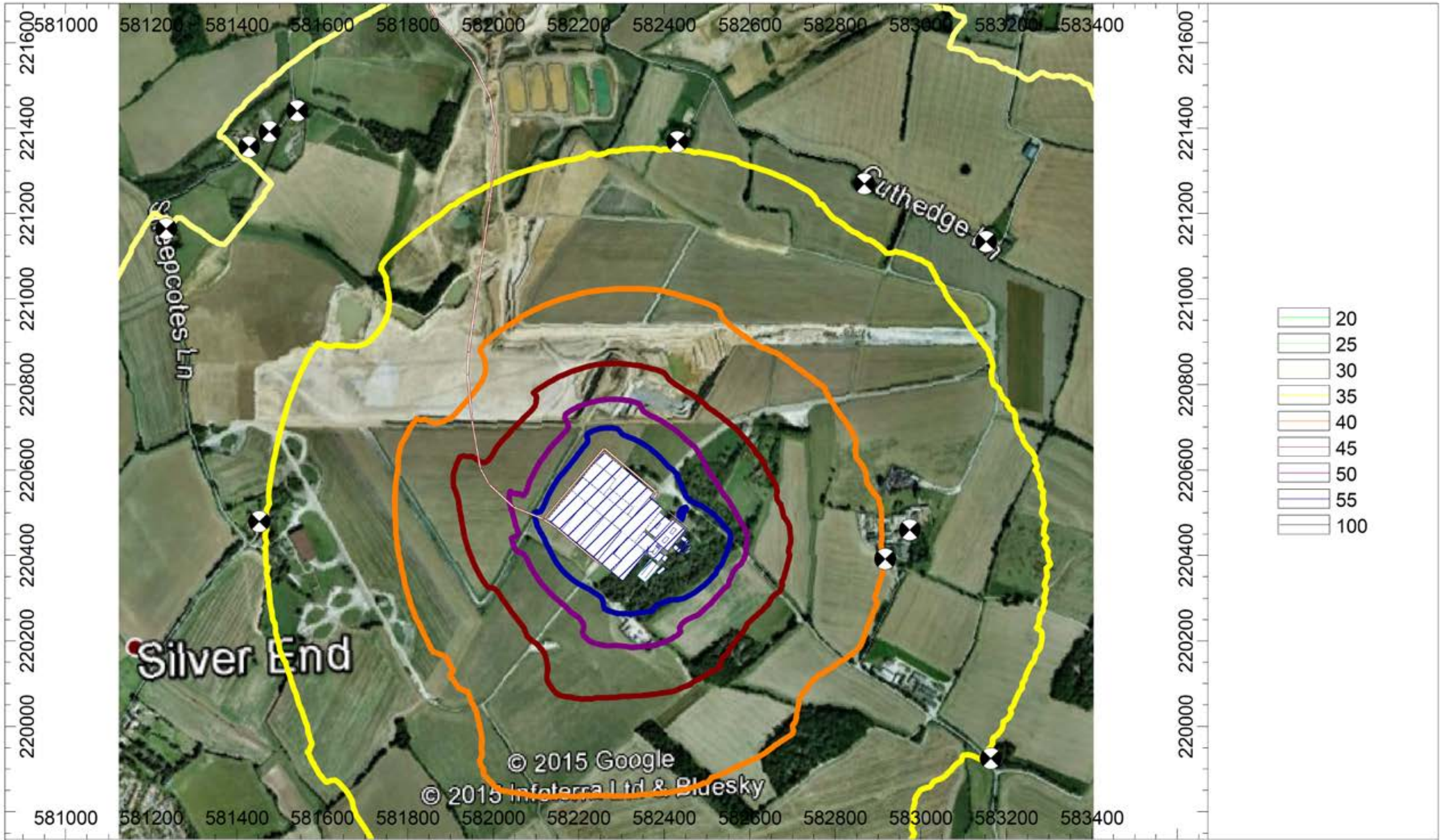
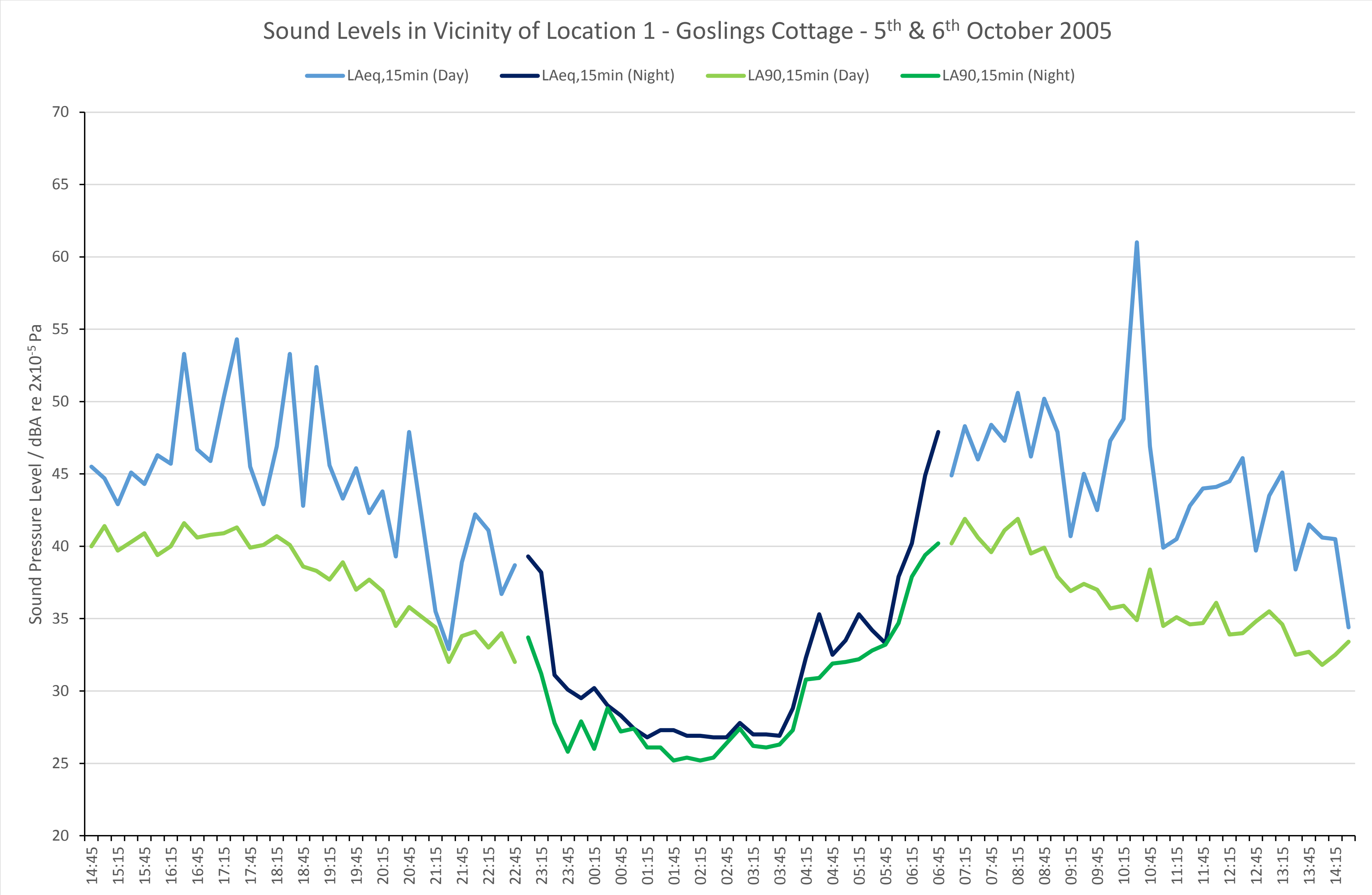
PROJECT: IWMF Rivenhall - Night-Time 1.5m Grid Height	DATE: 16/09/2015
REF: B3749	AUTHOR: TSL



PROJECT: IWMF Rivenhall - Night-Time 4m Grid Height	DATE: 16/09/2015
REF: B3749	AUTHOR: TSL

Appendix 2 Baseline data – October 2005


Sound Levels in Vicinity of Location 1 - Goslings Cottage - 5th & 6th October 2005
LAeq,15min (Day)
LAeq,15min (Night)
LA90,15min (Day)
LA90,15min (Night)
Sound Pressure Level / dBA re 2x10-5 Pa
70
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14:45 15:15 15:45 16:15 16:45 17:15 17:45 18:15 18:45 19:15 19:45 20:15 20:45 21:15 21:45 22:15 22:45 23:15 23:45 00:15 00:45 01:15 01:45 02:15 02:45 03:15 03:45 04:15 04:45 05:15 05:45 06:15 06:45 07:15 07:45 08:15 08:45 09:15 09:45 10:15 10:45 11:15 11:45 12:15 12:45 13:15 13:45 14:15

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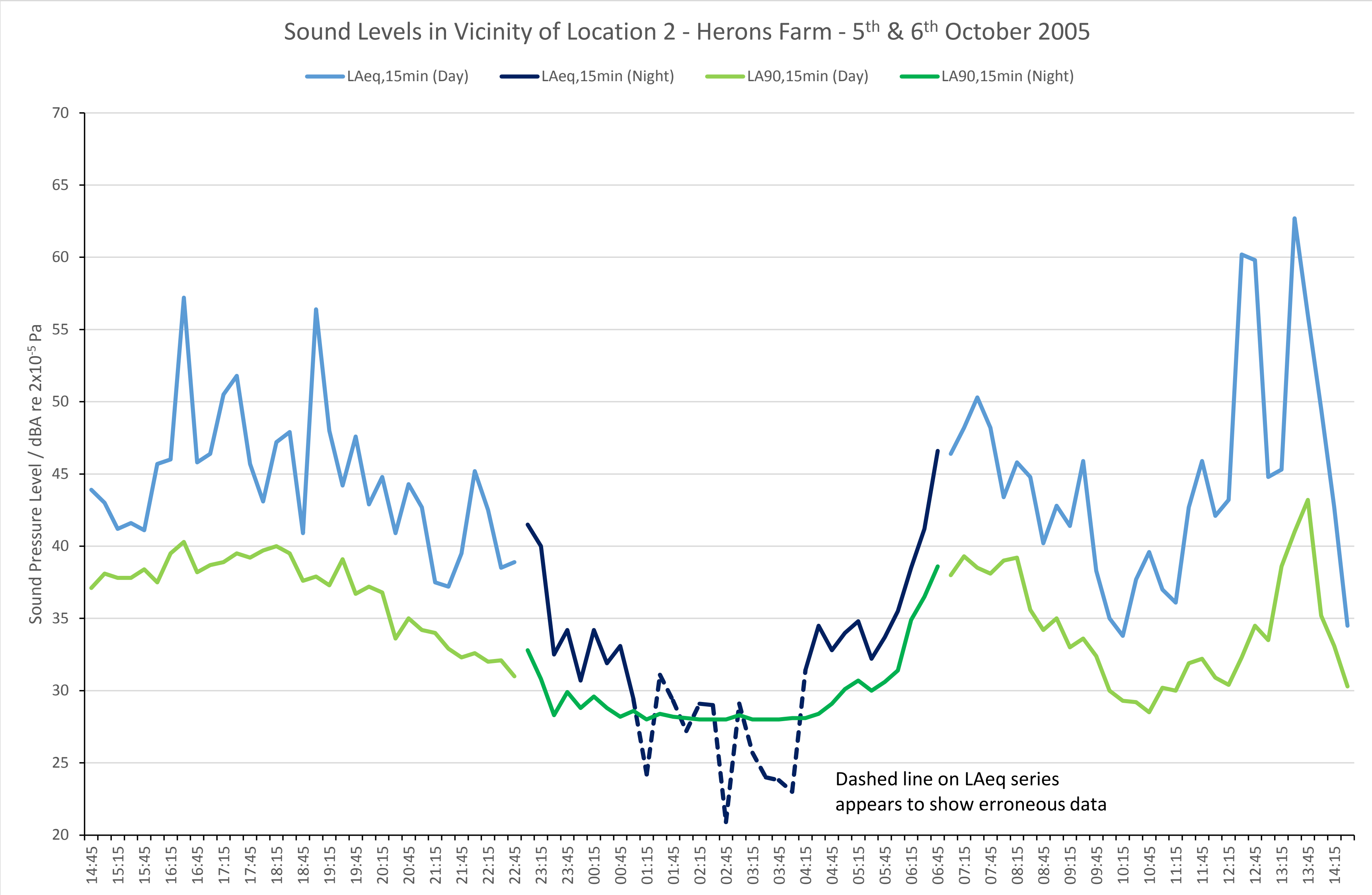

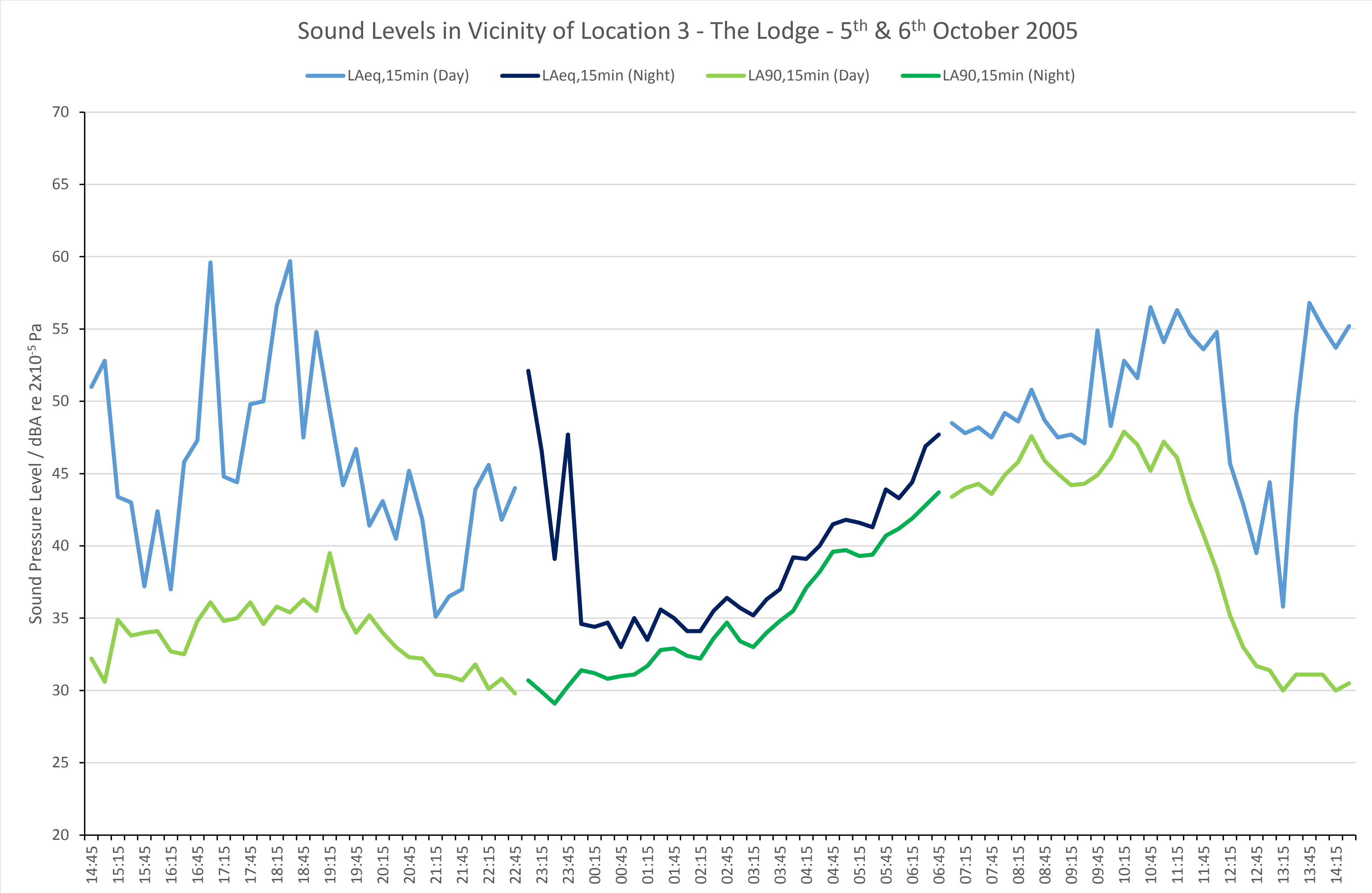
Sound Levels in Vicinity of Location 3 - The Lodge - 5th & 6th October 2005
LAeq,15min (Day)
LAeq,15min (Night)
LA90,15min (Day)
LA90,15min (Night)
Sound Pressure Level / dBA re 2x10-5 Pa
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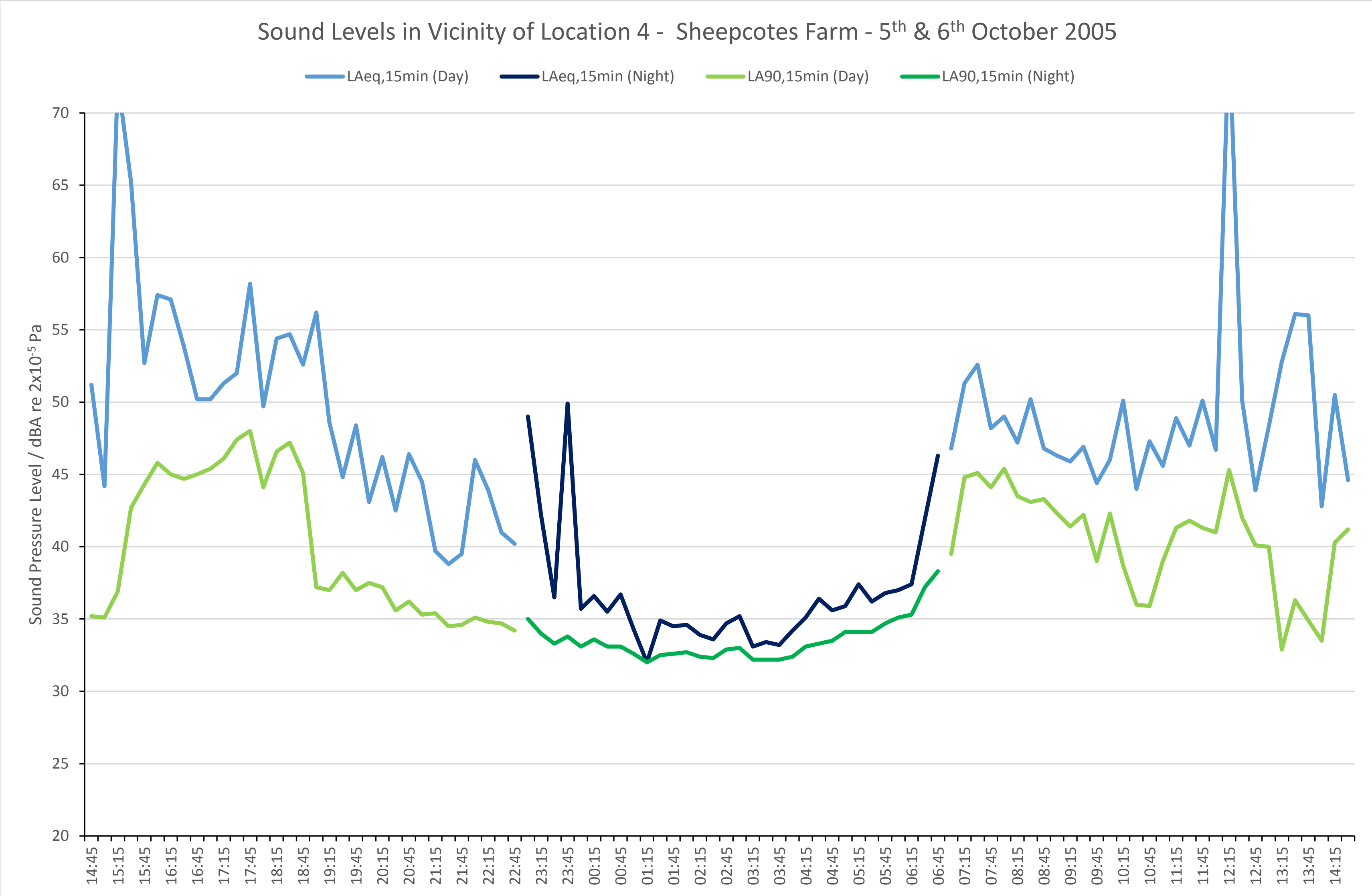
Sound Levels in Vicinity of Location 4 - Sheepcotes Farm - 5th & 6th October 2005
LAeq,15min (Day)
LAeq,15min (Night)
LA90,15min (Day)
LA90,15min (Night)
Sound Pressure Level / dBA re 2x10-5 Pa
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Annex A Background Sound Level

Synopsis

A.1 The Background Sound Level is not a single numerical value but a range that is unlikely to be precisely defined numerically.

A.2 It is equally important to understand the range of factors that affect the Background Sound Level as the actual measured levels.

A.3 Appropriately timed short duration attended measurements can provide much better quality data than unattended measurements taken over a significantly longer period.

Introduction

A.4 This edition of the Standard provides clearer and more specific guidance that the background sound level should be representative and not the lowest level that can be measured. This is to prevent some abuses of the Standard which have occurred in the past, such as where criteria have been set based on the lowest background level measured during any 5 minute period throughout the night.

A.5 Clause 8.1.4 states that: '*The monitoring duration should reflect the range of background sound levels for the period being assessed. In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed*'.

A.6 This means that if a single 'representative' background sound level is used for an assessment, consideration must also then be given to the likely range of variation in background sound and its effect on the outcome of the assessment. Ideally, the range of variation should reflect the variation of the residual sound during the period(s) of interest, taking account of both level and likelihood of such levels occurring, rather than simply attempting to consider the maximum potential range between lowest or highest possible sound levels that may occur.

A.7 However, it must also be recognised that the background sound level will usually vary significantly depending upon many different factors such as weather conditions; time of the day or night; day of the week; and time of the year. Even at the same time of day/ night and same time of the year, the background sound level can often vary by more than 10 dBA depending upon wind direction, even under conditions that are all regarded as being 'suitable' for valid measurements to be taken.

A.8 Most residual sound and the associated Background Sound Levels are affected by sources close to the measurement location and also more distant sources such as transportation systems; commercial/ industrial and other human activity; and foliage moving in the wind or even water flowing. The sound level at the measurement location will therefore vary as the wind changes in speed and direction. Sound from more distant sources is affected by wind at low and higher altitudes, which can be significantly different in both speed and direction. Therefore even under apparently similar conditions at the measurement location, the residual sound level may vary to a greater extent than would be expected if the wind at higher altitude is more variable than at lower altitude.

A.9 Whilst it may appear that taking measurements for a few days will provide better data covering a range of weather conditions, this may not be the case. Weather conditions tend to remain fairly similar for several days so a measurement period of this duration is likely to provide several days data for similar conditions. It is also highly unlikely that this period will cover the range of conditions that affect the background sound level which means that the extended measurement period may provide a false sense of reliability of data when it is of no more benefit than that obtained over a single 24 hour period.

A.10 A further problem with this approach is that unattended measurements provide very little or even no data about what has actually been measured. Fully attended measurements enable the acoustic environment to be properly understood and factors that affect the sound level to be identified and their contribution quantified. A short duration attended survey can usually provide far better quality data than a longer term unattended survey, although where long term measuring is required, such as for compliance monitoring, this may not be appropriate.

A.11 Where it is necessary to fully understand the variation in residual sound during the day and night it may be appropriate to take measurements throughout this period. However, this is unlikely to be representative of different conditions such as days of the week, public holidays and even school holiday conditions. In many situations it is more appropriate to specifically consider the most sensitive times of the day or night, on the basis that if these are satisfactory then less sensitive times will also be satisfactory. For plant that operates on a 24/7 basis the most sensitive time of the night is likely to be when people are going to or awakening from sleep rather than the quietest part of the night. During the day the most sensitive time is likely to be the evening when the residual level may be lower than at other times of the day.

Annex B **Rating Penalty**

Synopsis

B.1 A Rating Penalty is applicable if sound has significant characteristics such as tonality or impulsivity that attract a listener's attention at the noise sensitive location to be considered for the assessment.

B.2 A Rating Penalty can comprise separate corrections for tonality, impulsivity, other characteristics (if neither tonality nor impulsivity apply), and intermittency. These corrections are additive.

B.3 The subjective method(s) should be used to determine the Rating Penalty unless agreement cannot be reached, in which case the objective/ reference methods may be appropriate alternatives.

B.4 Whilst the maximum Rating Penalty could arguably be 15 dB or possibly even 18 dB, in reality it is expected that, where a Rating Penalty is applicable, a correction in the range of 5 dB to 10 dB is likely to be appropriate in the vast majority of cases.

Introduction

B.5 Sound which has characteristics that attract a listener's attention may be significantly more intrusive than sound of a somewhat higher level that is more innocuous. The most common acoustically distinguishing characteristics are tonality, impulsivity and intermittency. BS4142 provides guidance regarding how a rating penalty should be determined. It is important to note that this is based on the level and character of the specific sound at the noise sensitive location(s) in comparison to the level, character and context of the residual acoustic environment. It is intended that the subjective method be used where agreement can be reached regarding penalties where appropriate, with the objective/ reference methods only being used in more contentious situations.

B.6 Because the level and character of both the specific and residual sound vary with time, it is likely that the significance of any acoustically distinguishing characteristics will also vary with time. It is most appropriate to establish a rating penalty for representative conditions but to then consider the range of variation of potential rating penalty as part of the consideration of the uncertainty of the assessment.

Tonality

B.7 For tonality, Clause 9.2 states that: '*For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible*'.

B.8 In most cases where plant produces sound that is tonal but similar in level to the residual sound, the tonality may tend to be slightly or clearly rather than highly perceptible at the noise sensitive location(s), with the relative prominence of the tonality being reduced due to masking by the residual acoustic environment. In such cases it may be appropriate to apply a penalty of 2-4 dB to account for this effect.

Impulsivity

B.9 For impulsivity, Clause 9.2 states that: '*A correction of up to +9 dB can be applied for sound that is* highly *impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible*'.

B.10 In most cases where plant produces sound that is impulsive but similar in level to the residual sound, the impulsivity may tend to be slightly or clearly rather than highly perceptible at the noise sensitive location(s), with the relative prominence of the impulsivity being reduced due to masking by the residual acoustic environment. In such cases it may be appropriate to apply a penalty of 3-6 dB to account for this effect.

Other Characteristics

B.11 Clause 9.2 also states that '*Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*'.

B.12 This means that, depending upon circumstances such as the context, it may be applicable to apply a 3 dB penalty to sound that is neither tonal nor impulsive where it has other characteristics that tend to attract a listener's attention to the sound against the residual acoustic environment at the noise sensitive location(s).

Intermittency

B.13 For intermittency Clause 9.2 states that: '*When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*'.

B.14 This means that, depending upon circumstances such as the context, it may be applicable to apply a 3 dB penalty where the intermittency of the specific sound tends to attract a listener's attention to the sound against the residual acoustic environment at the noise sensitive location(s).

Conclusion

B.15 On an extremely rare occasion when the specific sound is both highly tonal and highly impulsive at a noise sensitive location, it could conceivably be appropriate to apply a rating penalty of 15 dB and possibly even 18 dB if the intermittency of the specific sound exacerbates the impact of what is already highly intrusive sound still further. If sound is both tonal and impulsive but one of these characteristics is dominant then it may be appropriate to apply just the correction for that characteristic. In situations where the specific sound is similar in level to the residual sound it is more likely that such characteristics will be masked to some extent by the residual sound at the noise sensitive location(s). In this case it is more likely that a rating penalty of 2-4 dB for tonality and/ or 3-6 dB for impulsivity may be applicable, possibly with an additional 3 dB penalty for intermittency if this is significant. In most cases it is expected that a Rating Penalty, if applicable, will be in the range of 5-10 dB.

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Annex C Uncertainty

Synopsis

C.1 Despite sound measurement systems usual precision of 0.1dB, any measurement of environmental sound or specific components of this can only be representative of its constantly varying level and character, at best.

C.2 In addition to uncertainty in sound level measurement systems, the actual level being measured varies continuously in level and character. Analysis of the measured levels adds further uncertainty, as does assessment of the potential impact of sound, which is greatly affected by the specific context of the situation being assessed.

C.3 It is not appropriate to estimate all uncertainty that may occur and deduct this from a 'suitable' level to establish a 'safe' level that 'should be ok'. This would result in sound levels that are substantially lower than necessary or appropriate, providing no benefit for those being 'protected', whilst creating significant adverse impacts on the sustainability of any development and making many impracticable, thereby preventing much development that should proceed, and denying the benefits of such development, often to the very people that are being 'protected'.

C.4 The way in which uncertainty is addressed must depend upon factors such as the sensitivity of the situation, the potential magnitude of the uncertainty, and its potential significance on the outcome of the assessment.

Introduction

C.5 Environmental sound is constantly changing in level and character. The relative significance of any component of this similarly varies continuously as sound from both the specific component and all other residual sources varies. The propagation paths between sources and receiver change for reasons such as varying wind speed and direction which further alters the level and character of environmental sound at any location. Sound can be measured and expressed in many different ways using different parameters such as the maximum, logarithmic average, minimum, or statistical distribution. These values will themselves depend upon other factors such as the time period over which they apply and the response time of the measurement system. This means that any quantified level of residual sound or that from a specific source is representative rather than precise and it is necessary to more fully understand the acoustic characteristics of the acoustic environment that is being considered.

C.6 Uncertainty has been the acoustic 'elephant in the room' for many years. Some acousticians have considered it; many have ignored it; and other people, particularly non-acousticians, have been unaware of it, assuming incorrectly that acoustic analyses presented to a precision of 1 dB or even 0.1 dB are accurate to that level of accuracy.

C.7 In most cases, when setting sound levels based on an acoustic assessment it is not appropriate to set a criterion that incorporates uncertainty to the extent that the criterion is highly unlikely to be exceeded under any circumstances. Clearly there are some exceptions to this, such as the safety requirement to protect personnel from hearing damage at work. In this case subtracting 1 standard deviation (σ) from a hearing protector's average performance is used to give an assumed level of performance that should be achieved for 84% of users. Although subtracting 2σ would protect 97.5% of users and 3σ would protect 99.9%, a balance has been struck between cost/ practicability and benefit in deciding that uncertainty where 16% of people may not be provided with the expected level of protection is appropriate in this case.

C.8 In non-safety critical situations it is generally appropriate to accept a greater level of uncertainty in the outcome of any assessment. In many acoustic assessments it is also not practicable to numerically quantify the level of uncertainty in the manner that is possible for hearing protection devices which can be thoroughly tested and measured under carefully controlled laboratory conditions.

C.9 BS4142 aims to provide guidance as to the likely significance of impact of industrial or commercial sound, taking into account not only the level and character of that sound but also the context in which it is heard, which can significantly affect the significance of its impact.

C.10 The impact of industrial or commercial sound will vary as the level and character of both the source and residual sound changes. This means that the assessment of its impact will be a general indication and that its significance will change continuously. As noted above, it is generally not appropriate to consider a theoretical 'worst case' scenario comparing the highest possible rating level against the lowest possible background sound level. Instead, representative rating and background sound levels should be compared, considering the level, character and context of the specific sound and residual acoustic environment. There will inevitably be occasions when the impact is slightly greater than this representative situation and conversely there will be other occasions when the impact is less. This is no different to the impact of different sources of sound in the residual acoustic environment, such as pedestrians conversing loudly whilst passing a dwelling, a vehicle horn being sounded, or a siren being heard on occasion.

Measurement Uncertainty

C.11 Any measurement whether acoustic or not, includes an element of uncertainty in the measured value, the magnitude and significance of which usually depends upon many factors. The most obvious factor for measurements undertaken for this assessment is due to instrumentation, but this is minimised by a range of controls set out in Craven & Kerry's *'A Good Practice Guide on the Sources and Magnitude of Uncertainty Arising in the Practical Measurement of Environmental Noise'* (as referenced in BS4142: 2014) including:

- Use of Type 1 sound level analysers
- Bi-annual calibration of sound level analysers and annual calibration of calibrators (relevant calibration certificates are provided elsewhere.
- Periodic cross-calibration with other calibrated analysers and monitoring of system's calibration characteristics.
- On site calibration checks before and after measurements are taken.
- Avoidance and control of interference due to electromagnetic sources, weather or other factors.

Other Causes of Uncertainty

C.12 These measures ensure that the uncertainty due to the measurement system is relatively small in comparison with factors that affect the overall uncertainty incorporated in this assessment. These include:

- Variations in the level and character of residual and associated background sound at the measurement and noise sensitive receptor locations.
- Variations in the level and character of the specific sound.
- Where the specific sound level is calculated from the difference between the ambient sound level with the source operating and the residual level without, significant variability in either of these levels increases the uncertainty in the calculated specific level and significant variability in both increases the uncertainty by a greater amount.
- The magnitude of any rating penalty that should be applied and under which conditions e.g. full load or partial load operation or different plant characteristics.
- Modelling of the sound path from source to receptor.

C.13 In addition to the Good Practice measures identified by Craven and Kerry, appropriate measurement techniques can further reduce uncertainty such as undertaking fully attended surveys, recording the sound level many times each second and noting acoustically significant factors that may affect the measured level on a second by second basis.

Background & Residual Sound Level Uncertainty

C.14 In many cases the level and character of residual and background sound is strongly affected not only by the level of activity which varies with time of day, but also by seasonal effects such as foliage generated noise and to an even greater extent by weather conditions, of which the most significant is usually wind speed and direction, which itself varies with location and altitude. Because weather conditions tend to remain fairly similar for several days, taking measurements for this length of time is likely to provide a few days and nights of similar data rather than a reflection of the likely range of sound levels under different weather conditions. Where it is necessary to fully understand this effect it is necessary to undertake long term monitoring for extended periods, generally also at different times of the year. Clearly this is only likely to be practicable for major developments such as national infrastructure construction. Long term residual and background sound level measurements are neither practicable nor appropriate for small scale developments, particularly if the background sound level informs rather than dictates the outcome of a BS4142 assessment.

C.15 Where the residual sound level is relatively steady measuring for a short time can provide as good an indication of the representative level prevailing at that time under those specific as a longer duration measurement. As the variability of the residual sound level increases the range of residual and background sound levels also increases and the uncertainty in these levels similarly increases. However, as discussed above, the variability and uncertainty in the residual and background sound levels will tend to be greater under different weather conditions than at different times of the day or night under similar weather conditions. Measuring the sound level many times every second provides a clear understanding of how the sound level depends upon a range of factors such as passing traffic, distant plant and activity, so that the likely range of variation of the residual and background sound levels can be better understood.

C.16 There is a balance to be struck between reducing uncertainty and the duration and associated costs of the measurement period(s).

Source Level Uncertainty

C.17 There is uncertainty in the level and character of sound from sources for many reasons. These include:

- Varying plant operational conditions.
- Variation in sound level produced by different items of equipment.
- Uncertainty or error in manufacturer's data.
- Uncertainty or error in measured levels of other 'representative' sources.
- Acoustic characteristics of plant such as directivity.

C.18 Plant may operate differently under different conditions and for example, may be restricted so that the level and character of sound will be different during the night than day time. Even where plant operates in only one mode, the level and character of sound that it produces may vary. BS4142 considers the average sound level that the plant may produce over a 15 minute period during the night and 1 hour during the day. The characteristics of the sound may also differ during these times as a result of which the rating correction(s) may be different.

C.19 Where there are multiple items of equipment, the variation in level and character of each is likely to result in even greater variation of the overall level and character of sound from the equipment as a whole. However, there can also be some 'smoothing' effect if the overall result is that plant operates more or less continuously, with individual items of plant starting and stopping at different times. Provided that the changes in level and character due to individual items of plant are not significant this can result in slight variations in an otherwise relatively steady sound that may be less significant than a single item of plant intermittently stopping and starting.

C.20 Where a new source is proposed, it may be appropriate/ necessary to use manufacturer's data to assess the likely significance of its impact. This data may vary from a single figure dBA level that may or may not clarify whether it is a sound pressure level measured at a specific distance under known acoustic conditions, or a sound power level, to a detailed frequency spectrum, possibly for different operating conditions. Experience can greatly assist the interpretation of such data and the assessment of its reliability. Even where detailed frequency spectra are provided, this does not provide a definitive indication of appropriateness or otherwise of a rating penalty and its magnitude if this is found to be applicable.

C.21 In many cases it is appropriate to use data obtained from other similar equipment as an indication of the likely level and character of sound that will be produced by proposed plant. In these cases it is necessary to consider the uncertainty in these measured levels including not only the effects of the measurement environment and operational characteristics of the representative plant, but also any differences due to other factors such as required maintenance.

Rating Penalty Uncertainty

C.22 The rating penalty includes corrections for sound that is tonal, impulsive, intermittent, or has other characteristics that will tend to attract a listener's attention. The significance of these characteristics should be assessed by comparison of the specific and residual sound at the noise sensitive location(s), not closer to the source. This may be difficult to do for existing sources due to difficulties in measuring the specific and residual sound, although in most cases it should be possible to use the simplified subjective method set out in clause 9.2 of BS4142.

C.23 For a proposed source it will not be possible to directly measure or subjectively assess the sound it produces at the noise sensitive receptors, but it may still be possible to apply the subjective method in such situations, considering the known level and character of sound the source will produce and the level and character of the residual acoustic environment at the noise sensitive location(s).

C.24 There may be uncertainty whether a specific sound may have tonal or impulsive content that is just or clearly perceptible; or is clearly or highly perceptible. It is up to the parties undertaking the assessment to form an opinion regarding what would constitute an appropriate rating penalty and to clearly explain how this has been arrived at. The uncertainty in the magnitude of the rating penalty and the likely significance of the character of the specific sound at the noise sensitive location(s) should then be considered further as part of the assessment process.

Modelling Uncertainty

C.25 Where an existing source is being assessed based on measurements and observations at the noise sensitive location(s) there may be no need for any acoustic modelling of the source characteristics or sound propagation path. However, in most cases it is likely that a combination of measurement and calculation will be necessary and this will introduce further uncertainty. For example levels measured close to a source can be extrapolated back to the noise sensitive location(s) but the actual level produced at the more distant location(s) will be affected by factors such as reflections or screening by structures, attenuation due to the ground or air, and possibly most significantly by wind speed and direction.

Conclusion

C.26 Some of the elements of uncertainty that affect the actual level and character of sound at noise sensitive locations can be numerically estimated, although this is unlikely to be the case for the more significant ones. However, the aim is not to derive a precise numerical outcome from a BS4142 assessment but to consider the likely significance of the impact of industrial or commercial sound at affected noise sensitive locations.

C.27 Where there is a very clear outcome and relatively small uncertainty, then the uncertainty will have negligible effect on the outcome of the assessment. However, where the outcome is less clear and/ or the level of uncertainty is greater, this should be reflected in the assessment.

C.28 The assessment must consider not only the level and character of sound from the source(s) and also the residual acoustic environment but also the context in which it is experienced. The effect of sound on a listener is subjective and it is necessary to incorporate some subjectivity into a BS4142 assessment. This is generally the most appropriate way in which to incorporate the effects of uncertainty into the outcome of the assessment.

Annex D Guidance

Synopsis

D.1 BS4142:2014 uses a comparison between the Rating and Background Sound Levels to establish an Initial Estimate of the Likely Significance of Impact. The context of the assessment must then be considered, which can significantly alter the outcome of the assessment.

D.2 Where the aim is to ensure that people are not disturbed by plant during the night it is the absolute level of sound within the dwelling that will be of most significance. What constitute a suitable level of sound from plant will depend upon the character of the acoustic environment. This means that identification of a suitable criterion to properly protect residents must be informed by the existing residual sound level, of which the Background Sound Level is one partial indicator, with others such as the average or maximum providing further information.

D.3 For gardens and other outdoor amenity areas, BS8233 indicates that an average level of 50dBA may be desirable, but this is based on considering residential development in what may be relatively noisy areas. For quieter locations NPPF and NPSE provide further assistance. When establishing what may be a suitable level in gardens etc. for sound from plant, it is important to consider the existing acoustic environment including the residual levels (background, average, etc.) and the character of the area e.g. quiet rural, busy urban, adjacent to a car park or service yard.

BS4142:2014 Methods of rating industrial and commercial sound

D.4 BS4142:2014 differs from previous editions of this Standard in many ways, including that:

- The aim is to assess the likely significance of impact not the likelihood of complaint. This is consistent with current Government planning policy but is not aligned to it because this is a British standard, whereas planning policy does not apply to all of Britain.
- The context of the situation must be considered as part of and can significantly affect the outcome of the assessment.
- The outcome of the numerical assessment will not be a single number but a range, together with uncertainty, the significance of which must be considered as part of the assessment process.
- The absolute sound levels may be more significant than the difference between the rating and background sound levels.
- It may also be appropriate to consider other guidance such as BS8233:2014 as part of the assessment.

- Sound having significant characteristics that attract a listener's attention may be significantly more intrusive than featureless sound of a somewhat higher level, as a result of which the rating penalty may now be significantly greater than before.
- The reference to a rating level 10 dB below the background sound level has been removed because this was mis-applied in many cases to impose unreasonably low criteria.
- The many factors that affect the uncertainty of an assessment must be taken into account.

D.5 Clause 11 states: '*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context*'.

D.6 BS4142 requires that the Rating Level be compared to the Background Sound Level to provide an Initial Estimate of the Likely Significance of Impact. This is then amended to take account of the context of the assessment, and the effects of the uncertainty in the entire process on the outcome of the assessment must also be considered.

D.7 The Background Sound Level ($L_{A90,T}$) is defined as the level exceeded for 90% of the time i.e. the quietest 10% level. This specifically excludes consideration of the sound level prevailing for 90% of the time and is intended to provide an indication of the sound level during 'lulls' in activity. This means that the same Background Sound Level can be measured outside a dwelling in a continuously quiet location with little activity or sources of residual sound, and outside a dwelling beside a road with vehicles passing at high speed every few minutes. Clearly these two locations have very different acoustic characteristics and sensitivity to sound, despite having the same L_{A90} level. In this situation the average ($L_{Aeq,T}$) levels may differ by around 20dBA to 30dBA and the maximum ($L_{AMax,T}$) levels may differ by 40dBA or more.

BS8233:2014 Guidance on sound insulation and noise reduction for buildings

D.8 This Standard draws on authoritative guidance such as that issued by the World Health Organisation to identify suitable noise levels for a wide range of different environments. For dwellings these include bedrooms, where the aim is to protect people from sleep disturbance; other habitable rooms that are in use during the day, where the aim is to provide good listening/ communication/ recreational conditions; and outdoor amenity space including gardens.

D.9 This confirms that a steady average level of 30dBA within a bedroom, due to external sound sources, is desirable and that this should not have significant acoustically distinguishing characteristics. For habitable rooms during the day a desirable level is 35dBA.

D.10 For outdoor areas such as gardens and patios a desirable upper average level of 50dBA is stated, with an upper guideline average limit of 55dBA, which would be acceptable in noisier environments. However it is also recognised that for strategic reasons it may be appropriate to permit higher levels, such as for new dwellings in busy urban areas.

National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE) and National Planning Practice Guidance (NPPG)

D.11 These documents clarify Government policy regarding development and noise. There is a presumption in favour of sustainable development and a recognition that when considering sustainability, the various factors that affect the sustainability of a proposed development must be considered collectively.

D.12 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

D.13 Paragraph 123 of NPPF states that:

Planning policies and decisions should aim to:

a. avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

b. mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

c. recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and

d. identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

D.14 The Noise Policy Statement for England (NPSE) sets out the long term vision of Government noise policy by promoting good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

D.15 Paragraph 2.23 of NPSE clarifies the first part of the above excerpt:

a. The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.

D.16 Similarly paragraph 2.24 of NPSE clarifies the second part:

a. The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL (Lowest Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level). It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.

D.17 These make it clear that noise must not be considered in isolation but as part of the overall sustainability and associated impacts of the proposed development. There is no benefit in reducing noise to an excessively low level, particularly if this creates or increases some other adverse impact. Similarly, it may be appropriate for noise to have an adverse impact if this is outweighed by the reduction or removal of some other adverse impact that is of greater significance when considering the overall sustainability of the proposed development.

D.18 NPSE clarifies the difference between NOEL (No Observed Effect Level) and LOAEL as used in Night Noise Guidelines for Europe, which gives values of 30dB(A) and 40dB(A) for the night time average level measured outside dwellings respectively. This indicates that there may be no significant overall benefit in achieving an average level of less than around 40dB(A) outside dwellings during the night.

D.19 It should also be considered that in order to make equipment quieter it is often necessary to use larger equipment that operates more slowly and for longer periods of time. This may increase energy consumption and hence the carbon footprint of the equipment. The overall impact of this may outweigh any acoustic benefit of the equipment being slightly quieter.

World Health Organisation: Guidelines for Community Noise; Night Noise Guidelines for Europe

D.20 The WHO publication 'Guidelines for Community Noise – 1999' provides guidance regarding suitable levels of noise that will protect vulnerable groups against sleep disturbance. A steady level of 30dB(A) in bedrooms, with occasional maximum levels of 45dB(A) are identified as being suitable to achieve this, with an assumed difference of approximately 15dB(A) between the noise level outdoors and that resulting in the bedroom, assuming that the bedroom windows are partly open for ventilation. This means that the corresponding targets for the noise level outdoors are steady levels of up to about 45dB(A) and occasional maxima of up to around 60dB(A).

D.21 The more recent WHO guidance 'Night Noise Guidelines for Europe – 2009' is more concerned with the longer term average noise levels that are covered by the EU Directive on Environmental Noise, although this does appear to suggest slightly lower external maximum noise levels of around 57dB(A) outside bedrooms during the night.

D.22 Furthermore the 1999 guidance states that: *'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dBLAeq on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dBLAeq. Where it is practicable and feasible, the lower outdoor level should be considered the maximum desirable sound level for new development.'*

Annex E Assessment of the Impacts

Assessment Method

E.1 Clause 11 states: '*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context*'.

E.2 An initial estimate of the impact should be made by subtracting the background sound level from the rating level, and it may be appropriate to make more than one assessment.

E.3 This initial estimate must then be modified as appropriate to take account of the context. This must consider all pertinent factors including:

- The absolute level of sound. This may be more as or more significant than the difference between the rating and background sound levels, particularly where the residual sound level is particularly high or low.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor and whether the receptor may be protected by specific measures that will reduce the impact in comparison to receptors without such protection.

Specific Considerations

E.4 Clause 8.1 includes the following: '*the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes*'.

E.5 Annex A of the Standard provides an increased number of examples of how to use the standard to obtain ratings for various different scenarios. This states that: '*These examples illustrate how the standard could be applied and are not to be taken as a definitive interpretation of how it is intended to be used*'.

E.6 Examples 6, 7 & 8 of Annex A *'show how similar sound levels can produce different results, depending primarily upon the context in which the sound occurs'*. Examples 6 & 8 specifically consider the likely significance of the specific sound during the night on residents *'who could be sleeping with open bedroom windows'*. In this case other guidance such as BS8233 might also be applicable for several reasons:

- At low external residual sound levels the sound level within a dwelling with open windows is likely to be controlled not by the external residual sound level but by sounds created within the dwelling by a range of sources including refrigerators, pumps, boilers, water flowing through pipes, conversation, radios/ televisions, equipment cooling fans, animals, and even people breathing particularly when considering sound during the night.
- During the night people the level and character of sound outside a dwelling is of less significance than the acoustic environment within bedrooms and its suitability for going to sleep or not disturbing residents whilst asleep.
- The World Health Organisation provides authoritative guidance regarding suitable sound levels in bedrooms, from which the guidance in BS8233 is derived.

Annex F Competence & Experience

F.1 Belair Research Limited has the advantage of personnel that were directly involved in the drafting of the original 1967 edition of BS4142 and the most recent 2014 edition, who have specialised in the measurement, assessment and control of noise from industrial and commercial sources throughout their careers. This type of work forms a major part of our activity and has done so for several decades. Our culture, systems and working practices are geared towards ensuring that this type of work is consistently undertaken to the high and robust level of quality for which we are known.

F.2 **Richard Collman** has specialised in acoustic engineering for half a century and was the founding director of Belair Research Limited (BRL) in 1981. He was seconded onto the BSI committee that drafted the original 1967 version of BS4142 and has been involved in the assessment of sound from industrial and commercial plant since then. He pioneered the consideration of sustainability as part of acoustic assessments rather than simply assessing the level and character of noise in isolation.

F.3 **Richard A Collman** now has overall responsibility for BRL's activities including BS4142 assessments. He graduated with a BSc (Class I) in Acoustics and Computer Science from Salford University in 1984, being awarded the course prize in both the second and final years. He is a Chartered Engineer and has specialised in the measurement and assessment of sound from industrial and commercial plant for over 30 years, writing articles and papers on this subject for Acoustics Bulletin and IOA conferences. He pioneered the use of digital instrumentation for short duration consecutive logging rather than longer term statistical averaging measurement techniques. As an expert on sound from refrigeration and air conditioning plant he represented the Institute of Refrigeration on the BSI committee and the Drafting Panel responsible for the 2014 edition of BS4142, presented the section on Uncertainty at the BS4142 Launch Meeting in November 2014, and authored an associated Technical Article in Acoustics Bulletin. He has been closely involved in the development of BRL's BS4142 measurement, assessment and reporting system to ensure that it is fully compliant with all aspects of BS4142.

F.4 **Lee Dursley,** Senior Acoustician has specialised in the measurement and assessment of sound from commercial and industrial sites for over 10 years. He has a BSc(Hons) in Engineering Physics, a Post Graduate Diploma in Acoustics and Noise Control and is a corporate member of both the Institute of Physics and the Institute of Acoustics. With day to day responsibility for BRL's consultancy activities he has been significantly involved in the development of the measurement, assessment and reporting systems to ensure that they are compliant with the requirements of the latest version of BS4142.

F.5 **Thomas Leach** has a BSc (Hons) in Sound Technology from the University of South Wales, a MSc in Sound and Vibration Studies from the Institute of Sound and Vibration Research, University of Southampton and is currently an associate member of the Institute of Acoustics. Thomas has been an acoustic consultant for nearly 5 years, primarily focused in environmental acoustics for which he has undertaken assessments in accordance with BS4142.

ACOUSTICAL CONTROL Engineers & Consultants

GUARANTEED SOLUTIONS TO YOUR NOISE & VIBRATION PROBLEMS

Acoustic Assessment in Support of Environmental Permit Application

at

Rivenhall Airfield Integrated Waste Management Facility, Braintree, Essex

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Contents

1.0 Introduction

1.1 Belair Research Limited (BRL) trading as Acoustical Control Consultants (ACC) is an independent acoustic consultancy company. All of our acoustic consultants are qualified and experienced practitioners and are either Associate or Corporate members of the Institute of Acoustics. Acoustical Control Engineers Limited is our associated company specialising in engineered solutions to acoustic problems.

1.2 Belair Research Limited (BRL) has been appointed by Gent Fairhead & Co Limited to undertake an acoustic assessment of the proposals. This assessment provides evidence in support of the Environmental Permit application for the Integrated Waste Management Facility (IWMF) on Rivenhall Airfield, Braintree, Essex.

1.3 The author also undertook and supported the 2008 Acoustic Impact assessment and has been involved with acoustic monitoring at the adjacent Bradwell Quarry since 2004 therefore has a good understanding of factors affecting the acoustic environment surrounding the site.

1.4 The IWMF has evolved since 2008 and more detailed information has become available upon which this assessment is based.

1.5 This assessment benefits from detailed design of elements of the IWMF as set out in text and an updated computer model

2.0 Site Description

2.1 The site is approximately 7km to the southeast of Braintree, approximately 4km to the southwest of Coggeshall and 5km to the north of Witham, these making up the largest settlements in the area. Closer settlements are Silver End, 1km and Bradwell, 3km are situated to the south west and north-north west respectively. Other single or small groups of properties are situated within 450m to 1000m from the site.

2.2 The site is located on the disused Rivenhall Airfield, which is in the process of being removed through systematic quarrying activity at the adjacent Bradwell Quarry.

2.3 To the north of the site is the A120, which runs in an approximately west-east direction. The dedicated access road runs in an approximate southerly direction from the A120 to Bradwell Quarry and will be extended in a southerly direction across the restored airfield to provide access to the IWMF.

2.4 With the exception of the active quarry, the area is predominantly rural in nature comprising mainly arable crops, the terrain is approximately flat at a height of approximately 50mAOD. Figures 2.1 and 2.2 show the relative location of the site, surrounding areas and closest potentially sensitive receptors.

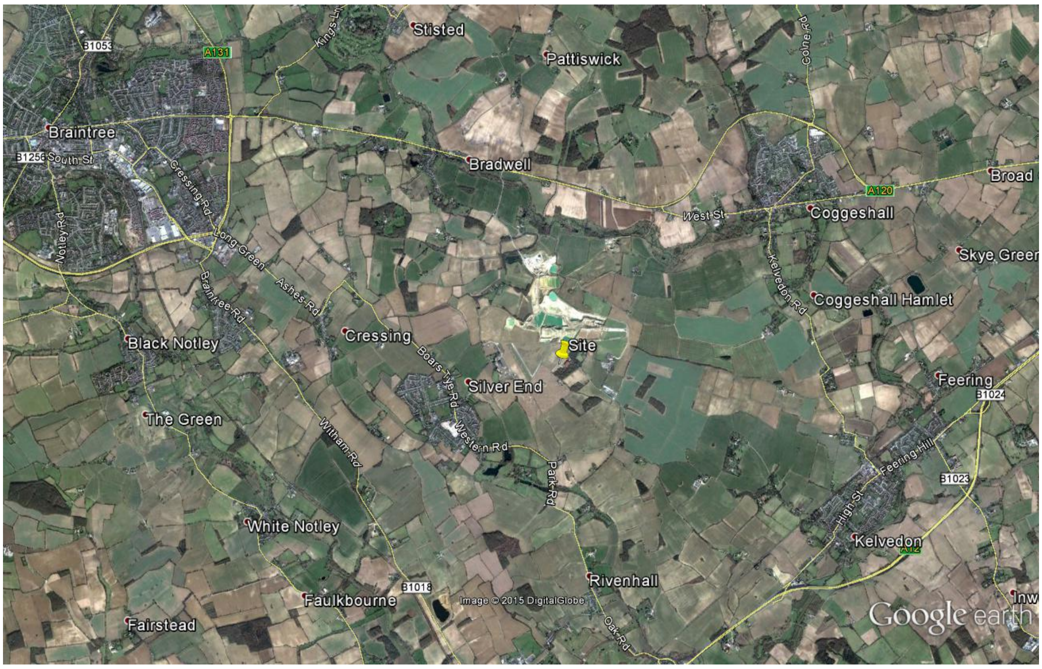

Figure 2.1 Location of site in context of surrounding area

Figure 2.2 Site and closest potentially sensitive receptors

2.5 The IWMF will be constructed at 35mAOD, with some elements down to 30mAOD, this is at least 13m below surrounding ground level, the excavations will provide a good degree of acoustic screening to many of the processes and operations.

3.0 Proposals

3.1 The IWMF comprises a number of operations, which are detailed elsewhere within the submissions, however in broad terms they comprise a materials recycling facility, mechanical biological treatment plant, a paper pulp plant, a waste water treatment plant, an anaerobic digestion plant and a combined heat and power plant. These processes are contained within the building along with vehicle circulation areas. Outside the building are vehicle routes, the access road, air cooled condensers, switchgear, the stack and various fans and filters.

3.2 A planning application for the Integrated Waste Management Facility (IWMF) was submitted in August 2008 and was accompanied by an Environmental Statement. The application was "called-in" for determination by the Secretary of State (SoS). The Call-In Public Inquiry was held in Sept/Oct 2009 and the Secretary of State issued the Inspectors report and decision on 2 March 2010, granting planning permission subject to 63 conditions and a legal agreement.

3.3 Following a number of modifications since that date, the extant planning permission is reference number ESS/55/14/BTE. The previous noise assessment, for the purposes of the Environmental Impact Assessment, made a number of assumptions regarding the sound emissions from the facility due to the fact that the details of the development were not know at that time. These assumptions were considered reasonable at the time and were based on the experience of the project team. The basis of the noise impact assessment has remained consistent throughout and has been accepted by Essex County Council.

3.4 The IWMF involves several different operators, each specialising in a different technology. Considering the overall integration associated with the IWMF's waste recovery, recycling and treatment operations, the noise attenuation measures applied at the site will be implemented through a strategic review of the cumulative operations. This will optimise the various interfaces between each operator to ensure that the cumulative effect of their operations will comply with the planning condition limits. In practice this means that they will work together with a specialist acoustic advisor to devise the most efficient, sustainable and cost effective approach to controlling noise emissions from the site as a whole.

3.5 Gent Fairhead & Co Limited are the applicants and retain overall responsibility for the site including ensuring any permit conditions are properly implemented.

4.0 Planning Conditions

4.1 Planning conditions reference ESS/55/14/BTE and numbered 38 to 42 inclusive set out the noise limits for the operation of the site during construction and operation.

4.2 The planning conditions relating to noise are numbered 38-42. Numbers 38 to 40 relate to the maximum permitted noise emissions from the IWMF and numbers 41 and 42 relate to the monitoring for compliance. Numbers 38 to 40 are duplicated below.

38. Except for temporary operations, as defined in Condition 42, between the hours of 07:00 and 19:00 the free field Equivalent Continuous Noise Level (LAeq 1 hour) at noise sensitive properties adjoining the Site, due to operations in the Site, shall not exceed the LAeq 1 hour levels set out in the following table:

Location	**Location Criterion $dBL_{Aeq,1hr}$**
Herons Farm	45
Deeks Cottage	45
Haywards	45
Allshots Farm	47
The Lodge	49
Sheepcotes Farm	45
Greenpastures Bungalow	45
Goslings Cottage	47
Goslings Farm	47
Goslings Barn	47
Bumby Hall	45
Parkgate Farm Cottages	45

Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface facing the site and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.
Reason: In the interests of residential and local amenity and to comply with MLP policy MLP13, WLP policy W10E and BDLPR policy RLP62.

39. The free field Equivalent Continuous Noise Level (LAeq 1 hour) shall not exceed 42 dB(A) LAeq 1hour between the hours of 19:00 and 23:00, as measured or predicted at noise sensitive properties, listed in Condition 38, adjoining the site. Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface facing the site and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

Reason: In the interests of residential and local amenity and to comply with MLP policy MLP13, WLP policy W10E and BDLPR policy RLP62.

40. The free field Equivalent Continuous Noise Level (LAeq 1 hour) shall not exceed 40 dB(A) LAeq 5min between the hours of 23:00 and 07:00, as measured and/or predicted at 1 metre from the façade facing the site at noise sensitive properties, listed in Condition 38, adjoining the site.

Reason: In the interests of residential and local amenity and to comply with MLP policy MLP13, WLP policy W10E and BDLPR policy RLP62.

5.0 Relevant Guidance

Integrated Pollution Prevention and Control (IPPC) Horizontal Guidance for Noise Part 2 – Noise Assessment and Control

5.1 The Integrated Pollution Prevention and Control (IPPC) system employs an integrated approach to controlling the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single Permitting process. To gain a Permit, Operators will have to show that they have systematically developed proposals to apply the Best Available Techniques (BATs) and meet certain other requirements, taking account of relevant local factors.

5.2 The Regulators implement IPPC to:

- protect the environment as a whole
- promote the use of “clean technology” to minimise waste at source
- encourage innovation, by leaving significant responsibility for developing satisfactory solutions to environmental issues with industrial Operators
- provide a “one-stop shop” for administering applications for Permits to operate.

5.3 Once a Permit has been issued, other parts of IPPC are applicable. These include compliance monitoring, periodic Permit reviews, variation of Permit conditions and transfers of Permits between Operators. IPPC also provides for the restoration of industrial sites when the Permitted activities cease to operate.

Noise impact assessment – information requirements (for applications which include computer modelling or spreadsheet calculations) Version 2 June 2015

5.4 This brief document sets out the basic reporting requirements to be presented as part of any assessment that is reliant on some form of computer modelling. In general terms the data that is necessary to be reported includes the source locations, sizes, noise emissions receptor positions and any factors that might influence the propagation of sound from source to receiver.

BS4142:2014 Methods for rating industrial and commercial sound

5.5 The original assessment noted that BS4142:1997 may not be the most appropriate assessment methodology and that other guidance for example from the World Health Organisation (WHO) and BS8233:1999 Sound Insulation and Noise Reduction for Buildings offered more appropriate means of assessing internal sound levels as a result of external sound at night. The majority of the updates are associated with noise incidence during the night.

5.6 Both BS4142:1997 and BS8233:1999 were revised in 2014. One of the significant differences between BS4142:2014 and previous editions of the Standard is the explicit requirement to consider context as part of the assessment. It is no longer adequate to simply compare the Rating Level and the Background Sound Level without due regard to the context of the acoustic environment and the sound source. This is consistent with the original assessment's approach to also consider other more appropriate guidance.

5.7 Under BS4142:2014 the context of the acoustic environment and the sound source can significantly affect the outcome of the Initial Estimate, which is based solely on the difference between the Rating and Background Sound Levels. The Background Sound Level (L_{A90}) specifically excludes acoustic events occurring for less than 90% of the time, such as passing vehicles or activity occurring for much but not all of the time. This means that the difference between Rating and Background Sound Levels can be identical for two locations with very different acoustic characteristics and corresponding sensitivities to noise.

Rating Level - Background Sound Level	Initial Estimate
Around 10dB or more	Likely to be an indication of a significant adverse impact, depending on the context.
Around 5dB	Likely to be an indication of an adverse impact, depending on the context.
Similar levels	An indication of the specific sound source having a low impact, depending on the context.

5.8 In addition to comparing the level and character of the specific and residual sound, the context also includes careful consideration of other factors such as the character of the locale e.g. quiet rural or predominantly industrial; noise sensitive receptors e.g. outdoor amenity space or indoors; and duration and time of specific sound e.g. 24/7 operation or one event per week.

5.9 Depending upon the context, other guidance may be more appropriate, such as considering the potential impact of sound on residents during the night when the primary concern is to ensure that they are not disturbed whilst sleeping, possibly with open bedroom windows. In this case the difference between Background Sound Level and Rating Level outdoors is likely to be of little significance to the residents indoors.

BS8233:2014 Guidance on sound insulation and noise reduction for buildings

5.10 For dwellings the main considerations are to protect sleep in bedrooms and to protect resting, listening and communicating in other rooms. For noise without a specific character it is desirable that the overall average levels during the 8 hour night or 16 hour day time periods do not exceed 30dBA or 35dBA respectively.

5.11 For amenity space, such as gardens and patios, it is desirable that the average level does not exceed 50dBA, with an upper guideline value of 55dBA which would be acceptable in noisier environments. For dwellings with conventional windows, an internal target of 35dBA during the day equates to around 50dBA (possibly slightly lower) outside noise sensitive rooms with openable windows

National Planning Policy Framework, Noise Policy Statement for England and National Planning Practice Guidance

5.12 The National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE) and National Planning Practice Guidance (NPPG) were issued in 2012, 2010 and 2012 respectively.

5.13 These documents note that there is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking. Assessments should be proportionate to the proposed development. Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations.

5.14 Below the No Observed Effect Level (NOEL) sound is unnoticeable and of no significance. Below the Lowest Observed Adverse Effect Level (LOAEL) sound can be heard but does not cause any changes in behaviour or attitude, although the acoustic character of the area may be slightly changed. Below the Significant Observed Adverse Effect Level (SOAEL) sound may cause slight changes in behaviour or attitude e.g. turning up volume of a television or closing windows. There is potential for some sleep disturbance and a perceived change in the acoustic character of the area and quality of life.

5.15 Areas of Tranquillity should be protected, but in general cases it may be inappropriate to achieve a level below the LOAEL as this provides no benefit but may require additional resources such as energy, materials, space, time and money, adversely affecting the sustainability of doing so. Noise above the LOAEL should be mitigated and reduced to a minimum, although it may be appropriate to exceed the LOAEL and create an adverse acoustic impact, if this provides other sustainability benefits that are of greater significance. Noise above the SOAEL should be avoided.

5.16 The World Health Organisation: Night Noise Guidelines for Europe provides an update to the WHO - Guidelines for Community Noise document. These documents note that a steady level of 30dBA within bedrooms is suitable to protect vulnerable people from sleep disturbance and that occasional maximum levels of up to around 42dBA to 45dBA are also consistent with this. The difference between a sound level outdoors and the resultant level indoors with open windows varies through Europe due to differing building characteristics and particularly window type. An average difference of around 15dBA is often used, although this is also dependent upon other factors such as the frequency spectrum of the incident sound.

6.0 Sound Level Predictions

6.1 Acoustic modelling of the site has been undertaken using DataKustik's CadnaA version 4.5.151. The modelling package implements ISO 9613-1 and 2: Acoustics – Attenuation of sound during propagation outdoors and VDI 3733 Noise at pipes.

6.2 An Engineering Procurement Contractor (EPC) will operate the CHP element of the IWMF, including the stack, air cooled condensers and various other items of external plant. The EPC have separately commissioned consultants to produce an acoustic model of their process and to predict sound levels at the closest sensitive receptors. The model was reproduced with the support of EPC's acoustic consultants, to include this aspect in to the wider IWMF acoustic model. The two models show very good correlation which provides confidence in the calculations.

6.3 Other operations within the IWMF are at similar stages of advanced design and the acoustic environment associated with the operation of plant and equipment within the IWMF buildings is understood. Where appropriate assumptions relating to the likely internal reverberant sound levels based on experience of similar operations to understand the noise levels associated with the integrated operation of the materials recycling facility, mechanical biological treatment plant, paper pulp plant, wastewater treatment plant and anaerobic digestion plant within the IWMF's buildings. The building dimensions and attenuation performance of the structural elements are then used to calculate sound power levels for these individual (wall, roof, louvre) elements that are modelled as area sources.

6.4 To account for environmental conditions the model assumes down wind conditions with a wind speed of $3ms^{-1}$, $10^{o}C$ ambient temperature, 70% humidity, mixed ground cover and one order of reflection.

6.5 The acoustic model input and output tables are shown separately in *B3749 20150915 Cadna Data*, due to the amount of information. Where available octave band source data has been included in the model, sources have been modelled as either point, line or area sources as appropriate, the model is three dimensional and so the height and geometry of the sources is included in the model. Where spectral data is not available reasonable worst case assumptions have been made based on experience of similar plant and equipment. The model assumes flat ground between the site boundary and the closest sensitive properties, including the IWMF site access road. This simplification will lead to higher predicted sound levels than would occur in reality when the intervening ground profile is taken into account and represents a worst case situation. The assessment includes all operational vehicle movements to and from the A120 and within the site boundary.

6.6 Plant and equipment will be selected, located orientated and if required attenuated to avoid any tonal, impulsive or other characteristics that might otherwise attract an acoustic feature correction. Vents located across the roof of the building, these are operable in emergency situations only and at all other times will be closed with a mechanical damper system which will provide the same level of attenuation as the roof structure.

6.7 Models of the operations during the daytime and night-time operations have been produced. It is assumed that the daytime operations will cease before the start of the evening period as referenced in the planning conditions, therefore it is only necessary to consider the daytime and night-time operational conditions, in reality there will not be a transition period during the evening.

6.8 The models assume a height of 1.5m and 4m above ground height at the receptor locations to allow for ground and first floor receptors. Some of the properties around the site, for example The Lodge and Green Pastures bungalow are single storey properties. Where this is the case the 1.5m receptor height is considered appropriate for both day and night periods.

6.9 Table 6.1 shows the results of the prediction exercise, the sound levels are Rating Levels. Contour plots are shown in Appendix 1.

Location	Daytime (1.5m) dBA	Night-time (4m) dBA	Night-time (1.5m) dBA
Herons Farm	42	35	
Deeks Cottage	37	34	
Haywards	35	33	
Allshots Farm	39	39	
The Lodge	39	n/a	38
Sheepcotes Farm	39	35	
Greenpastures Bungalow	39	n/a	28
Goslings Cottage	43	31	
Goslings Farm	42	31	
Goslings Barn	41	31	
Bumby Hall	34	35	
Parkgate Farm Cottages	33	33	

Table 6.1 Predicted sound levels

6.10 Tables showing the partial sound levels corresponding to each source are shown in *B3749 20150915 Cadna Data*.

7.0 Analysis

7.1 Baseline surveys were originally undertaken in October 2005 and are routinely reviewed for the adjacent quarrying operations; with the most recent targeted baseline monitoring being completed in January and February 2014; this has confirmed that the acoustic environment has remained consistent. In consideration of the context of the area there has been no significant development or changes in the area that we would expect to alter the acoustic environment. The baseline noise data was presented in the original assessment report in tabular format. Presenting the data in a graphical format provides a visual representation of the variation in sound levels at the four locations. These are presented in Appendix 2.

7.2 Referring to the graphs in Appendix 2, the residual sound level generally fluctuated around 35dB$L_{Aeq,15min}$ to 50dB$L_{Aeq,15min}$, during the daytime with occasional peaks due to localised events such as road traffic and farm activity. At night the residual sound level fell as would be expected and generally fluctuated between just below 30dB$L_{Aeq,15min}$ and around 35dB$L_{Aeq,15min}$.

7.3 The background (L_{A90}) sound level was generally around 35dB$L_{A90,15min}$ to 40dB$L_{A90,15min}$ at Goslings Cottage, Herons Farm and Sheepcotes Farm during the day. At The Lodge background sound levels was generally in the region of 30dB$L_{A90,15min}$ to 40dB$L_{A90,15min}$.

7.4 At night the background sound level was around 25dB$L_{A90,15min}$ to 40dB$L_{A90,15min}$ at Goslings Cottage, just below 30dB$L_{A90,15min}$ to around 35dB$L_{A90,15min}$ at Herons Farm, approximately 30dB$L_{A90,15min}$ to 40dB$L_{A90,15min}$ at The Lodge, and approximately mid-way between 30dB$L_{A90,15min}$ and 35dB$L_{A90,15min}$ at Sheepcotes Farm.

7.5 It is important to note that the standards and guidance note that the crucial times in terms of protecting residents from sleep disturbance are around those times when residents are preparing to sleep or are awakening. In the UK this is generally around 2300 to midnight and 0600 to 0700 respectively.

7.6 The representative night-time background sound level in this case is reasonably consistent across locations at these more crucial times and is approximately 30dB$L_{A90,15min}$ at the beginning of the night and around 35dB$L_{A90,15min}$ at the end of the night.

7.7 Table 7.1 below shows a comparison of the range of predicted sound levels at the sensitive properties and representative background and residual sound levels across the area. It is designed to provide an Initial Estimate according to BS4142:2014.

Result	Daytime	Night-time
Residual sound level	35dB$L_{Aeq,T}$ to 50dB$L_{Aeq,T}$	30dB$L_{Aeq,T}$ to 35dB$L_{Aeq,T}$
Background sound level	30dB$L_{A90,T}$ to 40dB$L_{A90,T}$	30dB$L_{A90,T}$ to 35dB$L_{A90,T}$
Specific sound level	33dB$L_{Aeq,T}$ to 43dB$L_{Aeq,T}$	28dB$L_{Aeq,T}$ to 38dB$L_{Aeq,T}$
Acoustic feature correction	0dB	0dB
Rating Level	33dB$L_{Aeq,T}$ to 43dB$L_{Aeq,T}$	28dB$L_{Aeq,T}$ to 38dB$L_{Aeq,T}$
Excess over background sound level	+3 to +13	-2 to +8
Initial Estimate	Likely to be an indication of the source having between a low impact and significant adverse impact, depending on the context	Likely to be an indication of the source having between a low impact and an adverse impact, depending on the context

Table 7.1 Initial Estimate of Likely Significance of Impact

7.8 Table 7.2 shows a comparison of the predicted Rating Sound Levels against the planning condition noise limits. In all cases the Rating Sound Levels are below the planning condition limits.

Location	Predicted Rating sound level dBA	Planning condition limit dBA	Difference dBA
Herons Farm	42	45	-3
Deeks Cottage	37	45	-8
Haywards	35	45	-10
Allshots Farm	39	47	-8
The Lodge	39	49	-10
Sheepcotes Farm	39	45	-6
Greenpastures Bungalow	39	45	-6
Goslings Cottage	43	47	-4
Goslings Farm	42	47	-5
Goslings Barn	41	47	-6
Bumby Hall	34	45	-11
Parkgate Farm Cottages	33	45	-12

Table 7.2 Comparison with Planning Condition Noise Limits – Daytime

7.9 When considering the context of the assessment during the daytime the acoustic environment is influenced by road traffic in the vicinity of most of the receptors and more distant sources for example the A120 and aircraft movements. Farming and quarry activity are also established activities in the area which have the potential to influence the acoustic environment.

7.10 The predicted rating sound levels are elevated by the access road traffic, which in this model is at the same ground level as surrounding receptors, in reality this is not the case and the access road is reasonably well screened along most of its length, this means that the contribution from this source is an overestimate and sound levels during the daytime will be lower than those shown in the tables. Screening that just intersects the line of sight between the source and the receiver will reduce sound levels at the receiver by 5dBA.

7.11 During the day, the residual sound level will vary significantly depending upon factors such as activity in the immediate area, together with more distant sources and traffic density. The Background Sound Level will be somewhat higher than at night. This means that a Rating Level of up to 43dBA at the nearest noise sensitive receptors, due to the IWMF, will be towards the middle of the range of variation of the residual acoustic environment. This is also consistent with levels recommended in BS8233 and by the World Health Organisation.

7.12 During the night operations will be contained to within the IWMF building. At night, the primary concern is to ensure that residents will not be disturbed by the level or character of sound from plant at the site, whilst avoiding the potential adverse sustainability consequences of trying to achieve an unnecessarily low level that provides no additional benefit. Authoritative guidance such as BS8233 and the World Health Organisation indicates that a Rating Level of up to around 40dBA outside the nearest dwellings will be consistent with these objectives.

Table 7.3 shows a comparison of the predicted Rating Sound Levels against the planning condition noise limits. In all cases the Rating Sound Levels are below the planning condition limits.

Location	**Predicted Rating sound level dBA**	**Planning condition limit dBA**	**Difference dBA**
Herons Farm	35	40	-5
Deeks Cottage	34		-6
Haywards	33		-7
Allshots Farm	39		-1
The Lodge	38		-2
Sheepcotes Farm	35		-5
Greenpastures Bungalow	28		-12
Goslings Cottage	31		-9
Goslings Farm	31		-9
Goslings Barn	31		-9
Bumby Hall	35		-5
Parkgate Farm Cottages	33		-7

Table 7.3 Comparison with Planning Condition Noise Limit – Night-time

7.14 When considering the context of this assessment and the acoustic environment during the night-time period, a Rating Level of between 28dBA and 38dBA due to the IWMF will not disturb neighbouring residents who may be sleeping with open bedroom windows. This equates to internal sound levels of less than 20dBA to around 25dBA and will be consistent with National Planning Policy and with relevant authoritative guidance. There is therefore likely to be negligible acoustic impact associated with the operations at night.

8.0 Conclusion

8.1 A three dimensional computer model of the site and surrounding area has been constructed. All of the processing plant associated with the IWMF has been built into the model, where specific information is not available reasonable worst case assumptions have been made.

8.2 The assessment has demonstrated that the IWMF will produce sound levels at the closest sensitive receptors that comply with the planning condition noise limits.

8.3 This assessment has also considered a range of authoritative guidance and has demonstrated that the predicted sound levels will comply with recommendations set out in these documents.

8.4 Operation of the site will follow IPPC/EP guidance with regard to noise and vibration and will utilise appropriate control measures and monitoring to ensure that the noise and vibration from the installation complies with the relevant criteria and does not give rise to cause for annoyance.

Appendix 1 Sound Contour Plots

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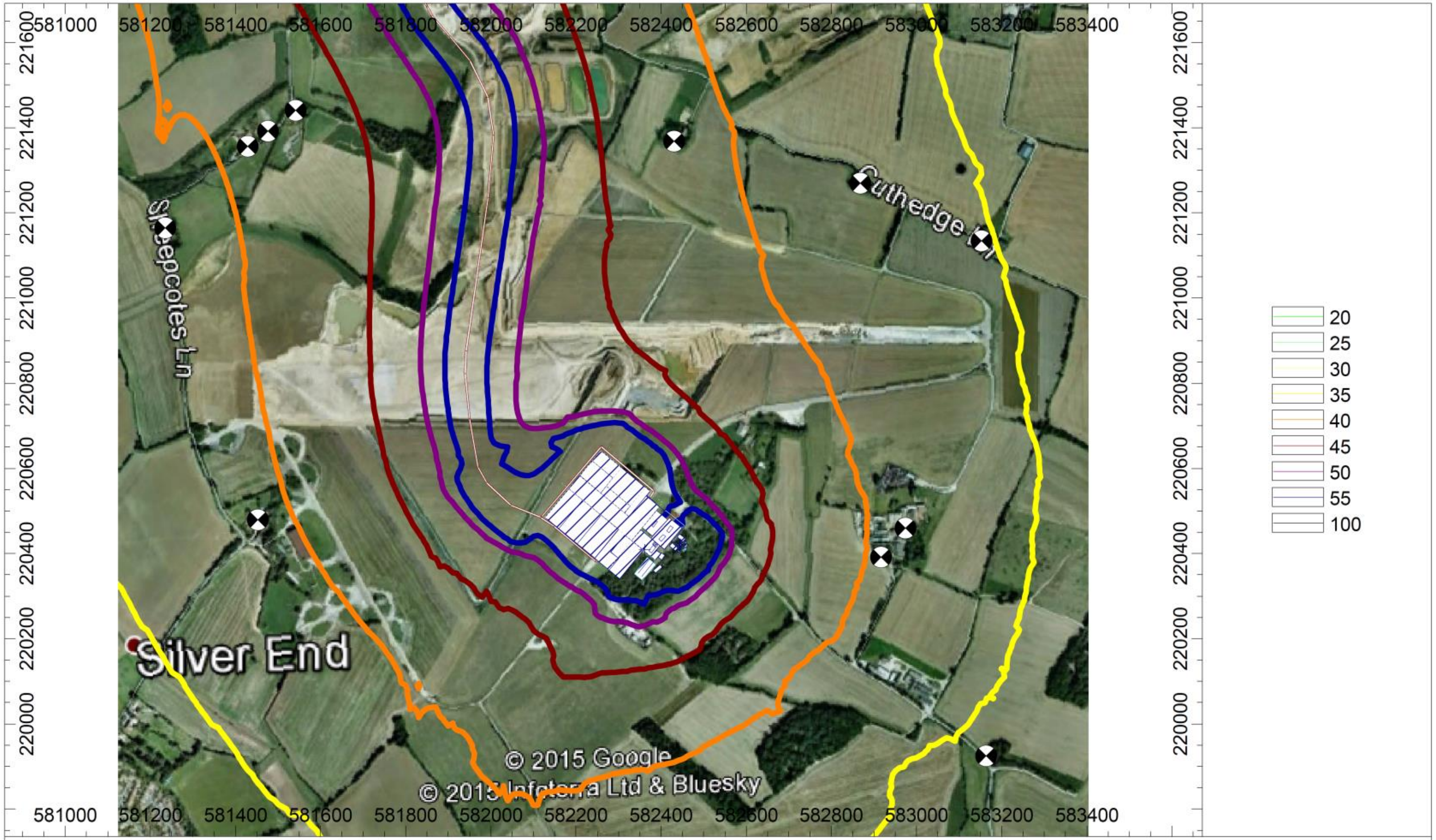
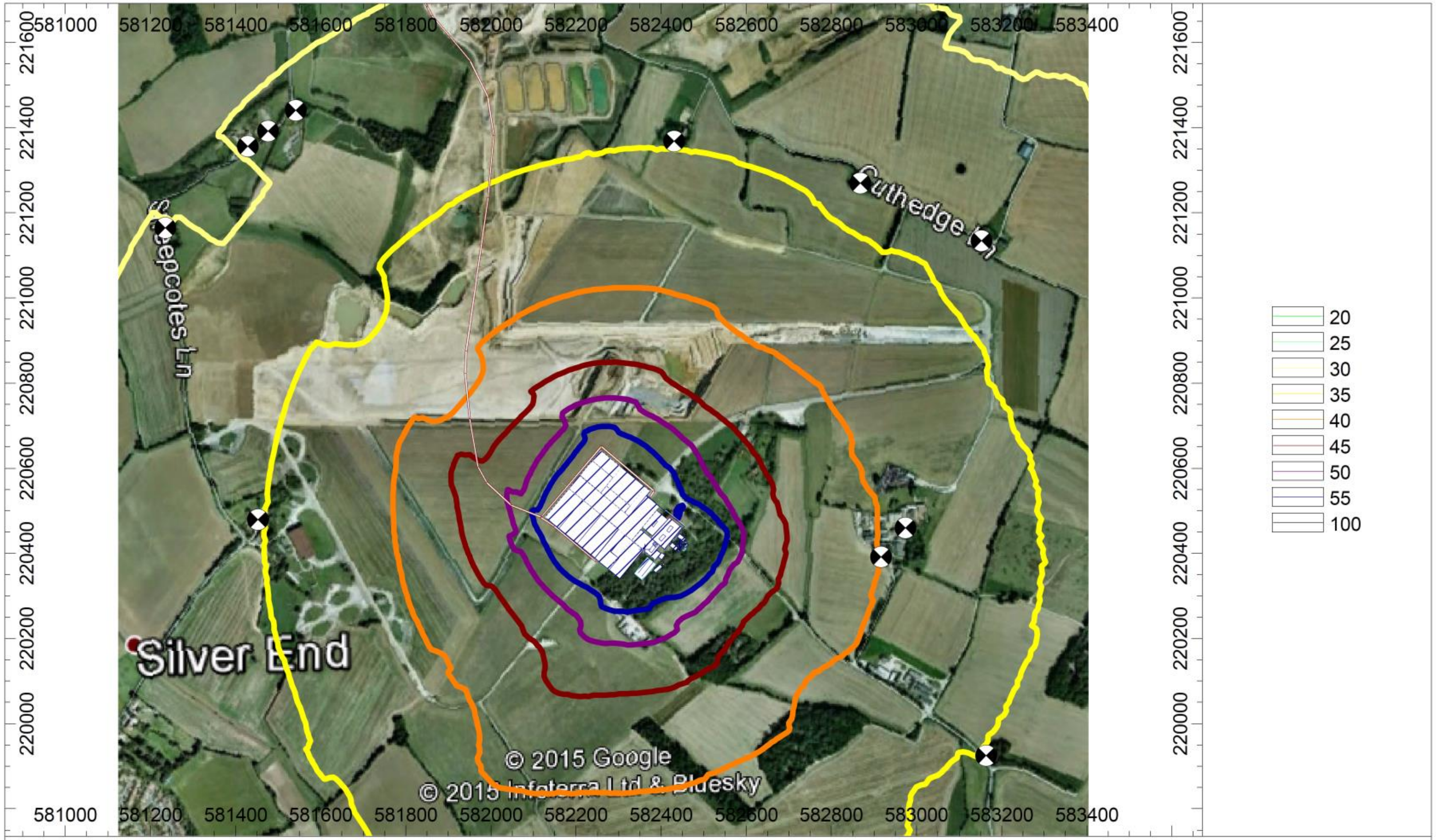


PROJECT: IWMF Rivenhall - Daytime 1.5m Grid Height	DATE: 16/09/2015
REF: B3749	AUTHOR: TSL

ACOUSTICAL CONTROL Engineers & Consultants

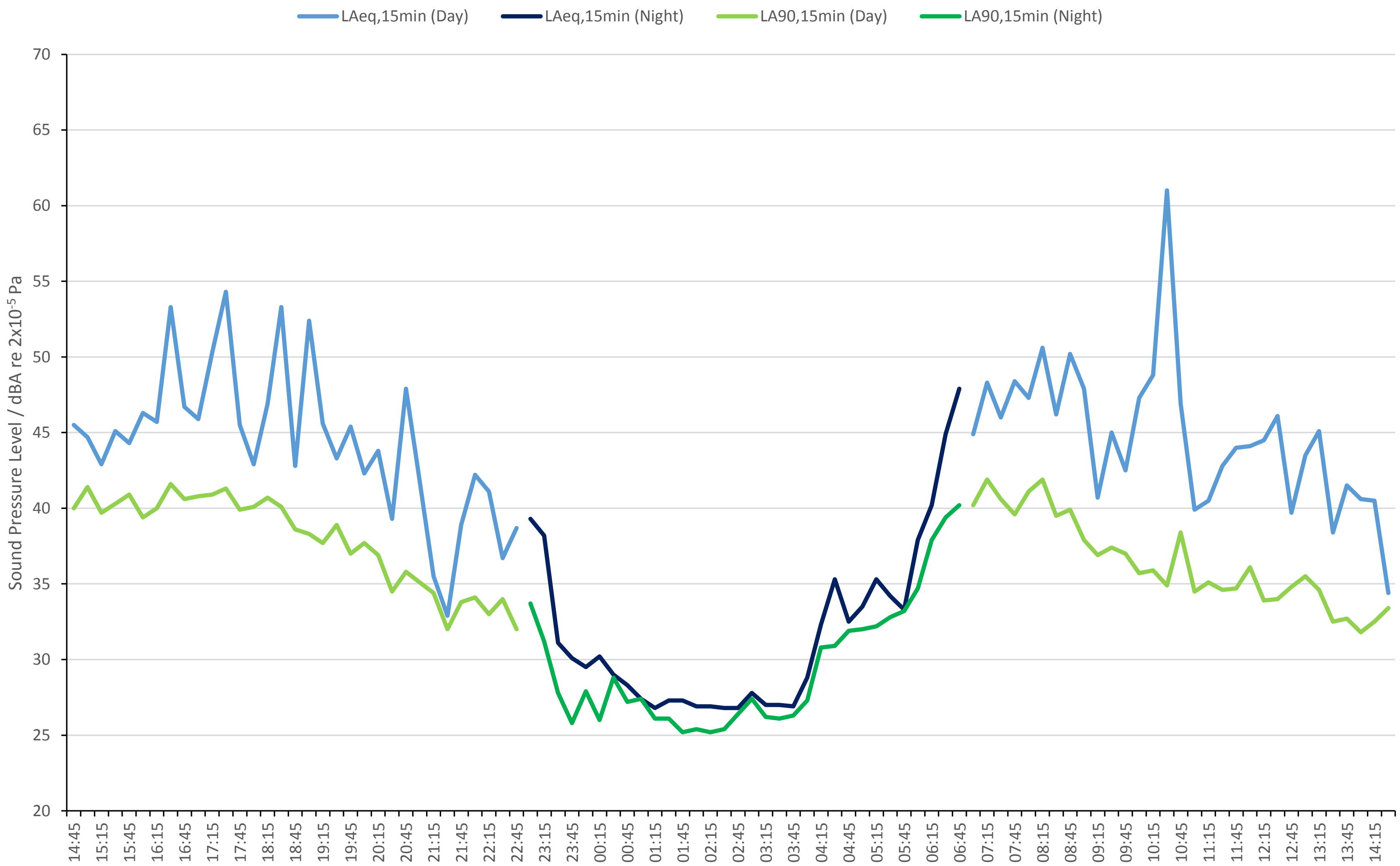
PROJECT: IWMF Rivenhall - Night-Time 1.5m Grid Height	DATE: 16/09/2015
REF: B3749	AUTHOR: TSL

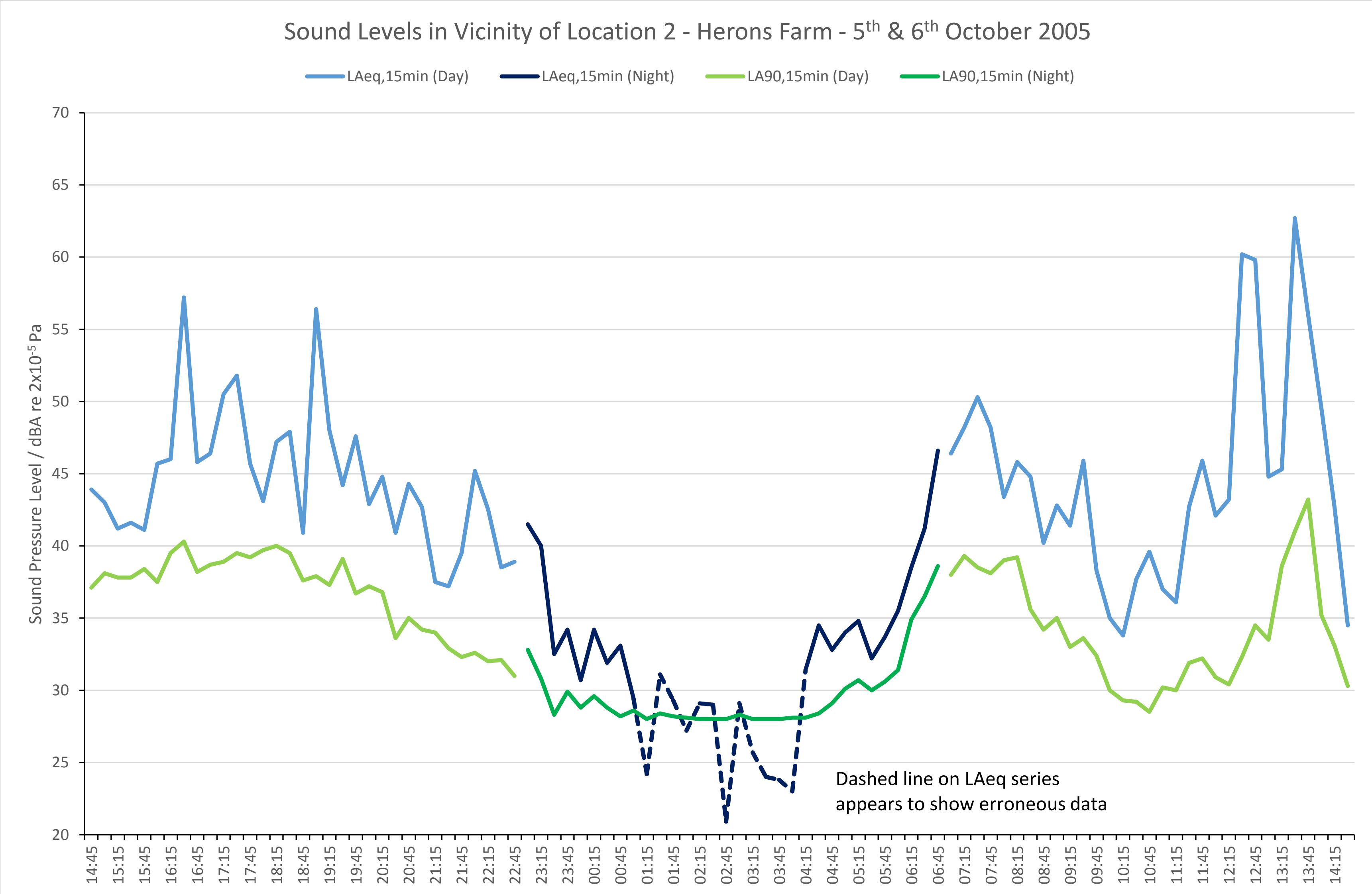


PROJECT: IWMF Rivenhall - Night-Time 4m Grid Height	DATE: 16/09/2015
REF: B3749	AUTHOR: TSL

Appendix 2 Baseline data – October 2005

Sound Levels in Vicinity of Location 1 - Goslings Cottage - 5th & 6th October 2005





Sound Levels in Vicinity of Location 2 - Herons Farm - 5th & 6th October 2005
LAeq,15min (Day)
LAeq,15min (Night)
LA90,15min (Day)
LA90,15min (Night)
Sound Pressure Level / dBA re 2x10-5 Pa
70
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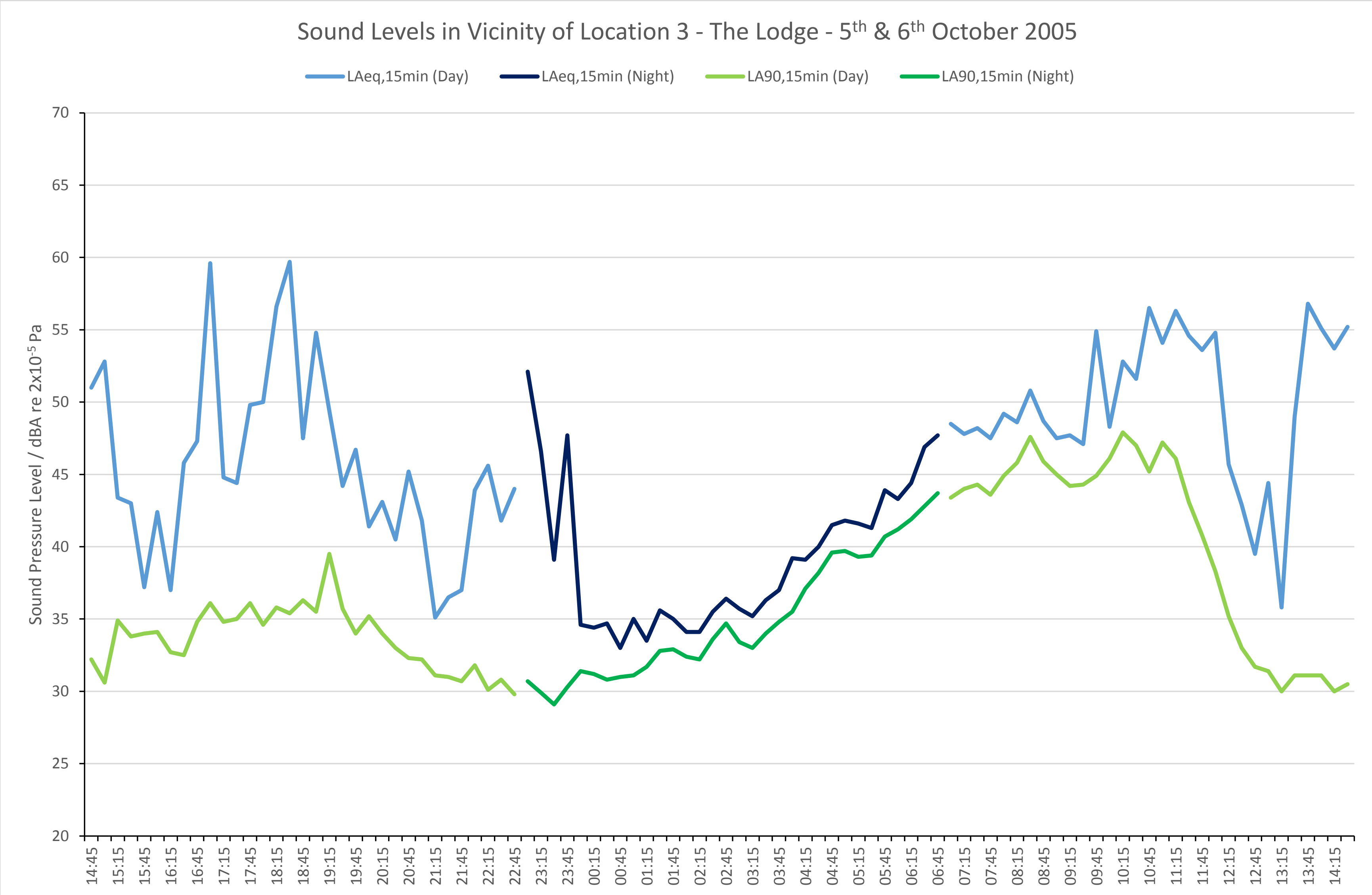
14:15
Dashed line on LAeq series
appears to show erroneous data


Sound Levels in Vicinity of Location 3 - The Lodge - 5th & 6th October 2005
LAeq,15min (Day)
LAeq,15min (Night)
LA90,15min (Day)
LA90,15min (Night)
Sound Pressure Level / dBA re 2x10-5 Pa
70
65
60
55
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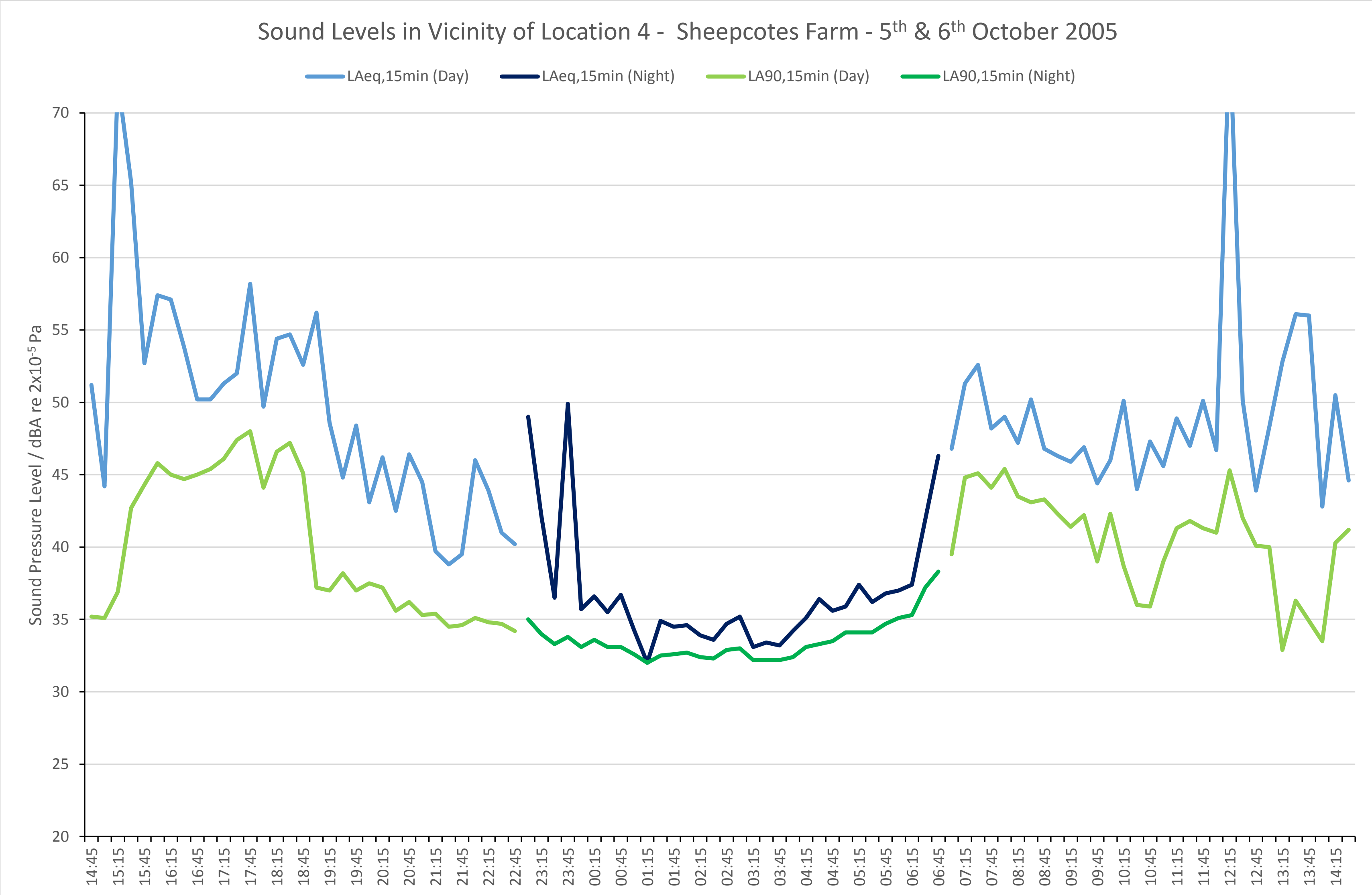
Sound Levels in Vicinity of Location 4 - Sheepcotes Farm - 5th & 6th October 2005
LAeq,15min (Day)
LAeq,15min (Night)
LA90,15min (Day)
LA90,15min (Night)
Sound Pressure Level / dBA re 2x10-5 Pa
70
65
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Annex A Background Sound Level

Synopsis

A.1 The Background Sound Level is not a single numerical value but a range that is unlikely to be precisely defined numerically.

A.2 It is equally important to understand the range of factors that affect the Background Sound Level as the actual measured levels.

A.3 Appropriately timed short duration attended measurements can provide much better quality data than unattended measurements taken over a significantly longer period.

Introduction

A.4 This edition of the Standard provides clearer and more specific guidance that the background sound level should be representative and not the lowest level that can be measured. This is to prevent some abuses of the Standard which have occurred in the past, such as where criteria have been set based on the lowest background level measured during any 5 minute period throughout the night.

A.5 Clause 8.1.4 states that: '*The monitoring duration should reflect the range of background sound levels for the period being assessed. In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed*'.

A.6 This means that if a single 'representative' background sound level is used for an assessment, consideration must also then be given to the likely range of variation in background sound and its effect on the outcome of the assessment. Ideally, the range of variation should reflect the variation of the residual sound during the period(s) of interest, taking account of both level and likelihood of such levels occurring, rather than simply attempting to consider the maximum potential range between lowest or highest possible sound levels that may occur.

A.7 However, it must also be recognised that the background sound level will usually vary significantly depending upon many different factors such as weather conditions; time of the day or night; day of the week; and time of the year. Even at the same time of day/ night and same time of the year, the background sound level can often vary by more than 10 dBA depending upon wind direction, even under conditions that are all regarded as being 'suitable' for valid measurements to be taken.

A.8 Most residual sound and the associated Background Sound Levels are affected by sources close to the measurement location and also more distant sources such as transportation systems; commercial/ industrial and other human activity; and foliage moving in the wind or even water flowing. The sound level at the measurement location will therefore vary as the wind changes in speed and direction. Sound from more distant sources is affected by wind at low and higher altitudes, which can be significantly different in both speed and direction. Therefore even under apparently similar conditions at the measurement location, the residual sound level may vary to a greater extent than would be expected if the wind at higher altitude is more variable than at lower altitude.

A.9 Whilst it may appear that taking measurements for a few days will provide better data covering a range of weather conditions, this may not be the case. Weather conditions tend to remain fairly similar for several days so a measurement period of this duration is likely to provide several days data for similar conditions. It is also highly unlikely that this period will cover the range of conditions that affect the background sound level which means that the extended measurement period may provide a false sense of reliability of data when it is of no more benefit than that obtained over a single 24 hour period.

A.10 A further problem with this approach is that unattended measurements provide very little or even no data about what has actually been measured. Fully attended measurements enable the acoustic environment to be properly understood and factors that affect the sound level to be identified and their contribution quantified. A short duration attended survey can usually provide far better quality data than a longer term unattended survey, although where long term measuring is required, such as for compliance monitoring, this may not be appropriate.

A.11 Where it is necessary to fully understand the variation in residual sound during the day and night it may be appropriate to take measurements throughout this period. However, this is unlikely to be representative of different conditions such as days of the week, public holidays and even school holiday conditions. In many situations it is more appropriate to specifically consider the most sensitive times of the day or night, on the basis that if these are satisfactory then less sensitive times will also be satisfactory. For plant that operates on a 24/7 basis the most sensitive time of the night is likely to be when people are going to or awakening from sleep rather than the quietest part of the night. During the day the most sensitive time is likely to be the evening when the residual level may be lower than at other times of the day.

Annex B Rating Penalty

Synopsis

B.1 A Rating Penalty is applicable if sound has significant characteristics such as tonality or impulsivity that attract a listener's attention at the noise sensitive location to be considered for the assessment.

B.2 A Rating Penalty can comprise separate corrections for tonality, impulsivity, other characteristics (if neither tonality nor impulsivity apply), and intermittency. These corrections are additive.

B.3 The subjective method(s) should be used to determine the Rating Penalty unless agreement cannot be reached, in which case the objective/ reference methods may be appropriate alternatives.

B.4 Whilst the maximum Rating Penalty could arguably be 15 dB or possibly even 18 dB, in reality it is expected that, where a Rating Penalty is applicable, a correction in the range of 5 dB to 10 dB is likely to be appropriate in the vast majority of cases.

Introduction

B.5 Sound which has characteristics that attract a listener's attention may be significantly more intrusive than sound of a somewhat higher level that is more innocuous. The most common acoustically distinguishing characteristics are tonality, impulsivity and intermittency. BS4142 provides guidance regarding how a rating penalty should be determined. It is important to note that this is based on the level and character of the specific sound at the noise sensitive location(s) in comparison to the level, character and context of the residual acoustic environment. It is intended that the subjective method be used where agreement can be reached regarding penalties where appropriate, with the objective/ reference methods only being used in more contentious situations.

B.6 Because the level and character of both the specific and residual sound vary with time, it is likely that the significance of any acoustically distinguishing characteristics will also vary with time. It is most appropriate to establish a rating penalty for representative conditions but to then consider the range of variation of potential rating penalty as part of the consideration of the uncertainty of the assessment.

Tonality

B.7 For tonality, Clause 9.2 states that: '*For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible*'.

B.8 In most cases where plant produces sound that is tonal but similar in level to the residual sound, the tonality may tend to be slightly or clearly rather than highly perceptible at the noise sensitive location(s), with the relative prominence of the tonality being reduced due to masking by the residual acoustic environment. In such cases it may be appropriate to apply a penalty of 2-4 dB to account for this effect.

Impulsivity

B.9 For impulsivity, Clause 9.2 states that: '*A correction of up to +9 dB can be applied for sound that is* highly *impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible*'.

B.10 In most cases where plant produces sound that is impulsive but similar in level to the residual sound, the impulsivity may tend to be slightly or clearly rather than highly perceptible at the noise sensitive location(s), with the relative prominence of the impulsivity being reduced due to masking by the residual acoustic environment. In such cases it may be appropriate to apply a penalty of 3-6 dB to account for this effect.

Other Characteristics

B.11 Clause 9.2 also states that '*Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*'.

B.12 This means that, depending upon circumstances such as the context, it may be applicable to apply a 3 dB penalty to sound that is neither tonal nor impulsive where it has other characteristics that tend to attract a listener's attention to the sound against the residual acoustic environment at the noise sensitive location(s).

Intermittency

B.13 For intermittency Clause 9.2 states that: '*When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*'.

B.14 This means that, depending upon circumstances such as the context, it may be applicable to apply a 3 dB penalty where the intermittency of the specific sound tends to attract a listener's attention to the sound against the residual acoustic environment at the noise sensitive location(s).

Conclusion

B.15 On an extremely rare occasion when the specific sound is both highly tonal and highly impulsive at a noise sensitive location, it could conceivably be appropriate to apply a rating penalty of 15 dB and possibly even 18 dB if the intermittency of the specific sound exacerbates the impact of what is already highly intrusive sound still further. If sound is both tonal and impulsive but one of these characteristics is dominant then it may be appropriate to apply just the correction for that characteristic. In situations where the specific sound is similar in level to the residual sound it is more likely that such characteristics will be masked to some extent by the residual sound at the noise sensitive location(s). In this case it is more likely that a rating penalty of 2-4 dB for tonality and/ or 3-6 dB for impulsivity may be applicable, possibly with an additional 3 dB penalty for intermittency if this is significant. In most cases it is expected that a Rating Penalty, if applicable, will be in the range of 5-10 dB.

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Annex C Uncertainty

Synopsis

C.1 Despite sound measurement systems usual precision of 0.1dB, any measurement of environmental sound or specific components of this can only be representative of its constantly varying level and character, at best.

C.2 In addition to uncertainty in sound level measurement systems, the actual level being measured varies continuously in level and character. Analysis of the measured levels adds further uncertainty, as does assessment of the potential impact of sound, which is greatly affected by the specific context of the situation being assessed.

C.3 It is not appropriate to estimate all uncertainty that may occur and deduct this from a 'suitable' level to establish a 'safe' level that 'should be ok'. This would result in sound levels that are substantially lower than necessary or appropriate, providing no benefit for those being 'protected', whilst creating significant adverse impacts on the sustainability of any development and making many impracticable, thereby preventing much development that should proceed, and denying the benefits of such development, often to the very people that are being 'protected'.

C.4 The way in which uncertainty is addressed must depend upon factors such as the sensitivity of the situation, the potential magnitude of the uncertainty, and its potential significance on the outcome of the assessment.

Introduction

C.5 Environmental sound is constantly changing in level and character. The relative significance of any component of this similarly varies continuously as sound from both the specific component and all other residual sources varies. The propagation paths between sources and receiver change for reasons such as varying wind speed and direction which further alters the level and character of environmental sound at any location. Sound can be measured and expressed in many different ways using different parameters such as the maximum, logarithmic average, minimum, or statistical distribution. These values will themselves depend upon other factors such as the time period over which they apply and the response time of the measurement system. This means that any quantified level of residual sound or that from a specific source is representative rather than precise and it is necessary to more fully understand the acoustic characteristics of the acoustic environment that is being considered.

C.6 Uncertainty has been the acoustic 'elephant in the room' for many years. Some acousticians have considered it; many have ignored it; and other people, particularly non-acousticians, have been unaware of it, assuming incorrectly that acoustic analyses presented to a precision of 1 dB or even 0.1 dB are accurate to that level of accuracy.

C.7 In most cases, when setting sound levels based on an acoustic assessment it is not appropriate to set a criterion that incorporates uncertainty to the extent that the criterion is highly unlikely to be exceeded under any circumstances. Clearly there are some exceptions to this, such as the safety requirement to protect personnel from hearing damage at work. In this case subtracting 1 standard deviation (σ) from a hearing protector's average performance is used to give an assumed level of performance that should be achieved for 84% of users. Although subtracting 2σ would protect 97.5% of users and 3σ would protect 99.9%, a balance has been struck between cost/ practicability and benefit in deciding that uncertainty where 16% of people may not be provided with the expected level of protection is appropriate in this case.

C.8 In non-safety critical situations it is generally appropriate to accept a greater level of uncertainty in the outcome of any assessment. In many acoustic assessments it is also not practicable to numerically quantify the level of uncertainty in the manner that is possible for hearing protection devices which can be thoroughly tested and measured under carefully controlled laboratory conditions.

C.9 BS4142 aims to provide guidance as to the likely significance of impact of industrial or commercial sound, taking into account not only the level and character of that sound but also the context in which it is heard, which can significantly affect the significance of its impact.

C.10 The impact of industrial or commercial sound will vary as the level and character of both the source and residual sound changes. This means that the assessment of its impact will be a general indication and that its significance will change continuously. As noted above, it is generally not appropriate to consider a theoretical 'worst case' scenario comparing the highest possible rating level against the lowest possible background sound level. Instead, representative rating and background sound levels should be compared, considering the level, character and context of the specific sound and residual acoustic environment. There will inevitably be occasions when the impact is slightly greater than this representative situation and conversely there will be other occasions when the impact is less. This is no different to the impact of different sources of sound in the residual acoustic environment, such as pedestrians conversing loudly whilst passing a dwelling, a vehicle horn being sounded, or a siren being heard on occasion.

Measurement Uncertainty

C.11 Any measurement whether acoustic or not, includes an element of uncertainty in the measured value, the magnitude and significance of which usually depends upon many factors. The most obvious factor for measurements undertaken for this assessment is due to instrumentation, but this is minimised by a range of controls set out in Craven & Kerry's *'A Good Practice Guide on the Sources and Magnitude of Uncertainty Arising in the Practical Measurement of Environmental Noise'* (as referenced in BS4142: 2014) including:

- Use of Type 1 sound level analysers
- Bi-annual calibration of sound level analysers and annual calibration of calibrators (relevant calibration certificates are provided elsewhere.
- Periodic cross-calibration with other calibrated analysers and monitoring of system's calibration characteristics.
- On site calibration checks before and after measurements are taken.
- Avoidance and control of interference due to electromagnetic sources, weather or other factors.

Other Causes of Uncertainty

C.12 These measures ensure that the uncertainty due to the measurement system is relatively small in comparison with factors that affect the overall uncertainty incorporated in this assessment. These include:

- Variations in the level and character of residual and associated background sound at the measurement and noise sensitive receptor locations.
- Variations in the level and character of the specific sound.
- Where the specific sound level is calculated from the difference between the ambient sound level with the source operating and the residual level without, significant variability in either of these levels increases the uncertainty in the calculated specific level and significant variability in both increases the uncertainty by a greater amount.
- The magnitude of any rating penalty that should be applied and under which conditions e.g. full load or partial load operation or different plant characteristics.
- Modelling of the sound path from source to receptor.

C.13 In addition to the Good Practice measures identified by Craven and Kerry, appropriate measurement techniques can further reduce uncertainty such as undertaking fully attended surveys, recording the sound level many times each second and noting acoustically significant factors that may affect the measured level on a second by second basis.

Background & Residual Sound Level Uncertainty

C.14 In many cases the level and character of residual and background sound is strongly affected not only by the level of activity which varies with time of day, but also by seasonal effects such as foliage generated noise and to an even greater extent by weather conditions, of which the most significant is usually wind speed and direction, which itself varies with location and altitude. Because weather conditions tend to remain fairly similar for several days, taking measurements for this length of time is likely to provide a few days and nights of similar data rather than a reflection of the likely range of sound levels under different weather conditions. Where it is necessary to fully understand this effect it is necessary to undertake long term monitoring for extended periods, generally also at different times of the year. Clearly this is only likely to be practicable for major developments such as national infrastructure construction. Long term residual and background sound level measurements are neither practicable nor appropriate for small scale developments, particularly if the background sound level informs rather than dictates the outcome of a BS4142 assessment.

C.15 Where the residual sound level is relatively steady measuring for a short time can provide as good an indication of the representative level prevailing at that time under those specific as a longer duration measurement. As the variability of the residual sound level increases the range of residual and background sound levels also increases and the uncertainty in these levels similarly increases. However, as discussed above, the variability and uncertainty in the residual and background sound levels will tend to be greater under different weather conditions than at different times of the day or night under similar weather conditions. Measuring the sound level many times every second provides a clear understanding of how the sound level depends upon a range of factors such as passing traffic, distant plant and activity, so that the likely range of variation of the residual and background sound levels can be better understood.

C.16 There is a balance to be struck between reducing uncertainty and the duration and associated costs of the measurement period(s).

Source Level Uncertainty

C.17 There is uncertainty in the level and character of sound from sources for many reasons. These include:

- Varying plant operational conditions.
- Variation in sound level produced by different items of equipment.
- Uncertainty or error in manufacturer's data.
- Uncertainty or error in measured levels of other 'representative' sources.
- Acoustic characteristics of plant such as directivity.

C.18 Plant may operate differently under different conditions and for example, may be restricted so that the level and character of sound will be different during the night than day time. Even where plant operates in only one mode, the level and character of sound that it produces may vary. BS4142 considers the average sound level that the plant may produce over a 15 minute period during the night and 1 hour during the day. The characteristics of the sound may also differ during these times as a result of which the rating correction(s) may be different.

C.19 Where there are multiple items of equipment, the variation in level and character of each is likely to result in even greater variation of the overall level and character of sound from the equipment as a whole. However, there can also be some 'smoothing' effect if the overall result is that plant operates more or less continuously, with individual items of plant starting and stopping at different times. Provided that the changes in level and character due to individual items of plant are not significant this can result in slight variations in an otherwise relatively steady sound that may be less significant than a single item of plant intermittently stopping and starting.

C.20 Where a new source is proposed, it may be appropriate/ necessary to use manufacturer's data to assess the likely significance of its impact. This data may vary from a single figure dBA level that may or may not clarify whether it is a sound pressure level measured at a specific distance under known acoustic conditions, or a sound power level, to a detailed frequency spectrum, possibly for different operating conditions. Experience can greatly assist the interpretation of such data and the assessment of its reliability. Even where detailed frequency spectra are provided, this does not provide a definitive indication of appropriateness or otherwise of a rating penalty and its magnitude if this is found to be applicable.

C.21 In many cases it is appropriate to use data obtained from other similar equipment as an indication of the likely level and character of sound that will be produced by proposed plant. In these cases it is necessary to consider the uncertainty in these measured levels including not only the effects of the measurement environment and operational characteristics of the representative plant, but also any differences due to other factors such as required maintenance.

Rating Penalty Uncertainty

C.22 The rating penalty includes corrections for sound that is tonal, impulsive, intermittent, or has other characteristics that will tend to attract a listener's attention. The significance of these characteristics should be assessed by comparison of the specific and residual sound at the noise sensitive location(s), not closer to the source. This may be difficult to do for existing sources due to difficulties in measuring the specific and residual sound, although in most cases it should be possible to use the simplified subjective method set out in clause 9.2 of BS4142.

C.23 For a proposed source it will not be possible to directly measure or subjectively assess the sound it produces at the noise sensitive receptors, but it may still be possible to apply the subjective method in such situations, considering the known level and character of sound the source will produce and the level and character of the residual acoustic environment at the noise sensitive location(s).

C.24 There may be uncertainty whether a specific sound may have tonal or impulsive content that is just or clearly perceptible; or is clearly or highly perceptible. It is up to the parties undertaking the assessment to form an opinion regarding what would constitute an appropriate rating penalty and to clearly explain how this has been arrived at. The uncertainty in the magnitude of the rating penalty and the likely significance of the character of the specific sound at the noise sensitive location(s) should then be considered further as part of the assessment process.

Modelling Uncertainty

C.25 Where an existing source is being assessed based on measurements and observations at the noise sensitive location(s) there may be no need for any acoustic modelling of the source characteristics or sound propagation path. However, in most cases it is likely that a combination of measurement and calculation will be necessary and this will introduce further uncertainty. For example levels measured close to a source can be extrapolated back to the noise sensitive location(s) but the actual level produced at the more distant location(s) will be affected by factors such as reflections or screening by structures, attenuation due to the ground or air, and possibly most significantly by wind speed and direction.

Conclusion

C.26 Some of the elements of uncertainty that affect the actual level and character of sound at noise sensitive locations can be numerically estimated, although this is unlikely to be the case for the more significant ones. However, the aim is not to derive a precise numerical outcome from a BS4142 assessment but to consider the likely significance of the impact of industrial or commercial sound at affected noise sensitive locations.

C.27 Where there is a very clear outcome and relatively small uncertainty, then the uncertainty will have negligible effect on the outcome of the assessment. However, where the outcome is less clear and/ or the level of uncertainty is greater, this should be reflected in the assessment.

C.28 The assessment must consider not only the level and character of sound from the source(s) and also the residual acoustic environment but also the context in which it is experienced. The effect of sound on a listener is subjective and it is necessary to incorporate some subjectivity into a BS4142 assessment. This is generally the most appropriate way in which to incorporate the effects of uncertainty into the outcome of the assessment.

Annex D Guidance

Synopsis

D.1 BS4142:2014 uses a comparison between the Rating and Background Sound Levels to establish an Initial Estimate of the Likely Significance of Impact. The context of the assessment must then be considered, which can significantly alter the outcome of the assessment.

D.2 Where the aim is to ensure that people are not disturbed by plant during the night it is the absolute level of sound within the dwelling that will be of most significance. What constitute a suitable level of sound from plant will depend upon the character of the acoustic environment. This means that identification of a suitable criterion to properly protect residents must be informed by the existing residual sound level, of which the Background Sound Level is one partial indicator, with others such as the average or maximum providing further information.

D.3 For gardens and other outdoor amenity areas, BS8233 indicates that an average level of 50dBA may be desirable, but this is based on considering residential development in what may be relatively noisy areas. For quieter locations NPPF and NPSE provide further assistance. When establishing what may be a suitable level in gardens etc. for sound from plant, it is important to consider the existing acoustic environment including the residual levels (background, average, etc.) and the character of the area e.g. quiet rural, busy urban, adjacent to a car park or service yard.

BS4142:2014 Methods of rating industrial and commercial sound

D.4 BS4142:2014 differs from previous editions of this Standard in many ways, including that:

- The aim is to assess the likely significance of impact not the likelihood of complaint. This is consistent with current Government planning policy but is not aligned to it because this is a British standard, whereas planning policy does not apply to all of Britain.
- The context of the situation must be considered as part of and can significantly affect the outcome of the assessment.
- The outcome of the numerical assessment will not be a single number but a range, together with uncertainty, the significance of which must be considered as part of the assessment process.
- The absolute sound levels may be more significant than the difference between the rating and background sound levels.
- It may also be appropriate to consider other guidance such as BS8233:2014 as part of the assessment.

- Sound having significant characteristics that attract a listener's attention may be significantly more intrusive than featureless sound of a somewhat higher level, as a result of which the rating penalty may now be significantly greater than before.
- The reference to a rating level 10 dB below the background sound level has been removed because this was mis-applied in many cases to impose unreasonably low criteria.
- The many factors that affect the uncertainty of an assessment must be taken into account.

D.5 Clause 11 states: '*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context*'.

D.6 BS4142 requires that the Rating Level be compared to the Background Sound Level to provide an Initial Estimate of the Likely Significance of Impact. This is then amended to take account of the context of the assessment, and the effects of the uncertainty in the entire process on the outcome of the assessment must also be considered.

D.7 The Background Sound Level ($L_{A90,T}$) is defined as the level exceeded for 90% of the time i.e. the quietest 10% level. This specifically excludes consideration of the sound level prevailing for 90% of the time and is intended to provide an indication of the sound level during 'lulls' in activity. This means that the same Background Sound Level can be measured outside a dwelling in a continuously quiet location with little activity or sources of residual sound, and outside a dwelling beside a road with vehicles passing at high speed every few minutes. Clearly these two locations have very different acoustic characteristics and sensitivity to sound, despite having the same L_{A90} level. In this situation the average ($L_{Aeq,T}$) levels may differ by around 20dBA to 30dBA and the maximum ($L_{AMax,T}$) levels may differ by 40dBA or more.

BS8233:2014 Guidance on sound insulation and noise reduction for buildings

D.8 This Standard draws on authoritative guidance such as that issued by the World Health Organisation to identify suitable noise levels for a wide range of different environments. For dwellings these include bedrooms, where the aim is to protect people from sleep disturbance; other habitable rooms that are in use during the day, where the aim is to provide good listening/ communication/ recreational conditions; and outdoor amenity space including gardens.

D.9 This confirms that a steady average level of 30dBA within a bedroom, due to external sound sources, is desirable and that this should not have significant acoustically distinguishing characteristics. For habitable rooms during the day a desirable level is 35dBA.

D.10 For outdoor areas such as gardens and patios a desirable upper average level of 50dBA is stated, with an upper guideline average limit of 55dBA, which would be acceptable in noisier environments. However it is also recognised that for strategic reasons it may be appropriate to permit higher levels, such as for new dwellings in busy urban areas.

National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE) and National Planning Practice Guidance (NPPG)

D.11 These documents clarify Government policy regarding development and noise. There is a presumption in favour of sustainable development and a recognition that when considering sustainability, the various factors that affect the sustainability of a proposed development must be considered collectively.

D.12 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

D.13 Paragraph 123 of NPPF states that:

Planning policies and decisions should aim to:

a. avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

b. mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

c. recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and

d. identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

D.14 The Noise Policy Statement for England (NPSE) sets out the long term vision of Government noise policy by promoting good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

D.15 Paragraph 2.23 of NPSE clarifies the first part of the above excerpt:

a. The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.

D.16 Similarly paragraph 2.24 of NPSE clarifies the second part:

a. The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL (Lowest Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level). It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.

D.17 These make it clear that noise must not be considered in isolation but as part of the overall sustainability and associated impacts of the proposed development. There is no benefit in reducing noise to an excessively low level, particularly if this creates or increases some other adverse impact. Similarly, it may be appropriate for noise to have an adverse impact if this is outweighed by the reduction or removal of some other adverse impact that is of greater significance when considering the overall sustainability of the proposed development.

D.18 NPSE clarifies the difference between NOEL (No Observed Effect Level) and LOAEL as used in Night Noise Guidelines for Europe, which gives values of 30dB(A) and 40dB(A) for the night time average level measured outside dwellings respectively. This indicates that there may be no significant overall benefit in achieving an average level of less than around 40dB(A) outside dwellings during the night.

D.19 It should also be considered that in order to make equipment quieter it is often necessary to use larger equipment that operates more slowly and for longer periods of time. This may increase energy consumption and hence the carbon footprint of the equipment. The overall impact of this may outweigh any acoustic benefit of the equipment being slightly quieter.

World Health Organisation: Guidelines for Community Noise; Night Noise Guidelines for Europe

D.20 The WHO publication 'Guidelines for Community Noise – 1999' provides guidance regarding suitable levels of noise that will protect vulnerable groups against sleep disturbance. A steady level of 30dB(A) in bedrooms, with occasional maximum levels of 45dB(A) are identified as being suitable to achieve this, with an assumed difference of approximately 15dB(A) between the noise level outdoors and that resulting in the bedroom, assuming that the bedroom windows are partly open for ventilation. This means that the corresponding targets for the noise level outdoors are steady levels of up to about 45dB(A) and occasional maxima of up to around 60dB(A).

D.21 The more recent WHO guidance 'Night Noise Guidelines for Europe – 2009' is more concerned with the longer term average noise levels that are covered by the EU Directive on Environmental Noise, although this does appear to suggest slightly lower external maximum noise levels of around 57dB(A) outside bedrooms during the night.

D.22 Furthermore the 1999 guidance states that: '*To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dBLAeq on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dBLAeq. Where it is practicable and feasible, the lower outdoor level should be considered the maximum desirable sound level for new development.'*

Annex E Assessment of the Impacts

Assessment Method

E.1 Clause 11 states: '*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context*'.

E.2 An initial estimate of the impact should be made by subtracting the background sound level from the rating level, and it may be appropriate to make more than one assessment.

E.3 This initial estimate must then be modified as appropriate to take account of the context. This must consider all pertinent factors including:

- The absolute level of sound. This may be more as or more significant than the difference between the rating and background sound levels, particularly where the residual sound level is particularly high or low.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor and whether the receptor may be protected by specific measures that will reduce the impact in comparison to receptors without such protection.

Specific Considerations

E.4 Clause 8.1 includes the following: '*the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes*'.

E.5 Annex A of the Standard provides an increased number of examples of how to use the standard to obtain ratings for various different scenarios. This states that: '*These examples illustrate how the standard could be applied and are not to be taken as a definitive interpretation of how it is intended to be used*'.

E.6 Examples 6, 7 & 8 of Annex A *'show how similar sound levels can produce different results, depending primarily upon the context in which the sound occurs'*. Examples 6 & 8 specifically consider the likely significance of the specific sound during the night on residents *'who could be sleeping with open bedroom windows'*. In this case other guidance such as BS8233 might also be applicable for several reasons:

- At low external residual sound levels the sound level within a dwelling with open windows is likely to be controlled not by the external residual sound level but by sounds created within the dwelling by a range of sources including refrigerators, pumps, boilers, water flowing through pipes, conversation, radios/ televisions, equipment cooling fans, animals, and even people breathing particularly when considering sound during the night.
- During the night people the level and character of sound outside a dwelling is of less significance than the acoustic environment within bedrooms and its suitability for going to sleep or not disturbing residents whilst asleep.
- The World Health Organisation provides authoritative guidance regarding suitable sound levels in bedrooms, from which the guidance in BS8233 is derived.

Annex F Competence & Experience

F.1 Belair Research Limited has the advantage of personnel that were directly involved in the drafting of the original 1967 edition of BS4142 and the most recent 2014 edition, who have specialised in the measurement, assessment and control of noise from industrial and commercial sources throughout their careers. This type of work forms a major part of our activity and has done so for several decades. Our culture, systems and working practices are geared towards ensuring that this type of work is consistently undertaken to the high and robust level of quality for which we are known.

F.2 **Richard Collman** has specialised in acoustic engineering for half a century and was the founding director of Belair Research Limited (BRL) in 1981. He was seconded onto the BSI committee that drafted the original 1967 version of BS4142 and has been involved in the assessment of sound from industrial and commercial plant since then. He pioneered the consideration of sustainability as part of acoustic assessments rather than simply assessing the level and character of noise in isolation.

F.3 **Richard A Collman** now has overall responsibility for BRL's activities including BS4142 assessments. He graduated with a BSc (Class I) in Acoustics and Computer Science from Salford University in 1984, being awarded the course prize in both the second and final years. He is a Chartered Engineer and has specialised in the measurement and assessment of sound from industrial and commercial plant for over 30 years, writing articles and papers on this subject for Acoustics Bulletin and IOA conferences. He pioneered the use of digital instrumentation for short duration consecutive logging rather than longer term statistical averaging measurement techniques. As an expert on sound from refrigeration and air conditioning plant he represented the Institute of Refrigeration on the BSI committee and the Drafting Panel responsible for the 2014 edition of BS4142, presented the section on Uncertainty at the BS4142 Launch Meeting in November 2014, and authored an associated Technical Article in Acoustics Bulletin. He has been closely involved in the development of BRL's BS4142 measurement, assessment and reporting system to ensure that it is fully compliant with all aspects of BS4142.

F.4 **Lee Dursley,** Senior Acoustician has specialised in the measurement and assessment of sound from commercial and industrial sites for over 10 years. He has a BSc(Hons) in Engineering Physics, a Post Graduate Diploma in Acoustics and Noise Control and is a corporate member of both the Institute of Physics and the Institute of Acoustics. With day to day responsibility for BRL's consultancy activities he has been significantly involved in the development of the measurement, assessment and reporting systems to ensure that they are compliant with the requirements of the latest version of BS4142.

F.5 **Thomas Leach** has a BSc (Hons) in Sound Technology from the University of South Wales, a MSc in Sound and Vibration Studies from the Institute of Sound and Vibration Research, University of Southampton and is currently an associate member of the Institute of Acoustics. Thomas has been an acoustic consultant for nearly 5 years, primarily focused in environmental acoustics for which he has undertaken assessments in accordance with BS4142.

Annex 4 – Environmental Risk Assessment

FICHTNER
Consulting Engineers Limited

GENT FAIRHEAD & CO LIMITED

ENVIRONMENTAL RISK ASSESSMENT

RIVENHALL IWMF

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ENVIRONMENTAL RISK ASSESSMENT
RIVENHALL IWMF

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1 INTRODUCTION

Gent Fairhead & Co Limited is proposing to construct and operate the Rivenhall Integrated Waste Management Facility (IWMF). The Rivenhall IWMF will be located at the former RAF Rivenhall Airfield site. The Installation will comprise the following treatment processes:

- A Materials Recycling Facility (MRF);
- An anaerobic digestion (AD) facility;
- A Mechanical Biological Treatment (MBT) facility;
- A De-inked Paper Pulp Production Facility (Pulp plant);
- Combined Heat and Power (CHP) Plant; and
- Water treatment plant.

The aim of this report is to assess the environmental risks from the activities undertaken at the installation.

Within the permit application, the applicant is required to demonstrate that the necessary measures are in place to protect the environment and ensure that the Installation, throughout its life, will not pose an unacceptable risk to the environment.

The aim of this document is to:

a) identify potential risks that the activity may present to the environment;
b) screen out those that are insignificant and don't require detailed assessment;
c) identify potentially significant risks, where appropriate;
d) choose the right control measures, where appropriate; and
e) report the findings of the assessment.

This document has been developed to consider the requirements of Environment Agency Guidance Notes H1 Annexes A, C, H and F.

1.1 Risk Assessment Process

This assessment has been developed in accordance with the Environment Agency Guidance Note H1. This guidance promotes four key steps:

a) identify risks from the activity;
b) assess the risks and check that they are acceptable;
c) justify appropriate measures to control the risks; and
d) present the assessment.

1.2 Step 1 – Identify risks

The following report will identify the activities that present different types of risk to the environment associated with the operation of the Installation, including:

a) odour;
b) noise;
c) fugitive emissions; and
d) accidents.

1.3 Step 2 – Assess the Risk

The report will include an assessment of risks associated with the operation of the Installation, and will identify the:

a) hazard;
b) receptor; and
c) pathway.

1.4 Step 3 – Justify appropriate measures

The report will demonstrate that the applicant has considered the risks associated with the operation of the regulated activities and its directly associated activities, and will identify the control measures which will be in place to demonstrate that the risks are being appropriately managed.

1.5 Step 4 – Present the Assessment

The assessment will conclude by presenting the following:

a) possibility of exposure;

b) consequence; and

c) the overall risk.

The report will present the Overall Risk applying the Environment Agency's H1 criteria, defined as:

a) insignificant;

b) not significant; or

c) significant.

2 Table A1 Odour Risk Assessment and Management Plan

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Odorous emissions may occur during the delivery of waste, reception of waste and the storage and handling of waste prior to processing at the installation.	Immediate area. The nearest residential receptor to the Installation is located at 'The Lodge' which is located approximately 450m from the stack.	Air - Winds generally blow from a south westerly direction.	All wastes received at the installation will be unloaded inside enclosed Waste Reception areas. Wastes will be processed on a first-in, first-out principle. The reception halls will be retained at negative pressure. Air from waste reception areas will be extracted and treated as detailed in the Odour Management Plan (Annex 7).	Minimal.	Odour annoyance which will have more impact in summer when people are outdoors and temperatures are higher.	Not significant if managed well.
Odorous emissions may occur during the preparation and feed of organics to the digester and during digestion.	Immediate area. The nearest residential receptor to the Installation is located at 'The Lodge' which is located approximately 450m from the stack.	Air - Winds generally blow from a south westerly direction.	The feed of organics preparation takes place within an enclosed building and within enclosed processing equipment. Feed to the digester is contained within pipework and sealed buffer tanks. The digestion process is undertaken in sealed vessels with appropriate containment and pressure control systems. Biogas will be flared if there is excess biogas for combustion.	Minimal.	Odour annoyance which will have more impact in summer when people are outdoors and temperatures are higher.	Not significant if managed well.

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Odorous emissions may occur during the processing of digestate after the anaerobic digestion plant prior to transfer off-site.	Immediate area. The nearest residential receptor to the Installation is located at 'The Lodge' which is located approximately 450m from the stack.	Air - Winds generally blow from a south westerly direction.	Air will be extracted from processing areas and treated in a biofilter prior to release to atmosphere via the stack.	Minimal.	Odour annoyance which will have more impact in summer when people are outdoors and temperatures are higher.	Not significant if managed well.

3 Table A2 Noise Risk Assessment and Management Plan

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Noise from plant items such as the waste treatment processes, heat recovery boiler, exhaust air fans, the stack exhaust, steam turbine, cooling condensers, and noise radiation from the building envelope itself etc.	Immediate area. The nearest residential receptor to the Installation is located at 'The Lodge' which is located approximately 450m from the stack.	Sound propagation through air and the ground.	Noisy plant items, where practicable, will be installed inside buildings rather than outside and where appropriate they will be fitted with noise insulation. The Installation will be designed to reduce noise and tonal components. Regular maintenance of plant items. Additional recommendations detailed in the Noise assessment in Annex 3 will also be completed.	Minimal.	Annoyance.	Not significant if managed well. See Noise Assessment, Annex 3 for further information on the impact of noise emissions.
Noise from vehicle movements	Immediate area.	Sound propagation through air and the ground.	Waste deliveries will shall only be delivered between 0700 and 1830 from Monday to Friday and between 0700 and 1300 on Saturdays. Additional recommendations detailed in the Noise assessment in Annex 3 will also be completed.	Minimal.	Annoyance.	Not significant if managed well. See Noise Assessment, Annex 3 for further information on the impact of noise emissions.

4 Table A3 Fugitive Emissions Risk Assessment and Management Plan

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Emission releases from main building when opening/closing doors.	Immediate area - air	Air, surface runoff, direct contact.	All waste handling activities will be undertaken within enclosed buildings.	Low	Nuisance, dust on clothing and cars	Insignificant
Spillage of waste during delivery and offloading	Immediate area – air, land, water	Air, surface runoff.	All waste handling activities will be undertaken within enclosed buildings.	Low	Nuisance and dust	Insignificant
Dust from waste deliveries being blown off-site	Immediate area – air, land	Air, surface runoff.	All waste handling activities will be undertaken within enclosed buildings.	Low	Nuisance and dust	Insignificant
Bottom ash discharge from the waste incineration plant	Immediate area - air	Air, surface runoff, direct contact.	Once removed from the combustion chamber by the bottom ash extractors, the bottom ash is then discharged to an ash quench system, prior to storage in a bottom ash storage area.	Low	Nuisance	Insignificant
Sludge from the Pulp Plant	Immediate area – air, water	Air, surface runoff, direct contact.	Once dewatered the sludge will be discharged into an enclosed sludge storage area. The drainage from the sludge storage area will be used as feedwater water for the ash quench.	Low	Nuisance, water pollution.	Insignificant

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely it this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Sludge from the Wastewater Treatment Plant	Immediate area – air, water	Air, surface runoff, direct contact.	The sludge will be discharged into an enclosed sludge storage area prior to combustion within the CHP Plant. The drainage from the sludge storage area will be used as feedwater for the ash quench.	Low	Nuisance, water pollution	Insignificant
Discharge of Air Pollution Control residues (APCr) when emptying the APCr silo.	Immediate area– air, land	Air, surface runoff, direct contact.	When unloading the APCr silo, negative pressure will be maintained to prevent releases into the atmosphere.	Low	Nuisance, release of hazardous dust	Insignificant
Reagent and chemical discharges when filling silos.	Immediate area – air	Air, surface runoff, direct contact.	Reagents will be delivered in sealed tankers and off-loaded via a standard hose connection. Air displaced from the silo will be discharged through fabric filters on the top of the silo. Regular inspections/maintenance of abatement equipment. Unloading activities will only be undertaken in areas of hard standing with contained drainage.	Low	Nuisance	Insignificant
Lime leak during injection into APC system.	Immediate area – air	Air, surface runoff, direct contact.	Systems are enclosed and regular inspections/maintenance will be carried out. Reagent will be injected via a completely enclosed dosing and conveying system.	Low	Nuisance	Insignificant

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely it this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Spillage of air pollution control reagents when capping or changing filter bags.	Immediate area – air, land	Air, surface runoff, direct contact.	Enclosed system. Kept under suction by the ID fan. The fabric filter will have a number of cells. When capping or changing bags, the relevant cell will be shut down for a sufficient time to enable the dust to settle.	Low	Nuisance, release of hazardous dust	Insignificant
Spillage/leak of liquid chemicals, when tanker off-loading	Immediate area – air, land	Air, direct contact.	Deliveries will be from sealed tankers and off-loaded via a hose. Spillage will be prevented by good operating procedures, high tank level alarm/trips etc. Tanks will be located within suitably designed secondary containment.	Low	Liquid or vapour release	Insignificant
Spillage/leak when unloading from delivery vehicles chemical containers (IBC's, FIBC's, drums, etc)	Immediate area – air, land	Air, direct contact.	Deliveries will be from road vehicles and off-loaded via mobile plant. Potential leaks/spills will be prevented by experienced mobile equipment operators undertaking unloading activities. Unloading activities will only be undertaken in areas of hard standing with contained drainage. Chemical containers will be stored within suitably designed secondary containment.	Low	Hazardous liquid or vapour release	Insignificant
Release off-site of litter.	Immediate area – air, land	Air, direct contact.	Loading/unloading of all waste vehicles will be within enclosed buildings.	Low	Nuisance, dust on cars and road	Insignificant

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Release of dusts from the transfer off-site of bottom ash and sludge	Immediate area – air, land	Air, direct contact.	Loading of bottom ash and sludge into vehicles will be undertaken within enclosed buildings. Bottom ash and sludge will be transferred off-site in covered road vehicles.	Low	Nuisance, dust on cars and road	Insignificant
Re-suspension of dust from road surface, when site vehicles arrive/leave.	Immediate area – air, land, water	Air, surface runoff.	Control speeds, maintain the condition of the road, and take due care and attention of trafficking conditions.	Low	Nuisance, dust on cars and road	Insignificant
Release of recovered pulp fibre during transfer off-site	Immediate area – air, land	Air, direct contact.	The pulp will be dried and pressed into boards prior to loading onto contained vehicles within enclosed buildings.	Low	Nuisance, dust on cars and road	Insignificant

5 TABLE A4 ACCIDENTS RISK ASSESSMENT AND MANAGEMENT PLAN

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Spill during unloading of chemicals	Immediate area – air, land, water	Direct contact	Training in unloading practices. Under manual control, continual observation. Impervious surfaces outdoors. Containment of drainage from chemical handling areas,	Unlikely	Low	Not significant
Overfilling of vessels	Local environment air, land, water	Surface runoff, wind.	Training in unloading practices. Under manual control, continual observation. Impervious surfaces outdoors. High level alarms. Secondary containment for storage vessels.	Unlikely	Low	Not significant
Leak of demineralised water treatment and boiler water treatment chemicals	Immediate area - water	Surface runoff	Secondary containment for storage vessels. Routine inspection and maintenance. Impervious surface indoor, separate drains for process water.	Unlikely	Pollution of surface water	Not significant
Flue gas leak	Local environment - air	Air	Design standards. Inspection and maintenance programme. Controls and alarms for pressure. Most of the systems are retained at negative pressure.	Very unlikely	Pollution of atmosphere, health impacts	Not significant
Fuel storage failure in the CHP Plant	Immediate area - litter	Direct contact	Storage of waste in a dedicated waste storage bunker.	Unlikely	Litter	Insignificant

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Control failure leading to combustion control upset	Local environment - air	Air - Winds generally blow from a south westerly direction.	Fuel inspection. Design of control system. Monitoring of combustion conditions. Maintenance of combustion air systems.	Unlikely	Pollution of atmosphere (short term), human health	Not significant
Failure of emission abatement equipment	Local environment - air	Air - Winds generally blow from a south westerly direction.	Regular maintenance, inspections. Redundancy of critical equipment or spares on stock.	Unlikely	Pollution of atmosphere, human health	Not significant
Failure of emission monitoring systems	Immediate area - air	Air - Winds generally blow from a south westerly direction.	Regular maintenance, inspections. Back-up CEMS system will be available.	Unlikely	Lack of data, public concern.	Not significant
Failure of containment (e.g. bund)	Immediate area – water, land	Surface runoff, wind, leaching.	Regular inspections of bunds.	Unlikely	Pollution of surface water	Not significant
Making the wrong connections to drains	Local environment – water	Direct contact, leaching.	Detailed site drainage plan, which will be available to all staff.	Low	Pollution of surface water	Not significant
Preventing incompatible substances coming into contact	Immediate area	Surface runoff, wind, direct contact.	Due care and attention.	Low	Low	Not significant
Unwanted reactions	Immediate area	Surface runoff, wind, direct contact.	Due care and attention.	Unlikely	Low	Not significant

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Loss of power	None	N/A	Back-up generation for combustion control systems. Controlled shutdown of the pulp and wastewater treatment plants.	Low	None	Not significant
Loss of compressed air	None	N/A	Multiple compressors, backup power supplies.	Low	None	Not significant
Loss of boiler water	None	N/A	Failsafe shutdown.	Low	None	Not significant
Steam leak to plant building/atmosphere	Noise, Visual	Air	Statutory design, fabrication and inspection standards for steam systems. Controls and alarms for pressure. Routine operator checks.	Low	Nuisance from noise and visual impact	Not significant
Residues handling failure	Immediate area – air, land, water	Direct contact	Training in residue handling practices. Contained transfer systems. Impervious surfaces in residue handling areas with designated drainage systems in areas where residues are stored	Unlikely	Pollution of surface waters	Not significant
Fires in FGT bag filter	Local environment	Air - Winds generally blow from a south westerly direction.	Temperature measurement in filter, fire-fighting fighting and detection systems.	Low	Dust, pollution of air	Not significant
Fire in furnace / feed system	Immediate area - air	Air	Furnace charging procedures / training. Level indicator in chute. Fire detection and fighting systems.	Low	Pollution of air	Not significant

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely it this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Over pressurisation of the boiler	Immediate area – air	Direct contact	The boiler will be fitted with a pressure release valve which will open to prevent the risk of an explosion within the boiler.	Low	Pollution of air	Not significant
Fires in all waste reception storage and handling areas	Immediate area – air	Direct contact	Fire detection systems, water sprinklers and fire hoses. Fire marshals.	Low	Visual impact, pollution of air	Not significant
Generation of excess process waste waters from pulp plant	Immediate area – water	Surface runoff, direct contact	Excess containment capacity will be maintained in a Buffer tank within the waste water treatment plant. The Buffer tank will provide storage of process water prior to treatment.	Low	Pollution of water	Insignificant
Failure of the waste water treatment system	Immediate area – water	Surface runoff, direct contact	Treated process water is analysed prior to release. Each batch will be analysed prior to release to the lagoon. Any batch which does not achieve the required standards will be returned to the treatment plant for further treatment.	Low	Pollution of water	Insignificant
Fire from ignition of lube oil leak	Immediate area – air	Wind, direct contact	Use of fire-proof lube oil. Fire detection and protection systems.	Low	Visual	Not significant

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Possibility of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely it this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains? The balance and probability and consequence.**
Contaminated fire water	Immediate area – water, land	Surface runoff, leaching.	Site drainage for external areas will be fitted with a shut-off alarm, linked to the fire detection systems to contain any firefighting water from external areas. Additional storage will be available from site kerbing.	Low	Pollution of surface water	Not significant
Failure to contain firewater	Land	Land, water, ground water	Maintenance of the shut-off valve within the drainage system. Inspection and maintenance of roadways and areas of hardstanding.	Unlikely	Release of chemicals to water	Not significant
Vandalism	Immediate area	Land, air, water	Security fences, controlled entrance to the site.	Low	Release of substances to any environment	Not significant
Flooding of the water storage lagoon.	Land, Water.	Flood water	Storm attenuation capacity to be maintained within the lagoon.	Low	Release of surface water	Insignificant

6 Detailed Assessment

The environmental impact of the Installation has been evaluated using the H1 software tool as described in Part 2 of Technical Guidance Note EPR-H1, presented in Appendix A. This assessment has been expanded by a more comprehensive Dispersion Modelling Assessment (see Annex 5) and a Noise Assessment (see Annex 3).

6.1 Emissions to Air

An assessment of emissions to air has been undertaken using the Environment Agency's assessment tool H1. The H1 assessment is presented in Appendix A of this report.

A more detailed assessment and discussion of the emissions to air has been presented within the Dispersion Modelling Assessment which is contained within Annex 5. In summary, as presented within the Dispersion Modelling Assessment, the Installation is not predicted to have a significant impact on local air quality, the general population or the local community.

6.1.1 Habitats Assessment

There are a number of habitat sites within the Environment Agency screening distances. These habitat sites are presented in **Error! Reference source not found.**.

Table 6.1: Sensitive Ecological Receptors

Site	Location (m)		Distance from the Main Stack at Closest Point (km)	Lichens identified as present within APIS database
	x	y		
European designated sites (within 10km)				
None identified	-	-	-	-
UK designated sites (SSSIs) (within 2km)				
None identified	-	-	-	-
Locally designated sites (within 2km)				
Blackwater Plantation	582769	222075	1.7	-
Maxeys Spring	582730	220038	0.5	-
Storeys Wood	581843	220964	0.8	-

An assessment of the impact of the Installation upon these habitat sites is presented in Annex 5. A summary of the assessment is as follows:

(1) No European or UK designated site have been identified as requiring consideration within this air quality assessment.

(2) A number of non-statutory designated sites have been identified within 2km of the facility. APIS does not include site specific Critical Loads for non-statutory designated sites. In lieu of this the search-by-location function of APIS has been used. The broad habitat type has been assumed. The assessment has concluded that emissions are not significant. This conclusion has been drawn because the process contribution is less than 100% of the Critical Level or Load.

6.2 Emissions to Water

There will no process emissions to water or sewer from the installation. Process effluents will be recirculated, reused or treated. The water (from the Pulp plant) which is treated within the wastewater treatment plant will be recycled into the process as process feedwater.

The installation will give rise to surface water run-off from roads, vehicle parking areas, building roofs, hard-standings and hard landscaped areas. Surface water run-off from these areas will be discharged to the Upper Lagoon which is adjacent to the installation. The lagoon will be used to store uncontaminated run-off these areas prior to re-use within the installation.

External areas of hardstanding will be provided with curbed containment, where appropriate, to prevent any potential spills from causing pollution of the ground/groundwater and surface water.

All chemicals will be stored in an appropriate manner incorporating the use of bunding and other measures (such as acid and alkali resistant coatings) to ensure appropriate containment. The potential for accidents, and associated environmental impacts, is therefore limited.

Adequate quantities of spillage absorbent materials will be made available on-site, at an easily accessible location(s), where liquids are stored. A site drainage plan, including the locations of foul and surface water drains and interceptors will be made available on-site, where practicable.

Unloading of chemicals will take place within areas of concrete hardstanding with falls to a gully and/or a sump.

6.3 Noise

The impact of noise from the Installation is considered in the noise assessment contained in Annex 3.

6.4 Visual Impact

The visual impact of the plant buildings have not been considered in this application, since this is primarily a matter for the planning authorities.

6.5 Odour

An odour management plan for the installation is presented in Annex 7.

6.6 Photochemical Ozone Creation

Releases of CO, NO_2, SO_2 and benzene contribute to the generation of excess tropospheric ozone, while releases of NO remove ozone from the atmosphere. The annual releases of these substances can be ascribed a photochemical ozone creation potential (POCP). Values for the POCP values relative to ethylene are stated in Annex (f) of Technical Guidance Note EPR-H1 as:

a) CO 2.7

b) NO_2 2.8

c) SO_2 4.8

d) Benzene 21.8

e) NO -42.7

The total POCP for the plant is calculated in the H1 Software Tool as 6,014 tonnes, on the assumption that all NO_x is released as NO_2.

6.7 Global Warming

The assessment of the contribution of the Installation to Global Warming is complex. On the one hand, the Installation releases carbon dioxide to the atmosphere by the combustion of gasoil and RDF. On the other hand, the Installation generates electricity, which displaces other electricity generation, which would release carbon dioxide from the combustion of fossil fuels.

In accordance with the Environment Agency requirements, a Greenhouse Gas Assessment which considers the direct and indirect emissions from the combustion of RDF within the Installation and compares this with the emissions produced if the electricity were produced by conventional fossil fuel power station has been presented in Annex 5.

6.8 Disposal of Waste

Methods for reducing the impact from waste disposal are considered in section 2.8 of the supporting information.

7 CONCLUSIONS

As presented in this report, the Installation is considered to contain appropriate control measures and management systems to ensure that the Installation does not have any significant impacts upon the local environment.

Appendix A - H1 Assessment

Annex 5 – Air Quality Assessment

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RIVENHALL IWMF

GREENHOUSE GAS ASSESSMENT

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1 INTRODUCTION

The aim of this report is to assess the impact of greenhouse gas emissions, as previously required by the Environment Agency for similar power generating activities. The assessment considers the direct greenhouse gas emissions from the proposed power generating activities at the Rivenhall IWMF (the Installation) and considers these in relation to other forms of power generation in the UK.

The Installation will generate power from two sources:

(1) The incineration of waste in the CHP Plant; and

(2) The combustion of biogas generated from anaerobic digestion (AD) of waste.

In this report, we have examined the amount of greenhouse gas released through the incineration of waste and the combustion of biogas from the anaerobic digestion of organic waste. We have calculated emissions of CO_2, and we have presented the quantities of other greenhouse gases released (for example N_2O) as a CO_2 equivalent.

Power generated through energy recovery from waste displaces electricity that would have otherwise been sourced from conventional power stations. Therefore, we have calculated the net change in carbon dioxide emissions as a result of using waste to generate electricity rather than generating it by conventional means (based on the average UK power mix). For the purpose of this report, the power from renewable sources has been assumed to displace the same power as that generated by conventional means.

This report does not consider the equivalent emissions of carbon dioxide from the power consumed by the Installation other than that consumed by the CHP plant and the AD plant and indirect carbon dioxide emissions associated with the operation of the installation.

2 ASSUMPTIONS

2.1 CHP Plant

For the purposes of this assessment the following assumptions have been applied to the CHP Plant:

(1) The facility has a maximum capacity of 595,000 tonnes per annum.

(2) The facility will have a maximum availability of 8,150 hours operation.

(3) The facility will generate up to 49 MWe with a parasitic load of 5.5MWe.

(4) The composition of the RDF combusted in the facility as follows:

- The composition of combustible C&I waste, contains 35% carbon by weight; and
- 64% of the carbon content of the incoming waste is biodegradable, as defined by the Government in the legislation for the Landfill Allowance Trading Scheme.

(5) Nitrous oxide is emitted at a concentration of 10 mg/m^3.

(6) The facility will be in start-up and shut down for 170 hours per annum.

(7) During periods when the facility is not available, the parasitic load will be 20% of the operational load. Therefore the facility will have a non-availability of 590 hours per annum with a parasitic load of 1.1MW.

(8) The volumetric flow of flue gases from the CHP Plant is 184,902 Nm^3/hr.

(9) The facility will have 10 start-ups and shut-downs per annum. Each start-up will take 16 hours, and each period of shut-down will take 1 hour. Therefore, the auxiliary burners will be in operation for 170 hours per annum.

(10) The burners will operate at 60% of the maximum continuous rating of the thermal capacity of the facility. Therefore the burner capacity will be approximately 96MW.

(11) As stated in Environment Agency Guidance Note H1 (h) the combustion of heavy fuel has emissions of 0.26 t CO_2/MWh.

2.2 AD Plant

For the purposes of this assessment, the following assumptions have been applied to the operation of the AD plant:

(1) The facility will generate up to 1MWe with a parasitic load of 0.2MWe.

(2) The facility will be available to operate for 8,352 hours per annum. During periods when the facility is not available the facility will operate at 20% of the parasitic load.

(3) The power generated by the AD plant is considered to be generated from Renewable Sources. As stated in Environment Agency guidance note H1 Annex H – Global Warming Potential, 'carbon dioxide released from the conversion of renewable sources, a factor of zero should be assigned'. The guidance explains that renewable non-fossil energy sources include biomass, landfill gas, sewage treatment plant gas and biogas.

3 Displaced Power

Table 3.1 shows the energy sources for UK electricity generation, with their associated carbon intensities. It is important to consider which of these power sources would be displaced by the power generated by the installation.

Table 3.1 - UK Electricity Supply Characteristics[1]

Energy source	Proportion of UK supply (%)	Carbon emissions during operation (gCO_2/kWh)
Coal	52.3	910
Natural gas	30.7	390
Nuclear	4.7	0
Renewables	8.3	0
Other	4.0	590

Current energy strategy uses nuclear power stations to operate as baseload stations run with a relatively constant output over a daily and annual basis. Power supplied from them is relatively low in cost and has the benefit of extremely low CO_2 emissions. Electricity generated from renewable energy is more expensive than non-renewable sources although, due to the benefit of very low greenhouse gas emissions, it is encouraged through government policies. For these reasons, the construction and operation of nuclear and renewable power stations would not be greatly influenced by that which would otherwise be generated by the installation.

It is most likely that the power displaced by the Rivenhall IWMF would otherwise be generated by gas-fired combined cycle gas turbine (CCGT) power plants, or from coal fired power plants. Generation using CCGT technology is more thermally efficient and presently has a lower average cost per unit of electricity produced than coal-fired power plants. Economics of operation dictate that either coal or gas may be preferable at any particular time, which would affect the specific release of carbon dioxide.

The change in carbon dioxide emissions estimated for the Installation has been based on the UK ratio of coal-fired to gas-fired generation in 2012/13, as presented in Table 3.1. On this basis, the proportion of coal-fired generation is 52.3 / (52.3 + 30.7) = 63.0%, which gives an average carbon intensity of 63.0% × 910 + 37.0% × 390 = 718 g of carbon dioxide released per kWh of power generated. Therefore, for the purposes of this assessment it is assumed that the carbon dioxide emissions from a fossil fuel fired power station, is equivalent to 718 g/kWh.

We have made the following assumptions regarding the energy outputs from the installation.

- The CHP Plant will generate up to 49 MW of electricity with a net output of 5.5MW, giving a gross and net electrical efficiency of 26.0% and 22.8% respectively.
- The AD facility will generated up to 1 MW of electricity with a net output of 0.8 MW, assuming 8,352 hours operation.

[1] Department of Energy and Climate Change. Fuel Mix Disclosure data table (1 April 2012 – 31 March 2013)

- For the purposes of this greenhouse gas assessment there will be no heat export from the CHP Plant or the AD plant. It should be noted that the CHP Plant will supply heat to the Pulp Plant. If this heat export was included within the assessment it would lead to a more thermally efficient process, and therefore a more favourable assessment.

On this basis:

- The CHP Plant will generate approximately 399,000 MWh of power per annum. Of this power approximately 348,000 MWh per annum will be available for export. This will displace a total of approximately 249,700 tonnes of carbon dioxide equivalent.
- The AD facility will export approximately 6,680 MWh of power per annum and this will displace a total of approximately 4,800 tonnes of carbon dioxide equivalent.
- In total the installation will export approximately 354,680 MWh of power per annum. This will displace up to approximately 254,500 tonnes of carbon dioxide.

4 EMISSIONS FROM THE IWMF

The CHP Plant will release carbon dioxide from the combustion of the carbon content of commercial and industrial (C&I) waste; and the combustion of biogas produced from the processing of organic waste within the AD facility.

4.1 CHP Plant

For the purposes of this assessment carbon dioxide released from the combustion of fuel oil used for auxiliary firing within the CHP Plant is included as a global warming contributor.

During start-up, auxiliary burners fired with fuel oil will be used to raise the temperature within the boiler to 850°C before starting to feed waste into the combustion chamber, as required by the Industrial Emissions Directive (IED). These burners will also be used to maintain the temperature within the boiler above 850°C when needed, as required by the IED. During shut-down, the auxiliary burners will be used to ensure complete burn-out of the waste. The combustion of natural gas will release carbon dioxide.

4.1.1 Emissions from the Process

The CHP Plant will export 585 kW of power per tonne of input waste.

The carbon dioxide equivalent emissions would be 1,283kg per tonne of input waste, of which 477 kg is derived from fossil fuels (approximately 462kg CO_2 and 15 kg N_2O).

The total carbon dioxide equivalent emissions from fossil fuels (excluding auxiliary fuels) will be approximately 300,100 tonnes per year (approximately 274,900 tonnes CO_2 and 25,900 tonnes N_2O).

4.1.2 Electricity Import

During periods of start-up and shutdown the CHP Plant will have an electrical demand of approximately 850 MWh electricity; and during periods of non-availability the facility will have an electrical demand of approximately 650 MWh electricity. Therefore the CHP Plant will consume approximately 1,500 MWh of electricity per annum.

As stated in Environment Agency Guidance Note H1 (h) the import of electricity from public supply should be assumed to have emissions of 0.166 t CO_2/MWh. Therefore the CHP Plant is anticipated to release approximately 600 tonnes per year of carbon dioxide equivalent from the import of electricity.

4.1.3 Emissions from Auxiliary Firing

The auxiliary burners will consume approximately 25,000 MWh of fuel oil per annum and there will be a total of approximately 6,250 tonnes per year of CO_2 equivalent from the combustion of fuel oil for auxiliary firing.

4.2 AD Facility

4.2.1 Emissions from the Process

Emissions from the combustion of biogas within the AD facility are considered to release approximately 0 tonnes per year of carbon dioxide equivalent.

4.2.2 Electricity Import

During periods of non-availability the facility will have an electrical demand of approximately 340 MWh electricity.

As stated in Environment Agency Guidance Note H1 (h) the import of electricity from public supply should be assumed to have emissions of 0.166 tCO_2/MWh. Therefore the AD facility is anticipated to release approximately 60 tonnes per year of carbon dioxide equivalent from the import of electricity.

4.2.3 Emissions from Firing of Fuel Oil

During normal operation of the AD facility there will be no emissions of carbon dioxide or equivalent from the AD facility. It is acknowledged that heat will be required by a package boiler for the start-up of the AD facility during commissioning. It is not expected that this boiler will be required to operate during normal operation and has therefore not been considered within this assessment.

4.3 Summary

The operation of the power generating processes at the Installation will lead to the release of approximately:

- 274,900 tonnes per year of carbon dioxide equivalent would be released from the incineration of non-biogenic waste;
- 25,900 tonnes per year of carbon dioxide equivalent from nitrous oxide from the incineration process;
- 600 tonnes per year of carbon dioxide equivalent from imported electricity for the incineration facility;
- 6,250 tonnes per year of carbon dioxide equivalent from the combustion of fuel oil for auxiliary firing in the CHP Plant; and
- 60 tonnes per year of carbon dioxide equivalent from imported electricity for the AD facility.

Therefore, in total it is predicted that approximately 245,310 tonnes per year of carbon dioxide equivalent would be released from the Installation.

5 CONCLUSIONS

The information presented within this assessment is summarised below.

	GWP (tonnes CO_2 equivalent)			
Process	**CHP Plant**		**AD Facility**	
Parameter	**Released**	**Saving / Offset**	**Released**	**Saving / Offset**
CO_2 emissions from derived from fossil fuels(a)	274,900		0	
N_2O from the process (urea) (b)	9,200		0	
Indirect CO_2 emissions (imported electricity) (c)	600		3	
Direct CO_2 emissions (auxiliary fuel) (d)	6,200		0	
Total released (e=a+b+c+d)	**245,200**		**60**	
Energy recovered (electricity) (f)		255,600		4,800
Energy recovered (heat) (g)		-		-
Total offset (h=f+g)		255,600		**4,800**
Net GWP (j= e-h)	**-10,400**		**-4,740**	

To conclude, from the operation of the installation there will be a reduction of approximately 15,140[2] tonnes per year of carbon dioxide equivalent from the generation of power from the incineration of MSW and C&I waste and processing of organic waste in the Rivenhall IWMF compared to generating the equivalent power in a conventional power station.

It should be noted that this assessment methodology does not consider the avoidance of emissions from the disposal of the waste in a landfill, or from any other alternative methods of waste treatment. Furthermore, no allowance has been made for the export of heat from the CHP Plant to the Pulp Plant.

[2] A WRATE assessment was completed for the original IWMF planning application which considered the holistic impact of the facility which included direct and indirect emissions (construction, transport, disposal of residues, etc.). This reported annual savings of greater than 120,000 tonnes of carbon dioxide emissions compared to existing waste management arrangements.

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ABNORMAL EMISSIONS ASSESSMENT

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1 INTRODUCTION

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged to undertake an Abnormal Emissions Assessment to support the Environmental Permit application for the Rivenhall Integrated Waste Management Facility (IWMF).

The only significant source of atmospheric emissions from the Facility will be the stack, containing the multiple flue system. These emissions will be regulated by the Environment Agency under the terms of an Environmental Permit and will comply with the requirements of the Industrial Emissions Directive (IED).

The IWMF will include a Combined Heat and Power (CHP) plant consisting of 2 streams to process up to 595,000 tonnes per annum of non-hazardous Solid Recovered Fuel (SRF) and Refuse Derived Fuel (RDF). Due to the nature of the feedstock the Facility will require an Environmental Permit to operate which will include limits on emissions to air based on those outlined in Annex VI of the IED for waste incineration plants. This will include limits on emissions of oxides of nitrogen, sulphur dioxide, heavy metals and dioxins and furans.

The Environmental Permitting Regulations require that abnormal event scenarios are considered.

Article 46(6) of the IED states that:

> *"… the waste incineration plant … shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded.*
>
> *The cumulative duration or operation in such conditions over 1 year shall not exceed 60 hours."*

Article 47 continues with:

> *"In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored."*

The conditions detailed in Article 46(6) are considered to be "abnormal operating conditions" for the purpose of this assessment and only applies to the CHP plant.

2 Identification of Abnormal Operating Conditions

The following are considered to be examples of abnormal operating conditions which may lead to 'abnormal emission levels' of pollutants:

(1) Reduced efficiency of sodium bicarbonate injection system such as through blockages or failure of fans leading to elevated acid gas emissions (with the exception of hydrogen chloride);

(2) Complete failure of the sodium bicarbonate injection system leading to unabated emissions of hydrogen chloride. (Note: this would require the plant to have complete failure of the bag filter system. As a plant of modern design the plant would have shut down before reaching these operating conditions);

(3) Reduced efficiency of particulate filtration system due to bag failure and inadequate isolation, leading to elevated particulate emissions and metals in the particulate phase;

(4) Reduced efficiency of the Selective Non-Catalytic Reduction (SNCR) system as a result of blockages or failure of ammonia injection system, leading to elevated oxides of nitrogen emissions; and

(5) Complete failure of the activated carbon injection system and loss of temperature control leading to high levels of dioxin reformation and their unabated release.

As a modern design, it is anticipated that the proposed Facility would be operated to a high degree of compliance. Therefore the identification of plausible abnormal emission levels has been based primarily on the data obtained from modern plants. Where actual data is not available, worst case conservative assumptions have been made.

2.1 Plant start-up and shutdown

Start-up of the CHP plant from cold will be conducted with clean support fuel (low sulphur light fuel oil). Waste is not introduced into the CHP plant unless the temperature is above the minimum requirement (850ºC) and other operating parameters (for example, air flow and oxygen levels) are within the range stipulated in the permit. During the warming up period the gas cleaning plant will be operational as will be the control systems and monitoring equipment.

The same is true during plant shutdown. The waste remaining on the grate is allowed to burn out, the temperature not being permitted to drop below 850ºC by the simultaneous introduction of clean support auxiliary fuel. After complete burnout of the waste, the burners are turned off and the plant is allowed to cool. During this period the gas cleaning equipment is fully operational, as will be the control systems and monitoring equipment.

It should also be noted that start-up and shutdown are infrequent events; the CHP plant is designed to operate continuously, and ideally only close down for its annual maintenance programme.

In relation to the magnitude of dioxin emissions during plant start-up and shutdown, recent research has been undertaken by AEA Technology on behalf of the Environment Agency . Whilst elevated emissions of dioxins (within one order of magnitude) were found during shutdown and start-up phases where the waste was not fully established on the grate, the report concluded that:

"The mass of dioxin emitted during start-up and shutdown for a 4-5 day planned outage was similar to the emission which would have occurred during normal operation in the same period. The emission during the shutdown and restart is equivalent to less than 1 % of the estimated annual emission (if operating normally all year)."

There is therefore no reason why such start-up and shutdown operations will affect the long term impact of the Facility.

3 Plausible Abnormal Emission Levels

The following plausible abnormal emission levels for the proposed CHP plant have been identified based on the performance of similar plants in the UK. The plausible abnormal emissions concentrations are presented in Table 1, where available, these have been based on measured data from a comparable Facility.

Table 1: Plausible Abnormal Emissions from an EfW

Pollutant	WID Permitted Emission, (mg/m³)		Plausible Abnormal Emission, (mg/m³)	% Above Max Permitted Emission
	Daily Average	½ hourly max		
Oxides of nitrogen	200	400	550	38
Particulate matter (PM_{10}s)	10	30	150(1)	400
Sulphur dioxide	50	200	480	125
Hydrogen chloride	10	60	900(2)	1,400
Hydrogen fluoride	1	4	90	2,150
Dioxins		0.1 ng/m^3 (3)	10 ng/m^3 (4)	9900

(1) Taken from the Industrial Emissions Directive.
(2) Based on information presented in the Devonport Decision Document
(3) *As previously requested by the Environment Agency.*

A number of assumptions have been made with regard to the emissions of individual metals.

(1) Emission concentration of mercury has been assumed to be 100% of the WID emission concentration of 0.05mg/m³.

(2) Emission concentration of cadmium has been taken as half the WID emission concentration for cadmium and thallium and compounds of 0.05mg/m³.

(3) Emission concentration of heavy metals that have a short or long term EAL have been considered (antimony, arsenic, chromium, copper, lead, manganese, nickel, vanadium) and have been taken from "Environment Agency Guidance to Applicants on Metals Impact Assessment for Stack Emissions (September 2012 Version 3". This guidance summarises the existing emissions from 19 EfW facilities in the UK over a period between 2007 and 2009.

(4) Emission concentration of chromium (VI) is based on the ratio of the effective chromium (VI) emission concentration presented in the "Environment Agency Guidance to Applicants on Metals Impact Assessment for Stack Emissions (September 2012 Version 3", to total metals emission.

(5) The Predicted Abnormal Emission are calculated based on 15 times the emission concentration, as it is assumed that metals are in the particulate phase.

The plausible abnormal emissions concentrations are presented in Table 2 for metals.

Table 2: Predicted Abnormal Metal Emissions from an EfW			
Pollutant	**Emission Concentrations (µg/m³)**	**Predicted Abnormal Emission (µg/m³)**	**% Above Max Permitted Emission**
Antimony	11.5	172.5	1400
Arsenic	3	45	1400
Cadmium	25	375	1400
Chromium	52.1	781.5	1400
Chromium (VI)	0.013546	0.20319	1400
Copper	16.3	244.5	1400
Lead	36.8	552	1400
Manganese	36.5	547.5	1400
Mercury	50	750	1400
Nickel	136.2	2043	1400
Vanadium	1	15	1400

The definition of 'abnormal operating conditions' also encompasses periods where the continuous emission monitoring equipment is not operating correctly and data relating to the actual emission concentrations are not available. This assessment has only used data where the concentration of continuously monitored pollutants has been quantified. Furthermore no data on flow characteristics (flow rate, temperature etc) during these abnormal operating conditions is available, so for the purposes of this assessment the design flow characteristics have been applied to the plausible emission levels to derive an emission rate and assess impact.

4 Impact Resulting from Plausible Abnormal Emissions

All point source emissions from the Facility will emit to atmosphere via stacks contained within a common windshield. The effect of this is to have one visible stack. Emissions from this stack will include the two CHP lines, exhaust air from the pulp plant, the two AD gas engines, and the AD biofilter. Although there will be no combustion gases within the exhaust from the pulp plant or the biofilter, the temperature of the release is much lower than the CHP and will impact upon the buoyancy of the plume. The exhaust air from the pulp plant and the bioflter has been included to ensure any reduction in buoyancy is considered in the assessment. For the purpose of this Abnormal Emissions Assessment any process contribution from the AD gas engines has been excluded but the effect that the source has upon the dispersion has been included. This has been done by re-running the dispersion model with the combined flue option but having a zero emission rate for combustion sources from the AD gas engines.

4.1 Predicted short term impacts

In order to assess the effect on short term ground level concentrations associated with the CHP plant operating at the identified abnormal emission concentration, the calculated ground level concentration has been increased pro-rata as presented in Table 3.

Table 3: Short term Impacts Resulting from Plausible Abnormal Emissions

Pollutant	EAL / AQO (µg/m³)	Predicted Impact – IED Half Hourly Limit		Predicted Impact – Abnormal Emission	
		Conc. µg/m³	% of EAL	Conc. µg/m³	% of EAL
Nitrogen dioxide	200	35.0	17.48%	48.1	24.03%
Particulate matter (PM_{10}s)	50	2.0	4.06%	10.2	20.30%
Sulphur dioxide (24-hour)	125	31.4	25.14%	70.7	56.57%
Sulphur dioxide (1-hour)	350	48.9	13.98%	110.1	31.45%
Sulphur dioxide (15-min)	266	54.8	20.59%	123.3	46.34%
Hydrogen chloride	750	18.7	2.49%	279.9	37.32%
Hydrogen fluoride	160	1.2	0.78%	28.0	17.49%
Pollutant	**EAL / AQO (ng/m³)**	**Predicted Impact – IED Daily Average Limits**		**Predicted Impact – Abnormal Emission**	
		Conc. ng/m³	**% of EAL**	**Conc. ng/m³**	**% of EAL**
Antimony	150,000	3.58	0.002%	53.65	0.036%
Chromium	150,000	16.20	0.011%	243.05	0.162%
Copper	200,000	5.07	0.003%	76.04	0.038%
Manganese	1,500,000	11.35	0.001%	170.27	0.011%
Mercury	7,500	15.55	0.207%	233.25	3.110%
Vanadium	1,000	0.31	0.031%	4.67	0.467%

This is considered to be a highly conservative assessment as it assumes that the plausible abnormal emissions coincide with worst case meteorological conditions. Even with these highly conservative factors, there are no exceedences of any of the short term air quality limits. The maximum predicted process contribution (as a % of the applied EAL) is less than 60% for sulphur dioxide with all other pollutants considerably lower.

4.2 Predicted long term impacts

In order to assess the effect on long term ground level concentrations associated with the Facility operating at the identified abnormal emission levels, the calculated long term ground level concentrations have been increased pro-rata as presented in Table 4 and Table 5. This assessment assumes that the Facility is operating at the daily average IED emission limits for 8,700 hours per year and at the plausible abnormal emission levels for 60 hours per year.

Table 4: Long Term Impacts Resulting from Plausible Abnormal Emissions

Pollutant	EAL / AQO (μg/m³)	Predicted Impact – WID Daily Average Limits		Predicted Impact – Abnormal Emission	
		Conc. (μg/m³)	% of EAL	Conc. (μg/m³)	% of EAL
Nitrogen dioxide	40	2.66	6.65%	2.69	6.73%
Particulate matter (PM_{10}s)	40	0.19	0.48%	0.21	0.52%
Hydrogen fluoride	16	0.02	0.12%	0.03	0.19%
Pollutant	**EAL / AQO (ng/m³)**	**Predicted Impact – WID Daily Average Limits**		**Predicted Impact – Abnormal Emission**	
		Conc. (ng/m³)	**% of EAL**	**Conc. (ng/m³)**	**% of EAL**
Antimony	5,000	0.06	0.001%	0.06	0.001%
Arsenic	3	0.22	7.283%	0.24	7.982%
Cadmium	5	0.24	4.750%	0.26	5.205%
Chromium	5,000	0.99	0.020%	1.08	0.022%
Chromium (VI)	0.2	0.000257	0.129%	0.000282	0.141%
Copper	10,000	0.31	0.003%	0.34	0.003%
Lead	250	0.70	0.280%	0.77	0.306%
Manganese	150	0.69	0.462%	0.76	0.507%
Mercury	250	0.95	0.380%	1.04	0.416%
Nickel	20	2.59	12.939%	2.84	14.180%
Vanadium	5,000	0.02	0.000%	0.02	0.00042%

This is considered to be a highly conservative assessment as it assumes that the plausible abnormal emissions coincide with worst case meteorological conditions. Even with these highly conservative factors, there are no exceedences of any of the long term air quality limits. The maximum predicted process contribution (as a % of the applied EAL) is less than 15%.

There is no Air Quality Objective for dioxins against which the impact can be assessed. Therefore to assess the impact of dioxins, the increase for the receptor exposed to the Tolerable Daily Intake has been used to assess whether there will be a significant increase in the impact of dioxins by assessing against the receptor exposed to the Tolerable Daily Intake. As can be seen from the results presented in Table 5 this represents an increase in the maximum ground level concentration of 67.81%.

Table 5: Long Term Impacts from Predicted Dioxin Emissions

Pollutant	Predicted Impact – IED Limits	Predicted Impact –Abnormal Emission	
	pg/m^3	pg/m^3	% increase
Dioxins	1.90	3.19	67.81%

Based on the results of the Human Health Risk Assessment, the receptor receiving the highest dose of dioxins from the Facility is predicted to be exposed to 6.28 % of the Tolerable Daily Intake (TDI) adult farmer at receptor HH25 – Grange Farm. Assuming the impact of abnormal operations, it is calculated that the receptor receiving the highest maximum dose will be exposed to (6.28% x 1.6781) = 10.54 % of the UK TDI for dioxins.

Assuming the conservative factors stated within the modelling, there will be no exceedences of the TDI for dioxins.

5 Predicted Environmental Concentration –Abnormal Operations

Environment Agency guidance note H1 Annex F includes the following method for identifying which emissions require further assessment by applying the following criteria:

- the long term process contribution is <1% of the long term environmental standard; and
- the short term process contribution is <10% of the short term environmental standard.

Where the impact of abnormal emissions is greater than the above criteria consideration of the background concentration has been made to ensure that the AQO/EAL is not exceeded as a result of abnormal operations.

5.1 Background concentrations

Appendix A outlines the values for the annual average background concentrations that have been used to evaluate the impact of the Facility. These are as presented in the Air Quality Assessment submitted with the Environmental Permit application.

5.2 Predicted short term impacts

Table 6 below presents the predicted impacts of plausible abnormal operations in the short term at the point of maximum impact and the Predicted Environmental Concentration (PEC) (process contribution plus background) for those pollutants for which the impact presented in Table 3 is greater than 10%.

Table 6: Short Term PEC Resulting from Plausible Abnormal Emissions

Pollutant	EAL / AQO (µg/m³)	Background Conc.	PC – Abnormal Emissions	PEC – Abnormal Emission	
		µg/m³	µg/m³	µg/m³	% of EAL
Nitrogen dioxide	200	29.8	48.06	77.8	38.92%
Particulate matter (PM_{10}s)	50	39.2	10.15	49.3	98.62%
Particulate matter (PM_{10}s)	50	19.6	10.15	29.7	59.46%
Sulphur dioxide (24-hour)	125	7.3	70.72	78.0	62.41%
Sulphur dioxide (1-hour)	350	7.3	110.07	117.4	33.53%
Sulphur dioxide (15-min)	266	7.3	123.26	130.6	49.08%
Hydrogen chloride	750	1.4	279.90	281.3	37.51%
Hydrogen fluoride	160	4.7	27.99	32.7	20.43%

As shown, the PEC is not predicted to be exceed the AQO/EAL at the point of maximum impact for any pollutant during abnormal operations.

5.3 Predicted long term impact

The following table presents the predicted impacts of plausible abnormal operations in the long term at the point of maximum impact and the PEC. This assessment assumes that the Facility is operating at the daily average IED emission limits for 8,700 hours per year and at the plausible abnormal emission levels for 60 hours per year.

Table 7: Long Term PEC Resulting from Plausible Abnormal Emissions					
Pollutant	EAL / AQO (µg/m³)	Background Conc.	PC – Abnormal Emissions	PEC – Abnormal Emission	
		µg/m³	µg/m³	µg/m³	% of EAL
Nitrogen dioxide	40	14.9	2.69	17.6	43.95%
Pollutant	EAL / AQO (ng/m³)	Background Conc.	PC – Abnormal Emissions (1)	PEC – Abnormal Emission	
		ng/m³	ng/m³	ng/m³	% of EAL
Cadmium	5	0.20	0.26	0.46	9.21%
Arsenic	3	0.81	0.24	1.05	34.98%
Nickel	20	1.43	2.84	4.27	21.33%

(1) The ground level impact has been calculated by apportioning the maximum monitored emission concentration for each metal to the total group 3 metal Process Contribution.

As shown, the PEC is not predicted to be exceed the AQO/EAL at the point of maximum impact for any pollutant during abnormal operations.

6 SUMMARY

An assessment of the impact on air quality associated with abnormal operating conditions from the Facility has identified plausible abnormal emissions based on a review of monitoring data from operational facilities of a similar type in the UK. Notwithstanding the low frequency of occurrence of such abnormal operating conditions identified by the review, the potential impact on air quality has been assessed.

The predicted impact on air quality associated with the identified plausible abnormal emissions has been calculated by pro-rating the impact associated with normal operations by the ratio between the normal and plausible abnormal emission values. This is considered to be a highly conservative assessment as it assumes that the plausible abnormal emissions coincide with the worst case meteorological conditions.

Even with these highly conservative factors, there are no predicted exceedences of any of the short term or long term air quality limits associated with abnormal operations. The maximum predicted short term process contribution (as % of the applied EAL) is less than 60%; and the maximum predicted long term process contribution (as % of the applied EAL) is less than 15%. Abnormal emissions from the Facility will not cause any exceedences of any Air Quality Objective. In addition, there will not be any exceedences of the TDI for dioxins.

It is concluded that during periods of abnormal operation as permissible under the IED (Article 46) is not predicted to give rise to an unacceptable impact on air quality or the environment.

Appendix A – Background Concentrations

Summary of Background Concentrations			
Pollutant	**Annual Mean Concentration**	**Units**	**Justification**
Nitrogen dioxide	14.89	µg/m^3	2011 mapped background dataset maximum grid square within the modelling domain.
Oxides of nitrogen	22.01	µg/m^3	
Sulphur dioxide	3.65	µg/m^3	2001 mapped background dataset maximum grid square within the modelling domain.
Particulate matter (as PM_{10})	19.58	µg/m^3	2011 mapped background dataset maximum grid square within the modelling domain.
Particulate matter (as $PM_{2.5}$)	12.47	µg/m^3	
Carbon monoxide	267	µg/m^3	2001 mapped background dataset maximum grid square within the modelling domain.
Hydrogen chloride	0.72	µg/m^3	Maximum over the past 4 years from all UK monitoring sites.
Hydrogen fluoride	2.35	µg/m^3	Maximum measured baseline hydrogen fluoride concentration as presented in the EPAQS report.
Ammonia	1.48	µg/m^3	Maximum mapped background concentration within the modelling domain – 2011 dataset.
Benzene	0.35	µg/m^3	Maximum mapped background concentration within the modelling domain – 2001 dataset.
1,3-butadiene	0.14	µg/m^3	
Mercury	1.38	ng/m^3	The maximum monitored metal concentration from at a rural site between 2012 and 2013.
Cadmium	0.20	ng/m^3	
Arsenic	0.81	ng/m^3	
Antimony	-	ng/m^3	
Chromium	1.32	ng/m^3	
Cobalt	-	ng/m^3	
Copper	4.44	ng/m^3	
Manganese	3.49	2ng/m^3	
Lead	8.38	ng/m^3	
Nickel	1.43	ng/m^3	
Vanadium	1.75	ng/m^3	
Dioxins and furans	22.82	fg/m^3	The maximum monitored metal concentration from at a rural site between 2008 to 2010
Polychlorinated biphenyl (PCBs)	141.5	pg/m^3	
Benzo(a)pyrene (PaB)	2.00	ng/m^3	Maximum monitored concentration from a background site between 2009 and 2011.

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MANAGEMENT SUMMARY

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged to undertake a Dispersion Modelling Assessment to support the Environmental Permit and Section 72 planning application for the Rivenhall Integrated Waste Management Facility. The proposals include a Combined Heat and Power (CHP) plant, Materials Recovery Facility, Anaerobic Digester, Mechanical Biological Treatment plant, Pulp Facility and Water Treatment Plant. The principal fuel for the CHP plant will be waste. Therefore the Facility will be required to comply with the Industrial Emissions Directive (IED) and the limits on emissions to air will be based on those outlined in Annex VI of the IED for an incinerator. This will include limits on emissions of oxides of nitrogen, sulphur dioxide, heavy metals and dioxins and furans, as well as other substances.

The assessment has been carried out in a number of stages.

(1) Review of Legislation

In the UK, the levels of pollution in the atmosphere are controlled by a number of European Directives, which have been fully implemented, and by the National Air Quality Strategy. These have led to the setting of a number of Air Quality Objectives (AQOs) for the most significant pollutants, such as oxides of nitrogen and particulate matter. The AQOs are set at a level well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups.

For other pollutants, the Environment Agency sets control levels, called Environmental Assessment Levels, based on work by the World Health Organisation and other national and international bodies.

The Environment Agency sets Critical Levels for the protection of ecosystems. In addition it is noted that deposition of nitrogen and acid gases can cause nutrification and acidification of habitats. The Air Pollution Information System provides Critical Loads for different habitats which consider the existing pollution loading for the site.

(2) Review of Ambient Air Quality

Monitoring information collected by the UK Government and by local authorities has been used to assess the current levels of pollutants in the atmosphere close to the Facility.

Where local monitoring data is not available, conservative estimates based on national UK monitoring results have been used as a background concentration.

(3) Identification of Sensitive Receptors

When assessing the impact of the development, the assessment considers the point of maximum impact as a worst-case. In addition, the impact has been assessed at a number of identified sensitive receptors including the closest houses and footpaths, all European statutory designated ecological sites within 10km, and all UK statutory and locally designated ecological sites within 2km of the Facility.

(4) Dispersion Modelling of Emissions

The ADMS 5.1 dispersion model is routinely used for air quality assessments to the satisfaction of local authorities and the Environment Agency. The model uses weather data from the local area was used to predict the spread and movement of the exhaust gases from the stack for each hour over a five year period. The model takes account of wind speed, wind direction, temperature, humidity and the amount of cloud cover, as all of these have an influence on the dispersion of emissions. The model also takes account of the effects of buildings and terrain on the movement of air.

Emissions from the CHP Plant have been assumed to comply with the limits prescribed within Chapter VI of the IED and emissions from the gas-fired boilers have been assumed to comply with the limits prescribed within Environment Agency guidance notes for emissions for gas engines. These sources will emit to atmosphere via a common wind shield. In addition this wind shield will include stacks for the exhaust air from the pulp plant, and the AD biofilter. Although there will be no combustion gases from these additional sources, the temperature of the release is much lower than the CHP and will impact upon the buoyancy of the plume. The exhaust air from the pulp plant and the bioflter has been included to ensure any reduction is buoyancy is considered in the assessment.

To set up the model, it has been assumed that the each item of plant operates for the whole year and releases emissions at the emission limit all the time. In reality, this is very conservative as the Facility will run below the emission limit and will be offline for part of the year for maintenance.

The model was used to predict the ground level concentration of pollutants on a long term and short term basis across a grid of points. In addition concentrations were predicted at the identified sensitive receptors.

(5) Approach and Assessment of Impact on Air Quality – Protection of Human Health

The impact of air quality on human health has been assessed using a standard approach.

a) The Environment Agency has stated that the contribution to air quality can be screened out as 'insignificant' if the short term contribution is less than 10% of the air quality objective and the long term contribution is less than 1% of the air quality objective. These screening criteria have been applied initially.

b) For those pollutants which are not screened out, the background concentration has been reviewed to see if there is any potential for any exceedences of an assessment level.

The impact of many pollutants on human health can be screened out as 'insignificant'. For those which cannot be screened out, the background concentrations are low and there is little chance of significant pollution.

The Environment Agency approach to assessing the impact of metals has been used which considers the risk of exceeding the EAL based on the existing background levels and contribution from the Facility. Using this approach there is no risk of exceeding the EAL.

(6) Approach and Assessment of Impact on Air Quality – Protection of Ecosystems

The impact of air quality on ecosystems has been assessed using a standard approach.

a) The Environment Agency has stated that, if the contribution within an entire protected site is less than 1% of the long-term and less than 10% of the short term benchmark, the emissions are not significant and it can be concluded no likely significant effect either alone and in-combination with other sources of pollutants, irrespective of background levels.

b) If the process contribution at European and UK designated sites is greater than 1% of the relevant long-term, or 10% of the short term benchmark, but the total predicted concentration including background levels is less than 70% of the relevant benchmark, the Environment Agency has stated that the emissions are not likely to have a significant effect.

c) If the process contribution at locally designated sites is less than the relevant benchmark, the Environment Agency has stated that the emissions are not likely to have a significant effect.

The impact of the deposition of nitrogen and acid gases on sensitive habitats has been assessed using a standard approach.

a) It has been assumed that all items of plant operate at the emission limits for the entire year whereas actual operational emission concentrations will be lower and the plant will be offline for maintenance purposes.

b) It has been assumed that all habitats are present at the point of greatest impact.

c) The impact has been calculated based on the maximum predicted concentration over a 5-year period at each ecological site and applying conservative deposition assumptions from the Environment Agency.

d) The results have been compared to habitat specific Critical Loads.

No European or UK designated site have been identified as requiring consideration within this air quality assessment.

A number of non-statutory designated sites have been identified within 2km of the Facility. An assessment, based on broad habitat types, has concluded that the impact of emissions on these sites is not significant. This conclusion has been drawn because the PC is less than 100% of the Critical Level or Load.

(7) Plume Visibility

A CHP Management Plan for Plume Abatement has been developed to discharge the existing planning conditions for the Facility. A feedforward mechanism will be used to adjust the temperature of the exhaust air from the pulp plant based on a set of meteorological parameters. The implementation of the proposed operating regimes will increase the buoyancy of the emissions and lead to increased dispersion of emissions. This has not been taken into account in this Dispersion Modelling Assessment, so the results presented are conservative.

In summary, a comprehensive assessment of the impact of the proposed Integrated Waste Management Facility with a single stack has shown that the proposals would not have a significant impact on local air quality, the general population or the local community.

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1 Introduction

1.1 Background

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged to undertake a Dispersion Modelling Assessment to support the planning and Environmental Permit application for the proposed Rivenhall Integrated Waste Management Facility (IWMF).

Planning permission was granted on 02 March 2010 by the Secretary of State, following a Public Inquiry, for an Integrated Waste Management Facility at Rivenhall Airfield, Essex, C5 9DF, in accordance with application reference ESS/37/08/BTE, dated 28 August 2008. An amendment to the planning permission was granted on 26 March 2015 (ref: ESS/55/14/BTE).

Detailed design work has now been undertaken and an application is being made for an Environmental Permit to operate the Facility. In addition a minor variation to the planning application is being made to reflect the updates to the scheme as part of the detailed design work.

There will be six principal activities to the Rivenhall IWMF:

(1) A Combined Heat and Power (CHP) plant consisting of 2 streams with the potential to process up to 595,000 tonnes per annum of non-hazardous Solid Recovered Fuel (SRF) and Refuse Derived Fuel (RDF);

(2) A Materials Recovery Facility (MRF) designed to process approximately 300,000 tonnes per annum of waste to recover recyclates for transfer off-site, with the residual material being transferred to the Mechanical Biological Treatment (MBT) Facility;

(3) An Anaerobic Digester (AD) plant designed to process up to 30,000 tonnes per annum of food and organic waste, with the resultant biogas being combusted in a CHP engine;

(4) An MBT Plant designed to process approximately 170,000 tonnes per annum of waste to produce a non-hazardous waste derived fuel (SRF/RDF) to be incinerated as a fuel within the CHP plant;

(5) A Pulp Plant designed to process approximately 170,000 tonnes per annum of waste paper to produce approximately 85,500 tonnes per annum of paper pulp; and

(6) A Water Treatment Plant to process wastewater from the installation.

Of the above activities the CHP and AD gas engines will produce emissions to atmosphere which will be regulated by the Environment Agency. The pulp plant includes a drying process which will result in a moist exhaust which will need to be emitted to atmosphere. A system to condense moisture from the pulp plant exhaust prior to it being emitted to atmosphere is proposed. The proposals also include a building ventilation system to provide abatement of odours from each of the waste treatment processes. This ventilation system will include a biofilter to process the 'dirty' AD air prior to emitting to atmosphere.

The planning permission restricts the Facility to having a single stack, emissions from all sources need to emit to atmosphere via a common wind shield. Therefore, the main stack will include emissions from the following sources:

(1) Exhaust gases from the CHP plant (two streams);

(2) Exhaust air from the pulp plant;

(3) Exhaust gases from the two AD gas engines; and

(4) Exhaust from the bio-filter.

Due to the nature of the feedstock the Facility will require an Environmental Permit to operate which will include limits on emissions to air based on those outlined in Annex VI of the IED for waste incineration plants. This will include limits on emissions of oxides of nitrogen, sulphur dioxide, heavy metals and dioxins and furans. This assessment considers the impact of the pollutants potentially released from the Facility on human health and ecosystems.

A separate Human Health Risk Assessment has been undertaken to assess the pathway intake of these pollutants and impacts compared to the Tolerable Daily Intakes (TDIs).

When considering the impact on ecosystems the predicted atmospheric concentrations have been compared to the Critical Levels for the protection of ecosystems. Deposition of emissions over a prolonged period can have nitrification and acidification impacts. An assessment of the long term deposition of pollutants has been undertaken and the results compared to the habitat specific Critical Loads.

1.2 Structure of Report

This report has the following structure.

- National and international air quality legislation and guidance, and local planning policies which relate to air quality, are considered in section 2.
- The assessment methodology is outlined in section 3.
- The current levels of ambient air quality are described in section 4.
- Section 5 highlights residential properties and ecological receptors in the vicinity of the proposed development.
- The inputs used for the dispersion model are contained within section 6.
- A sensitivity analysis of the model inputs are contained within section 7.
- Section 8 presents the assessment methodology and results of the impact of emissions at human sensitive receptors.
- Section 9 presents the assessment methodology and results of the assessment of the impact of emissions including their long term deposition at ecological sites.
- Section 11 presents the analysis of the effect the implementation of the CHP Management Plan for Plume Abatement will have on the predicted impacts.
- The conclusions of the assessment can be found in section 13.
- The Appendices include illustrative figures and detailed results tables.

2 LEGISLATION

2.1 European legislation

European air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides new air quality objectives for fine particulates. The consolidated Directives include:

- Directive 99/30/EC – the First Air Quality "Daughter" Directive – which sets ambient air limit values for nitrogen dioxide and oxides of nitrogen, sulphur dioxide, lead and particulate matter;
- Directive 2000/69/EC – the Second Air Quality "Daughter" Directive – which sets ambient air limit values for benzene and carbon monoxide; and
- Directive 2002/3/EC – the Third Air Quality "Daughter" Directive – which seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The fourth daughter Directive – 2004/107/EC - was not included within the consolidation. It sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.2 UK legislation

Directives 2008/50/EC and 2004/107/EC are transposed under UK Law into the Air Quality Standards Regulations (2010).

The UK Air Quality Strategy (2007) is the method of implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland.

The Air Quality Strategy defines "standards" and "objectives" in paragraph 17:

> *"For the purposes of the strategy*
>
> - *standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems*
> - *objectives are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedences, within a specified timescale."*

The status of the objectives is clarified in paragraph 22, which also emphasises the importance of European Directives.

> *"The air quality objectives in the Air Quality Strategy are a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except in as far as these mirror any equivalent legally binding limit values in EU legislation. Where UK standards or objectives are the sole consideration, there is no legal obligation upon regulators, to set Emission Limit Values (ELVs) any more stringent than the emission levels associated with the use of Best Available Techniques (BAT) in issuing permits under the PPC Regulations. This aspect is dealt with fully in the PPC Practical Guides."*

3 Air Quality Standards, Objectives and Guidelines

In the UK, air quality standards and objectives (AQOs) for major pollutants are described in The Air Quality Strategy (AQS).

The Environment Agency includes Environmental Assessment Levels (EALs) for other pollutants in Environmental Agency Horizontal Guidance Note H1 - Annex F. The long term and short term EALs from this document have been used when the Air Quality Strategy does not contain relevant objectives.

Both AQOs and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups.

Standards and objectives for the protection of sensitive ecosystems and habitats are also contained within Environmental Agency Horizontal Guidance Note H1 - Annex F.

3.1 Nitrogen dioxide

All combustion processes produce nitric oxide (NO) and nitrogen dioxide (NO_2), known by the general term of nitrogen oxides (NOx). In general, the majority of the NOx released is in the form of NO, which then reacts with ozone in the atmosphere to form nitrogen dioxide. Of the two compounds, nitrogen dioxide is associated with adverse effects on human health, principally relating to respiratory illness. The World Health Organisation (WHO) has stated that "many chemical species of nitrogen oxides exist, but the air pollutant species of most interest from the point of view of human health is nitrogen dioxide".

The major sources of NOx in the UK are road transport and power stations. According to the most recent annual report from the National Atmospheric Emissions Inventory (NAEI), road transport accounted for 37% of UK emissions, with power stations accounting for a further 27%. High levels of NOx in urban areas are almost always associated with high traffic densities.

The AQS includes two objectives to be achieved by 31st December 2005. Both of these objectives are included in the Air Quality Directive, with an achievement date of 1st January 2010.

- A limit for the one-hour mean of 200 µg/m^3, not to be exceeded more than 18 times a year (equivalent to the 99.79th percentile).
- A limit for the annual mean of 40 µg/m^3.

In addition, the AQS includes objectives for the protection of sensitive vegetation and ecosystems of 30 µg/m^3 for the annual mean, and 75 µg/m^3 for the daily mean concentration of nitrogen oxides.

3.2 Sulphur dioxide

Sulphur dioxide is predominantly released by the combustion of fuels containing sulphur. Around 68% of UK emissions in 2004 were associated with power stations, with much of the remainder associated with other combustion processes. Emissions of sulphur dioxide have reduced by 87% since 1970, due to a reduction in the number of coal fired combustion plants, the installation of flue gas desulphurisation plants on a number of large coal-fired power stations and the reduction in sulphur content of liquid fuels.

The AQS contains three objectives for the control of sulphur dioxide:

- A limit for the 15 minute mean of 266 µg/m^3, not to be exceeded more than 35 times a year (the 99.9th percentile) to be achieved by 31st December 2005.
- A limit for the one hour mean of 350 µg/m^3, not to be exceeded more than 24 times a year (the 99.73rd percentile) to be achieved by 31st December 2004.
- A limit for the daily mean of 125 µg/m^3, not to be exceeded more than 3 times a year (the 99.2nd percentile) to be achieved by 31st December 2004.

The hourly and daily objectives are included in the Air Quality Directive.

In addition, the AQS includes two objectives for the protection of vegetation and ecosystems. These are a concentration of 20 µg/m^3 (reduced to 10 µg/m^3 where lichens or bryophytes are present) as an annual mean and as a winter average.

3.3 Particulate matter

Concerns over the health impact of solid matter suspended in the atmosphere tend to focus on particles with a diameter of less than 10 µm, known as PM_{10}s. These particles have the ability to enter and remain in the lungs. Various epidemiological studies have shown increases in mortality associated with high levels of PM_{10}s, although the underlying mechanism for this effect is not yet understood. Significant sources of PM10s are road transport (22%), quarrying (16%) and stationary combustion (34%).

The AQS includes two objectives for PM_{10}s to be achieved by the end of 2004, both of which are included in the Air Quality Directive.

- A limit for the annual mean of 40 µg/m^3, to be achieved by 2004.
- A daily limit of 50 µg/m^3, not to be exceeded more than 35 times a year (the 90.4th percentile) to be achieved by 2004.

The previous AQS included some provisional objectives for 2010. These have been replaced by an exposure reduction objective for $PM_{2.5}$s in urban areas and a target value for $PM_{2.5}$s of 25 µg/m^3 as an annual mean. This target value is included in the Air Quality Directive.

3.4 Carbon monoxide

Carbon monoxide is produced by the incomplete combustion of fuels containing carbon. By far the most significant source is road transport, which produces 67% of the UK's emissions. Carbon monoxide can interfere with the processes that transport oxygen around the body, which can prove fatal at very high levels.

Concentrations in the UK are well below levels at which health effects can occur. The AQS includes the following objective for the control of carbon monoxide, which is also included in the Air Quality Directive:

- A limit for the 8-hour running mean of 10 mg/m^3, to be achieved by 1st January 2005.

3.5 Hydrogen chloride

There are no AQOs for hydrogen chloride contained within the AQS. However Environment Agency Horizontal Guidance Note H1 Annex F defines the short term EAL as 750 µg/m^3. There is no long-term EAL.

3.6 Hydrogen fluoride

There are no AQOs for hydrogen fluoride contained within the AQS. However Environment Agency Horizontal Guidance Note H1 Annex F defines the short term EAL as 160 µg/m^3 and the long term EAL as 16 µg/m^3.

Appendix B to Annex F of the Environment Agency Horizontal Guidance Note H1 also provides Critical Levels for the protection of vegetation and ecosystems of 5 µg/m^3 as a daily mean and 0.5 µg/m^3 as a weekly mean concentration of hydrogen fluoride.

3.7 Ammonia

There are no AQOs for ammonia contained within the AQS. However Environment Agency Horizontal Guidance Note H1 Annex F defines the short term EAL as 2,500 µg/m^3 and the long term EAL as 180 µg/m^3.

In addition, Appendix B to Annex F of the Environment Agency Horizontal Guidance Note H1 also provides Critical Levels for the protection of vegetation and ecosystems. These are a concentration of 3 µg/m^3 as an annual mean, reduced to 1 µg/m^3 where lichens or bryophytes are present.

3.8 Metals

Lead is the only metal included in the AQS. Lead can have many health effects, including effects on the synthesis of haemoglobin, the nervous system and the kidneys. Emissions of lead in the UK have declined by 98% since 1970, due principally to the virtual elimination of leaded petrol.

The AQS includes objectives to limit the annual mean to 0.5 µg/m^3 by the end of 2004 and to 0.25 µg/m^3 by the end of 2008. Only the first objective is included in the Air Quality Directive.

The fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes target values for arsenic, cadmium and nickel. However, the preamble to the Directive makes it clear that the use of these target values is relatively limited. Paragraph (5) states:

> *"The target values would not require any measures entailing disproportionate costs. Regarding industrial installations, they would not involve measures beyond the application of best available techniques (BAT) as required by Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (5) and in particular would not lead to the closure of installations. However, they would require Member States to take all cost-effective abatement measures in the relevant sectors."*

And paragraph (6) states:

> *"In particular, the target values of this Directive are not to be considered as environmental quality standards as defined in Article 2(7) of Directive 96/61/EC and which, according to Article 10 of that Directive, require stricter conditions than those achievable by the use of BAT."*

Although these target values have been included in the assessment, it is important to note that the application of the target values would not have an effect on the design or operation of Facility. The Facility will be designed in accordance with BAT and will include cost effective methods for the abatement of arsenic, cadmium and nickel, including the injection of activated carbon and a fabric filter.

Emissions limits have been set in Environmental Permits for similar facilities for a number of heavy metals which do not have air quality standards associated with them. The EALs for these metals, and lead, are summarised in Table 3.1.

Table 3.1: Environmental Assessment Levels (EALs) for Metals			
Metal	Daughter Directive Target Level (µg/m^3)	EALs (µg/m^3)	
		Long Term	Short Term
Arsenic	0.006	0.003	-
Antimony	-	5	150
Cadmium	0.005	0.005	-
Chromium (II & III)	-	5	150
Chromium (VI)	-	0.0002	-
Cobalt	-	-	-
Copper	-	10	200
Lead	-	0.25	-
Manganese	-	0.15	1500
Mercury	-	0.25	7.5
Nickel	0.020	0.020	-
Thallium	-	-	-
Vanadium	-	5	1

The EALs in Appendix B to Annex F of the Environment Agency Horizontal Guidance Note H1 take into account the guidelines for metals and metalloids in ambient air for the protection of human health produced by EPAQS in 2009.

3.9 Volatile Organic Compounds (VOCs)

A variety of VOCs could be released from the stack, of which benzene and 1,3-butadiene are included in the AQS and monitored at various stations around the UK. The AQS includes the following objectives for the running annual mean:

- Benzene 5 µg/m^3, to be achieved by 2010.
- 1,3-butadiene 2.25 µg/m^3, to be achieved by 2003.

There are no short-term AQO/EALs for either benzene or 1,3-butadiene.

3.10 Dioxins and furans

Dioxins and furans are a group of organic compounds with similar structures, which are formed as a result of combustion in the presence of chlorine. Principal sources include steel production, power generation, coal combustion and uncontrolled combustion, such as bonfires. The Municipal Waste Incineration Directive and UK legislation imposed strict limits on dioxin emissions in 1995, with the result that current emissions from incineration of municipal solid waste in the UK in 1999 were less than 1% of the emissions from waste incinerators in 1995. The Waste Incineration Directive, now included in the IED, imposes even lower limits, reducing the limit to one tenth of the previously permitted level.

One dioxin, 2,3,7,8-TCDD, is a definite carcinogen and a number of other dioxins and furans are considered to be possible carcinogens. A tolerable daily intake (TDI) for Dioxins, furans and dioxins like PCBs has been recommended by the Committee on the Toxicity of Chemicals in Food, Consumer Products and the Environment of 2 pg I-TEQ per kg bodyweight per day.

Dioxins are not normally compared with set EALs, but the probable ingestion rates of dioxins by different groups of people is considered as part of the Human Health Risk Assessment contained as a separate document within the application.

3.11 Polychlorinated biphenyl (PCBs)

PCBs have high thermal, chemical and electrical stability and were manufactured in large quantities in the UK between the 1950s and mid 1970s. Commercial PCB mixtures, which contained a range of dioxin-like and non-dioxin like congeners, were sold under a variety of trade names, the most common in the UK being the Aroclor mixtures. UK legislative restrictions on the use of PCBs were first introduced in the early 1970s.

Although now banned from production current atmospheric levels of PCBs are due to the ongoing primary anthropogenic emissions (e.g. accidental release of products or materials containing PCBs), volatilisation from environmental reservoirs which have previously received PCBs (e.g. sea and soil) or incidental formation of some congeners during the combustion process.

There are no AQOs for PCBs contained within the AQS. However Environment Agency Horizontal Guidance Note H1 Annex F defines the short term EAL as 6 $\mu g/m^3$ and the long term EAL as 0.2 $\mu g/m^3$.

A number of PCBs are considered to possess dioxin like toxicity and are known as dioxin-like PCBs. The total intake from dioxins, furans and dioxins like PCBs is compared to the TDI for dioxins, furans and dioxin like PCBs as part of the Human Health Risk Assessment contained as a separate document within the application.

3.12 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are members of a large group of organic compounds widely distributed in the atmosphere. The best known PAH is benzo[a]pyrene (B[a]P). The AQS included an objective to limit the annual mean of B[a]P to 0.25 ng/m^3 by the end of 2010. This goes beyond the requirements of European Directives, since the fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes a target value for benzo(a)pyrene of 1 ng/m^3 as an annual mean.

3.13 Summary

Table 3.2 summarises the air quality objectives and guidelines used in the air quality assessment. The sources for each of the values can be found in the preceding sections.

Table 3.2: Air Quality Standards (AQS) and Environmental Assessment Levels (EALs)

Pollutant	Limit Value ($\mu g/m^3$)	Averaging Period	Frequency of Exceedences
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)
	40	Annual	-
Sulphur dioxide	266	15 minutes	35 times per year (99.9th percentile)
	350	1 hour	24 times per year (99.73rd percentile)
	125	24 hours	3 times per year (99.18th percentile)

Table 3.2: Air Quality Standards (AQS) and Environmental Assessment Levels (EALs)			
Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41th percentile)
	40	Annual	-
Particulate matter ($PM_{2.5}$)	25	Annual	-
Carbon monoxide	10,000	8 hours, running	-
Hydrogen chloride	750	1 hour	-
Hydrogen fluoride	160	1 hour	-
	16	Annual	-
Ammonia	2,500	1 hour	-
	180	Annual	-
Lead	0.25	Annual	-
Benzene	5.00	Annual	-
1,3-butadiene	2.25	Annual, running	-
PCBs	6	1-hour	-
	0.2	Annual	-
PAHs	0.00025	Annual	-

Table 3.3 Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Concentration ($\mu g/m^3$)	Measured as
Nitrogen oxides (as nitrogen dioxide)	75	Daily mean
	30	Annual mean
Sulphur dioxide	10	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystems integrity
	20	Annual mean for all higher plants
Hydrogen fluoride	<5	Daily mean
	<0.5	Weekly mean
Ammonia	1	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystems integrity
	3	Annual mean for all higher plants

4 Baseline Air Quality

The Facility is located to the south-east of the disused airfield known as Rivenhall airfield, in rural Essex approximately 3.4km south east of Kelvedon. Reference should be made to Figure 1 which shows the site location. In this section, we have reviewed the baseline air quality and defined appropriate background concentrations to be used within this assessment.

4.1 Air quality review and assessment

As required under Section 82 of the Environment Act (1995) (Part IV), local authorities are required to undertake an ongoing exercises to review air quality within their area of jurisdiction. The closest Air Quality Management Area (AQMA) is located in Chelmsford approximately 15 to the south-east of the Facility. Due to the distance to the closest AQMAs it is not likely that the emissions from the Facility would have any measureable impact on any designated AQMA.

4.2 National modelling – mapped background data

In order to assist local authorities with their responsibilities under Local Air Quality Management, the Department for the Environment Food and Rural Affairs (DEFRA) provides modelled background concentrations of pollutants throughout the UK on a 1 km by 1 km grid. This model is based on known pollution sources and background measurements and is used by local authorities in lieu of suitable monitoring data. Mapped background concentrations were downloaded for the grid squares containing the Facility and immediate surroundings. A summary is presented within Table 4.1.

In addition, mapped atmospheric concentrations of ammonia are available from DEFRA throughout the UK on a 5 km by 5 km grid. Mapped ammonia background concentrations were downloaded for the grid square containing the Facility, as presented within Table 4.1.

Table 4.1: Mapped Background Data – at Facility

Pollutant	Annual Mean Concentration ($\mu g/m^3$)	Dataset
Nitrogen dioxide (1)	12.29	2011 mapped background dataset
Oxides of nitrogen (1)	17.88	2011 mapped background dataset
Sulphur dioxide (1)	3.53	2001 mapped background dataset
Particulate matter (as PM_{10}) (1)	19.20	2011 mapped background dataset
Particulate matter (as $PM_{2.5}$) (1)	11.96	2011 mapped background dataset
Carbon monoxide (1)	254	2001 mapped background dataset
Benzene (1)	0.31	2001 mapped background dataset
1,3-butadiene (1)	0.13	2001 mapped background dataset
Ammonia (2)	1.48	2012 mapped background dataset

Notes:
(1) 1km x 1km grid square centred upon 582500, 220500
(2) 5km x 5km grid square centred upon 580000, 220000

The mapped background data is calibrated against monitoring data. For instance, the 2011 mapped background concentrations are based on 2011 meteorological data and are calibrated against monitoring undertaken in 2011. As a conservative approach where mapped background data is used the concentration for the year against which the data was validated has been used for the purpose of this assessment. This eliminates any potential uncertainties over anticipated trends in future background concentrations.

Background concentrations will vary over the modelling domain area therefore the maximum mapped background concentration within the modelling domain has been calculated as presented in Table 4.2.

Table 4.2: Mapped Background Data – Maximum within Modelling Domain

Pollutant	Annual Mean Concentration (µg/m^3)	Dataset
Nitrogen dioxide	14.89	2011 mapped background dataset
Oxides of nitrogen	22.01	2011 mapped background dataset
Sulphur dioxide	3.65	2001 mapped background dataset
Particulate matter (as PM_{10})	19.58	2011 mapped background dataset
Particulate matter (as $PM_{2.5}$)	12.47	2011 mapped background dataset
Carbon monoxide	267	2001 mapped background dataset
Benzene	0.35	2001 mapped background dataset
1,3-butadiene	0.14	2001 mapped background dataset
Ammonia	1.48	2011 mapped background dataset

4.3 AURN and LAQM monitoring data

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of the DEFRA this includes automatic monitoring of oxides of nitrogen, nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and particulates. No AURN sites have been identified within 20km of the Facility.

In addition to the national AURN, local authorities undertake monitoring of a range of pollutants as part of the LAQM review process. A review of the monitoring undertaken by Braintree District Council as part of their LAQM commitments has shown that they monitor for nitrogen dioxide concentrations at 12 sites using diffusion tubes. Of these only 3 are not classified as roadside sites and classified as either urban centre or urban background locations. A summary of the monitoring data from these sites is presented in the following table.

Table 4.3: Nitrogen Dioxide Diffusion Tubes – Braintree District Council					
Site	**Mapped Bg - 2011**	**2010**	**2011**	**2012**	**2013**
Braintree 1N – Blamford House, London Rd	15.6	36.7	34.3	30.1	36.6
Braintree 5N – The While Hart Hotel, Coggeshall Road	15.9	25.8	25.6	25.5	25.3
Braintree 4N – Beckers Green Road	15.3	21.1	21.2	21.0	22.8
Halstead 1 – Church yard, Colchester Road	15.2	31.5	31.5	30.7	30.0
Hadfield Peverel A12	21.2	45.6	49.5	44.7	50.5
Kelvedon High Street, Kelvedon	14.9	30.0	29.1	32.5	32.8
Bradwell – the Street, Bradwell	13.8	43.5	41.8	38.6	38.1
Braintree – Railway Street	15.7	32.4	28.8	29.2	29.5
Braintree – Stilemans Wood	15.3	32.6	37.1	33.2	28.1
Witham – Chipping Hill	22.4	50.3	47.1	47.0	45.8
Rivenahll Hotel A12	19.4	55.3	56.0	49.8	51.8
Rivenahll Foxden A12	19.4	50.5	53.2	49.8	51.8

Due to the rural nature of the area where impacts are predicted and the lack of rural baseline monitoring the maximum mapped background concentration within the modelling domain has been used as the background concentration for the purpose of this assessment. The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.4 Hydrogen chloride

Hydrogen chloride is measured on behalf of DEFRA as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. This consolidates the previous Acid Deposition Monitoring Network (ADMN), and National Ammonia Monitoring Network (NAMN). The closest monitoring station is located at London Cromwell Road approximately 60km to the south-east of the Facility. A summary of the data from all background and rural sites in the UK is presented in Table 4.4.

Table 4.4: Hydrogen Chloride Monitoring – UKEAP				
	Annual Mean Concentration (μg/m^3)			
	2011	2012	2013	2014
Min of all UK sites	0.10	0.14	0.15	0.10
Max of all UK sites	0.72	0.44	0.50	0.45
Average of all UK sites	0.29	0.27	0.31	0.25

Notes:
Data for each site downloaded from the DEFRA website.

In lieu of any local monitoring, the maximum monitored at any site has been used for the purpose of this assessment (0.72 μg/m^3 – 2011). The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.5 Hydrogen fluoride

Baseline concentrations of hydrogen fluoride are not measured locally or nationally, since these are not generally of concern in terms of local air quality. However, the EPAQS report 'Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects' contains some estimates of baseline levels, reporting that measured concentrations have been in the range of 0.036 μg/m^3 to 2.35 μg/m^3.

In lieu of any local monitoring, the maximum measured baseline hydrogen fluoride concentration has been used for the purpose of this assessment as a conservative estimate. The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.6 Ammonia

Ammonia is also measured as part of the UKEAP project and the closest site is located at London Crowell Road. In lieu of any local monitoring the maximum mapped background over the modelling domain as presented in Table 4.2 has been used for the purpose of this assessment. The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.7 Volatile Organic Compounds

As part of the Automatic and Non-Automatic Hydrocarbon Network, benzene and 1,3-butadiene concentrations are measured at sites co-located with the AURN across the UK. The closest monitoring sites are located in London. In lieu of any local monitoring the maximum mapped background over the modelling domain as presented in Table 4.2 has been used for the purpose of this assessment. The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.8 Metals

Metals are measured as part of the Rural Metals and UK Urban/Industrial Networks (previously the Lead, Multi-Element and Industrial Metals Networks). A summary of the maximum average monitored concentrations at rural sites across the UK is presented in Table 4.5.

Table 4.5: Heavy Metals Monitoring – Maximum Annual Mean from Rural Sites					
Metal	Annual Mean EAL (ng/m^3)	Annual Mean Conc. (ng/m^3)			Max as % of EAL
		2012	2013	2014	
Antimony	5,000	-	-	-	-
Arsenic	3	0.78	0.81	-	26.96%
Cadmium	5	0.19	0.20	-	3.91%
Chromium	5,000	0.99	1.32	-	0.03%
Cobalt	-	-	-	-	-
Copper	10,000	4.44	4.28	-	0.04%
Manganese	150	2.52	3.49	-	2.33%
Mercury	250	1.20	1.38	-	0.55%
Nickel	20	1.05	1.43	-	7.17%
Lead	250	7.16	8.38	-	3.35%
Thallium	-	-	-	-	-
Vanadium	5,000	1.44	1.75	-	0.03%

Notes:
Mercury is based on the monitored mercury in PM10.
To date no data is available for 2014.

As shown, the concentrations monitored over the last 3 years at rural sites were significantly lower than the EALs. In lieu of any local rural monitoring, the maximum annual average monitored metal concentration from rural sites across the UK between 2012 and 2013 has been used as the background concentration within this assessment.

4.9 Dioxins, furans and polychlorinated biphenyl (PCBs)

Dioxins, furans and PCBs are monitored on a quarterly basis at a number of urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. London Nobel House is the closest monitoring site with data from the most recent year. A summary of dioxin and furan and PCB concentrations from all monitoring sites across the UK is presented in Table 4.6.

Table 4.6: Dioxin, Furan and PCBs Monitoring Results - National						
Site	Annual Mean Dioxin and Furans Conc. (fg/TEQ/m^3)			Annual Mean PCBs Conc. (pg/m^3)		
	2008	2009	2010	2008	2009	2010
London	10.94	41.44	38.60	164.18	317.94	254.90
Manchester	18.99	14.21	14.21	133.42	168.38	185.28
Auchencorth*	6.44	0.56	5.01	12.12	44.66	37.40
Middlesbrough	23.98	-	-	138.43	-	-
High Muffles*	1.73	9.38	2.76	20.08	109.94	141.50
Hazelrigg*	3.67	13.49	8.03	14.52	89.18	110.00
Stoke Ferry	-	-	-	-	-	-
Weybourne*	-	22.82	2.49	-	44.66	21.30
UK Average	10.96	16.98	11.85	80.46	129.13	125.06
Notes: * rural site						

As shown, the concentrations vary significantly between sites and years. As no site is located in close proximity to the Facility, the maximum monitored concentration from a rural site has been used as the background concentration within this assessment (22.82 fg/TEQ/m^3 for dioxins and furans (Weybourne 2009) and 141.50 pg/m^3 for PCBs (High Muffles 2010)). The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.10 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are monitored as part of the PAH network. The closest background monitoring site is located at Crystal Palace, London. For the purpose of this assessment, benzo(a)pyrene is considered as this is the only PAH which an AQO has been set. A summary of benzo(a)pyrene concentrations from all background monitoring sites within the UK is presented in Table 4.7. Any exceedences of the EAL are highlighted.

Table 4.7: Benzo(a)pyrene Monitoring - National					
Site	**Quantity**	**AQO (ng/m^3)**	**Annual Mean Concentration (ng/m^3)**		
			2009	**2010**	**2011**
National Non-Automatic Monitoring					
Background	Min	0.25	0.04	0.03	0.02
	Max	0.25	1.80	2.00	1.30
	Average	0.25	0.41	0.48	0.33
Number of background sites exceeding EC Target Value (1 ng/m^3)			4	5	2
Number of background sites exceeding EC Upper Assessment Threshold (0.6 ng/m^3)			5	5	5
Number of background sites exceeding EC Lower Assessment Threshold (0.4 ng/m^3)			5	5	5
Notes: *Monitoring from 2012 to 2014 not available at the time of writing this report.*					

In lieu of any local monitoring the maximum monitored concentration from a background site has been used (2.00 ng/m^3 – 2010). The choice of background will be investigated if the impact of the Facility cannot be screened out as insignificant.

4.11 Summary

Table 4.8 outlines the values for the annual average background concentrations that have been used to evaluate the impact of the Facility. As noted in the background analysis the mapped background slightly underestimates the monitored concentration. The maximum mapped background concentration for any grid square within the modelling domain is greater than any background concentration monitored. Therefore for the purpose of this assessment the maximum mapped background concentration has been used. Further analysis of the background concentration has been undertaken where impacts cannot be screened out as 'insignificant'. In addition the impact at all identified monitoring locations within the modelling domain has been quantified.

Table 4.8: Summary of Background Concentrations			
Pollutant	**Annual Mean Concentration**	**Units**	**Justification**
Nitrogen dioxide	14.89	µg/m^3	2011 mapped background dataset maximum grid square within the modelling domain.
Oxides of nitrogen	22.01	µg/m^3	
Sulphur dioxide	3.65	µg/m^3	2001 mapped background dataset maximum grid square within the modelling domain.
Particulate matter (as PM_{10})	19.58	µg/m^3	2011 mapped background dataset maximum grid square within the modelling domain.
Particulate matter (as $PM_{2.5}$)	12.47	µg/m^3	
Carbon monoxide	267	µg/m^3	2001 mapped background dataset maximum grid square within the modelling domain.
Hydrogen chloride	0.72	µg/m^3	Maximum over the past 4 years from all UK monitoring sites.
Hydrogen fluoride	2.35	µg/m^3	Maximum measured baseline hydrogen fluoride concentration as presented in the EPAQS report.
Ammonia	1.48	µg/m^3	Maximum mapped background concentration within the modelling domain – 2011 dataset.
Benzene	0.35	µg/m^3	Maximum mapped background concentration within the modelling domain – 2001 dataset.
1,3-butadiene	0.14	µg/m^3	
Mercury	1.38	ng/m^3	The maximum monitored metal concentration from at a rural site between 2012 and 2013.
Cadmium	0.20	ng/m^3	
Arsenic	0.81	ng/m^3	
Antimony	-	ng/m^3	
Chromium	1.32	ng/m^3	
Cobalt	-	ng/m^3	
Copper	4.44	ng/m^3	
Manganese	3.49	2ng/m^3	
Lead	8.38	ng/m^3	
Nickel	1.43	ng/m^3	
Vanadium	1.75	ng/m^3	
Dioxins and furans	22.82	fg/m^3	The maximum monitored metal concentration from at a rural site between 2008 to 2010
Polychlorinated biphenyl (PCBs)	141.5	pg/m^3	
Benzo(a)pyrene (PaB)	2.00	ng/m^3	Maximum monitored concentration from a background site between 2009 and 2011.

5 Sensitive Receptors

5.1 Human sensitive receptors

The general approach to the assessment is to evaluate the highest predicted process contribution to ground level concentrations. In addition, the predicted process contribution at a number of sensitive receptors has been evaluated. These sensitive receptors are displayed in Figure 1 of Appendix A and listed in Table 5.1.

Table 5.1: Sensitive Receptors

ID	Receptor Name	Location		Distance from the Stack (m)
		X	Y	
D1	Sheepcotes Farm (Hanger No.1)	581564.6	220328.3	882
D2	Wayfarers Site	582557.4	220185.4	260
D3	Allshot's Farm (Scrap Yard)	582892.6	220458.3	452
D4	Haywards	583235.7	221162.6	1088
D5	Herons Farm	582443.0	221378.3	960
D6	Gosling's Farm	581426.9	221380.9	1399
D7	Curd Hall Farm	583261.7	221708.3	1528
D8	Church (adjacent to Bradwell Hall)	581832.3	222157.9	1844
D9	Bradwell Hall	581837.5	222319.1	1995
D10	Rolphs Farmhouse	580675.8	220512.8	1769
D11	Silver End / Bower Hall / Fossil Hall	581286.5	219730.6	1345
D12	Rivenhall Pl/Hall	581860.9	219104.3	1437
D13	Parkgate Farm / Watchpall Cottages	582336.5	219195.2	1228
D14	Ford Farm / Rivenhall Cottage	582697.7	218597.5	1839
D15	Porter's Farm	583391.6	219242.0	1511
D16	Unknown Building 1	583131.7	219462.9	1178
D17	Bumby Hall / The Lodge / Polish Site (Light Industry)	582947.2	220115.2	589
D18	Footpath 8, Receptor 1 (East of Site)	582660.7	220977.1	600
D19	Footpath 8, Receptor 2 (East of Site)	582597.0	220688.5	311
D20	Footpath 8, Receptor 3 (East of Site)	582609.1	220564.0	221
D21	Footpath 8, Receptor 4 (East of Site)	582627.3	220497.2	201
D22	Footpath 8, Receptor 5 (East of Site)	582590.9	220415.2	149
D23	Footpath 8, Receptor 6 (East of Site)	582761.0	220217.8	376
D24	Footpath 8, Receptor 7 (East of Site)	583016.1	220026.5	695
D25	Footpath 35, Receptor 1 (North of Site)	582861.2	220843.4	597
D26	Footpath 35, Receptor 2 (North of Site)	582454.2	221013.5	595
D27	Footpath 35, Receptor 3 (North of Site)	582032.1	221162.3	850

Table 5.1: Sensitive Receptors				
ID	Receptor Name	Location		Distance from the Stack (m)
		X	Y	
D28	Footpath 31, Receptor 1 (North west of Site)	581877.2	220958.8	782
D29	Footpath 31, Receptor 2 (North west of Site)	581740.6	220764.5	783
D30	Footpath 31, Receptor 3 (North west of Site)	581379.2	220548.8	1071
D31	Footpath 7, Receptor 1 (South east of Site)	582505.9	220117.6	307
D32	Footpath 7, Receptor 2 (South east of Site)	582757.9	220066.0	473
D33	Footpath 7, Receptor 3 (South east of Site)	582967.5	219959.7	697
D34	Footpath 7, Receptor 4 (South east of Site)	583167.9	220372.7	727
D35	Footpath 7, Receptor 5 (South east of Site)	583301.5	220725.0	912
D36	Elephant House (Street Sweepings)	582368.7	220189.0	241
D37	Green Pastures Bungalow	581249.9	221176.1	1413
D38	Deeks Cottage	582873.4	221255.1	941
D39	Woodhouse Farm	582583.9	220617.9	245
D40	Gosling Cottage / Barn	581508.4	221305.5	1288
D41	Felix Hall / The Clock House / Park Farm	584578.8	219574.9	2297
D42	Glazenwood House	579980.5	222134.8	3001
D43	Bradwell Hall	580570.6	222802.9	3032
D44	Perry Green Farm	580899.7	221973.3	2190
D45	The Granary / Porter Farm / Rook Hall	584106.2	218964.5	2209
D46	Grange Farm	584888.0	222222.0	3039
D47	Coggeshall	585070.0	222839.0	3573

5.2 Sensitive ecological receptors

A study was undertaken to identify the following sites of ecological importance in accordance with Environment Agency Horizontal Guidance H1:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the Facility (or 15 km coal- or oil- fired power station);
- Sites of Special Scientific Interest (SSSIs) within 2 km of the Facility; and
- National Nature Reserves (NNR), Local Nature Reserves (LNRs), local wildlife sites and ancient woodlands within 2 km of the Facility.

Some large emitters may be required to screen to 10 km or 15 km for SSSIs.

A screening distance of 10km has been used for all SACs, SPAs, Ramsar sites and 2km for all SSSIs. These sensitive ecological receptors are listed in Table 5.2 and displayed in Figure 2 of Appendix A. A review of the citation and APIS website for each site has been undertaken to determine if lichens are an important part of the ecosystem's integrity for the purposes of determining the relevant Critical Level for the habitat.

Table 5.2: Sensitive Ecological Receptors				
Site	**Location (m)**		**Distance from the Main Stack at Closest Point (km)**	**Lichens identified as present within APIS database**
	x	**y**		
European designated sites (within 10km)				
None identified	-	-	-	-
UK designated sites (SSSIs) (within 2km)				
None identified	-	-	-	-
Locally designated sites (within 2km)				
Blackwater Plantation	582769	222075	1.7	-
Maxeys Spring	582730	220038	0.5	-
Storeys Wood	581843	220964	0.8	-

6 Dispersion Modelling Methodology

6.1 Selection of model

Detailed dispersion modelling was undertaking using the model ADMS 5.1, developed and supplied by Cambridge Environmental Research Consultants (CERC). This is a new generation dispersion model, which characterises the atmospheric boundary layer in terms of the atmospheric stability and the boundary layer height. In addition, the model uses a skewed Gaussian distribution for dispersion under convective conditions, to take into account the skewed nature of turbulence. The model also includes modules to take account of the effect of buildings and complex terrain.

ADMS is routinely used for modelling of emissions for planning and Environmental Permitting purposes to the satisfaction of the Environment Agency and Local Authorities.

6.2 Model inputs

As noted all point source emissions from the Facility will emit to atmosphere via stacks contained within a common windshield. The effect of this is to have one visible stack. Emissions from this stack will include the two CHP lines, exhaust air from the pulp plant, the two AD gas engines, and the AD biofilter. The following sections detail the source and emissions data for each item of plant.

6.2.1 Source and emissions data – CHP

The principal inputs to the model with respect to the emissions to air from the CHP are presented in Table 6.1. This data has been provided by HZI (the technology provider).

Table 6.1: Source Data – EFW

Item	Unit	CHP (per stream)
Stack diameter	m	2.3
Flue Gas Conditions		
Temperature	°C	182.29
Exit moisture content	% v/v	18.11%
Exit oxygen content	% v/v dry	6.69%
Reference oxygen content	% v/v dry	11%
Volume at reference conditions (dry, ref O2)	Nm^3/s	51.36
	Nm^3/h	184,902
Volume at actual conditions	Am^3/s	73.93
	Am^3/h	266,138
Flue gas exit velocity	m/s	17.8
Moisture content	kg/kg	0.1308
Specific heat capacity (Cp)	J/°C/kg	1130
Molar mass	g	28.20

Emissions from the CHP have been assumed to comply with the limits prescribed within Chapter VI Part 3 of the IED.

Table 6.2: Emissions Data – CHP (per stream) – Daily Emission Limit Values

Pollutant	Conc. (mg/Nm^3)	Release Rate (g/s)
Oxides of nitrogen (as NO_2)	200	10.272
Sulphur dioxide	50	2.568
Carbon monoxide	50	2.568
Particulates	10	0.514
Hydrogen chloride	10	0.514
Volatile organic compounds (as TOC)	10	0.514
Hydrogen fluoride	1	0.051
Ammonia	10	0.514
Cadmium and thallium	0.05	2.568 mg/m^3
Mercury	0.05	2.568 mg/m^3
Other metals	0.5	25.681 mg/m^3
Benzo(a)pyrene (PaHs)	0.105 $\mu g/Nm^3$	5.393 µg/s
Dioxins and furans	0.1 ng/Nm^3	5.136 ng/s
PCBs	0.005 mg/Nm^3	256.81 mg/s

NOTES:

All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.

As a worst-case it has been assumed that the entire PM emissions consist of either PM10 or PM2.5 for comparison with the relevant AQOs.

The highest recorded emission concentration of B[a]P from the Environment Agency's public register was 0.105 $\mu g/m^3$, or 0.000105 mg/m^3 (dry, 11% oxygen, 273K). This has been assumed to be the emission concentration for the Facility.

Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co),copper Cu), manganese (Mn), nickel (Ni) and vanadium (V).

The Waste Incineration BREF provides a range of values for PCB emissions to air from European municipal waste incineration plants. This states that the annual average total PCBs is less than 0.005 mg/Nm^3 (dry, 11% oxygen, 273K). In lieu of other available data, this has been assumed to be the emission concentration for the Facility.

In addition to the limits shown in Table 6.2, the IED also details half hourly average limits for a number of pollutants. It should be noted that if the CHP continually operated at these limits the daily limits would be exceeded. The CHP will be designed to achieve the limits shown in Table 6.2 and as such will only operate at the shorter term limits for short periods on rare occasions.

The CHP is designed to operate at full capacity and it is not anticipated to have significant changes in loading. Therefore it is appropriate to base the assessment on the design point of the system.

Table 6.3: Emissions Data – CHP (per stream) – Half Hourly Emission Limit Values		
Pollutant	**Conc. (mg/Nm^3)**	**Release Rate (g/s)**
Oxides of nitrogen (as NO_2)	400	20.545
Sulphur dioxide	200	10.272
Carbon monoxide	100	5.136
Particulates	30	1.541
Hydrogen chloride	60	3.082
Volatile organic compounds (as TOC)	20	1.027
Hydrogen fluoride	4	0.205
NOTES: All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K		

6.2.2 Source and emissions data – Pulp Plant

The principal inputs to the model with respect to the emissions to air from the pulp plant are presented in Table 6.4.

Table 6.4: Source Data – Pulp Plant		
Item	**Unit**	**Energy from Waste Plant (per stream)**
Stack diameter	m	2.2
Flue Gas Conditions		
Temperature	°C	30.54
Exit moisture content	% v/v	1.83
Exit oxygen content	% v/v dry	20.56
Volume at actual conditions	Am^3/s	53.84
	Am^3/h	184,902
Flue gas exit velocity	m/s	14.2
Moisture content	kg/kg	0.0116
Specific heat capacity (Cp)	J/°C/kg	1016
Molar mass	g	28.76

The air from the pulp plant will not include any combustion gases and as such no emissions have been included in the model. The source has been included to ensure the effect of emitting to atmosphere with the other sources is considered.

6.2.3 Source and emissions data – gas engines

In addition to the CHP, the AD Facility will include two 450kWe gas engines. The principal inputs to the model with respect to the emissions to air from the AD gas engines are presented in Table 6.5.

Table 6.5: Source Data – AD Gas Engines		
Item	**Unit**	**Gas Engines (per engine) x 2**
Stack diameter	m	0.3
Flue Gas Conditions		
Temperature	°C	250
Exit moisture content	% v/v	14.37
Exit oxygen content	% v/v dry	6.00
Reference oxygen content	% v/v dry	5.00
Volume at reference conditions (dry, ref O2)	Nm^3/s	0.43
	Nm^3/h	1,531
Volume at actual conditions	Am^3/s	1.01
	Am^3/h	3,653
Flue gas exit velocity	m/s	14.4
Moisture content	kg/kg	0.1000
Specific heat capacity (Cp)	J/°C/kg	1135
Molar mass	g	28.44

Emissions from the gas engines have been assumed to comply with the limits prescribed within Environment Agency guidance note LFTG08[1].

Table 6.6: Emissions Data – Gas Engines – Daily Emission Limit Values		
Pollutant	**Conc. (mg/Nm^3)**	**Release Rate (g/s)**
Oxides of nitrogen (as NO_2)	500	0.213
Carbon monoxide	1400	0.595
VOCs	1000	0.425
NOTES: All emissions are expressed at reference conditions of dry gas, 5% oxygen, 273.15K.		

It is noted that the above emissions are daily averages. EPR 1.01 provides emission limits on a daily basis and states that hourly averages should not exceed 200% of the daily limit. This assumption has been used for the gas engines. It should be noted that if the gas engines continually operated at the higher level the daily limit would be exceeded. The boilers will be designed to achieve the limits shown in Table 6.6 and as such will only operate at the shorter term limits for short periods on rare occasions.

[1] Environment Agency Guidance for monitoring landfill gas engine emissions – LFTGN08v2 2010.

Table 6.7: Emissions Data – Gas Boilers – Half Hourly Emission Limit Values		
Pollutant	**Conc. (mg/Nm^3)**	**Release Rate (g/s)**
Oxides of nitrogen (as NO_2)	1000	0.425
Carbon monoxide	2800	1.191
VOCs	2000	0.851
NOTES: All emissions are expressed at reference conditions of dry gas, 5% oxygen, 273.15K		

6.2.4 Source and emissions data – AD biofilter

The principal inputs to the model with respect to the emissions to air from the AD biofilter are presented in Table 6.8.

Table 6.8: Source Data – AD Bio-filter		
Item	**Unit**	**AD Bio-filter**
Stack diameter	m	1.2
Flue Gas Conditions		
Temperature	°C	30.54
Exit moisture content	% v/v	1.00
Exit oxygen content	% v/v dry	20.95%
Volume at actual conditions	Am^3/s	17.08
	Am^3/h	61,500
Flue gas exit velocity	m/s	15.1
Moisture content	kg/kg	0.006
Specific heat capacity (Cp)	J/°C/kg	1011
Molar mass	g	28.86
Odour concentration	OU_E/m^3	3000
Odour release rate	OU_E/s	150,550

The air from the AD biofilter will not include any combustion gases and as such no emissions have been included in the model. The source has been included to ensure the effect of emitting to atmosphere with the other sources is considered.

6.2.5 Meteorological data and surface characteristics

The impact of meteorological data was taken into account by using weather data from Stansted Airport for the years 2009 – 2013. Stansted Airport is approximately 30km from the Facility. Other sources of weather data include Southend on Sea, but this is likely to be effected by the presence of the coastline. Stansted Airport is located at a similar altitude to the Rivenhall site. Although the Rivenhall site is in a more rural location than Stansted Airport this has been taken into account in the model inputs.

The periods 2009 to 2013 was chosen as this was the full set of data available at the time of starting to the air quality modelling. The Environment Agency recommends that 5 years of data are used to take into account inter-annual fluctuations in weather conditions. Therefore, using 5 years from 2009 to 2013 rather than 2010 to 2014 is not anticipated to affect the results significantly. Wind roses for each year can be found in Figure 3.

The surface roughness length can be selected in ADMS for both the site and the meteorological site. The surface roughness has been set to 0.3m for both the dispersion and meteorological site. This value is appropriate for agricultural areas and is considered representative of both the dispersion and meteorological site.

The Monin-Obukov length for the site and meteorological site can be specified in ADMS. This provides a measure of the stability of the atmosphere and indicates the height above which convective turbulence (i.e. thermal) is more important than mechanical (i.e. friction). This allows for the effect of the urban heat island, to prevent the atmosphere from ever becoming very stable, to be simulated within the model. The Monin-Obukov length of the modelling domain was taken to be 1 m which is the value appropriate for rural sites. The Monin-Obukov length of the meteorological data was taken to be 30 m which is the value appropriate for Stansted Airport. This difference in Monin-Obukov length has been used to account for the more rural setting of the Rivenhall site than Stansted Airport.

6.2.6 Modelling domain

Modelling has been undertaken over a 4.5 km x 4.5 km grid with a spatial resolution of 45m. The maximum grid spacing in each is less than 1.5 times the stack height in accordance with the Environment Agency modelling rule of thumb. Reference should be made to Figure 5 for a graphical representation of the modelling domain site and terrain file used.

Table 6.9: Modelling Domain

Grid	Domain
Grid Spacing (m)	53
Grid Points	101
Grid Start X	579750
Grid Finish X	585050
Grid Start Y	217750
Grid Finish Y	223050

6.2.7 Terrain

It is recommended that, where gradients within 500 m of the modelling domain are greater than 1 in 10, the complex terrain module within ADMS (FLOWSTAR) should be used. A review of the local area has deemed that the effect of terrain should be taken into account in the modelling. As such the terrain function in ADMS has been used. A terrain file with a grid resolution of 64 x 64 has been used. For sensitive receptors outside the modelling domain (i.e. all the ecological receptors), a terrain file has not been used due to the size of the terrain file which would be needed and the limitation of the calculation grid. Reference should be made to Figure 5 for a graphical representation of the modelling domain site and terrain file used.

6.2.8 Buildings

The presence of adjacent buildings can significantly affect the dispersion of the atmospheric emissions in various ways:

- Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.
- The rise and trajectory of the plume may be depressed slightly by the flow distortion. This downwash leads to higher ground level concentrations closer to the stack than those which would be present without the building.

The Environment Agency[2] recommends that buildings should be included in the modelling if they are both:

- Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and
- Taller than 40% of the stack.

A review of the site layout has been undertaken and the details of the applicable buildings are presented in Table 6.10. The building is to be located within the quarry and as such the height of the building (and stack) has been calculated based on the difference from the ground level outside of the quarry to the top of the building. For example the height of the main building is 60.75 m AOD, however the height of the surrounding land is ~50 m AOD. As such the building height has been set to 10.75 m.

A site plan showing which buildings have been contained in the model is presented in Figure 4 of Appendix A.

Table 6.10: Building Details

Buildings	Centre Point		Height (m)	Length (m)	Width (m)	Angle (°)
	X (m)	Y (m)				
Main Building	582287	220485	10.75	247	205	40

6.3 Chemistry

The plant will release nitric oxide (NO) and nitrogen dioxide (NO_2) which are collectively referred to as NOx. In the atmosphere, a proportion of nitric oxide will be converted to nitrogen dioxide in a reaction with ozone which is influenced by solar radiation. Since the air quality objectives are expressed in terms of nitrogen dioxide, it is important to be able to assess the conversion rate of nitric oxide to nitrogen dioxide.

Ground level NOx concentrations have been predicted through dispersion modelling. Nitrogen dioxide concentrations reported in the results section assume 70% conversion from NOx to nitrogen dioxide for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario in the Environment Agency methodology. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

6.4 Background concentrations

Background concentrations for the assessment have been derived from monitoring as presented previously in Table 4.8.

[2] AQTAG06 – Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air – January 2013.

For short term averaging periods the background concentration has been assumed to be twice the long term ambient concentration following the Environment Agency Horizontal Guidance Note H1 methodology.

7 Sensitivity Analysis

7.1 Surface roughness

The sensitivity of the results to surface roughness length has been considered by running the model with a range of surface roughness lengths for the dispersion site.

The following parameters were kept constant:

- Stack height – 35 m – (85m AOD);
- Source – all sources;
- Buildings – included;
- Terrain – included; and
- Met data year – 2010.

Table 7.1 presents the combined contribution to the ground level concentration of the emissions of oxides of nitrogen at the point of maximum impact.

Table 7.1: Surface Roughness Sensitivity

Surface roughness (m)	Max annual mean NOx process contribution	Max 1-hour mean NOx process contribution
0.2 – agricultural areas (min)	1.77	56.03
0.3 – agricultural areas (max)	1.94	57.43
0.5 – Parklands and open suburbia	2.19	59.74
1.0 – Cities and large towns	2.61	61.28

As shown, increasing the surface roughness leads to the predicted concentration at the point of maximum impact increasing for long and short term averages. The surface roughness of 0.3 m is most representative of agricultural environments like the wider area and has therefore been used within this assessment.

7.2 Sensitivity to operating below the design point

Dispersion modelling has been undertaken based on the emission parameters presented in the tables contained in Section 6.2. These are based on the design point for the Facility. The Facility would be operated as a commercial and therefore it is beneficial for the Facility to operate at full capacity. If loading does fall below the design point the volumetric flow rate and the exit velocity of the exhaust gases would reduce. The effect of this would to decrease the quantity of pollutants emitted but also to reduce the buoyancy of the plume due to momentum. The reduction in buoyancy, which would lead to reduced dispersion, would be more than offset by the decrease in the amount of pollutants being emitted, so that the impact of the plant when running below the design point would be reduced.

8 Dispersion Modelling Results

8.1 Screening

The Environment Agency Horizontal Guidance Note H1 states that:

"process contributions can be considered insignificant if:

- *the long term process contribution is <1% of the long term environmental standard; and*
- *the short term process contribution is <10% of the short term environmental standard."*

Predicted process contributions have been compared to the AQO/EALs provided in Section 3. Where the emissions of a particular pollutant cannot be considered to be 'insignificant', the predicted concentrations have been evaluated further.

In addition the following screening criteria are outlined in the Environment Agency guidance document "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012":

- Long-term Process Contribution (PC) <1% and Short-term Process Contribution (PC) <10%; or
- Long-term and Short-term Predicted Environmental Concentration (PEC) <100% (taking likely modelling uncertainties into account).

For screening purposes only, the Environment Agency methodology assumes that chromium (VI) comprises 20% of the total background chromium.

Where the impact is within these parameters, the Environment Agency concludes that there is no risk of exceeding the EAL.

8.2 Results

As discussed in Section 6.2, emissions from the Facility will be subject to emission limits. This section details the impact of the Facility assuming all items of plant operate for the entire year at the emission limits which were outlined in Section 6.2.

As identified in Section 6.2 the exhaust air from the pulp plant, and the AD biofilter will vent to atmosphere via within the same wind shield as the CHP and gas engines exhaust. Although there will be no combustion gases within the exhaust from the pulp plant or the biofilter, the temperature of the release is much lower than the CHP and will impact upon the buoyancy of the plume. The exhaust air from the pulp plant and the bioflter has been included to ensure any reduction is buoyancy is considered in the assessment.

Table 8.1 presents the results of the dispersion modelling of emissions from the Facility at the point of maximum impact and compares these results with the AQO/EALs presented in Table 3.2. Impacts which cannot be screened out as 'insignificant' are highlighted. This maximum impact has been calculated based on 100% operation of the CHP and AD gas engines. All short term impacts have been calculated based on operation of the CHP and AD gas engines at the short term emission limits concurrently during the worst-case weather conditions for dispersion. This is a highly conservative assumption.

Table 8.1: Dispersion Modelling Results – All Sources

Pollutant	Quantity	Units	AQO /EAL	Bg Conc.	Process Contribution (PC) at Point of Greatest Impact						Max as % of AQO /EAL	PEC (PC +Bg)	PEC as % of AQO /EAL
					2009	2010	2011	2012	2013	Max			
Nitrogen dioxide	Annual mean	µg/m^3	40	14.89	1.90	1.36	2.71	2.05	1.86	2.71	6.79%	17.60	44.01%
	99.79th%ile of hourly means(1)	µg/m^3	200	29.78	34.64	31.14	35.67	34.14	17.62	35.67	17.83%	65.45	32.72%
Sulphur dioxide	99.18th%ile of daily means	µg/m^3	125	7.30	6.09	5.20	7.86	6.28	6.20	7.86	6.29%	15.16	12.13%
	99.73rd%ile of hourly means(1)	µg/m^3	350	7.30	46.53	42.96	48.93	46.80	11.96	48.93	13.98%	56.23	16.06%
	99.9th%ile of 15 min. means(1)	µg/m^3	266	7.30	53.80	50.51	54.66	52.74	13.69	54.66	20.55%	61.96	23.29%
PM_{10}s	Annual mean	µg/m^3	40	19.58	0.13	0.10	0.19	0.14	0.13	0.19	0.48%	19.77	49.43%
	90.41th%ile of daily means	µg/m^3	50	39.16	0.47	0.40	0.68	0.53	0.53	0.68	1.36%	39.84	79.68%
$PM_{2.5}$s	Annual mean	µg/m^3	25	12.47	0.13	0.10	0.19	0.14	0.13	0.19	0.76%	12.66	50.64%
Carbon monoxide	8 hour running mean(1)	µg/m^3	10,000	534.00	14.67	14.81	15.16	14.84	19.14	19.14	0.19%	553.14	5.53%
Hydrogen chloride	Hourly mean(1)	µg/m^3	750	1.44	18.10	16.88	18.15	18.24	3.11	18.24	2.43%	19.68	2.62%
Hydrogen fluoride	Annual mean	µg/m^3	16	2.35	0.01	0.01	0.02	0.01	0.01	0.02	0.12%	2.37	14.81%
	Hourly mean(1)	µg/m^3	160	4.70	1.21	1.13	1.21	1.22	0.21	1.22	0.76%	5.92	3.70%
Ammonia	Annual mean	µg/m^3	180	1.48	0.13	0.10	0.19	0.14	0.13	0.19	0.11%	1.67	0.93%
	Hourly mean	µg/m^3	2,500	2.96	3.02	2.82	3.03	3.04	3.11	3.11	0.12%	6.07	0.24%
VOCs (as benzene)	Annual mean	µg/m^3	5	0.35	0.24	0.17	0.35	0.26	0.24	0.35	6.95%	0.70	13.95%

Table 8.1: Dispersion Modelling Results – All Sources

Pollutant	Quantity	Units	AQO /EAL	Bg Conc.	Process Contribution (PC) at Point of Greatest Impact						Max as % of AQO /EAL	PEC (PC +Bg)	PEC as % of AQO /EAL
					2009	2010	2011	2012	2013	Max			
VOCs (as 1,3-butadiene)	Annual mean	μg/m^3	2.25	0.14	0.24	0.17	0.35	0.26	0.24	0.35	15.44%	0.49	21.66%
Mercury	Annual mean	ng/m^3	250	1.38	0.66	0.48	0.95	0.72	0.65	0.95	0.38%	2.33	0.93%
	Hourly mean	ng/m^3	7,500	2.76	15.10	14.08	15.13	15.21	15.55	15.55	0.21%	18.31	0.24%
Cadmium	Annual mean	ng/m^3	5	0.20	0.66	0.48	0.95	0.72	0.65	0.95	19.01%	1.15	23.01%
	Hourly mean	ng/m^3	-	0.40	15.10	14.08	15.13	15.21	15.55	15.55	-	15.95	-
Dioxins	Annual mean	fg/m^3	-	22.82	1.33	0.95	1.90	1.44	1.30	1.90	-	24.72	-
PCBs	Annual mean	ng/m^3	200	0.14	0.07	0.05	0.10	0.07	0.07	0.10	0.05%	0.24	0.12%
	Hourly mean	ng/m^3	6,000	0.28	1.51	1.41	1.51	1.52	1.56	1.56	0.03%	1.84	0.03%
PAHs	Annual mean	pg/m^3	250	2000.00	1.39	1.00	2.00	1.51	1.37	2.00	0.80%	2002.00	800.80%
Other metals	Annual mean	ng/m^3	-	-	6.64	4.76	9.51	7.19	6.52	9.51	See metals assessment		
	Hourly mean	ng/m^3	-	-	150.97	140.77	151.34	152.09	155.52	155.52			

Notes:

(1) Based on operation of all items of plant at the ST ELV

(2) Based on operation of the EfW at the long term ELV and the gas boilers at the daily ELV

As shown in Table 8.1, the process contribution from the Facility does not cause an exceedence of the AQO for any pollutant. The only exceedence is predicted for PAHs, but the process contribution from the Facility can be screened out as 'insignificant' and the exceedence occurs as a result of the existing background concentration. For 24-hour PM_{10} the PEC is greater than 70% but it has been assumed that the background concentration is 2 times the annual mean background concentration as per Environment Agency H1 Annex F guidance. LAQM.TG(09) methodology states that to calculate the 90.4%ile of 24-hour particulate matter the annual mean concentration should be used (not 2 times as per Annex F). If we use the LAQM.TG(09) approach the PEC is predicted to be 40.52% of the AQO.

The predicted impact cannot be screened out as 'insignificant' for the following pollutants:

- Annual mean nitrogen dioxide process contributions;
- 99.79%ile 1-hour mean nitrogen dioxide process contributions;
- 99.73rd%ile of hourly means sulphur dioxide process contributions;
- 99.9th%ile of 15 min. means sulphur dioxide process contributions;
- Annual mean VOCs (as benzene) process contributions; and
- Annual mean VOCs (as 1,3-butadiene) process contributions; and
- Annual mean cadmium process emissions.

The impacts of all other pollutants can be screened out as 'insignificant' and further assessment is not required.

Analysis of the background concentrations has shown that the PEC is predicted to be less than 70% of the AQO/EAL for all long term impacts which are not screened out as insignificant.

This assessment is considered highly conservative as it assumes that:

- the CHP Facility and AD gas boilers operates concurrently at the long term or short term emission limit for the entire year;
- the entire VOC emissions are assumed to consist of benzene or 1,3-buitadiene; and
- cadmium is released at the combined emission limit for cadmium and thallium, while monitoring from waste facilities has indicated concentrations of cadmium are usually about 8% of the limit.

8.3 Nitrogen dioxide

The maximum predicted impact of annual mean nitrogen dioxide emissions is 6.79% of the AQO. This impact cannot be screened out as 'insignificant' using the Environment Agency H1 screening criteria. Analysis of the mapped background concentration has shown that background concentrations are relatively low and the PEC is predicted to be less than 50% of the AQO. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted annual mean concentrations as a result of emissions from the Facility. This assumes all items of plant operate for 100% of the time at the long term emission limit values.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of annual mean nitrogen dioxide emissions at a sensitive receptor is 6.6% of the AQO. This receptor is representative of a location along the footpath to the north of the site. The maximum predicted impact of annual mean nitrogen dioxide emissions at a location of long term exposure (i.e. a residential property) is 4.4% at Haywards. At all receptors the PEC is predicted to be less than 50%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

The maximum predicted impact of 99.79%ile 1-hour mean nitrogen dioxide emissions is 17.83% of the AQO. This impact cannot be screened out as 'insignificant' using the Environment Agency H1 screening criteria. Analysis of the mapped background has shown that background concentrations are relatively low and the PEC is predicted to be less than 35% of the AQO. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted 99.79%ile 1-hour mean concentrations as a result of emissions from the Facility. This assumes all items of plant operate for 100% of the time at the short term emission limit values. As such is considered worst-case as it assumes both plants operate at the short term emission limit concurrently and this operation coincides with the worst case weather conditions for dispersion.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of annual mean nitrogen dioxide emissions at a sensitive receptor is 16.1% of the AQO. This receptor is representative of a location along the footpath to the north of the site. At all receptors the PEC is predicted to be less than 35%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

8.4 Sulphur dioxide

The maximum predicted impact of hourly and 15-minute mean sulphur dioxide emissions is 13.98% and 20.55% of the AQO respectively. This impact cannot be screened out as 'insignificant' using the Environment Agency H1 screening criteria. Analysis of the mapped background has shown that background concentrations are relatively low and the PEC is predicted to be less than 25% of the AQO. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted 99.73 %ile of hourly mean and 99.9%ile of 15-minute mean sulphur dioxide concentrations as a result of emissions from the Facility. This assumes all items of plant operate for 100% of the time at the short term emission limit values. As such is considered worst-case as it assumes both plants operate at the short term emission limit concurrently and this operation coincides with the worst case weather conditions for dispersion.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of hourly and 15-minute mean sulphur dioxide emissions at a sensitive receptors is 12.7% and 20.0% of the AQO respectively. At all receptors the PEC is predicted to be less than 25%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

8.5 Volatile organic compounds

The maximum predicted impact of annual mean VOC emissions cannot be screened out as 'insignificant'. If it is assumed that the entire VOCs emissions consist of only benzene the impact is 6.95% of the AQO and if it is assumed the entire VOCs emissions consist of only 1,3-butadiene the impact is 15.44% of the AQO. Analysis of the mapped background has shown that background concentrations are relatively low and the PEC is predicted to be less than 25% of the AQO in both cases. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted annual mean VOC concentrations as a result of emissions from the Facility assuming the emissions consist of only benzene or 1,3-butadiene. This assumes all items of plant operate for 100% of the time at the long term emission limit values.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of annual mean VOC emissions at a sensitive receptors assuming the entire VOC emissions consist of only benzene or 1,3-butadiene is 6.8% and 15.0% of the AQO respectively. At all receptors the PEC is predicted to be less than 25%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

8.6 Cadmium

The maximum predicted impact of annual mean cadmium emissions is 19.01% of the EAL. This impact cannot be screened out as 'insignificant' using the Environment Agency H1 screening criteria. Analysis of the background data has shown that background concentrations are relatively low and the PEC is predicted to be less than 25% of the EAL. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted annual mean concentrations as a result of emissions from the Facility. This assumes all items of plant operate for 100% of the time at the long term emission limit values.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of annual mean cadmium emissions at a sensitive receptor is 18.5% of the AQO. This receptor is representative of a location along the footpath to the north of the site. The maximum predicted impact of annual mean nitrogen dioxide emissions at a location of long term exposure (i.e. a residential property) is 12.3% at Haywards. At all receptors the PEC is predicted to be less than 25%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

This assumes that the cadmium is released at the combined emission limit for cadmium and thallium. Monitoring from waste facilities has indicated that concentrations of cadmium are usually about 8% of the year. If this assumption is applied, the predicted process contribution at the point of maximum impact is only 1.5% of the EAL, and the maximum impact at a sensitive receptor representing long term exposure (a residential property) is 1.0% of the EAL. This is not a significant impact.

8.7 Metals – at point of maximum impact

There is a single emission limit for nine Group 3 metals (arsenic, antimony, chromium, cobalt, copper, lead, manganese, nickel and vanadium). The impact of these metals has been assessed using the three stage screening methodology outlined in the Environment Agency guidance document "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012".

8.7.1 Stage 1

Using the Environment Agency methodology, the first stage is to predict the impact of each metal, assuming each metal is emitted at 100% of the emission level, and compare against the EALs outlined in Table 3.1.

Table 8.2 displays the results of the first stage screening methodology for long term impacts of metals. Any exceedences of the Environment Agency screening criteria are highlighted.

Table 8.2: Heavy Metal Screening Assessment - Step 1 – Long Term						
Metal	EAL (ng/m^3)	Background Conc. (ng/m^3)	Process Contribution		PEC	
			Conc. (ng/m^3)	As % of EAL	Conc. (ng/m^3)	As % of EAL
Arsenic	3	0.81	9.51	316.86%	10.32	343.86%
Antimony	5,000	-	9.51	0.19%	-	-
Chromium	5,000	1.32	9.51	0.19%	10.83	0.22%
Chromium (VI)	0.2	0.26	9.51	4752.88%	9.77	4884.88%
Cobalt	-	-	9.51	-	-	-
Copper	10,000	4.44	9.51	0.10%	13.95	0.14%
Lead	250	8.38	9.51	3.80%	17.89	7.15%
Manganese	150	3.49	9.51	6.34%	13.00	8.66%
Nickel	20	1.43	9.51	47.53%	10.94	54.68%
Vanadium	5,000	1.75	9.51	0.19%	11.26	0.23%

Using the first stage screening methodology, the PCs of arsenic, chromium (VI), lead, manganese and nickel are predicted to be greater than 1% of the EAL. However, only the PEC for arsenic and chromium (VI) is predicted to be greater than 100% of the EAL. The assessment methodology states that the PEC should take into account of modelling uncertainty. For lead, manganese and nickel the PEC is less than 60% which means that, even when taking into account of any modelling uncertainty, it is expected that the PEC will remain below the EAL. Arsenic and chromium (VI) have been progressed to the second stage of assessment.

The PC for all other metals is less than 1% and the PEC is less than 100% of the EAL and so these can be screened out from further assessment. It is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution and progression to the second stage of assessment is not necessary.

Table 8.3 presents the results of the first stage screening methodology for short term impacts of metals.

Table 8.3: Heavy Metal Screening Assessment - Step 1 – Short Term						
Metal	EAL (ng/m^3)	Background Conc. (ng/m^3)	Process Contribution		PEC	
			Conc. (ng/m^3)	As % of EAL	Conc. (ng/m^3)	As % of EAL
Arsenic	-	1.62	155.52	-	157.14	-
Antimony	150,000	-	155.52	0.10%	-	-
Chromium	150,000	2.64	155.52	0.10%	158.16	0.11%
Chromium (VI)	-	0.53	155.52	-	156.05	-
Cobalt	-	-	155.52	-	-	-
Copper	200,000	8.88	155.52	0.08%	164.40	0.08%
Lead	-	16.76	155.52	-	172.28	-
Manganese	1,500,000	6.98	155.52	0.01%	162.50	0.01%
Nickel	-	2.86	155.52	-	158.38	-
Vanadium	1,000	3.50	155.52	15.55%	159.02	15.90%

Using the stage 1 screening methodology, the PEC for all metals, except vanadium, is less than 100% and so the short term impact of all metals can be screened out from further assessment. The PC for vanadium is greater than 10%, but the PEC is less than 16%. Therefore, even when taking into account any modelling uncertainty, it is expected that the PEC will remain below the EAL. It is therefore not necessary to progress short term vanadium emissions to the second stage of assessment.

8.7.2 Stage 2

The second stage of the assessment is to consider a worst case scenario based on currently operating plant, assuming each metal comprises 11% of the total group (i.e. a process contribution of 9.51 ng/m^3 apportioned equally across the nine metals).

It is assumed for this worst case screening that the proportion of chromium (VI) to total chromium is 20% as suggested as a worst case by the Expert Panel on Air Quality Standards (EPAQS) paper on Metals and Metalloids.

The results of the second stage assessment are shown below. Any exceedences of the Environment Agency screening criteria are highlighted.

Table 8.4: Heavy Metal Screening Assessment - Step 2 – Long Term						
Metal	EAL (ng/m^3)	Background Conc. (ng/m^3)	Process Contribution		PEC	
			Conc. (ng/m^3)	As % of EAL	Conc. (ng/m^3)	As % of EAL
Arsenic	3.00	0.81	1.06	35.21%	1.87	62.21%
Chromium (VI)	0.20	0.26	1.06	528.10%	1.32	660.10%

As shown, although the PC for arsenic is greater than 1% as a worst case scenario, the PEC is well below 100% of the EAL. As such it is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution and progression to the third stage of assessment for emissions of arsenic is not necessary.

As shown, assuming the entire chromium emissions are in the hexavalent form (chromium VI), emissions cannot be screened out using the worst case scenario. Therefore, additional consideration has to be given to the assumptions used in assessing the impact of this pollutant.

8.7.3 Stage 3

The third stage of the assessment is to consider site specific assumptions.

Percentages lower than 11% of the IED ELV

The Facility will incorporate a flue gas treatment system to remove heavy metals from the gas stream. This flue gas treatment system is similar to that in use at other UK waste combustion facilities and, as such, we would expect the performance of the proposed flue gas treatment system to be as effective in removing heavy metals as the same system employed at a typical facility.

An analysis of monitoring of metal emissions from 10 Municipal Waste Incinerators in England and Wales is presented in Appendix B of "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012". This is reproduced in the following table.

Table 8.5: Monitoring Data from Municipal Waste Incinerators

Pollutant	Measured Concentration as % of IED Group 3 Limit		
	Mean	Max	Min
Antimony	0.66%	2.30%	0.02%
Arsenic	0.14%	0.60%	0.06%
Chromium	2.18%	10.42%	0.08%
Cobalt	0.08%	0.78%	0.04%
Copper	1.54%	3.26%	0.50%
Lead	3.16%	7.36%	0.06%
Manganese	3.44%	7.30%	0.30%
Nickel	4.40%	27.24%	0.00%
Tin	0.48%	0.48%	0.48%
Vanadium	0.06%	0.20%	0.04%
Total (calculated)	**16.14%**	**59.94%**	**1.58%**

NOTES:
Nickel concentration is greater than 11% is due to one single measurement outlier. The average is around 4% of the Group ELV.

As shown, the total chromium emissions are a maximum of 10.42% of the limit; this includes some contribution from chromium (VI).

The Environment Agency guidance also provides an analysis of chromium (VI). Due to the very small amounts of chromium (VI) emitted from municipal waste incinerators, this has been undertaken based on analysis of APC residues. This is reproduced in the following table.

Table 8.6: Chromium VI Analysis from APC Residues		
	Effective Cr(VI) Emission Concentration (mg/Nm^3, 11% ref oxygen content	% of IED Limit for Total Metals
Mean	3.5 x 10^{-5}	0.0070%
Minimum	2.3 x 10^{-6}	0.0005%
Maximum	1.3 x 10^{-4}	0.0260%

As shown, the maximum chromium (VI) emissions are very low at 0.026% of the total Group ELV.

The Facility will process the same type of fuel as the plants considered within the Environment Agency guidance note and will include conventional gas clean up mechanisms. Therefore, it is appropriate to assume that the Facility would not have greater emissions of metals than the plants considered within the Environment Agency guidance note.

The results of the third stage assessment are presented in the following table, taking into account the likely emissions based on the maximum monitored concentrations from existing MSW incineration facilities. Any exceedences of the Environment Agency screening criteria are highlighted.

Table 8.7: Heavy Metal Screening Assessment - Step 3 – Long Term – Likely Emissions						
Metal	EAL (ng/m^3)	Background Conc. (ng/m^3)	Process Contribution		PEC	
			Conc. (ng/m^3)	As % of EAL	Conc. (ng/m^3)	As % of EAL
Chromium (VI)	0.20	0.26	1.24E-03	0.62%	0.27	132.62%

As shown, assuming the Facility performance will be similar to other UK waste incineration facilities, the PC is less than 1% of the EAL at the point of maximum impact. Therefore, there is little potential for significant pollution as a result of emissions of chromium (VI), even when taking likely modelling uncertainties into account.

8.7.4 Summary of metals screening

At the point of maximum impact the long term and short term impact of emissions of metals have been screened using the Environment Agency screening criteria, and it is considered that there is no risk of exceeding any EAL for these heavy metals as a result of emissions from the Facility.

9 Impact at Ecological Receptors

This section provides an assessment of the impact of the operation of the Facility at the identified ecological receptors.

9.1 Screening

The Environment Agency have produced Operational Instruction documents which explain how to assess aerial emissions from new or expanding Integrated Pollution Prevention and Control (IPPC) regulated industry applications, issued under the Environmental Permitting Regulations. The process to follow to satisfy the requirements of the Conservation of Habitats and Species Regulations 2010, Countryside and Rights of Way (CRoW) Act 2000, and the Environment Agency's wider duties under the Environment Act 1995 and the Natural Environment and Rural Communities Act 2006 (NERC06) is outlined.

Operational Instruction 67_12 "Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation" provides the following risk based screening criteria for nature conservation sites.

Table 9.1: Screening Criteria

Threshold	European Sites	SSSIs	NNR, LNR, LWS, ancient woodland
Y (% threshold long-term)	1	1	100
Y (% threshold short-term)	10	10	100
Z (% threshold)	70	70	100
NOTES: Short term considers both daily and weekly			

Where:

- Y is the long term process contribution calculated (PC) as a percentage of the relevant Critical Level or Load; and
- Z is the long term predicted environmental concentration (PEC) calculated as a percentage of the relevant Critical Level or Load.

Operational Instruction 66-12 states:

- If PC < Y% Critical Level and Load then emissions from the application are not significant, and
- If PEC < Z% Critical Level and Load it can be concluded 'no likely significant effect' (alone and in-combination).

AQTAG 17 – "Guidance on in combination assessments for aerial emissions from EPR permits" states that:

> *"Where the maximum process contribution (PC) at the European site(s) is less than the Stage 2 de-minimis threshold of the relevant critical level or load, the PC is considered to be inconsequential and there is no potential for an alone or in-combination effects with other plans and projects."*

Consultation with the Environment Agency has confirmed that the "Stage 2 de-minimis threshold" is the criteria outlined in Operational Instruction 67_12 outlined above.

9.2 Atmospheric emissions - Critical Levels

In addition to the objectives for the protection of human health, the AQS includes Critical Levels for the protection of ecosystems as presented in Table 3.3.

Predicted process contributions have been compared to the Critical Levels for the protection of ecosystems. Where the emissions of a particular pollutant are greater than 1% of the long term or 10% of the short term Critical Level, further assessment has been undertaken.

For the purpose of the ecological assessment the APIS mapped background dataset has been used.

9.3 Deposition of emissions – Critical Loads

The Air Pollution Information System (APIS) provides Critical Loads for nature conservation sites at risk from acidification and nitrogen deposition (eutrophication).

An assessment has been made for each habitat feature identified in APIS for the specific site. The search by location tool has been used to identify the feature habitats then the search by location tool to find the habitat specific Critical Load for the specific grid (i.e. the point of maximum impact with the designated site). If the impact of process emissions upon nitrogen or acid deposition is greater than 1% of the Critical Load, further assessment has been undertaken.

APIS does not include site specific Critical Loads for non-designated sites. In lieu of this the search by location function of APIS has been used. The Critical Loads are based on a broad habitat type and location.

9.3.1 Nitrogen deposition – eutrophication

A search has been undertaken on for each of the ecological receptors identified in Table 5.2. Appendix C summarises the Critical Loads for nitrogen deposition and background deposition rates as detailed in APIS for each habitat identified.

The impact of the Facility has been assessed against these Critical Loads for nitrogen deposition.

9.3.2 Acidification

The APIS Database contains a maximum critical load for sulphur (CLmax), a minimum critical load for nitrogen (CLminN) and a maximum critical load for nitrogen (CLmaxN). These components define the critical load function. Where the acid deposition flux falls within the area under the critical load function, no exceedences are predicted.

A search has been undertaken on for each of the ecological receptors identified in Table 5.2. Each site has a number of habitats, each with different Critical Loads. Appendix C summaries the Critical Loads for acidification and background deposition rates as detailed in APIS for each identified habitat.

The impact of the Facility has been assessed against these Critical Load functions. Where a critical load function for acid deposition is not available, the total nitrogen, sulphur and hydrogen chloride deposition has been presented and compared with the background concentration.

9.3.3 Calculation methodology – nitrogen deposition

The impact of deposition has been assessed using the methodology detailed within the Habitats Directive AQTAG 6 (March 2014). The steps to this method are as follows.

(1) Determine the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site.

(2) Calculate the dry deposition flux (µg/m^2/s) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 9.2.

(3) Convert the dry deposition flux into units of kgN/ha/yr using the conversion factors presented in Table 9.2.

(4) Compare this result to the nitrogen deposition Critical Load.

Table 9.2: Deposition Factors

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m^2/s to kg/ha/year)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0
Sulphur dioxide	0.0120	0.024	157.7
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

9.3.3.1 Acidification

Deposition of nitrogen, sulphur, hydrogen chloride and ammonia can cause acidification and should be taken into consideration when assessing the impact of the Facility.

The steps to determine the acid deposition flux are as follows.

(1) Determine the dry deposition rate in kg/ha/yr of nitrogen, sulphur, hydrogen chloride and ammonia using the methodology outlined in Section 9.3.3.

(2) Apply the conversion factor for N outlined in Table 9.3 to the nitrogen and ammonia deposition rate in kg/ha/year to determine the total keq N/ha/year.

(3) Apply the conversion factor for S to the sulphur deposition rate in kg/ha/year to determine the total keq S/ha/year.

(4) Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the dry keq Cl/ha/year.

(5) Determine the wet deposition rate of HCl in kg/ha/yr by multiplying the model output by the factors presented in Table 9.2.

(6) Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the wet keq Cl/ha/year.

(7) Add the contribution from S to HCl dry and wet and treat this sum as the total contribution from S.

(8) Plot the results against the Critical Load functions.

The March 2014 version of the AQTAG 6 document states that, for installations with an HCl emission, the process contribution of HCl, in addition to S and N, should be considered in the acidity Critical Load assessment. The H^+ from HCl should be added to the S contribution (and treated as S in the APIS tool). This should include the contribution of HCl from wet deposition.

Consultation with AQMAU confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. When modelling wet deposition the "falling drop" method has been used which includes plume depletion. The initial pH for droplets above the plume was selected as 5.6.

Table 9.3: Conversion Factors□	
Pollutant	**Conversion Factor (kg/ha/year to keq/ha/year)**
Nitrogen	Divide by 14
Sulphur	Divide by 16
Hydrogen chloride	Divide by 35.5

The process contribution has been calculated using the APIS formula:

Where PEC N Deposition < CLminN:

PC as % of CL function = PC S deposition / CLmaxS

Where PEC N Deposition > CLminN:

PC as % of CL function = (PC S + N deposition) / CLmaxN

9.4 Results – statutory designated sites – emissions

No statutory designated sites have been identified within the Environment Agency H1 screening distance.

9.5 Results – non-statutory designated sites – emissions

As identified in Section 5.2, there are a number of non-statutory designated sites within 2km of the Facility. The impact of emissions at these locally designated sites has been quantified and the results compared against the Critical Levels presented in Table 3.3. The highest predicted process contributions to ground level concentrations at the identified ecological receptors are presented in Table 9.4.

As shown the PC is not predicted to exceed the Critical Level at any of the locally-designated sites. Therefore, emissions from the Facility at locally designated sites are not significant.

Table 9.4: Impact of Emissions at Non-Statutory Designated Sensitive Ecological Receptors												
Site	Oxides of Nitrogen				Sulphur Dioxide		Hydrogen Fluoride				Ammonia	
	Daily		Annual		Annual		Daily		Weekly		Annual	
	Conc. µg/m^3	As % of CL	Conc. µg/m^3	As % of CL	Conc. µg/m^3	As % of CL	Conc. µg/m^3	As % of CL	Conc. µg/m^3	As % of CL	Conc. µg/m^3	As % of CL
Critical Level	**75**	**-**	**30**	**-**	**20**	**-**	**5**	**-**	**0.5**	**-**	**3**	**-**
Non-statutory designated sites (within 2km)												
River Blackwater	0.11	0.1%	0.57	1.9%	0.14	0.7%	0.08	1.6%	0.04	7.6%	0.03	0.9%
Storeys Wood	0.19	0.3%	1.15	3.8%	0.28	1.4%	0.23	4.5%	0.13	25.8%	0.06	1.9%
Maxley's Spring	0.17	0.2%	0.79	2.6%	0.19	1.0%	0.17	3.4%	0.09	18.1%	0.04	1.3%
Screening Criteria	-	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**

9.6 Results – non statutory designated sites – deposition

APIS does not include site specific Critical Loads for non-statutory designated sites. In lieu of this the search-by-location function of APIS has been used. The broad habitat type has been assumed.

The highest predicted levels of nitrogen and acid deposition are presented in Appendix D. Where process contributions are greater than 100%, or the PEC is greater than 100% of the Critical Load these are highlighted.

The maximum nitrogen deposition PC at a non-statutory designated site is predicted to be 29.06% and the maximum acid deposition is predicted to be 44.33% of the respective Lower Critical Loads. Therefore, the impact of emissions from the Facility at locally designated sites is not significant.

9.7 Summary of impact at ecological receptors

As a result of the habitats screening exercise a number of ecologically sensitive sites were identified which needed considering within the Air Quality Assessment. A summary of the impact at each site is provided below:

No European or UK designated sites have been identified as requiring consideration within this air quality assessment.

A number of non-statutory designated sites have been identified within 2km of the Facility. APIS does not include site specific Critical Loads for non-statutory designated sites. In lieu of this the search-by-location function of APIS has been used. The broad habitat type has been assumed. The assessment has concluded that emissions are not significant. This conclusion has been drawn because the PC is less than 100% of the Critical Level or Load.

10 Odour Assessment

An Odour Management Plan has been developed for the Environmental Permit application. This shows that there will be a building ventilation system to manage odorous emissions from the CHP plant bunker, the pulp plant, the AD plant, the MRF and MBT plant. Odorous air will either be used as combustion air or be vented to atmosphere via the main stack following treatment within the AD biofilter. The following section details the impact of the odorous emissions from the AD biofilter.

10.1 Evaluation Criteria

There is no specific legislation regarding acceptable or unacceptable odour levels. The primary means of regulation is through the concept of Statutory Nuisance under Part III of the Environmental Protection Act 1990 and under the Environmental Permitting Regulations, where odour is a type of pollution to be regulated. In both cases, the objective of regulation is to ensure that there is no cause for annoyance.

Odours are characterised in terms of European odour units, OU, and odour concentrations, OU_E/m^3.

- The OU strength of a release is the number of times the mixture must be diluted, at standard temperature and pressure, to reach the detection limit. A release of 1 OU can be detected by half of the members of an olfactory panel.
- One OU_E is the mass of a pollutant that, when evaporated into 1 m^3 of odourless gas, has the same odour nuisance as 1 OU of reference odorant.

The Environment Agency have published a guidance note on odour assessment, entitled Technical Guidance Note H4. In Appendix 4 to Part 1 of this document, the Environment Agency recommends some indicative odour exposure criteria for ground level concentrations of mixtures of odorant, below which there would be "no reasonable cause for annoyance". For "highly offensive odours", including those from activities involving putrescible waste, the criterion is 1.5 ouE/m^3 as the 98th percentile of hourly averages. This has been used as the evaluation criterion for the odour assessment.

10.2 Methodology

The detailed flue gas dispersion modelling was carried out using the computer model ADMS 5.1, as for the main dispersion modelling. For odour modelling, it is assumed that the odour is caused by a substance which disperses in the atmosphere, in the same way that any other pollutant (such as dust or sulphur dioxide) disperses.

10.3 Results

The highest predicted odour concentrations from the AD biofilter are shown in the following table. As with the combustion emissions the buoyancy of the AD biofilter odour emissions will be increased when it is released with the other warmer emissions sources such as the CHP and the AD gas engines. Therefore this analysis has considered normal operations when all items of plant are operating and any scenario in which only the AD biofilter is operating.

Table 10.1: Summary of Impact of Plume Visibility Operating Scenarios

Weather data year	Maximum 98th %ile 1-hour Odour (OU_E/m^3)	
	Normal Operations	Only AD Biofilter Operating
2009	0.26	1.09
2010	0.23	1.13
2011	0.28	1.06
2012	0.26	1.08
2013	0.26	1.01
Max all years	0.28	1.13

NOTES:
Normal operations assumes all plant operates and the exhaust from the pulp plant is emitted at 30°C.

As shown under normal operations the other sources provide additional buoyancy to the emissions from the biofilter promoting dispersion. In both cases the 98th percentile of odour concentrations at the point of maximum impact is less than 1.5 OU_E/m^3. Therefore, it can be concluded that there would be "no reasonable cause for annoyance" from odour from the proposed operation of the AD biofilter under normal or abnormal operations.

11 Plume Visibility

Planning permission was granted on 02 March 2010 by the Secretary of State for an Integrated Waste Management Facility at Rivenhall Airfield, Essex, C5 9DF, in accordance with application reference ESS/37/08/BTE, dated 28 August 2008. This was subject to a number of conditions including condition 17 which states:

> *"No development shall commence until a management plan for the CHP plant to ensure there is no visible plume from the stack has been submitted to and approved in writing by the Waste Planning Authority. The development shall be implemented in accordance with the approved plan."*

An amendment to the planning permission was granted on 26 March 2015 (ref: ESS/55/14/BTE). This included the same condition relating to the requirement to submit a management plan. A CHP Management Plan for Plume Abatement has been developed to discharge the above planning condition (document ref: S1552-0700-0008RSF). This is supported by a Plume Visibility Analysis report.

A feedforward mechanism will be used to adjust the temperature of the exhaust air from the pulp plant based on a set of meteorological parameters. These parameters have been determined based on the results of the dispersion model.

The following four operating conditions will be implemented for the emissions from the pulp plant:

(1) June to September – no additional heating – release at 30°C

(2) October to May – heating using low pressure steam – release at 130°C

(3) October to May – additional heating using high pressure steam – release at 210°C when the ambient temperatures is less than 4°C, wind speed is less than 9 m/s and the relative humidity is greater than 70%.

(4) October to May – additional heating using high pressure steam – release at 260°C when the ambient temperature is less than -1°C, wind speed is less than 8 m/s and the relative humidity is greater than 83%.

The implementation of the above operating regimes will impact upon the buoyancy of the emissions and thus the impact of emissions at ground level. As the mixed exhaust air from the pulp plant is heated additional buoyancy will be provided aiding the dispersion of pollutants. The following table presents a summary of the maximum impact of process emissions of nitrogen dioxide for each scenario (the model inputs are taken from the CHP Management Plan for Plume Management (document ref: S1552-0700-0008RSF).

Table 11.1: Summary of Impact of Plume Visibility Operating Scenarios

Operating scenario	Process Contribution (µg/m^3) at point of maximum impact	
	Annual Mean	Max 1-hour
1	2.71	61.59
2	2.25	54.76
3	1.94	50.62
4	1.82	48.53

NOTES:
Analysis based on 2009 weather data

As shown the implementation of the heating of the exhaust from the pulp plant increases buoyancy and reduces the ground level impact of emissions. Therefore the results presented in this Dispersion Modelling Report are still valid, and in fact are overly conservative, when the CHP Management Plan for Plume Abatement is implemented.

12 Flare

The operation of the flare has not been implicitly modelled as part of this Dispersion Modelling Assessment for the following reasons:

(1) The gas system has been designed such that the auxiliary flare will only be used for short periods of time during maintenance of gas engines.

(2) The Standard Rules Permit SR2010No15 for anaerobic digestion plants does not set emission limits for an auxiliary gas flare that is to be used infrequently.

(3) The auxiliary gas flare will be designed to meet the requirements for landfill gas flares (which state that the flue gas must be maintained at or above 1,000°C for at least 0.3 seconds).

(4) The emissions from the gas engines have been overestimated, as the period of maintenance and breakdown has not been taken into account when calculating the annual average ground level concentrations.

13 CONCLUSIONS

This Dispersion Modelling Assessment has been undertaken to support the Environmental Permit and updated planning application for the Rivenhall Integrated Waste Management Facility.

This assessment has included a review of baseline pollution levels, dispersion modelling of emissions and determination of the significance of the impact of these emissions on local air quality.

(1) The review of background monitoring data and DEFRA modelled data has been undertaken to determine the most suitable concentrations for use in the assessment. Where background monitoring is available this has been used in preference to modelled data.

(2) The methodology used in the assessment of the impact on air quality of the proposals uses a number of conservative assumptions. These include the following:

  a) The Facility will be applying BAT for the control of emissions and comply with the emission limits outlined in the IED for a waste incineration plant;

  b) It is assumed that the Facility will continually operate at the proposed limits whereas, in practice, this will not be the case and actual emissions will be less than the limits;

  c) It has been assumed that all items of plant operate concurrently at the short term emission limit values when determining short term impact to ensure the worst-case is accounted for where all items could be operating during adverse meteorological conditions for dispersion;

  d) It has been assumed that all items of plant operate concurrently at the daily emission limit values when determining long term impacts; and

  e) The maximum ground level concentrations are considered in each case. These concentrations occur in small areas; in general, the concentration will be much lower.

(3) In relation to the impact on ecologically sensitive sites, it has been assumed that all items of plant operate at the emission limits for the entire year as a worst-case. Even with this highly conservative assumption we conclude that:

  a) No UK or European designated sites have been identified within the H1 screening distance, and have not been considered in this assessment.

  b) At all locally designated sites emissions are not likely to have a significant impact.

In summary, the proposed Facility would not have a significant impact on local air quality, the general population or the local community.

Appendix A - Figures

Figure 1: Site Location and Human Sensitive Receptors

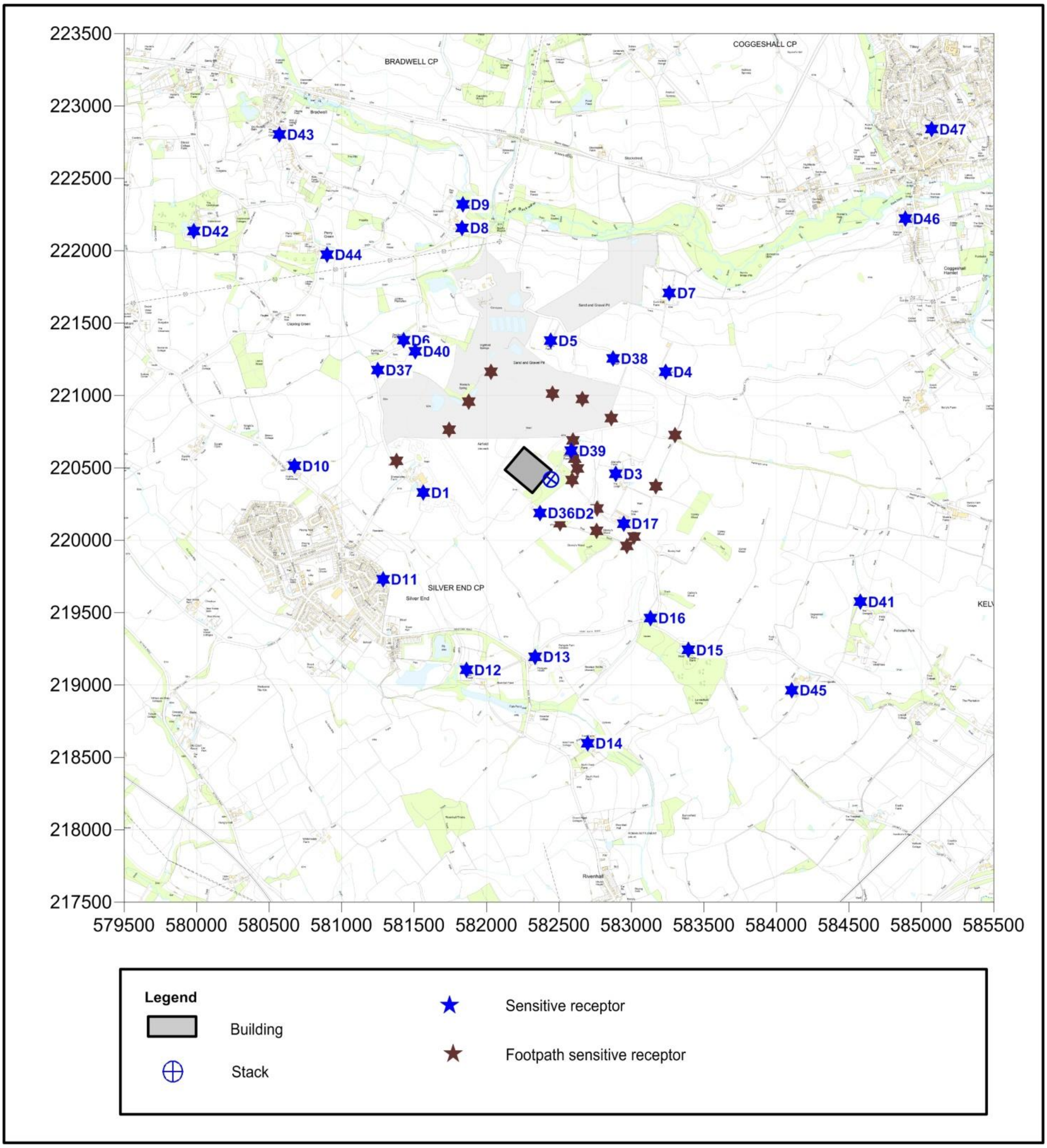


Figure 2: Sensitive Ecological Receptors

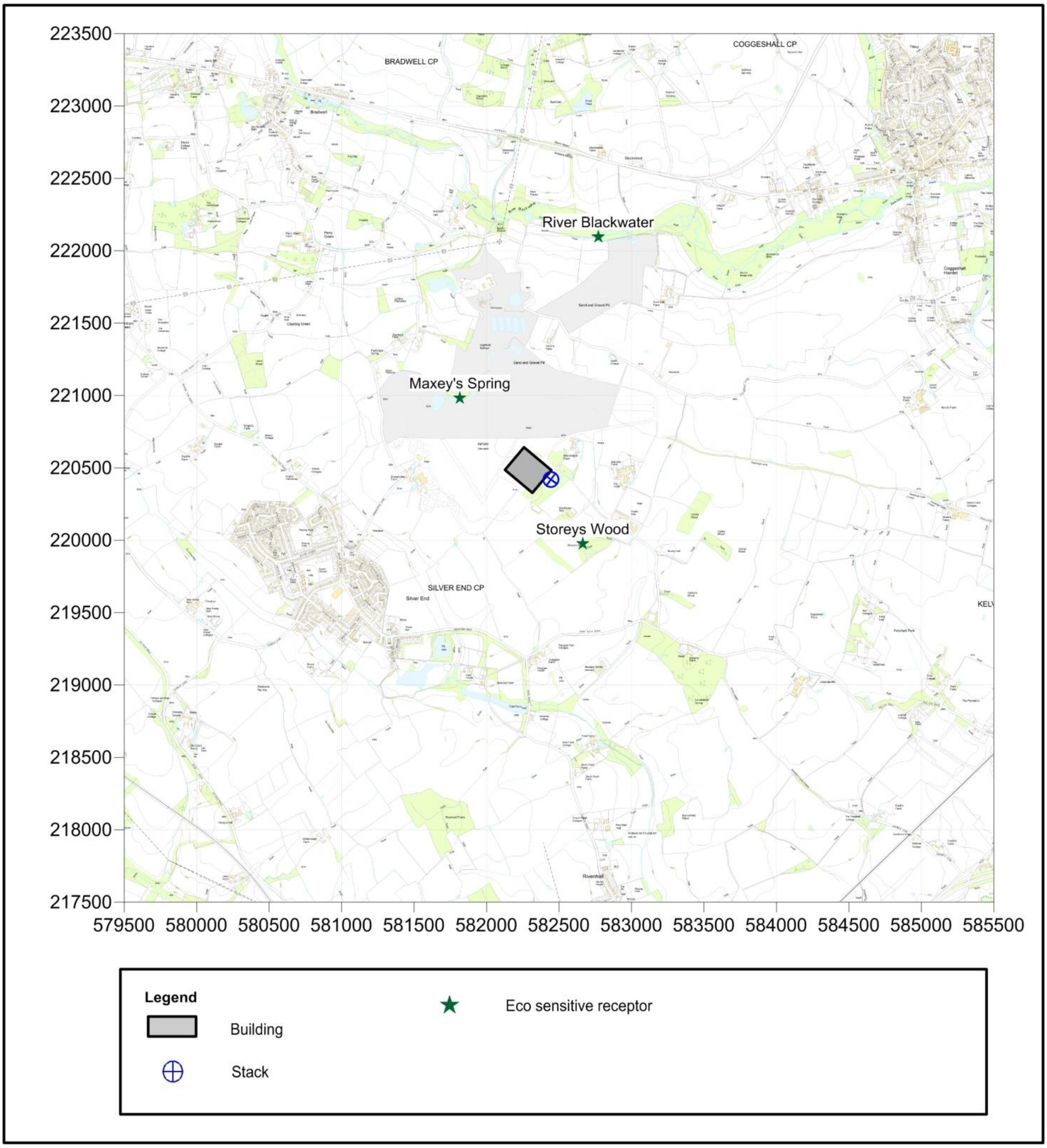
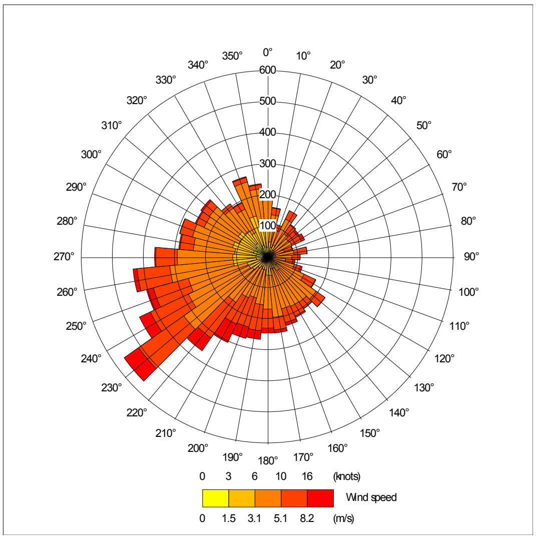
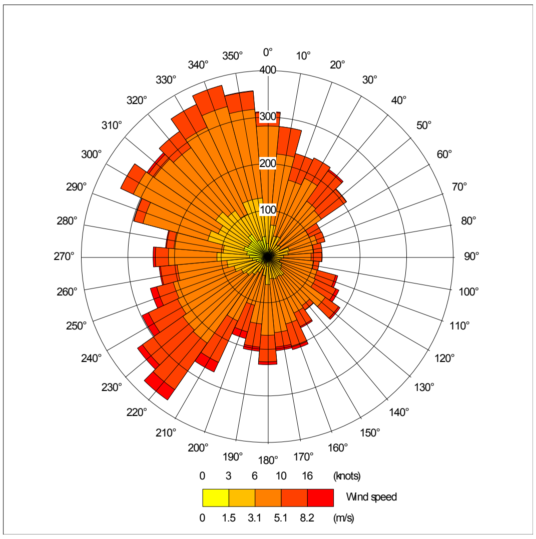


Figure 3: Wind Roses

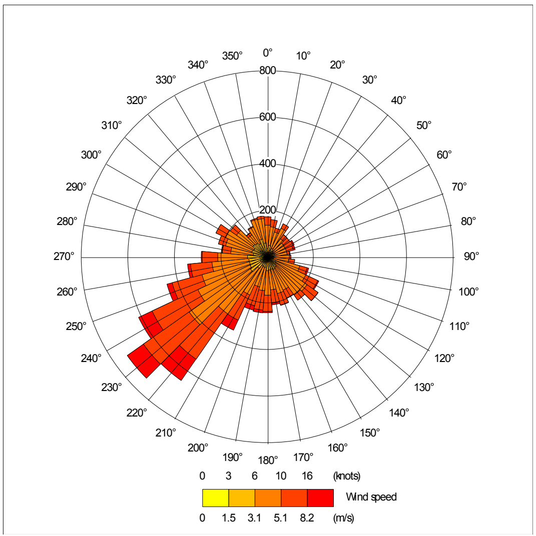
Stansted Airport 2009



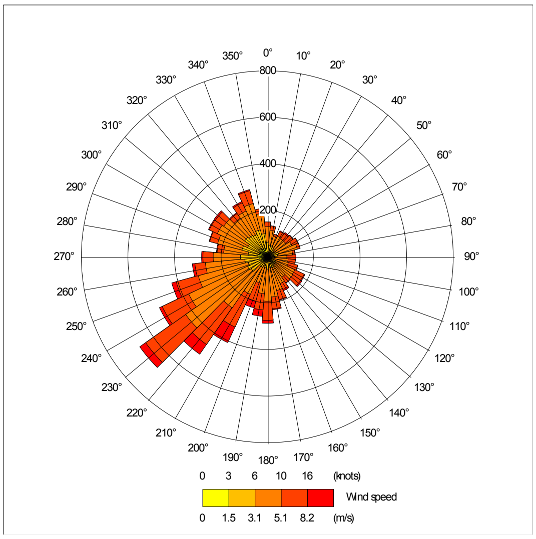
Stansted Airport 2010



Stansted Airport 2011



Stansted Airport 2012



Stansted Airport 2013

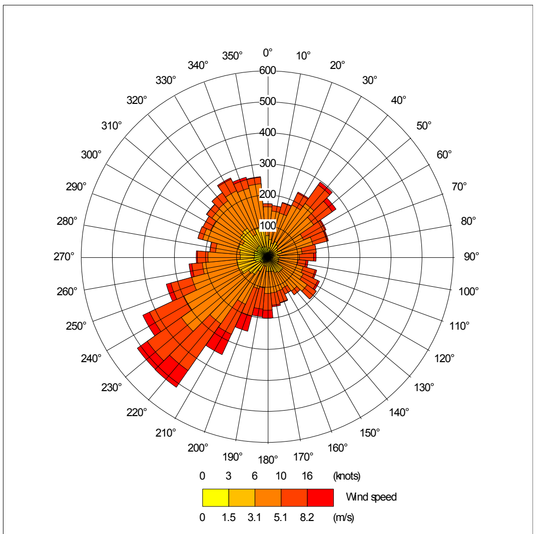


Figure 4: Building Layout

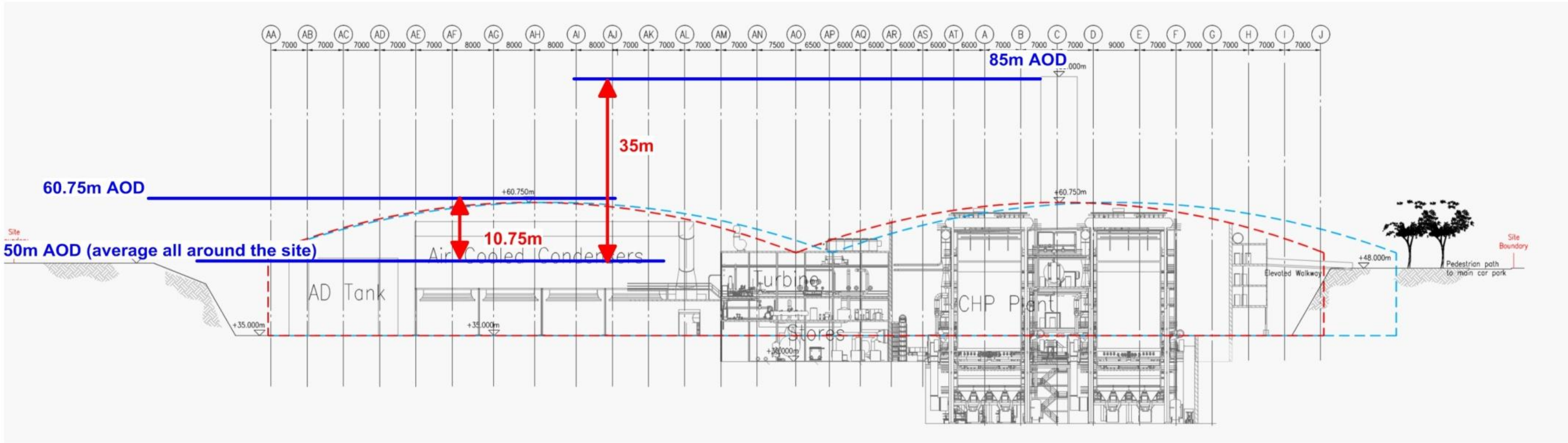


Figure 5: Site, Modelling Domain and Terrain Extents

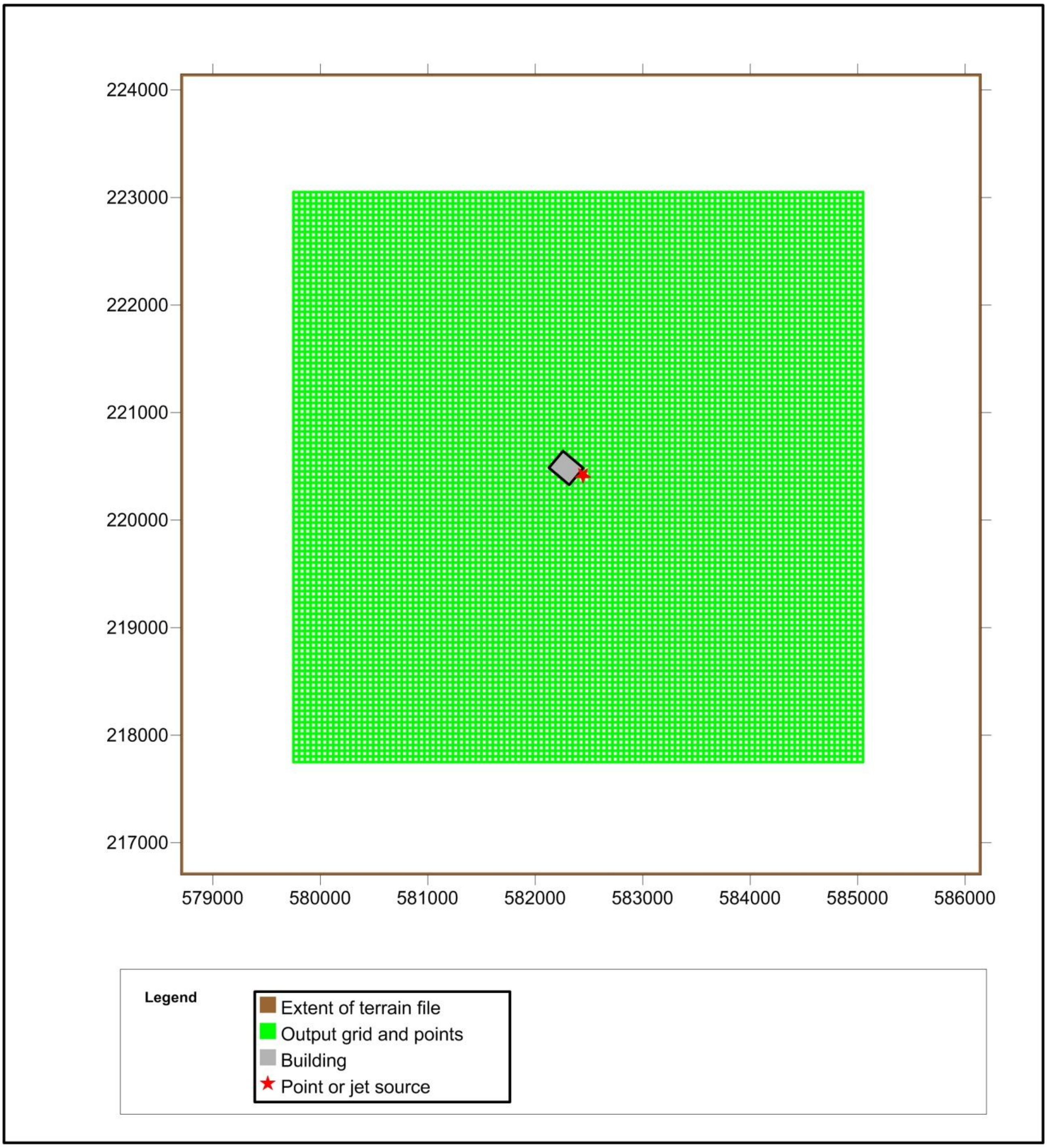
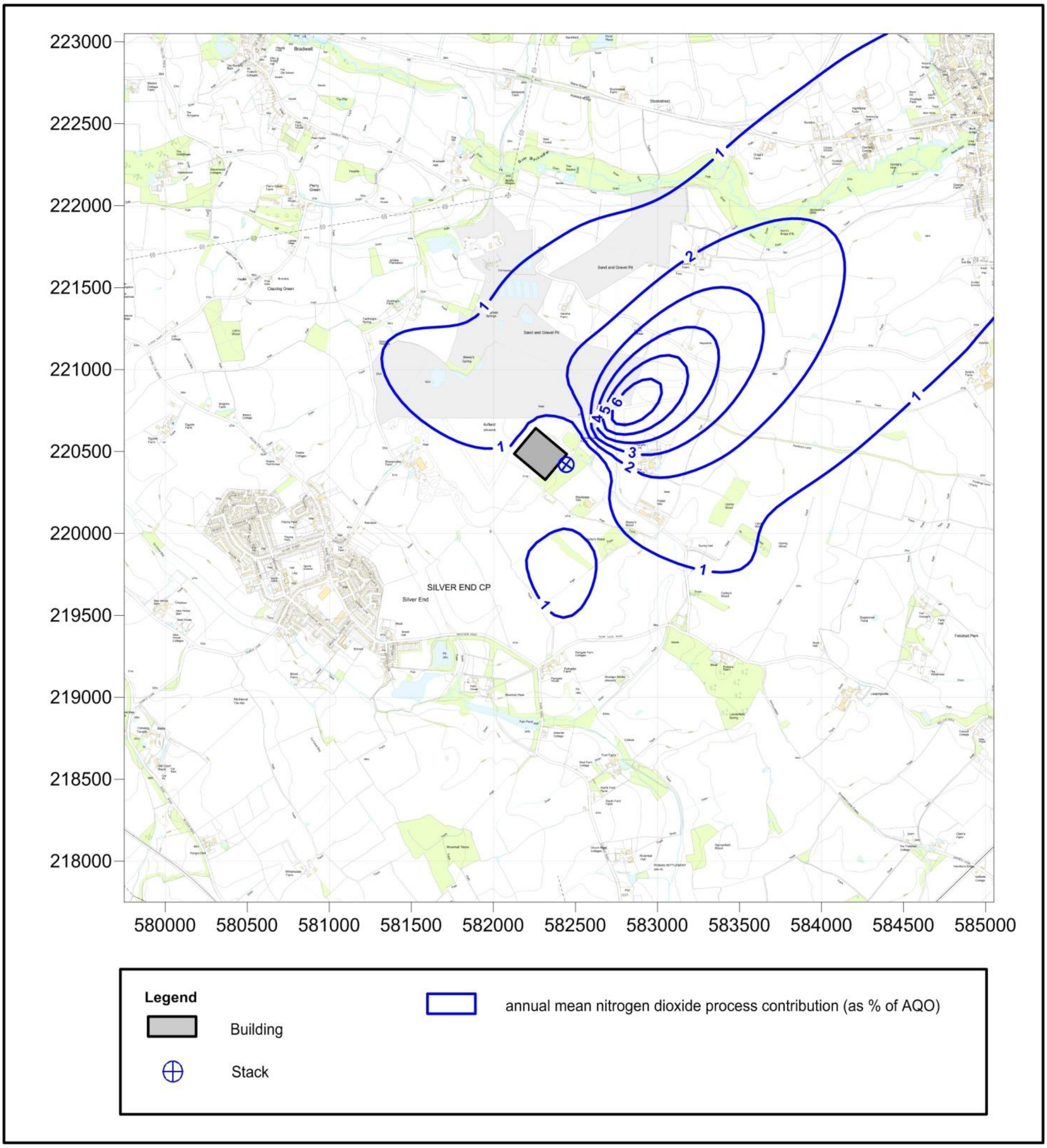
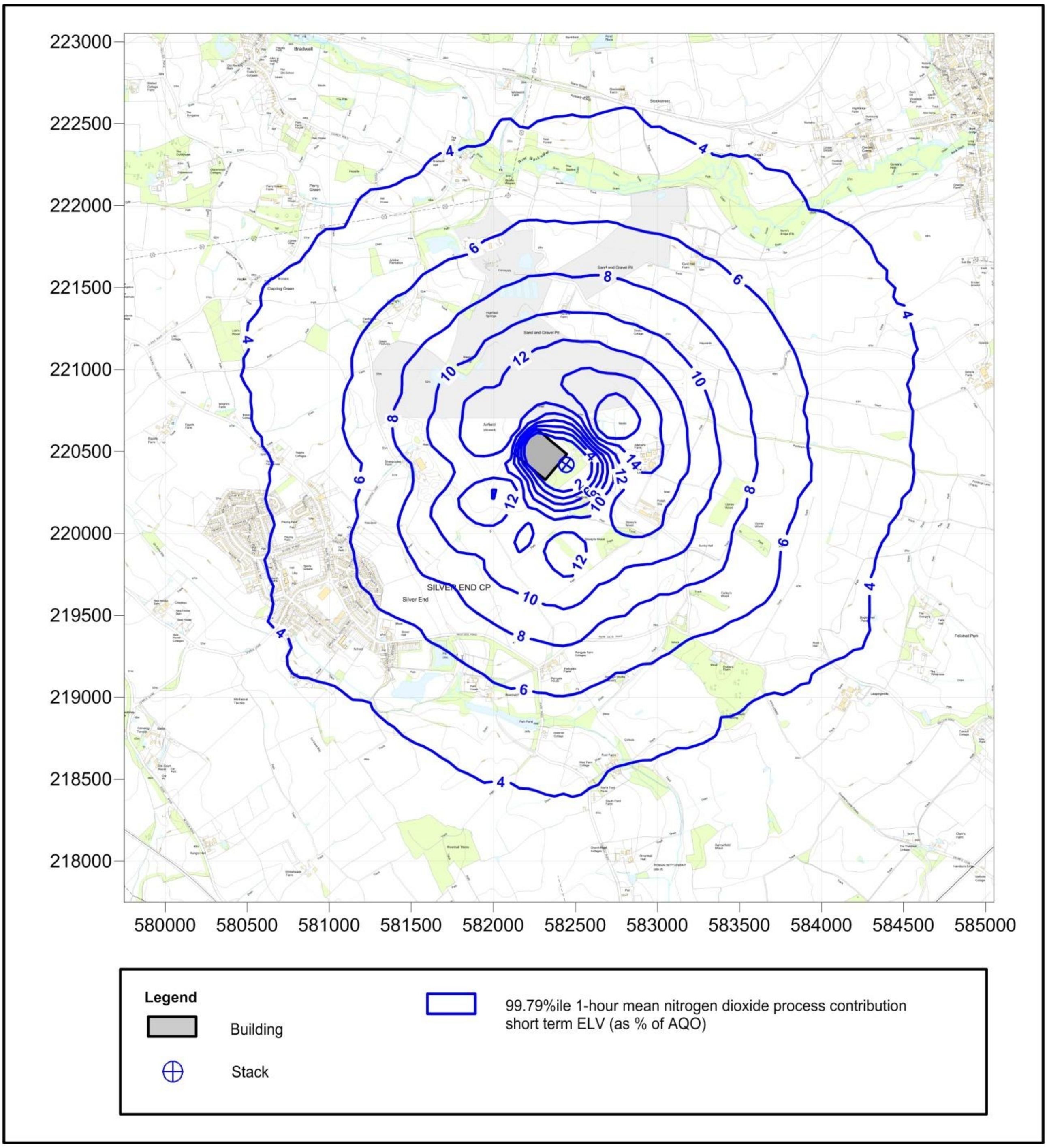


Figure 6: Annual Mean Nitrogen Dioxide Process Contribution (as a % of AQO) - 2011



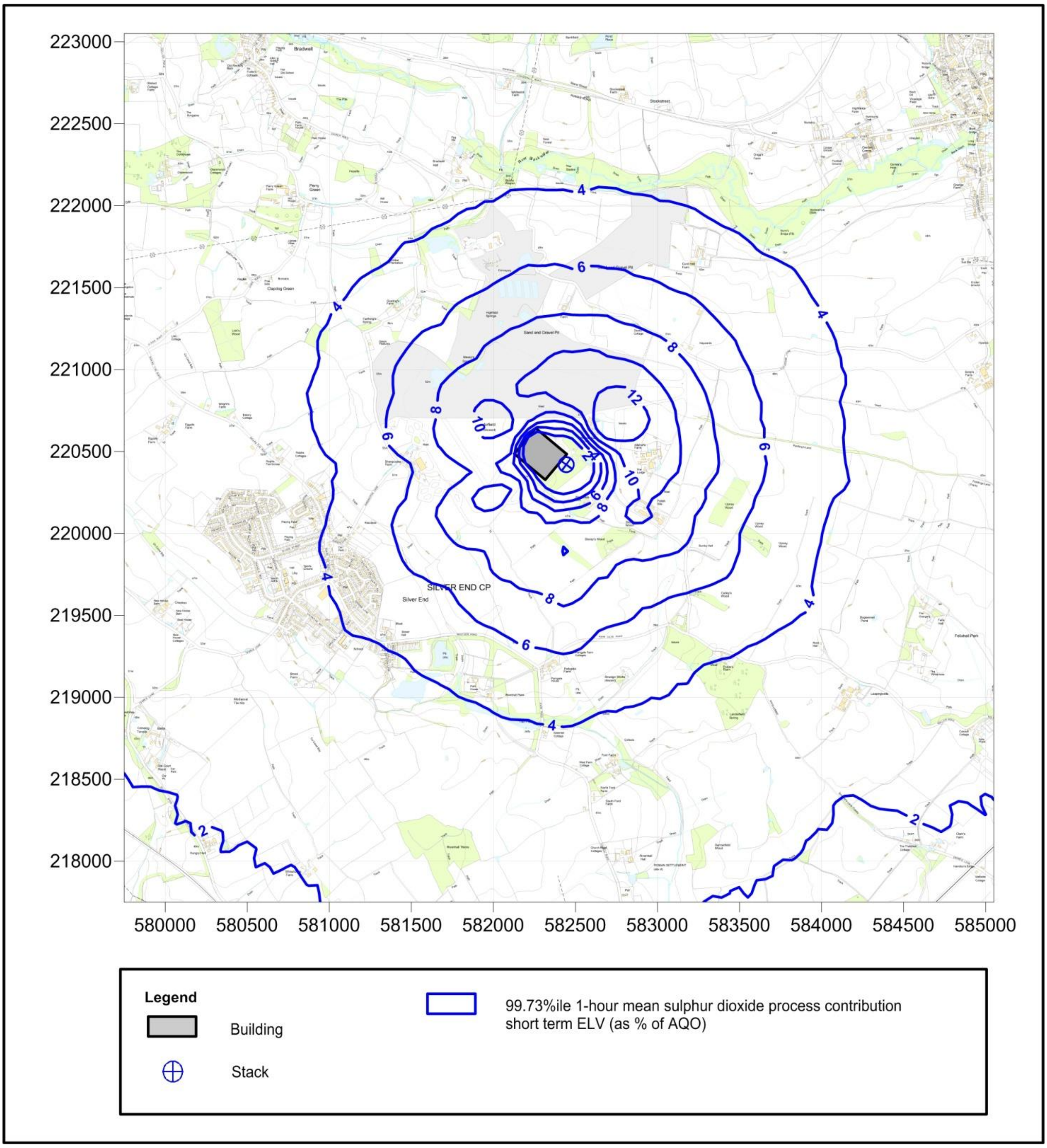
Assumes 100% operation of the all items of plant.

Figure 7: 99.79%ile 1-hour Mean Nitrogen Dioxide Process Contribution (as a % of AQO) - 2011



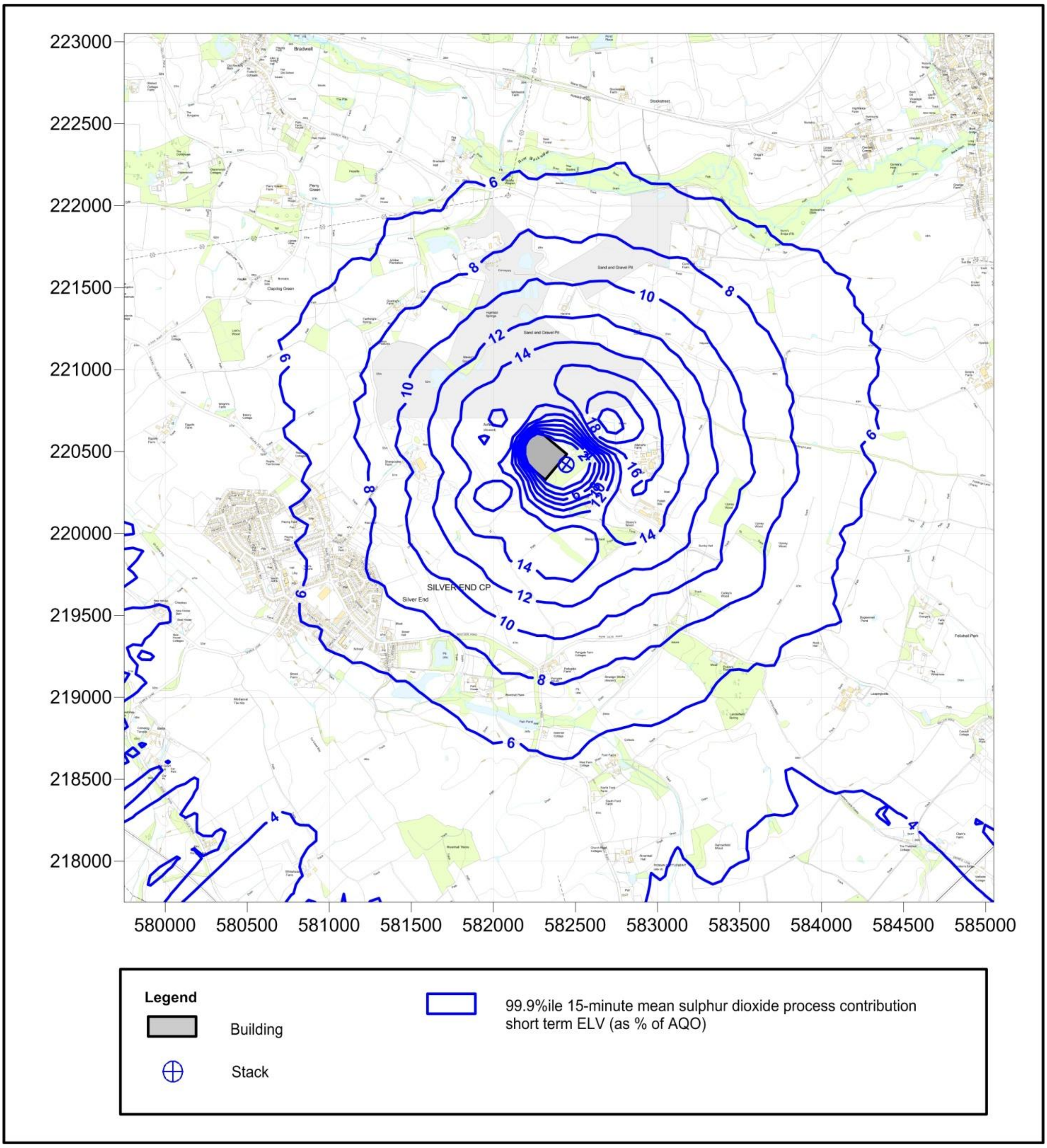
Assumes 100% operation of the all items of plant at the short term ELVs.

Figure 8: 99.73%ile 1-hour Mean Sulphur Dioxide Process Contribution (as a % of AQO) - 2011



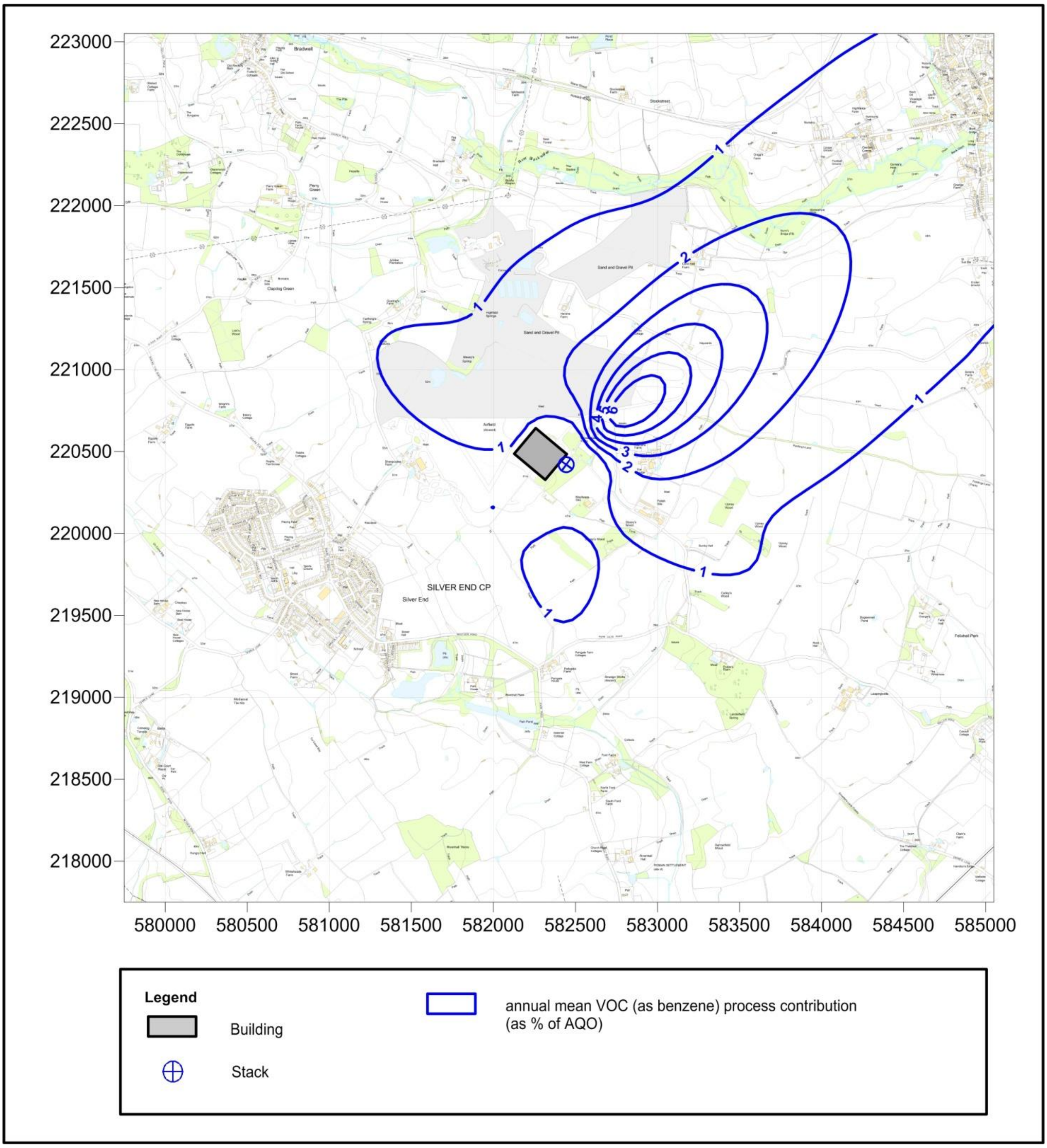
Assumes 100% operation of the all items of plant at the short term ELVs.

Figure 9: 99.9%ile 15-minute Mean Sulphur Dioxide Process Contribution (as a % of AQO) - 2011



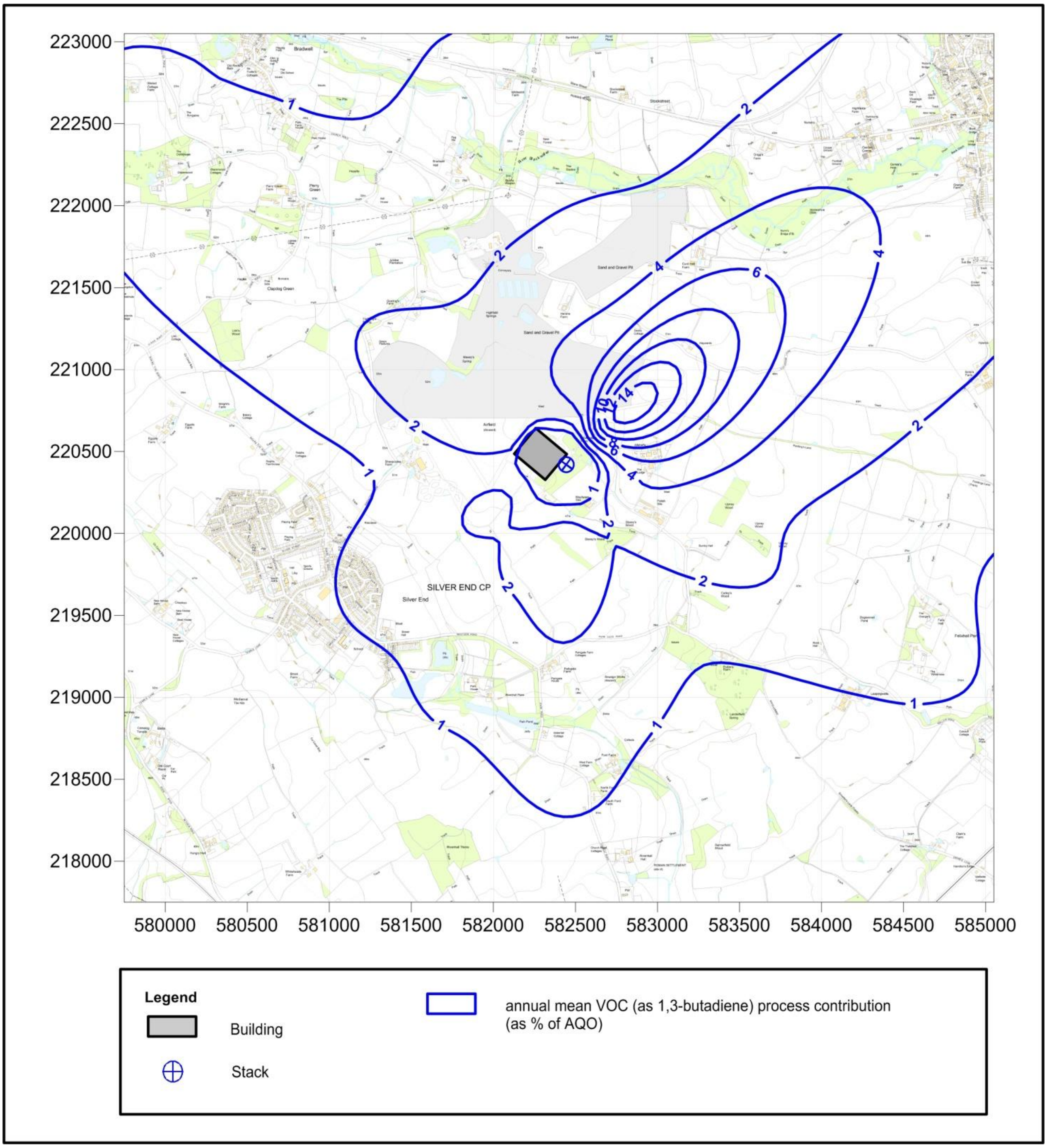
Assumes 100% operation of the all items of plant at the short term ELVs.

Figure 10: Annual Mean VOCs (as benzene) Process Contribution (as a % of AQO) - 2011



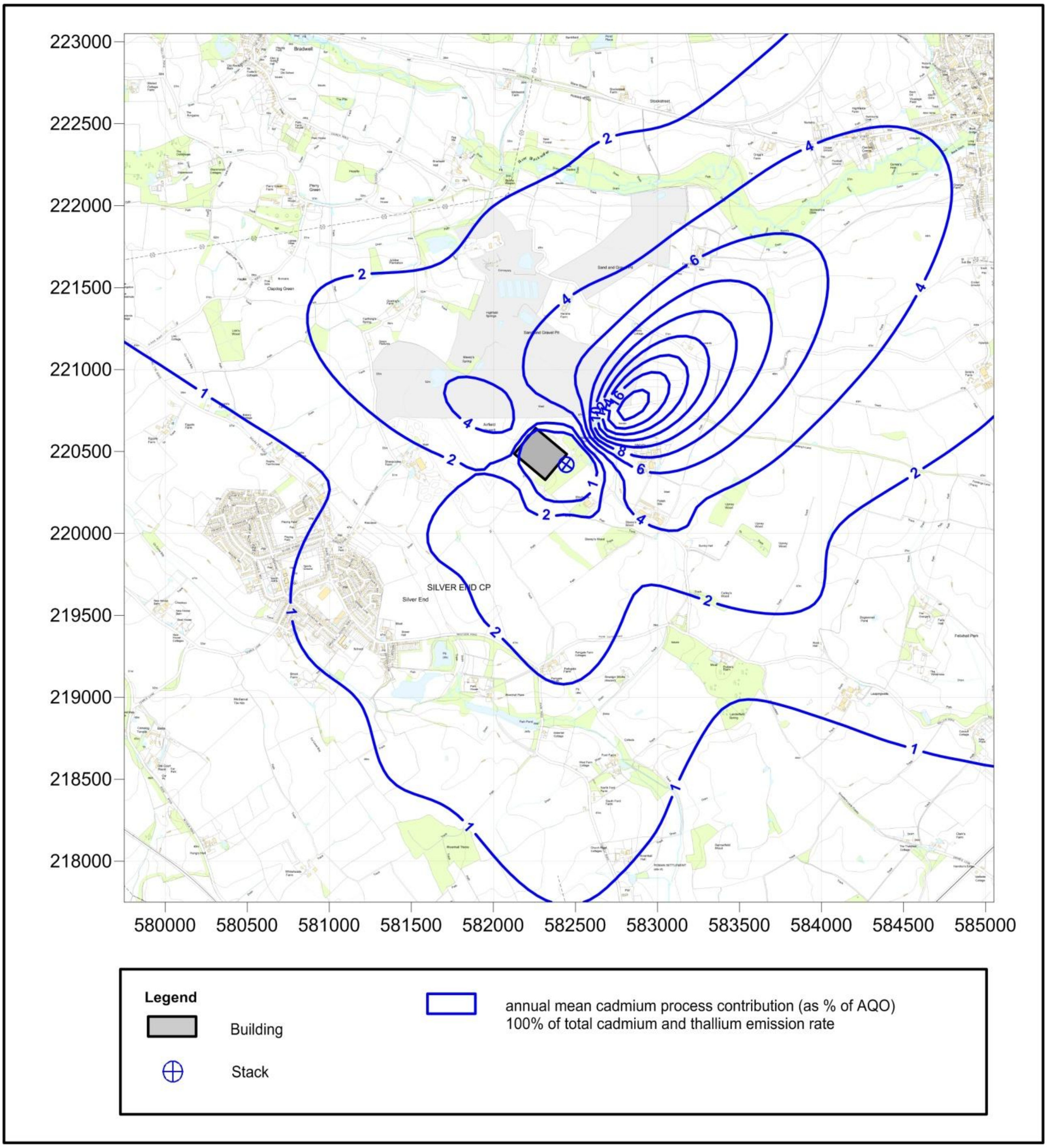
Assumes 100% operation of the all items of plant.

Figure 11: Annual Mean VOCs (as 1,3-butadiene) Process Contribution (as a % of AQO) - 2011



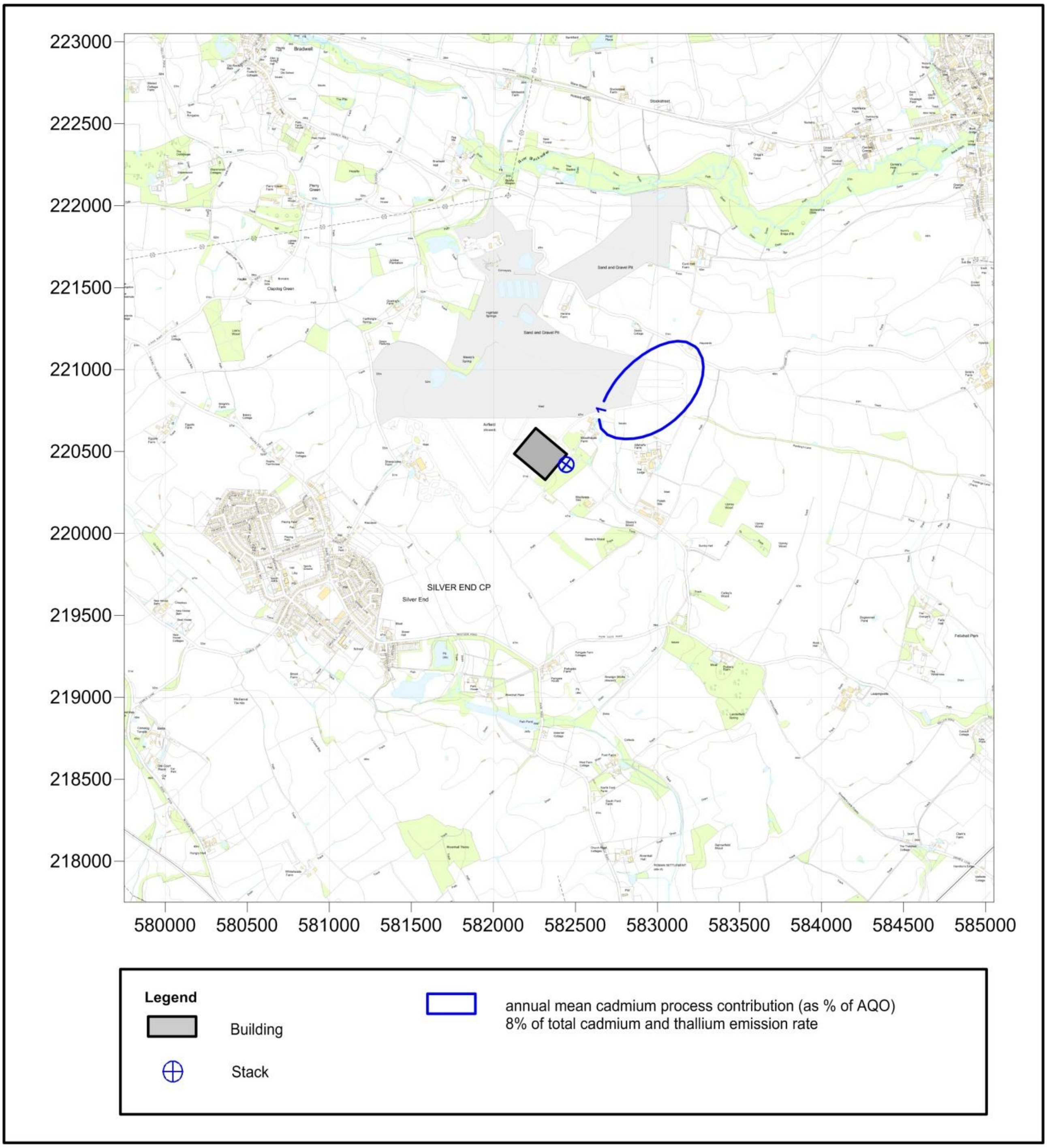
Assumes 100% operation of the all items of plant.

Figure 12: Annual Mean Cadmium Process Contribution (as a % of AQO) - 2011



Assumes emissions of Cadmium are 100% of the combined cadmium and thallium ELV.

Figure 13: Annual Mean Cadmium Process Contribution (as a % of AQO) - 2011



Assumes emissions of Cadmium are 8% of the combined cadmium and thallium ELV.

Appendix B – Detailed Results at Sensitive Receptors

Table B.1: Annual Mean Nitrogen Dioxide Impact at Sensitive Receptors				
Receptor	**Process Contribution**		**Predicted Environmental Concentration**	
	µg/m³	**As % of AQO**	**µg/m³**	**As % of AQO**
Sheepcotes Farm (Hanger No.1)	0.43	1.1%	15.32	38.3%
Wayfarers Site	0.34	0.9%	15.23	38.1%
Allshot's Farm (Scrap Yard)	1.16	2.9%	16.05	40.1%
Haywards	1.75	4.4%	16.64	41.6%
Herons Farm	0.68	1.7%	15.57	38.9%
Gosling's Farm	0.35	0.9%	15.24	38.1%
Curd Hall Farm	0.82	2.1%	15.71	39.3%
Church (adjacent to Bradwell Hall)	0.27	0.7%	15.16	37.9%
Bradwell Hall	0.25	0.6%	15.14	37.8%
Rolphs Farmhouse	0.20	0.5%	15.09	37.7%
Silver End / Bower Hall / Fossil Hall	0.44	1.1%	15.33	38.3%
Rivenhall Pl/Hall	0.39	1.0%	15.28	38.2%
Parkgate Farm / Watchpall Cottages	0.47	1.2%	15.36	38.4%
Ford Farm / Rivenhall Cottage	0.30	0.7%	15.19	38.0%
Porter's Farm	0.41	1.0%	15.30	38.2%
Unknown Building 1	0.53	1.3%	15.42	38.6%
Bumby Hall / The Lodge / Polish Site (Light Industry)	0.73	1.8%	15.62	39.0%
Footpath 8, Receptor 1 (East of Site)	1.31	3.3%	16.20	40.5%
Footpath 8, Receptor 2 (East of Site)	1.23	3.1%	16.12	40.3%
Footpath 8, Receptor 3 (East of Site)	0.87	2.2%	15.76	39.4%
Footpath 8, Receptor 4 (East of Site)	0.42	1.0%	15.31	38.3%
Footpath 8, Receptor 5 (East of Site)	0.05	0.1%	14.94	37.4%
Footpath 8, Receptor 6 (East of Site)	0.62	1.5%	15.51	38.8%
Footpath 8, Receptor 7 (East of Site)	0.69	1.7%	15.58	39.0%
Footpath 35, Receptor 1 (North of Site)	2.64	6.6%	17.53	43.8%
Footpath 35, Receptor 2 (North of Site)	0.89	2.2%	15.78	39.5%
Footpath 35, Receptor 3 (North of Site)	0.50	1.2%	15.39	38.5%
Footpath 31, Receptor 1 (North west of Site)	0.57	1.4%	15.46	38.6%
Footpath 31, Receptor 2 (North west of Site)	0.57	1.4%	15.46	38.7%
Footpath 31, Receptor 3 (North west of Site)	0.31	0.8%	15.20	38.0%

Table B.1: Annual Mean Nitrogen Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 1 (South east of Site)	0.44	1.1%	15.33	38.3%
Footpath 7, Receptor 2 (South east of Site)	0.74	1.8%	15.63	39.1%
Footpath 7, Receptor 3 (South east of Site)	0.68	1.7%	15.57	38.9%
Footpath 7, Receptor 4 (South east of Site)	0.96	2.4%	15.85	39.6%
Footpath 7, Receptor 5 (South east of Site)	1.38	3.4%	16.27	40.7%
Elephant House (Street Sweepings)	0.28	0.7%	15.17	37.9%
Green Pastures Bungalow	0.37	0.9%	15.26	38.2%
Deeks Cottage	1.16	2.9%	16.05	40.1%
Woodhouse Farm	0.95	2.4%	15.84	39.6%
Gosling Cottage / Barn	0.38	0.9%	15.27	38.2%
Felix Hall / The Clock House / Park Farm	0.25	0.6%	15.14	37.8%
Glazenwood House	0.21	0.5%	15.10	37.7%
Bradwell Hall	0.17	0.4%	15.06	37.6%
Perry Green Farm	0.23	0.6%	15.12	37.8%
The Granary / Porter Farm / Rook Hall	0.26	0.6%	15.15	37.9%
Grange Farm	0.55	1.4%	15.44	38.6%
Coggeshall	0.47	1.2%	15.36	38.4%

NOTES:
Assumes 100% operation of all items of plant

Table B.2: 99.79%ile of 1-hour Mean Nitrogen Dioxide Impact at Sensitive Receptors				
Receptor	**Process Contribution**		**Predicted Environmental Concentration**	
	µg/m^3	**As % of AQO**	**µg/m^3**	**As % of AQO**
Sheepcotes Farm (Hanger No.1)	19.98	10.0%	49.76	24.9%
Wayfarers Site	16.43	8.2%	46.21	23.1%
Allshot's Farm (Scrap Yard)	29.45	14.7%	59.23	29.6%
Haywards	17.91	9.0%	47.69	23.8%
Herons Farm	19.56	9.8%	49.34	24.7%
Gosling's Farm	12.59	6.3%	42.37	21.2%
Curd Hall Farm	12.06	6.0%	41.84	20.9%
Church (adjacent to Bradwell Hall)	9.00	4.5%	38.78	19.4%
Bradwell Hall	8.32	4.2%	38.10	19.0%
Rolphs Farmhouse	9.24	4.6%	39.02	19.5%
Silver End / Bower Hall / Fossil Hall	13.09	6.5%	42.87	21.4%
Rivenhall Pl/Hall	11.79	5.9%	41.57	20.8%
Parkgate Farm / Watchpall Cottages	14.51	7.3%	44.29	22.1%
Ford Farm / Rivenhall Cottage	8.87	4.4%	38.65	19.3%
Porter's Farm	11.42	5.7%	41.20	20.6%
Unknown Building 1	15.15	7.6%	44.93	22.5%
Bumby Hall / The Lodge / Polish Site (Light Industry)	25.95	13.0%	55.73	27.9%
Footpath 8, Receptor 1 (East of Site)	29.52	14.8%	59.30	29.7%
Footpath 8, Receptor 2 (East of Site)	32.29	16.1%	62.07	31.0%
Footpath 8, Receptor 3 (East of Site)	22.78	11.4%	52.56	26.3%
Footpath 8, Receptor 4 (East of Site)	13.15	6.6%	42.93	21.5%
Footpath 8, Receptor 5 (East of Site)	3.47	1.7%	33.25	16.6%
Footpath 8, Receptor 6 (East of Site)	26.44	13.2%	56.22	28.1%
Footpath 8, Receptor 7 (East of Site)	24.06	12.0%	53.84	26.9%
Footpath 35, Receptor 1 (North of Site)	30.25	15.1%	60.03	30.0%
Footpath 35, Receptor 2 (North of Site)	28.17	14.1%	57.95	29.0%
Footpath 35, Receptor 3 (North of Site)	21.08	10.5%	50.86	25.4%
Footpath 31, Receptor 1 (North west of Site)	22.71	11.4%	52.49	26.2%
Footpath 31, Receptor 2 (North west of Site)	22.60	11.3%	52.38	26.2%
Footpath 31, Receptor 3 (North west of Site)	16.29	8.1%	46.07	23.0%
Footpath 7, Receptor 1 (South east of Site)	20.03	10.0%	49.81	24.9%
Footpath 7, Receptor 2 (South east of Site)	26.08	13.0%	55.86	27.9%
Footpath 7, Receptor 3 (South east of Site)	23.77	11.9%	53.55	26.8%

Table B.2: 99.79%ile of 1-hour Mean Nitrogen Dioxide Impact at Sensitive Receptors

Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	24.71	12.4%	54.49	27.2%
Footpath 7, Receptor 5 (South east of Site)	20.96	10.5%	50.74	25.4%
Elephant House (Street Sweepings)	14.77	7.4%	44.55	22.3%
Green Pastures Bungalow	12.73	6.4%	42.51	21.3%
Deeks Cottage	20.49	10.2%	50.27	25.1%
Woodhouse Farm	25.27	12.6%	55.05	27.5%
Gosling Cottage / Barn	13.89	6.9%	43.67	21.8%
Felix Hall / The Clock House / Park Farm	7.03	3.5%	36.81	18.4%
Glazenwood House	6.66	3.3%	36.44	18.2%
Bradwell Hall	5.87	2.9%	35.65	17.8%
Perry Green Farm	7.74	3.9%	37.52	18.8%
The Granary / Porter Farm / Rook Hall	7.58	3.8%	37.36	18.7%
Grange Farm	6.59	3.3%	36.37	18.2%
Coggeshall	6.16	3.1%	35.94	18.0%

NOTES:
Assumes 100% operation of all items of plant at the short term ELVs

Table B.3: 99.73%ile of 1-hour Mean Sulphur Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	μg/m^3	As % of AQO	μg/m^3	As % of AQO
Sheepcotes Farm (Hanger No.1)	27.66	7.9%	34.96	10.0%
Wayfarers Site	21.42	6.1%	28.72	8.2%
Allshot's Farm (Scrap Yard)	40.48	11.6%	47.78	13.7%
Haywards	24.85	7.1%	32.15	9.2%
Herons Farm	27.03	7.7%	34.33	9.8%
Gosling's Farm	17.36	5.0%	24.66	7.0%
Curd Hall Farm	16.79	4.8%	24.09	6.9%
Church (adjacent to Bradwell Hall)	12.32	3.5%	19.62	5.6%
Bradwell Hall	11.29	3.2%	18.59	5.3%
Rolphs Farmhouse	12.69	3.6%	19.99	5.7%
Silver End / Bower Hall / Fossil Hall	18.09	5.2%	25.39	7.3%
Rivenhall Pl/Hall	16.32	4.7%	23.62	6.7%
Parkgate Farm / Watchpall Cottages	20.21	5.8%	27.51	7.9%
Ford Farm / Rivenhall Cottage	12.25	3.5%	19.55	5.6%
Porter's Farm	15.83	4.5%	23.13	6.6%
Unknown Building 1	20.99	6.0%	28.29	8.1%
Bumby Hall / The Lodge / Polish Site (Light Industry)	35.72	10.2%	43.02	12.3%
Footpath 8, Receptor 1 (East of Site)	40.99	11.7%	48.29	13.8%
Footpath 8, Receptor 2 (East of Site)	44.53	12.7%	51.83	14.8%
Footpath 8, Receptor 3 (East of Site)	30.33	8.7%	37.63	10.8%
Footpath 8, Receptor 4 (East of Site)	17.17	4.9%	24.47	7.0%
Footpath 8, Receptor 5 (East of Site)	3.65	1.0%	10.95	3.1%
Footpath 8, Receptor 6 (East of Site)	35.78	10.2%	43.08	12.3%
Footpath 8, Receptor 7 (East of Site)	32.85	9.4%	40.15	11.5%
Footpath 35, Receptor 1 (North of Site)	42.23	12.1%	49.53	14.2%
Footpath 35, Receptor 2 (North of Site)	38.56	11.0%	45.86	13.1%
Footpath 35, Receptor 3 (North of Site)	28.90	8.3%	36.20	10.3%
Footpath 31, Receptor 1 (North west of Site)	30.88	8.8%	38.18	10.9%
Footpath 31, Receptor 2 (North west of Site)	31.05	8.9%	38.35	11.0%
Footpath 31, Receptor 3 (North west of Site)	22.63	6.5%	29.93	8.6%
Footpath 7, Receptor 1 (South east of Site)	26.85	7.7%	34.15	9.8%
Footpath 7, Receptor 2 (South east of Site)	35.30	10.1%	42.60	12.2%
Footpath 7, Receptor 3 (South east of Site)	32.76	9.4%	40.06	11.4%

Table B.3: 99.73%ile of 1-hour Mean Sulphur Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	33.78	9.7%	41.08	11.7%
Footpath 7, Receptor 5 (South east of Site)	28.98	8.3%	36.28	10.4%
Elephant House (Street Sweepings)	18.82	5.4%	26.12	7.5%
Green Pastures Bungalow	17.65	5.0%	24.95	7.1%
Deeks Cottage	28.48	8.1%	35.78	10.2%
Woodhouse Farm	33.71	9.6%	41.01	11.7%
Gosling Cottage / Barn	19.09	5.5%	26.39	7.5%
Felix Hall / The Clock House / Park Farm	9.66	2.8%	16.96	4.8%
Glazenwood House	9.02	2.6%	16.32	4.7%
Bradwell Hall	7.84	2.2%	15.14	4.3%
Perry Green Farm	10.32	2.9%	17.62	5.0%
The Granary / Porter Farm / Rook Hall	10.31	2.9%	17.61	5.0%
Grange Farm	9.00	2.6%	16.30	4.7%
Coggeshall	8.40	2.4%	15.70	4.5%
NOTES: Assumes 100% operation of all items of plant at the short term ELVs				

Table B.4: 99.9%ile of 15-min Mean Sulphur Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	31.29	11.8%	38.59	14.5%
Wayfarers Site	28.61	10.8%	35.91	13.5%
Allshot's Farm (Scrap Yard)	45.45	17.1%	52.75	19.8%
Haywards	28.61	10.8%	35.91	13.5%
Herons Farm	30.69	11.5%	37.99	14.3%
Gosling's Farm	20.92	7.9%	28.22	10.6%
Curd Hall Farm	19.90	7.5%	27.20	10.2%
Church (adjacent to Bradwell Hall)	15.89	6.0%	23.19	8.7%
Bradwell Hall	14.37	5.4%	21.67	8.1%
Rolphs Farmhouse	16.04	6.0%	23.34	8.8%
Silver End / Bower Hall / Fossil Hall	21.59	8.1%	28.89	10.9%
Rivenhall Pl/Hall	19.91	7.5%	27.21	10.2%
Parkgate Farm / Watchpall Cottages	23.10	8.7%	30.40	11.4%
Ford Farm / Rivenhall Cottage	15.22	5.7%	22.52	8.5%
Porter's Farm	19.35	7.3%	26.65	10.0%
Unknown Building 1	24.30	9.1%	31.60	11.9%
Bumby Hall / The Lodge / Polish Site (Light Industry)	40.33	15.2%	47.63	17.9%
Footpath 8, Receptor 1 (East of Site)	44.32	16.7%	51.62	19.4%
Footpath 8, Receptor 2 (East of Site)	53.09	20.0%	60.39	22.7%
Footpath 8, Receptor 3 (East of Site)	36.86	13.9%	44.16	16.6%
Footpath 8, Receptor 4 (East of Site)	23.68	8.9%	30.98	11.6%
Footpath 8, Receptor 5 (East of Site)	7.44	2.8%	14.74	5.5%
Footpath 8, Receptor 6 (East of Site)	41.63	15.7%	48.93	18.4%
Footpath 8, Receptor 7 (East of Site)	37.67	14.2%	44.97	16.9%
Footpath 35, Receptor 1 (North of Site)	44.91	16.9%	52.21	19.6%
Footpath 35, Receptor 2 (North of Site)	43.53	16.4%	50.83	19.1%
Footpath 35, Receptor 3 (North of Site)	33.35	12.5%	40.65	15.3%
Footpath 31, Receptor 1 (North west of Site)	35.52	13.4%	42.82	16.1%
Footpath 31, Receptor 2 (North west of Site)	35.25	13.3%	42.55	16.0%
Footpath 31, Receptor 3 (North west of Site)	26.05	9.8%	33.35	12.5%
Footpath 7, Receptor 1 (South east of Site)	34.12	12.8%	41.42	15.6%
Footpath 7, Receptor 2 (South east of Site)	41.57	15.6%	48.87	18.4%
Footpath 7, Receptor 3 (South east of Site)	37.15	14.0%	44.45	16.7%

Table B.4: 99.9%ile of 15-min Mean Sulphur Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	38.03	14.3%	45.33	17.0%
Footpath 7, Receptor 5 (South east of Site)	32.48	12.2%	39.78	15.0%
Elephant House (Street Sweepings)	25.11	9.4%	32.41	12.2%
Green Pastures Bungalow	20.84	7.8%	28.14	10.6%
Deeks Cottage	31.88	12.0%	39.18	14.7%
Woodhouse Farm	41.97	15.8%	49.27	18.5%
Gosling Cottage / Barn	22.90	8.6%	30.20	11.4%
Felix Hall / The Clock House / Park Farm	13.15	4.9%	20.45	7.7%
Glazenwood House	14.16	5.3%	21.46	8.1%
Bradwell Hall	12.62	4.7%	19.92	7.5%
Perry Green Farm	13.72	5.2%	21.02	7.9%
The Granary / Porter Farm / Rook Hall	13.99	5.3%	21.29	8.0%
Grange Farm	13.75	5.2%	21.05	7.9%
Coggeshall	13.42	5.0%	20.72	7.8%

NOTES:
Assumes 100% operation of all items of plant at the short term ELVs

Table B.5: Annual Mean VOCs (as Benzene) Impact at Sensitive Receptors

Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	0.06	1.1%	0.41	8.1%
Wayfarers Site	0.04	0.9%	0.39	7.9%
Allshot's Farm (Scrap Yard)	0.15	3.0%	0.50	10.0%
Haywards	0.22	4.5%	0.57	11.5%
Herons Farm	0.09	1.7%	0.44	8.7%
Gosling's Farm	0.04	0.9%	0.39	7.9%
Curd Hall Farm	0.11	2.1%	0.46	9.1%
Church (adjacent to Bradwell Hall)	0.03	0.7%	0.38	7.7%
Bradwell Hall	0.03	0.6%	0.38	7.6%
Rolphs Farmhouse	0.02	0.5%	0.37	7.5%
Silver End / Bower Hall / Fossil Hall	0.06	1.1%	0.41	8.1%
Rivenhall Pl/Hall	0.05	1.0%	0.40	8.0%
Parkgate Farm / Watchpall Cottages	0.06	1.2%	0.41	8.2%
Ford Farm / Rivenhall Cottage	0.04	0.8%	0.39	7.8%
Porter's Farm	0.05	1.0%	0.40	8.0%
Unknown Building 1	0.07	1.4%	0.42	8.4%
Bumby Hall / The Lodge / Polish Site (Light Industry)	0.09	1.9%	0.44	8.9%
Footpath 8, Receptor 1 (East of Site)	0.17	3.3%	0.52	10.3%
Footpath 8, Receptor 2 (East of Site)	0.16	3.2%	0.51	10.2%
Footpath 8, Receptor 3 (East of Site)	0.11	2.2%	0.46	9.2%
Footpath 8, Receptor 4 (East of Site)	0.05	1.1%	0.40	8.1%
Footpath 8, Receptor 5 (East of Site)	0.01	0.1%	0.36	7.1%
Footpath 8, Receptor 6 (East of Site)	0.08	1.6%	0.43	8.6%
Footpath 8, Receptor 7 (East of Site)	0.09	1.8%	0.44	8.8%
Footpath 35, Receptor 1 (North of Site)	0.34	6.8%	0.69	13.8%
Footpath 35, Receptor 2 (North of Site)	0.11	2.3%	0.46	9.3%
Footpath 35, Receptor 3 (North of Site)	0.06	1.3%	0.41	8.3%
Footpath 31, Receptor 1 (North west of Site)	0.07	1.4%	0.42	8.4%
Footpath 31, Receptor 2 (North west of Site)	0.07	1.5%	0.42	8.5%
Footpath 31, Receptor 3 (North west of Site)	0.04	0.8%	0.39	7.8%
Footpath 7, Receptor 1 (South east of Site)	0.06	1.1%	0.41	8.1%
Footpath 7, Receptor 2 (South east of Site)	0.09	1.9%	0.44	8.9%
Footpath 7, Receptor 3 (South east of Site)	0.09	1.7%	0.44	8.7%

Table B.5: Annual Mean VOCs (as Benzene) Impact at Sensitive Receptors

Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m^3	As % of AQO	µg/m^3	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	0.12	2.4%	0.47	9.4%
Footpath 7, Receptor 5 (South east of Site)	0.18	3.5%	0.53	10.5%
Elephant House (Street Sweepings)	0.04	0.7%	0.39	7.7%
Green Pastures Bungalow	0.05	1.0%	0.40	8.0%
Deeks Cottage	0.15	3.0%	0.50	10.0%
Woodhouse Farm	0.12	2.4%	0.47	9.4%
Gosling Cottage / Barn	0.05	1.0%	0.40	8.0%
Felix Hall / The Clock House / Park Farm	0.03	0.6%	0.38	7.6%
Glazenwood House	0.03	0.5%	0.38	7.5%
Bradwell Hall	0.02	0.4%	0.37	7.4%
Perry Green Farm	0.03	0.6%	0.38	7.6%
The Granary / Porter Farm / Rook Hall	0.03	0.7%	0.38	7.7%
Grange Farm	0.07	1.4%	0.42	8.4%
Coggeshall	0.06	1.2%	0.41	8.2%

NOTES:
Assumes 100% operation of all items of plant
Assumes all VOCs are consist only of benzene

Table B.6: Annual Mean VOCs (as 1,3-butadiene) Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	0.06	2.4%	0.20	8.7%
Wayfarers Site	0.04	2.0%	0.18	8.2%
Allshot's Farm (Scrap Yard)	0.15	6.6%	0.29	12.8%
Haywards	0.22	10.0%	0.36	16.2%
Herons Farm	0.09	3.8%	0.23	10.1%
Gosling's Farm	0.04	2.0%	0.18	8.2%
Curd Hall Farm	0.11	4.7%	0.25	10.9%
Church (adjacent to Bradwell Hall)	0.03	1.5%	0.17	7.7%
Bradwell Hall	0.03	1.4%	0.17	7.6%
Rolphs Farmhouse	0.02	1.1%	0.16	7.3%
Silver End / Bower Hall / Fossil Hall	0.06	2.5%	0.20	8.7%
Rivenhall Pl/Hall	0.05	2.2%	0.19	8.4%
Parkgate Farm / Watchpall Cottages	0.06	2.6%	0.20	8.9%
Ford Farm / Rivenhall Cottage	0.04	1.7%	0.18	7.9%
Porter's Farm	0.05	2.3%	0.19	8.5%
Unknown Building 1	0.07	3.0%	0.21	9.3%
Bumby Hall / The Lodge / Polish Site (Light Industry)	0.09	4.1%	0.23	10.4%
Footpath 8, Receptor 1 (East of Site)	0.17	7.4%	0.31	13.7%
Footpath 8, Receptor 2 (East of Site)	0.16	7.0%	0.30	13.2%
Footpath 8, Receptor 3 (East of Site)	0.11	4.9%	0.25	11.2%
Footpath 8, Receptor 4 (East of Site)	0.05	2.4%	0.19	8.6%
Footpath 8, Receptor 5 (East of Site)	0.01	0.3%	0.15	6.5%
Footpath 8, Receptor 6 (East of Site)	0.08	3.5%	0.22	9.7%
Footpath 8, Receptor 7 (East of Site)	0.09	3.9%	0.23	10.2%
Footpath 35, Receptor 1 (North of Site)	0.34	15.0%	0.48	21.2%
Footpath 35, Receptor 2 (North of Site)	0.11	5.1%	0.25	11.3%
Footpath 35, Receptor 3 (North of Site)	0.06	2.8%	0.20	9.0%
Footpath 31, Receptor 1 (North west of Site)	0.07	3.2%	0.21	9.4%
Footpath 31, Receptor 2 (North west of Site)	0.07	3.3%	0.21	9.5%
Footpath 31, Receptor 3 (North west of Site)	0.04	1.8%	0.18	8.0%
Footpath 7, Receptor 1 (South east of Site)	0.06	2.5%	0.20	8.7%
Footpath 7, Receptor 2 (South east of Site)	0.09	4.2%	0.23	10.4%
Footpath 7, Receptor 3 (South east of Site)	0.09	3.9%	0.23	10.1%

Table B.6: Annual Mean VOCs (as 1,3-butadiene) Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	μg/m³	As % of AQO	μg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	0.12	5.4%	0.26	11.7%
Footpath 7, Receptor 5 (South east of Site)	0.18	7.8%	0.32	14.1%
Elephant House (Street Sweepings)	0.04	1.6%	0.18	7.8%
Green Pastures Bungalow	0.05	2.1%	0.19	8.3%
Deeks Cottage	0.15	6.6%	0.29	12.8%
Woodhouse Farm	0.12	5.4%	0.26	11.6%
Gosling Cottage / Barn	0.05	2.1%	0.19	8.4%
Felix Hall / The Clock House / Park Farm	0.03	1.4%	0.17	7.6%
Glazenwood House	0.03	1.2%	0.17	7.4%
Bradwell Hall	0.02	1.0%	0.16	7.2%
Perry Green Farm	0.03	1.3%	0.17	7.5%
The Granary / Porter Farm / Rook Hall	0.03	1.5%	0.17	7.7%
Grange Farm	0.07	3.1%	0.21	9.3%
Coggeshall	0.06	2.7%	0.20	8.9%

NOTES:
Assumes 100% operation of all items of plant
Assumes all VOCs are consist only of 1,3-butadiene

Table B.7: Annual Mean Cadmium Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	0.15	3.0%	0.35	7.0%
Wayfarers Site	0.12	2.4%	0.32	6.4%
Allshot's Farm (Scrap Yard)	0.41	8.1%	0.61	12.1%
Haywards	0.61	12.3%	0.81	16.3%
Herons Farm	0.24	4.7%	0.44	8.7%
Gosling's Farm	0.12	2.4%	0.32	6.4%
Curd Hall Farm	0.29	5.8%	0.49	9.8%
Church (adjacent to Bradwell Hall)	0.09	1.9%	0.29	5.9%
Bradwell Hall	0.09	1.7%	0.29	5.7%
Rolphs Farmhouse	0.07	1.4%	0.27	5.4%
Silver End / Bower Hall / Fossil Hall	0.15	3.1%	0.35	7.1%
Rivenhall Pl/Hall	0.14	2.7%	0.34	6.7%
Parkgate Farm / Watchpall Cottages	0.16	3.3%	0.36	7.3%
Ford Farm / Rivenhall Cottage	0.10	2.1%	0.30	6.1%
Porter's Farm	0.14	2.8%	0.34	6.8%
Unknown Building 1	0.19	3.7%	0.39	7.7%
Bumby Hall / The Lodge / Polish Site (Light Industry)	0.25	5.1%	0.45	9.1%
Footpath 8, Receptor 1 (East of Site)	0.46	9.2%	0.66	13.2%
Footpath 8, Receptor 2 (East of Site)	0.43	8.6%	0.63	12.6%
Footpath 8, Receptor 3 (East of Site)	0.30	6.1%	0.50	10.1%
Footpath 8, Receptor 4 (East of Site)	0.15	2.9%	0.35	6.9%
Footpath 8, Receptor 5 (East of Site)	0.02	0.4%	0.22	4.4%
Footpath 8, Receptor 6 (East of Site)	0.22	4.3%	0.42	8.3%
Footpath 8, Receptor 7 (East of Site)	0.24	4.8%	0.44	8.8%
Footpath 35, Receptor 1 (North of Site)	0.92	18.5%	1.12	22.5%
Footpath 35, Receptor 2 (North of Site)	0.31	6.3%	0.51	10.3%
Footpath 35, Receptor 3 (North of Site)	0.17	3.5%	0.37	7.5%
Footpath 31, Receptor 1 (North west of Site)	0.20	4.0%	0.40	8.0%
Footpath 31, Receptor 2 (North west of Site)	0.20	4.0%	0.40	8.0%
Footpath 31, Receptor 3 (North west of Site)	0.11	2.2%	0.31	6.2%
Footpath 7, Receptor 1 (South east of Site)	0.15	3.1%	0.35	7.1%
Footpath 7, Receptor 2 (South east of Site)	0.26	5.2%	0.46	9.2%
Footpath 7, Receptor 3 (South east of Site)	0.24	4.8%	0.44	8.8%

Table B.7: Annual Mean Cadmium Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m^3	As % of AQO	µg/m^3	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	0.33	6.7%	0.53	10.7%
Footpath 7, Receptor 5 (South east of Site)	0.48	9.7%	0.68	13.7%
Elephant House (Street Sweepings)	0.10	2.0%	0.30	6.0%
Green Pastures Bungalow	0.13	2.6%	0.33	6.6%
Deeks Cottage	0.41	8.1%	0.61	12.1%
Woodhouse Farm	0.33	6.7%	0.53	10.7%
Gosling Cottage / Barn	0.13	2.6%	0.33	6.6%
Felix Hall / The Clock House / Park Farm	0.09	1.7%	0.29	5.7%
Glazenwood House	0.07	1.4%	0.27	5.4%
Bradwell Hall	0.06	1.2%	0.26	5.2%
Perry Green Farm	0.08	1.6%	0.28	5.6%
The Granary / Porter Farm / Rook Hall	0.09	1.8%	0.29	5.8%
Grange Farm	0.19	3.8%	0.39	7.8%
Coggeshall	0.17	3.3%	0.37	7.3%

NOTES:
Assumes 100% operation of all items of plant
Assumes entire cadmium and thallium emissions are consist only of cadmium

Appendix C – APIS Critical Loads

Table C.1: N Deposition Critical Loads - APIS					
Site	**Habitat type**	**NCL Class**	**Lower Critical Load (kgN/ha/yr)**	**Upper Critical Load (kgN/ha/yr)**	**Background (kgN/ha/yr)**
European designated sites (within 10km)					
None identified					
UK designated sites (within 2km)					
None identified					
Non-statutory designated sites (within 2km)					
River Blackwater	Broadleaved, mixed and yew woodland	Broadleaved deciduous woodland	10	20	37.24
Storeys Wood	Broadleaved, mixed and yew woodland	Broadleaved deciduous woodland	10	20	37.24
Maxey's Spring	Calaereous grassland	Sub-atlantic semi-dry calcareous grassland	15	25	19.46
	Neutral grassland	Low and medium altitude hay meadows	20	30	19.46

Table C.1: Acid Deposition Critical Loads - APIS							
Site	**Broad habitat type**	**Acidity Class**	**Min Critical Load Function (keq/ha/yr)**			**Maximum Background (keq/ha/yr)**	
			ClminN	**CLmaxN**	**ClmaxS**	**N**	**S**
European designated sites							
UK designated sites							
Non-statutory designated sites							
River Blackwater	Broadleaved, mixed and yew woodland	Broadleafed/Coniferous unmanaged woodland	0.14	1.71	1.57	2.66	0.25
Storeys Wood	Broadleaved, mixed and yew woodland	Broadleafed/Coniferous unmanaged woodland	0.14	1.71	1.57	2.66	0.25
Maxey's Spring	Calaereous grassland	Calcareous grassland (using base cation)	0.85	4.75	3.89	1.39	0.2
	Neutral grassland	Calcareous grassland (using base cation)	0.85	4.75	3.89	1.39	0.2

Appendix D – Deposition Results Tables

Table D.1: Annual Mean Process Contribution Used for Dry Deposition Analysis				
Site	**Annual Mean Process Contribution (μg/m^3)**			
	Nitrogen Dioxide	**Sulphur Dioxide**	**Hydrogen Chloride**	**Ammonia**
European Designated Sites				
None identified				
UK Designated Sites				
None identified				
Non-statutory designated sites				
River Blackwater	0.3982	0.1393	0.1693	0.1693
Storeys Wood	0.8027	0.2809	0.3434	0.3434
Maxey's Spring	0.5541	0.1939	0.2373	0.2373

Table D.2: Annual Mean Process Contribution Used for Wet Deposition Analysis	
Site	**Annual Mean Wet Deposition (ng/m^2/s)**
European Designated Sites	
None identified	
UK Designated Sites	
None identified	
Non-statutory designated sites	
River Blackwater	0.0275
Storeys Wood	0.0560
Maxey's Spring	0.0389

Table D.3: Deposition Calculation – Grassland - Maximum								
Site	**Dry Deposition (kg/ha/yr)**				**Wet Deposition (kg/ha/yr)**	**Total N Deposition (kgN/ha/yr)**	**Acid Deposition keq/ha/yr**	
	Nitrogen Dioxide	**Sulphur Dioxide**	**Hydrogen Chloride**	**Ammonia**	**Hydrogen Chloride**		**N**	**S**
European designated sites								
None identified								
UK designated sites								
None identified								
Non-statutory designated sites								
River Blackwater	0.057	0.26	1.30	0.88	8.45	0.94	0.067	0.254
Storeys Wood	0.116	0.53	2.63	1.78	17.18	1.90	0.136	0.517
Maxey's Spring	0.080	0.37	1.82	1.23	11.92	1.31	0.094	0.359

Table D.3: Deposition Calculation – Woodland - Maximum								
Site	Dry Deposition (kg/ha/yr)				Wet Deposition (kg/ha/yr)	Total N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
	Nitrogen Dioxide	Sulphur Dioxide	Hydrogen Chloride	Ammonia	Hydrogen Chloride		N	S
European designated sites								
None identified								
UK designated sites								
None identified								
Non-statutory designated sites								
River Blackwater	0.11	0.53	3.12	1.32	8.45	1.43	0.102	0.271
Storeys Wood	0.23	1.06	6.32	2.68	17.18	2.91	0.208	0.550
Maxey's Spring	0.16	0.73	4.37	1.85	11.92	2.01	0.143	0.382

Table D.5: Detailed Results – Nitrogen Deposition - Maximum								
Site	Habitat	Deposition Velocity	Process Contribution			Predicted Environmental Concentration		
			PC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL	PEC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL
European designated sites								
None identified								
UK designated sites								
None identified								
Non-statutory designated sites								
River Blackwater	Broadleaved, mixed and yew woodland	Woodland	1.43E+00	14.34%	7.17%	38.674	386.74%	193.37%
Storeys Wood	Broadleaved, mixed and yew woodland	Woodland	2.91E+00	29.06%	14.53%	40.146	401.46%	200.73%
Maxey's Spring	Calaereous grassland	Grassland	1.31E+00	8.75%	5.25%	20.772	138.48%	83.09%
	Neutral grassland	Grassland	1.31E+00	6.56%	4.37%	20.772	103.86%	69.24%

Table D.6: Detailed Results – Acid Deposition								
Site	Habitat	Deposition Velocity	Process Contribution			Predicted Environmental Concentration		
			N (keq/ha/yr)	S (keq/ha/yr)	% of Min CL Function	N (keq/ha/yr)	S (keq/ha/yr)	% of CL Function
European designated sites								
None identified								
UK designated sites								
None identified								
Non-statutory designated sites								
River Blackwater	Broadleaved, mixed and yew woodland	Woodland	1.02E-01	2.71E-01	21.83%	2.762	0.521	192.01%
Storeys Wood	Broadleaved, mixed and yew woodland	Woodland	2.08E-01	5.50E-01	44.33%	2.868	0.800	214.50%
Maxey's Spring	Calaereous grassland	Grassland	9.37E-02	3.59E-01	9.53%	1.484	0.559	43.00%
	Neutral grassland	Grassland	9.37E-02	3.59E-01	9.53%	1.484	0.559	43.00%

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1 Introduction

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged to undertake a Human Health Risk Assessment (HHRA) to support the planning and Environmental Permit application for the proposed Rivenhall Integrated Waste Management Facility (IWMF). The Facility will include a Combined Heat and Power (CHP) plant consisting of 2 streams to process up to 595,000 tonnes per annum of non-hazardous Solid Recovered Fuel (SRF) and Refuse Derived Fuel (RDF). Due to the recycled nature of some of the fuel, the limits on emissions to air will be based on those outlined in Chapter IV and Annex VI of the Industrial Emissions Directive (IED) (2010/75/EU) for waste incineration and co-incineration plants. This will include limits on emissions of heavy metals and dioxins and furans.

The advice from health specialists such as the Health Protection Agency that the damage to health from emissions from incineration and co-incineration plants is likely to be very small, and probably not detectable. Nevertheless, the specific effects on human health of the proposed plant have been considered, and are presented in this report.

For most substances released from the Facility, the most significant effects on human health will arise by inhalation. The air quality objectives (AQOs) outlined within the air quality assessment have been set by the various authorities at a level which is considered to present minimum or zero risk to human health. It is widely accepted that, if the concentrations in the atmosphere are less than the AQOs, then the pollutant is unlikely to have an adverse effect on human health.

For some pollutants which accumulate in the environment, inhalation is only one of the potential exposure routes. Therefore, other exposure routes are considered in this assessment.

The Facility is located in a sparsely populated area, and areas in the direction of the maximum impact have either been subject to quarrying (the former Coggeshall Pit) or will be subject to quarrying operations (by Blackwater Aggregates adjacent to the Facility); and future residential development and/or habitation is therefore unlikely.

A number of agricultural and residential receptors have been identified and the impact of the Facility on those receptors considered. The point of maximum impact is located in an uninhabited site in the adjacent quarry.

2 Issue Identification

2.1 Issue

The key issue is the release of substances from the proposed CHP to atmosphere which have the potential to harm human health. No other sources will include emissions of either metals or dioxins. The Facility is to be located to the south-east of the disused airfield known as Rivenhall airfield, in rural Essex approximately 3.4km south east of Kelvedon. The closest residential properties are Allshots Farmhouse and The Lodge approximately 450m to the north east of the Facility.

The Facility will be designed to meet the emission limits outlined in the IED (2010/75/EU). Limits have been set for pollutants known to be produced during the combustion of waste which have the potential to impact upon the local environment either on human health or ecological receptors. These pollutants include:

- nitrogen dioxide, sulphur dioxide, particulate matter, carbon monoxide, ammonia;
- acid gases - hydrogen chloride, and hydrogen fluoride;
- total organic carbon;
- metals - mercury, cadmium, thallium, antimony, arsenic, lead, cobalt, copper, manganese, nickel and vanadium;
- dioxin and furans;
- dioxin like PCBs; and
- polycyclic aromatic hydrocarbons (PAHs).

For most substances released from the Facility, the most significant effects on human health will arise by inhalation. An Air Quality Assessment has been undertaken to determine the impact of atmospheric concentrations of the pollutants listed above based on the levels transposed under UK Law in the UK Air Quality Strategy and those set by the Environment Agency. These levels have been set at a level which is considered to present minimum or zero risk to human health.

Some pollutants, including dioxins, furans, dioxin-like polychlorinated biphenyls (PCBs) and heavy metals, accumulate in the environment, which means that inhalation is only one of the potential exposure routes. Therefore, impacts cannot be evaluated in terms of their effects on human health by simply reference to ambient air quality standards. An assessment needs to be made of the overall human exposure to the substances by the local population and the risk that this exposure causes.

2.2 Chemicals of Potential Concern (COPC)

The substances which have been considered within this assessment are those which are authorised (as listed above). Although Emission Limit Values (ELVs) for PAHs are not currently set from installations, monitoring is required by legislation in the UK. Therefore, benzo(a)pyrene has been included in the assessment to represent PAH emissions. The following have been considered COPCs for the purpose of this assessment:

- PCDD/Fs (individual congeners) and dioxin like PCBs;
- Hydrogen chloride
- Benzene
- Benzo(a)pyrene
- Mercury (Hg)
- Mercuric chloride
- Cadmium (Cd)
- Thallium (Tl)

- Antimony (Sb)
- Arsenic (As)
- Chromium (Cr), trivalent and hexavalent
- Lead (Pb); and
- Nickel (Ni).

This risk assessment investigates the potential for long term health effect of these COPCs through other routes than just inhalation.

3 Assessment Criteria

IRAP calculates the total exposure through each of the different pathways so that a dose from inhalation and ingestion can be calculated for each receptor. By default, these doses are then used to calculate a cancer risk, using the USEPA's approach. However, the Environment Agency recommend that the results be assessed using the UK's approach, which is explained in the Environment Agency's document "Human Health Toxicological Assessment of Contaminants in Soil", ref SC050021. This approach involves two types of assessment:

- For those substances with a threshold level for toxicity, a Tolerable Daily Intake (TDI) is defined. This is "an estimate of the amount of a contaminant, expressed on a bodyweight basis, which can be ingested daily over a lifetime without appreciable health risk." A Mean Daily Intake (MDI) is also defined, which is the typical intake from background sources (including dietary intake) across the UK. In order to assess the impact of the Facility, the predicted intake of a substance due to emissions from the Facility is added to the MDI and compared with the TDI.
- For substances without a threshold level for toxicity, an Index Dose (ID) is defined. This is a level of exposure which is associated with a negligible risk to human health. The predicted intake of a substance due to emissions from the Facility is compared directly with the ID without taking account of background levels.

Substances can reach the body either through inhalation or through ingestion (oral exposure) and the body handles chemicals differently depending on the route of exposure. For this reason, different TDI and IDs are defined for inhalation and oral exposure.

The following table outlines the MDIs (the typical intake from existing background sources) for the pollutants released from the Facility. These figures are defined in the "Contaminants in soil: updated collation of toxicology data and intake values for humans" series of toxicological reports, available from the Environment Agency's website.

Table 3.1: Mean Daily Intake of Each Substance

Substance	Mean Daily Intake, 70 kg adult (µg/kg bw/day)		Mean Daily Intake, 20 kg child (µg/kg bw/day)	
	Intake Ingestion	Intake, Inhalation	Intake Ingestion	Intake, Inhalation
Arsenic	0.07	0.0002	0.19	0.0005
Benzene	0.04	2.9	0.11	7.4
Benzene(a)pyrene	-	-	-	-
Cadmium	0.19	0.0003	0.5	0.0007
Chromium	1.81	0.0009	3.94	0.0011
Chromium (VI)	0.18	-	0.39	-
Methyl mercury	0.007	-	0.019	-
Mercuric chloride	0.014	-	0.037	-
Nickel	1.9	0.0009	4.8	0.002
Dioxins and dioxin like PCBs	0.7		1.8	

Table 3.2: Tolerable Daily Intake of Each Substance (µg/kg bw/day)				
Substance	**Index dose, Ingestion**	**Index dose, Inhalation**	**TDI, Ingestion**	**TDI, Inhalation**
Arsenic	0.3	0.002	-	-
Benzene	0.29	1.4	-	-
Benzene(a)pyrene	0.02	0.00007	-	-
Cadmium	-	-	0.36	0.0014
Chromium	-	0.001	3	-
Chromium (VI)	-	-	-	-
Methyl mercury	-	-	0.23	0.23
Mercuric chloride	-	-	2	0.06
Nickel	-	-	12	0.006
Dioxins and dioxin like PCBs (pg WHO-TEQ $kg\text{-}bw^{-1}$ day^{-1})	-	-	2	

To allow comparison with the TDI for dioxins, intake values for each dioxin are multiplied by a factor known as the WHO-TEF. A full list of the WHO-TEF values for each dioxin is provided in Appendix A.

The following table presents the MDI for an adult and child as a proportion of the TDI.

Table 3.3: Mean Daily Intake of Each Substance as a % of the TDI				
Substance	**Mean Daily Intake, 70 kg adult (µg/kg bw/day)**		**Mean Daily Intake, 20 kg child (µg/kg bw/day)**	
	Intake Ingestion	**Intake, Inhalation**	**Intake Ingestion**	**Intake, Inhalation**
Cadmium	52.78%	21.43%	138.89%	50.00%
Chromium	60.33%	-	131.33%	-
Methyl mercury	3.04%	-	8.26%	-
Mercuric chloride	0.70%	-	1.85%	-
Nickel	15.83%	15.00%	40.00%	33.33%
Dioxins and dioxin like PCBs	35.00%		90.00%	

As shown, the cadmium and chromium from existing sources exceeds the MDI. The MDI for chromium is set for chromium III and taken from the DEFRA report "Contaminants in Soil: Collation of Toxicological Data and Intake Values for Humans. Chromium". This states that there are no published reports on the adverse effects in humans resulting from ingested chromium III. Almost all toxicological opinion, is that chromium III compounds are of low oral toxicity, and indeed the UK Committee on Medial Aspects of Food Policy recommends chromium III in the diet. The World Health Organisation (WHO) have reviewed the daily intake of chromium from foods and found that existing levels do not represent a toxicity problem. The WHO conclude that "in the form of trivalent compounds, chromium is an essential nutrient and is relatively non-toxic for man and other mammalian species".

The DEFRA report explains that the TDI has been derived from the USEPA's Reference Dose of 3 µg/kg bw/day for chromium VI. This is the only explicitly derived safety limit for oral exposures of chromium. DEFRA recommends that the USEPA Reference Dose is applied to all the chromium content as a starting point. Therefore the TDI presented in Table 3.2 is actually the TDI for chromium VI not chromium. Assessing the total dietary intake of chromium against this TDI is highly conservative.

The key determinant of cadmium's toxicity potential is its chronic accumulation in the kidney. The Environment Agency in their toxicology report "SC050021/TOx 3) explain that chronic exposure to levels in excess of the TDI might be associated with an increase in kidney disease in a proportion of those exposed, but (small) exceedances lasting for shorter periods are of less consequence. Therefore, assessing a lifetime exposure is appropriate. If we assess the exposure of a receptor over a lifetime (i.e. a period as a child and adult) the lifetime MDI is below the TDI.

4 Conceptual Site Model

4.1 Conceptual site model

A detailed Human Health Risk Assessment has been carried out using the Industrial Risk Assessment Program-Human Health (IRAP-h View – Version 4.0). The programme, created by Lakes Environmental, is based on the United States Environment Protection Agency (USEPA) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities[1]. This Protocol is a development of the approach defined by Her Majesties Inspectorate on Pollution (HMIP) in the UK in 1996[2], taking account of further research since that date. The exposure pathways included in the IRAP model are shown in Figure 1.

Exposure to gaseous contaminants has the potential to occur by direct inhalation or vapour phase transfer to plants. In addition, exposure to particulate phase contaminants may occur via indirect pathways following the deposition of particles to soil. These pathways include:

- Ingestion of soil and dust;
- Uptake of contaminants from soil into the food-chain (through home-grown produce and crops); and
- Direct deposition of particles onto above ground crops.

The pathways through which inhalation and ingestion occur and the receptors that have been considered to be impacted via each pathway are:

• Direct inhalation	All receptors
• Ingestion of soil	All receptors
• Ingestion of home-grown produce	All receptors
• Ingestion of drinking water	All receptors
• Ingestion of eggs from home-grown chickens	Agricultural receptors
• Ingestion of home-grown chickens	Agricultural receptors
• Ingestion of home-grown beef	Agricultural receptors
• Ingestion of home-grown pork	Agricultural receptors
• Ingestion of home-grown milk	Agricultural receptors
• Ingestion of breast milk	Infants only

It is noted that some households may keep chickens and consume eggs and potentially the birds. The impact on these households is considered to be between the impact at an agricultural receptor and a standard resident receptor. The approach used considers an agricultural receptor at the point of maximum impact as a complete worst case.

As shown in Figure 1, the pathway from the ingestion of mother's milk in infants is considered within the assessment. This considers all dioxins and dioxin-like PCBs. The IRAP model calculates the amount of these COPCs entering the mother's milk and being passed on to the infants. The impacts are then compared against the TDI.

[1] USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

[2] HMIP (1996) Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes.

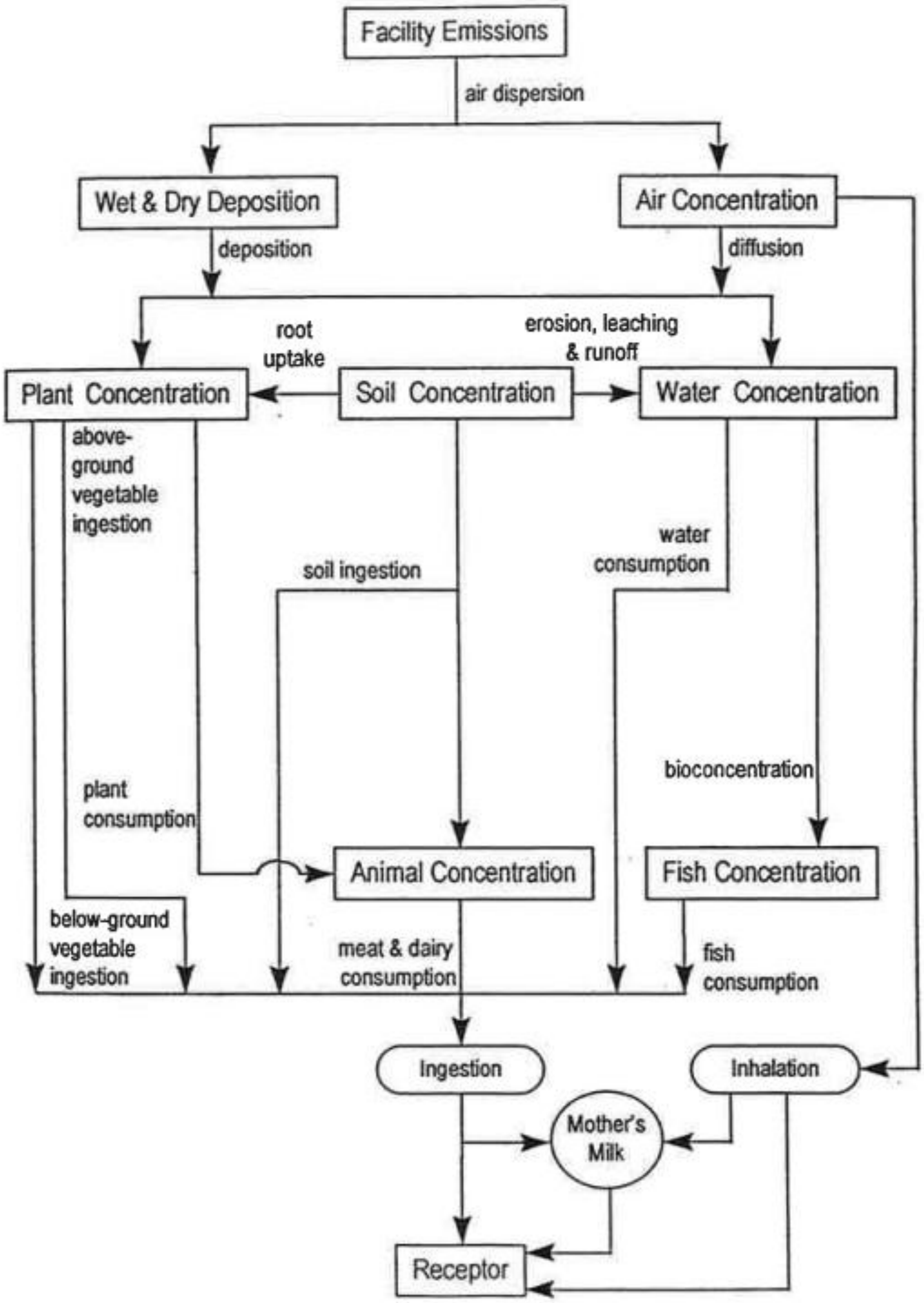

Figure 1: Conceptual Site Model – Exposure Pathways

4.2 Pathways excluded from assessment

The intake of dioxins via dermal absorption, groundwater and surface water exposure pathways is very limited and as such these pathways are excluded from the HHRA. The justification for excluding these pathways is highlighted in the following sections.

4.2.1 Dermal absorption

Both the HMIP and the USEPA note that the contribution from dermal exposure to soils impacted from waste combustion facilities is typically a very minor pathway and is typically very small relative to contributions resulting from exposures via the food chain.

The USEPA[3] provide an example from the risk assessment conducted for the Waste Technologies, Inc. hazardous waste incinerator in East Liverpool, Ohio. This indicated that for an adult subsidence farmer in a subarea with high exposures, the risk resulting from soil ingestion and dermal contact was 50-fold less than the risk from any other pathway and 300-fold less than the total estimated risk.

The HMIP document[4] provides a screening calculation using conservative assumptions, which states for a 1 pg I-TEQ/m^3 the intake via dermal absorption is 30 times lower than the intake via inhalation, which is itself a minor contributor to the total risk.

As such the pathway from dermal absorption is deemed to be an insignificant risk and has been excluded from this assessment.

4.2.2 Groundwater

Exposure via groundwater can only occur if the groundwater is contaminated and consumed untreated by an individual.

The USEPA[5] have concluded that the build up of dioxins in the aquifer over realistic travel times relevant to human exposure was predicted to be so small as to be essentially zero.

As such the pathway from groundwater is deemed to be an insignificant risk and has been excluded from this assessment.

4.2.3 Surface water

It is noted that a possible pathway is via deposition of emissions directly onto surface water – i.e local drinking water supplies or rainwater storage tanks.

Surface water generally goes through several treatment steps and as such any contaminants would be removed from the water before consumption. It is noted that run off to rainwater tanks may not go through the same treatment. However, rain water tanks have a very small surface area and as such the potential for deposition and build up of COPCs is limited. As such the pathway from contaminated surface water is deemed to be an insignificant risk and has been excluded from this assessment.

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3 USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

4 HMIP (1996) Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes.

5 USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

4.2.4 Fish consumption

The consumption of locally caught fish has been excluded from the assessment. Whilst it is noted that fish makes up a proportion of the UK diet, it is not likely that this would be sourced wide-scale from close proximity to the Facility as the majority of UK dietary fish comes from marine habitats, not inland waterways.

A review of the local waterbodies has been undertaken to see if there are any game fishing lakes in the local area (http://www.fisharound.net/where-to-fish/locations-map). This has shown that the local waterbodies are all coarse fishing lakes which are not routinely used for human consumption. The closest lake which both game and course fishing takes place is Chigboro Fisheries which is approximately 9km to the south east of the Facility. Whilst fish caught in this lake may be used for human consumption, due to the distance from the facility this source has been excluded from the analysis. No other game fishing lakes have been identified within 10km of the Facility.

It is noted that the Bradwell Trout Farm is located approximately 1.5km to the north of the Facility. The Bradwell Trout Farm website explains that they produce rainbow trout exclusively for the restaurant and catering trade and that the supply is limited. It is highly unlikely that any fish caught would make up a significant proportion of the local community's diet. Therefore this pathway has been excluded from this assessment, based on professional judgement.

5 Sensitive Receptors

This assessment considers the possible effects on human health at key receptors, where humans are likely to be exposed to the greatest impact from the Facility, and at the point of maximum impact of annual mean emissions.

For the purposes of this assessment, 'Residential' and 'Agricultural' receptors have been identified and can be defined as follows:

Residential: A known place of residence that is occupied within the study area;

Agricultural: A farm holding or area land of horticultural interest.

The emissions from the Facility are expected to be significant only in the locality of the plant. The specific receptors identified in the Air Quality Assessment have been considered in this Assessment. In addition a 'Point of maximum impact' receptor has been selected at the point of maximum impact within fields close to the Facility (and within the adjacent quarry) from annual mean process emissions, although it should be noted that this point is actually uninhabited.

These sensitive receptors are listed in Table 5.1 and displayed in Figure 2, which also contains the receptor designation considered most appropriate for each receptor.

Table 5.1: Sensitive Receptors

ID	Receptor Name	Location		Type of Receptor
		X	Y	
MAX	Point of maximum impact	582824	220771	Agricultural
HH1	Sheepcotes Farm (Hanger No.1)	581565	220328	Resident
HH2	Allshot's Farm (Scrap Yard)	582893	220458	Resident
HH3	Haywards	583236	221163	Resident
HH4	Herons Farm	582443	221378	Resident
HH5	Gosling's Farm	581427	221381	Resident
HH6	Curd Hall Farm	583262	221708	Resident
HH7	Church (adjacent to Bradwell Hall)	581832	222158	Resident
HH8	Bradwell Hall	581838	222319	Agricultural
HH9	Rolphs Farmhouse	580676	220513	Agricultural
HH10	Silver End / Bower Hall / Fossil Hall	581287	219731	Agricultural
HH11	Rivenhall Pl/Hall	581861	219104	Agricultural
HH12	Parkgate Farm / Watchpall Cottages	582337	219195	Agricultural
HH13	Ford Farm / Rivenhall Cottage	582698	218598	Agricultural
HH14	Porter's Farm	583391.6	219242	Agricultural
HH15	Unknown Building 1	583131.7	219462.9	Resident
HH16	Bumby Hall / The Lodge / Polish Site (Light Industry)	582947.2	220115.2	Resident
HH17	Green Pastures Bungalow	581249.9	221176.1	Resident
HH18	Deeks Cottage	582873.4	221255.1	Resident
HH19	Gosling Cottage / Barn	581508.4	221305.5	Resident

Table 5.1: Sensitive Receptors				
ID	**Receptor Name**	**Location**		**Type of**
HH20	Felix Hall / The Clock House / Park Farm	584578.8	219574.9	Agricultural
HH21	Glazenwood House	579980.5	222134.8	Resident
HH22	Bradwell Hall	580570.6	222802.9	Agricultural
HH23	Perry Green Farm	580899.7	221973.3	Agricultural
HH24	The Granary / Porter Farm / Rook Hall	584106.2	218964.5	Agricultural
HH25	Grange Farm	584888	222222	Agricultural
HH26	Coggeshall	585070	222839	Agricultural

It is noted that a number of additional receptors were included in the original HHRA, However on reviewing the status of these properties these were identified to be industrial units. These have therefore been excluded from this assessment.

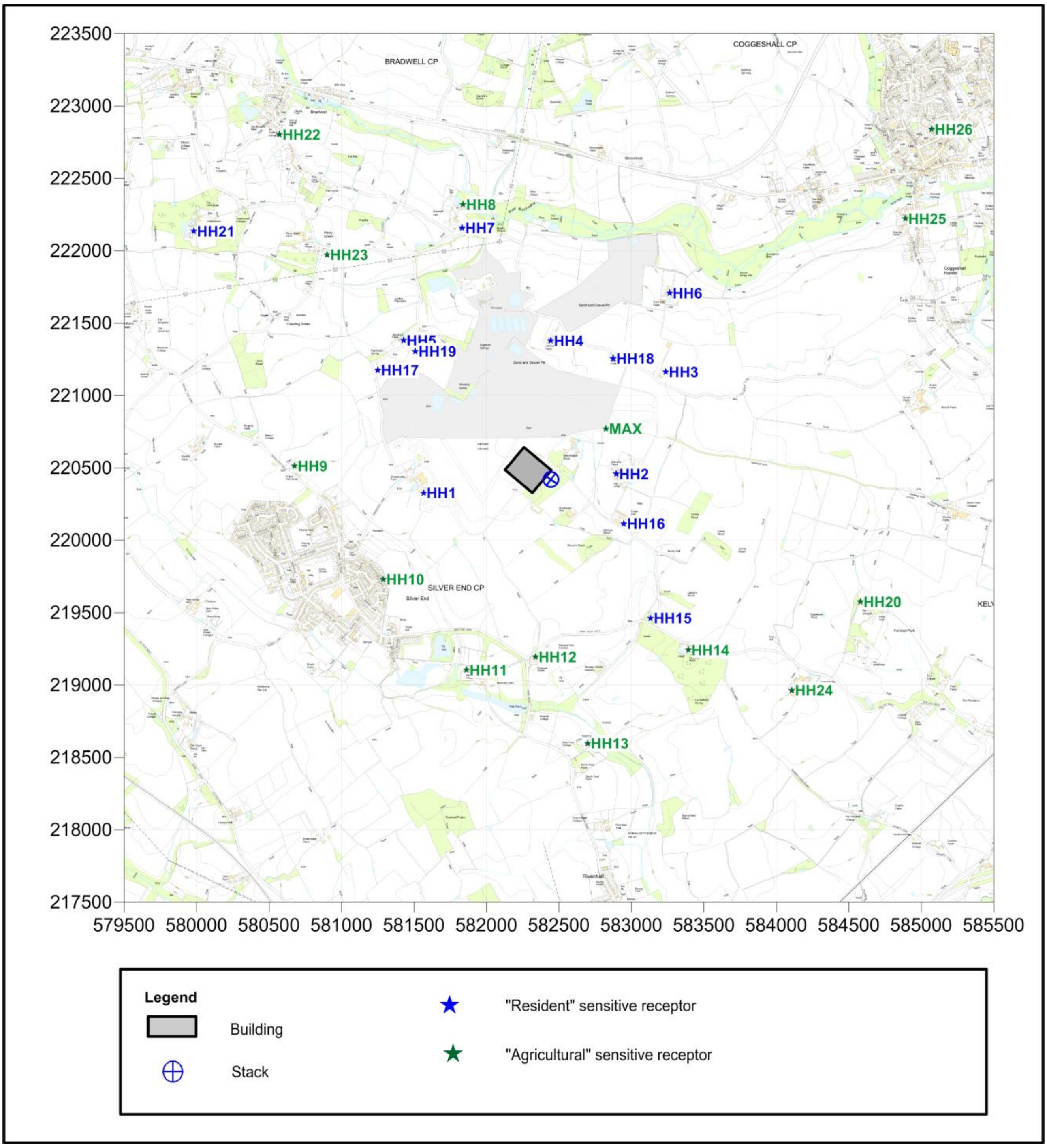

Figure 2: Sensitive Receptors

6 IRAP Model Assumptions and Inputs

The following section details the user defined assumptions used within the IRAP model and provides justifications where appropriate.

6.1 Concentration in soil

The concentration of each chemical in the soil is calculated from the deposition results of the air quality modelling for vapour phase and particle phase deposition. The critical variables in calculating the accumulation of pollutants in the soil are as follows:

- The lifetime of the Facility is taken as 30 years.
- The soil mixing depth is taken as 2 cm in general and 15 cm for produce.

The split between the solid and vapour phase for the substance considered depends on the specific physical properties of each chemical.

In order to assess the amount of substance which is lost from the soil each year through volatilisation, leaching and surface run-off, a soil loss constant is calculated. The rates for leaching and surface runoff are taken as constant, while the rate for volatilisation is calculated from the physical properties of each substance.

6.2 Concentration in plants

The concentrations in plants are determined by considering direct deposition and air-to-plant transfer for above ground produce, and root uptake for above ground and below ground produce. The calculation takes account of the different types of plant; for example, uptake of substances through the roots will differ for below ground and above ground vegetables, and deposition onto plants will be more significant for above ground vegetables.

6.3 Concentration in animals

The concentrations in animals, based on consumption of plants, are calculated from the concentrations in plants, assumed consumption rates and bio-concentration factors. These vary for different animals and different substances, since the transfer of chemicals between the plants consumed and animal tissue varies.

It is also assumed that 100% of the plant materials eaten by animals is grown on soil contaminated by emission sources. This is likely to be a highly pessimistic assumption for UK farming practice.

6.4 Concentration in humans

6.4.1 Intake via inhalation

This is calculated from inhalation rates of typical adults and children and atmospheric concentrations. The inhalation rates used for adults and children are:

- Adults - 20 m^3/day; and
- Children – 7.2 m^3/day.

These are as specified within the Environment Agency series of reports: "Contaminants in soil: updated collation of toxicology data and intake values for humans". The calculation also takes account of time spent outside, since most people spend most of their time indoors.

6.4.2 Intake via soil ingestion

This calculation allows for the ingestion of soil and takes account of different exposure frequencies. It allows for ingestion of soil attached to unwashed vegetables, unintended ingestion when farming or gardening and, for children, ingestion of soil when playing.

6.4.3 Ingestion of food

The calculation of exposure due to ingestion of food draws on the calculations of concentrations in animals and plants and takes account of different ingestion rates for the various food groups by different age groups.

For most people, locally-produced food is only a fraction of their diet and so exposure factors are applied to allow for this.

6.4.4 Breast milk ingestion

For infants, the primary route of exposure is through breast milk. The calculation draws on the exposure calculation for adults and then allows for the transfer of chemicals in breast milk to an infant who is exclusively breast-fed.

The only pathway considered for dioxins for a breast feeding infant is through breast milk. The modelled scenario consists of the accumulation of pollutants in the food chain up to an adult receptor, the accumulation of pollutants in breast milk and finally the consumption of breast milk by an infant.

The assumptions used were:

- Exposure duration of infant to breast milk 1 year
- Proportion of ingested dioxin that is stored in fat 0.9%
- Proportion of mothers weight that is stored in fat 0.3%
- Fraction of fat in breast milk 0.04%
- Fraction of ingested contaminant that is absorbed 0.9%
- Half life of dioxins in adults 2,555 days
- Ingestion rate of breast milk 0.688 kg/day

6.5 Estimation of COPC concentration in media

The IRAP-h model uses a database of physical and chemical parameters to calculate the COPC concentrations through each of the different pathways identified. The base physical and chemical parameters have been used in this assessment.

In order to calculate the COPC concentrations, a number of site specific pieces of information are required.

- Weather data was obtained for the period 2009-2013 from the Stansted weather station, as used within the air quality dispersion modelling. This provides the annual average precipitation which can be used to calculate the general IRAP-h input parameters. Unfortunately the dataset does not include data on precipitation rates. Therefore the annual average precipitation from Andrewsfield climatic monitoring station between the years 1981-2010 has been used. Andrewsfield monitoring station is located in Stebbing approximately 13km to the west of the Facility:

Table 6.1: Ground Type Dependent Properties		
Input Variable	**Assumption**	**Value (cm/year)**
Annual average evapo-transpiration	70% of annual average precipitation	42.91
Annual average irrigation	0% of annual average precipitation	0.00
Annual average precipitation	100% of annual average precipitation	61.30
Annual average runoff	10% of annual average precipitation	6.13

- The average wind speed was taken as 4.23 m/s, calculated from the average of the 5 years of weather data for the period 2009-2013 from the Stansted Airport weather station.

A number of assumptions have been made with regard to the deposition of the different phases. These are summarised in the following table.

Table 6.2: Deposition Assumptions			
Deposition Phase	**Dry Deposition Velocities (m/s)**	**Ratio Dry deposition to Wet deposition**	
		Dry Deposition	**Wet Deposition**
Vapour	0.005	1.0	2.0
Particle	0.010	1.0	2.0
Bound particle	0.010	1.0	2.0
Mercury vapour	0.029	1.0	0
The above deposition velocities have been agreed with the UK Environment Agency for all IRAP based assessments where modelling of specific deposition of pollutants is not undertaken. These are considered to be conservative.			

These deposition assumptions have been applied to the annual mean concentrations predicted using the dispersion modelling which was undertaken as part of the Dispersion Modelling Assessment, to generate the inputs needed for the IRAP modelling. For details of the dispersion modelling methodology please refer to the Dispersion Modelling Assessment.

6.6 Modelled emissions

For the purpose of this assessment it is assumed that the Facility operates at the IED Emission Limit Values for its entire operational life. In actual fact the facility will be shut down for periods of maintenance and monitoring of similar facilities in the UK shows they do not operate at the Emission Limit Values.

The following tables gives the emissions rates of each COPC modelled and the associated Emission Limit Values which have been used to derive the emission rate.

Table 6.3: COPC Emissions Modelled		
COPC	Emission Limit Value (mg/Nm^3)	Emission rate (µg/s)
Hydrogen chloride	10	1027.2
Benzene	10	1027.2
PAHs (Benzo(a)pyrene)	0.0002	0.021
Elemental mercury	0.0001	0.010
Mercuric chloride	0.024	2.465
Cadmium	0.025	2.568
Thallium (I)	0.025	2.568
Antimony	0.055	5.650
Arsenic	0.055	5.650
Chromium	0.055	5.650
Chromium, hexavalent	0.00013	0.013
Lead	0.055	5.650
Nickel	0.055	5.650

Table 6.4: COPC Emissions Modelled		
COPC	Emission Limit Value (ng I-TEQ/Nm^3)	Emission rate (pg/s)
TetraCDD,2,3,7,8	0.1	0.318
HexaCDD,1,2,3,7,8,9		0.211
OctaCDD,1,2,3,4,6,7,8,9		0.042
HeptaCDD,1,2,3,4,6,7,8		0.175
OctaCDF,1,2,3,4,6,7,8,9		0.037
HexaCDD,1,2,3,4,7,8		0.295
PentaCDD,1,2,3,7,8		1.258
TetraCDF,2,3,7,8		0.285
HeptaCDF,1,2,3,4,7,8,9		0.044
PentaCDF,2,3,4,7,8		2.748
PentaCDF,1,2,3,7,8		0.142
HexaCDF,1,2,3,6,7,8		0.829
HexaCDD,1,2,3,6,7,8		0.265
HexaCDF,2,3,4,6,7,8		0.895
HeptaCDF,1,2,3,4,6,7,8		0.451
HexaCDF,1,2,3,4,7,8		2.238
HexaCDF,1,2,3,7,8,9		0.043
Dioxin like PCBs	0.0092	0.945

A number of points should be noted for each group of COPCs:

(1) Hydrogen chloride (Table 6.3).

a) It has been assumed that HCl is emitted at the daily ELV.

(2) Benzene (Table 6.3).

a) It has been assumed that the entire TOC emissions consist of only benzene.

b) It has been assumed that TOC emissions are emitted at the daily ELV.

(3) PAHs (Table 6.3).

a) It has been assumed that the entire PAH emissions consist of only benzo(a)pyrene.

b) Benzo(a)pyrene is not a regulated pollutant within the IED. The highest recorded emission concentration of Benzo(a)pyrene from the UK Environment Agency's public register was 0.105 ug/m³, or 0.000105 mg/m³ (dry, 11% oxygen, 273K). As this is not a regulated pollutant and only monitored periodically we have applied a safety factor of 2.

(4) Group 1 metals - mercury and compounds (Table 6.3).

a) It has been assumed that the ELV of total mercury is 0.05mg/Nm^3

b) The concentration of elemental mercury has been taken as 0.2% of the total mercury and compounds ELV

c) The concentration of mercury chloride has been taken as 48% of the total mercury and compounds ELV.

d) The losses to the global cycle have been taken as 51.8% of the total mercury and compounds ELV.

(5) Group 2 metals - cadmium, thallium and compounds (Table 6.3).

a) The assessment is based on the IED ELV of 0.05 mg/Nm³ for cadmium, thallium and compounds.

b) It is assumed that the emissions of cadmium and thallium are each half of the combined ELV.

(6) Group 3 metals – antimony, arsenic, chromium, lead and nickel (Table 6.3).

a) The assessment is based on the IED ELV of 0.5 mg/Nm³ for "other metals".

b) The emissions of each of the nine "other metals" in the third group have been taken as one-ninth of the combined limit. The Environment Agency "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012" considers this to be a "worst case" scenario.

c) The emission rate of Chromium (VI) has been taken as equal to 0.026% (0.00013/0.5 mg/Nm^3) of the total chromium emission from the facility. This value is from the Environment Agency "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2011" which is based on the speciation of chromium emissions at ten municipal waste incinerators operating under IED in the UK.

(7) Dioxins and furans (Table 6.4).

These are a group of similar halogenated organic compounds, which are generally found as a complex mixture. The toxicity of each compound is different and is generally expressed as a Toxic Equivalent Factor (TEF), which relates the toxicity of each individual compound to the toxicity of 2,3,7,8-TCDD, the most toxic dioxin. A full list of the TEF values for each dioxin is provided in Appendix A. The total concentration is then expressed as a Toxic Equivalent (TEQ).

The split of the different dioxins and furans is based on split of congeners for a release of 0.1 ng I-TEQ/Nm³ as presented in Table A.7.

To determine the Emission Rate, the split of the different dioxins for a 0.1 ng I-TEQ/Nm³ has been multiplied by the TEF value for the specific compound and then multiplied by the normalised flow rate as shown in Table 6.6.

(8) Dioxin like PCBs (Table 6.4).

There are a total of 209 PCBs, which act in a similar manner to dioxins, are generally found in complex mixtures and also have TEFs.

The UK Environment Agency has advised that 44 measurements of dioxin like PCBs have been taken at 24 MWIs between 2008 and 2010. The following data summarises the measurements, all at 11% reference oxygen content:

- Maximum = 9.2×10^{-3} ng[TEQ]/m^3
- Mean = 2.6×10^{-3} ng[TEQ]/m^3
- Minimum = 5.6×10^{-5} ng[TEQ]/m^3

For the purpose of this assessment, as a conservative assumption, the maximum monitored PCB concentration has been used which has been converted to an emission rate using the volumetric flow rate at reference conditions.

The IRAP software, and the HHRAP database which underpins it, does not include any data on individual PCBs, but it does include data for take-up and accumulation rates within the food chain for two groups of PCBs, known as Aroclor 1254 and Aroclor 1016. Each Arocolor is based on a fixed composition of PCBs. Since we are not aware of any data on the specification of PCBs within incinerator emissions, as a worst case assumption we have assumed that the PCBs are released in each of the two Aroclor compositions.

As noted it is assumed that the metals are emitted as 11% of the total emission limit for group 3 metals. An analysis of monitoring of metal emissions from 10 Municipal Waste Incinerators in England and Wales is presented in Appendix B of “Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012”. This is reproduced in the following table.

Table 6.5: Monitoring Data from Municipal Waste Incinerators

Pollutant	Measured Concentration as % of IED Group 3 Limit		
	Mean	Max	Min
Antimony	0.66%	2.30%	0.02%
Arsenic	0.14%	0.60%	0.06%
Chromium	2.18%	10.42%	0.08%
Cobalt	0.08%	0.78%	0.04%
Copper	1.54%	3.26%	0.50%
Lead	3.16%	7.36%	0.06%
Manganese	3.44%	7.30%	0.30%
Nickel	4.40%	27.24%	0.00%
Tin	0.48%	0.48%	0.48%
Vanadium	0.06%	0.20%	0.04%
Total (calculated)	**16.14%**	**59.94%**	**1.58%**

NOTES:

Nickel concentration is greater than 11% is due to one single measurement outlier. The average is around 4% of the Group ELV.

As shown, the total chromium emissions are a maximum of 10.42%, or on average 2.18% of the limit; this includes some contribution from chromium (VI). Therefore assuming that any of the metals are emitted at 11% of the total group 3 limit is conservative.

Table 6.6: Basis for the Emission Rate of Dioxins and Furans				
Dioxin / furan	**Split of Congeners for a release of 0.1 ng I-TEQ/Nm³**	**I-TEFs for the congeners[6]**	**Total (I-TEQ) ng/Nm³**	**Emission rate (pg/s)**
2,3,7,8-TCDD	0.0031	1	0.0031	0.318
1,2,3,7,8-PeCDD	0.0245	0.5	0.0123	1.258
1,2,3,4,7,8-HxCDD	0.0287	0.1	0.0029	0.295
1,2,3,6,7,8-HxCDD	0.0258	0.1	0.0026	0.265
1,2,3,7,8,9-HxCDD	0.0205	0.1	0.0021	0.211
1,2,3,4,6,7,8-HpCDD	0.1704	0.01	0.0017	0.175
1,2,3,4,6,7,8,9-OctaCDD	0.4042	0.001	0.0004	0.042
2,3,7,8-TCDF	0.0277	0.1	0.0028	0.285
1,2,3,7,8-PCDF	0.0277	0.05	0.0014	0.142
2,3,4,7,8-PCDF	0.0535	0.5	0.0268	2.748
1,2,3,4,7,8-HxCDD	0.2179	0.1	0.0218	2.238
1,2,3,6,7,8-HxCDF	0.0807	0.1	0.0081	0.829
1,2,3,7,8,9-HxCDF	0.0042	0.1	0.0004	0.043
2,3,4,6,7,8-HxCDF	0.0871	0.1	0.0087	0.895
1,2,3,4,6,7,8-HpCDF	0.4395	0.01	0.0044	0.451
1,2,3,4,7,8,9-HpCDF	0.0429	0.01	0.0004	0.044
1,2,3,4,6,7,8,9-OctaCDF	0.3566	0.001	0.0004	0.037
Total (I-TEQ)	2.0150	-	0.1000	-

[6] Kutz et al.(1990) The International Toxicity Equivalency Factor (I-TEF) method for estimating risks associated with exposures to complex mixtures of dioxins and related compounds.

7 RESULTS

7.1 At point of maximum impact

The following tables outline the impact of emissions from the Facility at the Point of maximum impact for an 'Agricultural' receptor located on an open field (within the adjacent quarry) to the north of the Facility. As explained in section 4, this receptor type assumes the direct inhalation, and ingestion from soil, drinking water, and home-grown eggs and meat, beef, pork, and milk. This assumes that the person lives at the point of maximum impact and consumes home-grown produce etc. This is considered to be a very worst-case scenario. Reference should be made to Figure 2 for the location of the point in relation to the Facility. As shown this point is uninhabited. Where appropriate a comparison has been made to the TDI or ID.

Table 7.1: Impact Analysis – TDI – Point of Maximum Impact – "Agricultural" Receptor Located on an Open Field (within the adjacent quarry)

Substance	MDI (% of TDI)		Process Contribution (% of TDI)		Overall (% of TDI)	
	Inhalation	Ingestion	Inhalation	Ingestion	Inhalation	Ingestion
Adult						
Cadmium	21.43%	52.78%	9.70%	0.27%	31.13%	53.04%
Chromium	-	60.33%	-	0.68%	-	61.01%
Methyl mercury	-	3.04%	-	0.10%	-	3.14%
Mercuric chloride	-	0.70%	-	0.25%	-	0.95%
Nickel	15.00%	15.83%	4.98%	0.12%	19.98%	15.95%
Dioxins and dioxin like PCBs	35.00%		2.35%		37.35%	
Child						
Cadmium	50.00%	138.89%	12.22%	0.62%	62.22%	139.51%
Chromium	-	131.33%	-	1.10%	-	132.44%
Methyl mercury	-	8.26%	-	0.20%	-	8.46%
Mercuric chloride	-	1.85%	-	0.41%	-	2.26%
Nickel	33.33%	40.00%	6.27%	0.18%	39.61%	40.18%
Dioxins and dioxin like PCBs	90.00%		3.27%		93.27%	

The TDI is an estimate of the amount of a contaminant, expressed on a bodyweight basis, which can be ingested daily over a lifetime without appreciable health risk. As shown for this worst-case receptor the overall impact (including the contribution from existing dietary intakes) is less than the TDI for methyl mercury, mercuric chloride, nickel and dioxins. <u>Therefore there would not be an appreciable health risk based on the emission of these pollutants.</u>

For a child receptor the cadmium and chromium MDI (that sourced from existing dietary intake) exceeds the TDI. However, the process contribution is exceptionally small and the exceedance is a reflection of the fact the MDI is over 100% of the TDI. On this basis it is not considered that the Facility would increase the health risks from cadmium or chromium for children significantly.

As noted in Section 3, the key determinant of cadmium's toxicity potential is its chronic accumulation in the kidney. The Environment Agency explains that chronic exposure to levels in excess of either the TDI might be associated with an increase in kidney disease in a proportion of those exposed, but (small) exceedances lasting for shorter periods are of less consequence. If we assess the lifetime exposure (i.e. a period being a child and an adult) the overall impact is well below the TDI. Therefore there would not be an appreciable health risk based on the emission of cadmium over a lifetime of an individual.

As shown in Table 6.5 the concentrations of total chromium in emissions from municipal waste incineration processes are typically 2.18% of the emission limit, this consists of some in the hexavalent form. Even using the worst case assumption that emissions of chromium are 11% of the group 3 IED limit the process contribution is only 1.1% of the TDI for a child at the point of maximum impact. As explained in Section 3, almost all toxicological opinion, is that chromium III compounds are of low oral toxicity and the WHO state that "in the form of trivalent compounds, chromium is an essential nutrient and is relatively non-toxic for man and other mammalian species".

As explained in Section 3, although the TDI is predicted to be exceeded, this is due to existing dietary intake. The WHO have reviewed the daily intake of chromium from foods and found that existing levels do not represent a toxicity problem, and state that "in the form of trivalent compounds, chromium is an essential nutrient and is relatively non-toxic for man and other mammalian species". The TDI is based on the USEPA's Reference Dose for chromium IV. Assessing the total dietary intake of chromium against this TDI is highly conservative. As the process contribution is small, the existing levels of chromium do not represent a toxicity problem, and the TDI is highly conservative there would not be an appreciable health risk based on the emission of cadmium over a lifetime of an individual.

The total accumulation of dioxins in an infant, considering the breast milk pathway and based on the adult receptor at the point of maximum impact feeding an infant, is 0.624 pg WHO-TEQ / kg-bw / day which is 31.21% of the TDI.

Table 7.2: Impact Analysis – ID – Point of Maximum Impact – "Agricultural" Receptor Located on an Open Field (within the adjacent quarry)

Substance	Inhalation (% of ID)	Ingestion (% of ID)
Adult		
Arsenic	14.94%	1.21%
Benzene	3.88%	0.45%
Benzo[a]pyrene	1.55%	3.26%
Chromium (VI)	29.87%	-
Child		
Arsenic	18.82%	2.11%
Benzene	4.89%	1.06%
Benzo[a]pyrene	1.96%	4.71%
Chromium (VI)	37.64%	-

The ID is the level of exposure which is associated with a negligible risk to human health. As shown for this worst-case receptor the process contribution is well below the ID, therefore, emissions from the Facility are considered to have a negligible impact on human health.

7.2 Maximum impact at a receptor

The following tables outline the impact of emissions from the Facility at the most affected receptor (i.e the receptor with the greatest impact from ingestion and inhalation of emissions) (HH25 – Grange Farm). Where appropriate a comparison has been made to the TDI or ID.

Table 7.3: Impact Analysis – TDI –Maximum Impacted Receptor

Substance	MDI (% of TDI)		Process Contribution (% of TDI)		Overall (% of TDI)	
	Inhalation	Ingestion	Inhalation	Ingestion	Inhalation	Ingestion
Adult						
Cadmium	21.43%	52.78%	6.30%	0.11%	27.73%	52.95%
Chromium	-	60.33%	-	0.14%	-	60.47%
Methyl mercury	-	3.04%	-	0.02%	-	3.07%
Mercuric chloride	-	0.70%	-	0.049%	-	0.75%
Nickel	15.00%	15.83%	3.23%	0.024%	18.23%	15.86%
Dioxins and dioxin like PCBs	35.00%		0.47%		35.47%	
Child						
Cadmium	50.00%	138.89%	7.94%	0.27%	57.94%	139.16%
Chromium	-	131.33%	-	0.22%	-	131.56%
Methyl mercury	-	8.26%	-	0.06%	-	8.32%
Mercuric chloride	-	1.85%	-	0.08%	-	1.93%
Nickel	33.33%	40.00%	4.07%	0.037%	37.41%	40.04%
Dioxins and dioxin like PCBs	90.00%		0.66%		90.66%	

As shown for the most impacted receptor the overall impact (including the contribution from existing dietary intakes) is less than the TDI for methyl mercury, mercuric chloride, nickel and dioxins. Therefore there would not be an appreciable health risk based on the emission of these pollutants.

For a child receptor the cadmium and chromium MDI (that sourced from existing dietary intake) exceeds the TDI. However, the process contribution is exceptionally small and the exceedance is a reflection of the fact the MDI is over 100% of the TDI. On this basis it is not considered that the Facility would increase the health risks from cadmium or chromium for children significantly.

The total accumulation of dioxins in an infant, considering the breast milk pathway and based on the adult Agricultural receptor at HH25 –feeding an infant, is 0.126 pg WHO-TEQ / kg bw / day which is 6.28% of the TDI.

The total accumulation of dioxins in an infant, considering the breast milk pathway and based on the most impacted residential receptor HH4 –feeding an infant, is 0.008 pg WHO-TEQ / kg bw / day which is 0.38% of the TDI.

Table 7.4: Impact Analysis – ID – Maximum Impacted Receptor		
Substance	**Inhalation (% of ID)**	**Ingestion (% of ID)**
Adult		
Arsenic	9.70%	0.29%
Benzene	2.52%	0.31%
Benzo[a]pyrene	1.01%	0.66%
Chromium (VI)	19.40%	-
Child		
Arsenic	12.22%	0.70%
Benzene	3.18%	0.55%
Benzo[a]pyrene	1.27%	0.95%
Chromium (VI)	24.45%	-

As shown for this worst-case receptor the process contribution is well below the ID. Therefore, emissions from the Facility are considered to have a negligible impact on human health.

7.3 Uncertainty and sensitivity analysis

To account for uncertainty in the modelling the impact on human health was assessed for a receptor at the point of maximum impact.

To account for uncertainty in the dietary intake of a person, both residential and agricultural receptors have been assessed. The agricultural receptor is assumed to consume a greater proportion of home grown produce, which has the potential to be contaminated by the COPCs released, than for a residential receptor. In addition, the Agricultural receptor includes the pathway from consuming animals grazed on land contaminated by the emission source. This assumes that 100% of the plant materials eaten by the animals is grown on soil contaminated by emission sources.

The agricultural receptor at the point of maximum impact is considered the upper maximum of the impact of the Facility.

7.4 Upset process conditions

Article 46(6) of the IED (Directive 2010/75/EU) states that:

> *"… the waste incineration plant … shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded.*
>
> *The cumulative duration or operation in such conditions over 1 year shall not exceed 60 hours."*

Article 47 continues with:

> *"In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored."*

In addition Annex VI, Part 3, 2 of the IED states the emission limit values applicable in the circumstances described in Article 46(6) and Article 47:

> *"The total dust concentration in the emissions into the air of a waste incineration plant shall under no circumstances exceed 150 mg/Nm^3 expressed as a half-hourly average. The air emission limit values for TOC and CO set out in points 1.2 and 1.5(b) shall not be exceeded."*

The conditions detailed in Article 46(6) are considered to be "Upset Operating Conditions". As identified these periods are short term events which can only occur for a maximum of 60 hours per year.

Start-up of the Facility from cold will be conducted with clean support fuel (low sulphur light fuel oil). During start-up waste will not be introduced onto the grate unless the temperature within the oxidation zone is above the 850ºC as required by Article 50, paragraph 4(a) of the IED. During start-up, the flue gas treatment plant will be operational as will be the combustion control systems and emissions monitoring equipment.

The same is true during plant shutdown where waste will cease to be introduced to the grate. The waste remaining on the grate will be combusted, the temperature not being permitted to drop below 850ºC through the combustion of clean support auxiliary fuel. During this period the flue gas treatment equipment is fully operational, as will be the control systems and monitoring equipment. After complete combustion of the waste, the auxiliary burners will be turned off and the plant will be allowed to cool.

Start-up and shutdown are infrequent events. The facility is designed to operate continuously, and ideally only shutdown for its annual maintenance programme.

In relation to the magnitude of dioxin emissions during plant start-up and shutdown, research has been undertaken by AEA Technology on behalf of the Environment Agency[7]. Whilst elevated emissions of dioxins (within one order of magnitude) were found during shutdown and start-up phases where the waste was not fully established in the combustion chamber, the report concluded that:

> *"The mass of dioxin emitted during start-up and shutdown for a 4-5 day planned outage was similar to the emission which would have occurred during normal operation in the same period. The emission during the shutdown and restart is equivalent to less than 1 % of the estimated annual emission (if operating normally all year)."*

There is therefore no reason why such start-up and shutdown operations or upset operating conditions will affect the long term impact of the facility.

[7] AEA Technology (2012) Review of research into health effects of Energy from Waste facilities.

8 CONCLUSIONS

Of all the pollutants considered with a Tolerable Daily Intake (TDI), cadmium is the pollutant that results in the highest level of existing exposure (MDI). The combined impact of cadmium from existing background sources and contributions from the proposed Facility at the point of maximum impact is 139.51% of the ingestion TDI for children. However, the process contribution from the Facility for cadmium is exceptionally small, being only 0.62% of the TDI at the point of maximum impact, and 0.27% or less at receptors. Similarly, the ingestion of chromium from existing background sources and contributions from the proposed Facility also exceeds the ingestion TDI for children. However, the process contribution from the proposed Facility for chromium is again exceptionally small, being only 1.10% of the TDI at the point of maximum impact, and 0.22% or less at receptors

The TDI is set at a level "that can be ingested daily over a lifetime without appreciable health risk". The ingestion of cadmium and chromium by children as a result of background sources is already above the TDI. On the basis that the process contribution of these substances is exceptionally small it is not considered that the Facility would increase the health risks from this pollutant significantly. For all other pollutants, the combined impact from the Facility plus the existing MDI is below the TDI, so there would not be an appreciable health risk based on the emission of these pollutants.

Although the MDI exceeds the cadmium TDI for children, the Environment Agency explains that chronic exposure to levels in excess of either the TDI might be associated with an increase in kidney disease in a proportion of those exposed, but (small) exceedances lasting for shorter periods are of less consequence. Therefore, assessing a lifetime exposure is appropriate. If we assess the exposure over the lifetime (i.e. a period as a child and adult) the overall impact is well below the TDI, so there would not be an appreciable health risk based on the emission of cadmium.

Again the TDI for chromium for children is predicted to be exceeded due to existing dietary intake. Toxicological opinion is that chromium III is of low oral toxicity and is needed as part of a health diet. The UK Committee on Medial Aspects of Food Policy recommend a minimum safe and adequate intake, but do not restrict an upper limit. The WHO have analysed human intake for chromium through food and conclude that existing levels do not represent a toxicity problem. The TDI is based on the USEPA's Reference Dose for chromium IV. Assessing the total dietary intake of chromium against this TDI is highly conservative. Therefore it is concluded that as the process contribution is so small and the TDI is set at a highly conservative level there would not be an appreciable health risk based on the emission of chromium.

For pollutants which do not have a TDI, a comparison has been made against an Index Dose (ID). The ID is a threshold below which there are considered to be negligible risks to human health. The greatest contribution from the Facility is from chromium (VI), which is only 37.64% of the Index Dose for children at the point of maximum impact. Therefore, emissions from the Facility of chromium (VI) and all other pollutants are considered to have a negligible impact on human health.

In conclusion, the Facility will not result in appreciable health risks resulting from its operation. This is the same conclusion reached in the original human health risk assessment(s) completed by Golder Associates (UK) Ltd. This confirms that the design modifications that have been made to the Facility have not changed the overall health risks resulting from its operation.

Appendix A - Detailed Results Tables

Table A.1: Comparison with ID Limits for Adult Receptors							
Receptor	Ingestion (% of ID)			Inhalation (% of ID)			
	Arsenic	Benzene	Benzo(a)pyrene	Arsenic	Benzene	Benzo(a)pyrene	Chromium (VI)
Point of maximum impact	1.206%	0.45209%	3.257%	14.937%	3.880%	1.552%	29.874%
MAX	0.069%	0.07447%	0.005%	2.320%	0.602%	0.241%	4.639%
HH1	0.186%	0.19967%	0.013%	6.218%	1.615%	0.646%	12.436%
HH2	0.290%	0.31162%	0.021%	9.702%	2.520%	1.008%	19.404%
HH3	0.115%	0.12312%	0.008%	3.834%	0.996%	0.398%	7.667%
HH4	0.115%	0.12312%	0.008%	3.834%	0.996%	0.398%	7.667%
HH5	0.130%	0.13989%	0.009%	4.357%	1.132%	0.453%	8.715%
HH6	0.044%	0.04701%	0.003%	1.462%	0.380%	0.152%	2.925%
HH7	0.110%	0.04126%	0.297%	1.363%	0.354%	0.142%	2.726%
HH8	0.086%	0.03217%	0.232%	1.062%	0.276%	0.110%	2.124%
HH9	0.198%	0.07415%	0.534%	2.450%	0.636%	0.255%	4.901%
HH10	0.176%	0.06599%	0.475%	2.180%	0.566%	0.226%	4.360%
HH11	0.204%	0.07647%	0.551%	2.527%	0.656%	0.263%	5.054%
HH12	0.133%	0.04988%	0.359%	1.648%	0.428%	0.171%	3.296%
HH13	0.178%	0.06677%	0.481%	2.206%	0.573%	0.229%	4.411%
HH14	0.087%	0.09288%	0.006%	2.893%	0.751%	0.301%	5.785%
HH15	0.121%	0.12981%	0.009%	4.042%	1.050%	0.420%	8.084%
HH16	0.061%	0.06504%	0.004%	2.026%	0.526%	0.210%	4.051%
HH17	0.194%	0.20860%	0.014%	6.495%	1.687%	0.675%	12.991%
HH18	0.062%	0.06668%	0.004%	2.077%	0.539%	0.216%	4.153%
HH19	0.110%	0.04120%	0.297%	1.362%	0.354%	0.141%	2.723%
HH20	0.034%	0.03622%	0.002%	1.128%	0.293%	0.117%	2.257%

Table A.1: Comparison with ID Limits for Adult Receptors							
HH21	0.075%	0.02825%	0.204%	0.933%	0.242%	0.097%	1.866%
HH22	0.099%	0.03723%	0.268%	1.231%	0.320%	0.128%	2.462%
HH23	0.115%	0.04312%	0.311%	1.425%	0.370%	0.148%	2.851%
HH24	0.243%	0.09093%	0.655%	3.006%	0.781%	0.312%	6.011%
HH25	0.211%	0.07906%	0.570%	2.612%	0.678%	0.271%	5.223%
HH26	1.206%	0.45209%	3.257%	14.937%	3.880%	1.552%	29.874%

Table A.2: Comparison with ID Limits for Child Receptors							
Receptor	Ingestion (% of ID)			Inhalation (% of ID)			
	Arsenic	Benzene	Benzo(a)pyrene	Arsenic	Benzene	Benzo(a)pyrene	Chromium (VI)
Point of maximum impact	2.109%	1.061804%	4.709%	18.821%	4.889%	1.955%	37.642%
HH1	0.167%	0.132110%	0.014%	2.923%	0.759%	0.304%	5.845%
HH2	0.448%	0.354233%	0.036%	7.835%	2.035%	0.814%	15.669%
HH3	0.698%	0.552835%	0.057%	12.225%	3.175%	1.270%	24.449%
HH4	0.276%	0.218430%	0.022%	4.830%	1.255%	0.502%	9.661%
HH5	0.276%	0.218430%	0.022%	4.830%	1.255%	0.502%	9.661%
HH6	0.314%	0.248177%	0.025%	5.490%	1.426%	0.570%	10.981%
HH7	0.105%	0.083406%	0.009%	1.843%	0.479%	0.191%	3.685%
HH8	0.193%	0.096901%	0.430%	1.718%	0.446%	0.178%	3.435%
HH9	0.150%	0.075558%	0.335%	1.338%	0.348%	0.139%	2.677%
HH10	0.346%	0.174157%	0.772%	3.087%	0.802%	0.321%	6.175%
HH11	0.308%	0.154995%	0.687%	2.747%	0.713%	0.285%	5.494%
HH12	0.357%	0.179614%	0.797%	3.184%	0.827%	0.331%	6.368%
HH13	0.233%	0.117158%	0.520%	2.076%	0.539%	0.216%	4.153%
HH14	0.311%	0.156814%	0.695%	2.779%	0.722%	0.289%	5.558%
HH15	0.208%	0.164771%	0.017%	3.645%	0.947%	0.379%	7.289%
HH16	0.291%	0.230293%	0.024%	5.093%	1.323%	0.529%	10.185%
HH17	0.146%	0.115388%	0.012%	2.552%	0.663%	0.265%	5.105%
HH18	0.468%	0.370097%	0.038%	8.184%	2.126%	0.850%	16.368%
HH19	0.149%	0.118305%	0.012%	2.616%	0.680%	0.272%	5.233%
HH20	0.192%	0.096781%	0.429%	1.716%	0.446%	0.178%	3.431%
HH21	0.081%	0.064257%	0.007%	1.422%	0.369%	0.148%	2.843%

Table A.2: Comparison with ID Limits for Child Receptors

HH22	0.132%	0.066339%	0.294%	1.176%	0.305%	0.122%	2.351%
HH23	0.174%	0.087441%	0.388%	1.551%	0.403%	0.161%	3.102%
HH24	0.201%	0.101267%	0.449%	1.796%	0.466%	0.187%	3.592%
HH25	0.424%	0.213572%	0.947%	3.787%	0.984%	0.393%	7.574%
HH26	0.369%	0.185678%	0.823%	3.291%	0.855%	0.342%	6.582%

Table A.3: Comparison with TDI Limits for Adult Receptors							
Receptor	**Ingestion (% of ID)**					**Inhalation (% of ID)**	
	Cadmium	**Chromium**	**Methyl Mercury**	**Mercuric Chloride**	**Nickel**	**Cadmium**	**Nickel**
MDI of TDI (%)	**52.78%**	**60.33%**	**3.04%**	**0.70%**	**15.83%**	**21.43%**	**15.00%**
Point of maximum impact	53.04%	61.01%	3.14%	0.95%	15.95%	31.13%	19.98%
HH1	52.80%	60.34%	3.05%	0.70%	15.84%	22.93%	15.77%
HH2	52.85%	60.36%	3.06%	0.71%	15.84%	25.47%	17.07%
HH3	52.89%	60.37%	3.07%	0.72%	15.84%	27.73%	18.23%
HH4	52.82%	60.35%	3.05%	0.71%	15.84%	23.92%	16.28%
HH5	52.82%	60.35%	3.05%	0.71%	15.84%	23.92%	16.28%
HH6	52.83%	60.35%	3.05%	0.71%	15.84%	24.26%	16.45%
HH7	52.79%	60.34%	3.05%	0.70%	15.83%	22.38%	15.49%
HH8	52.80%	60.39%	3.05%	0.72%	15.84%	22.31%	15.45%
HH9	52.80%	60.38%	3.05%	0.72%	15.84%	22.12%	15.35%
HH10	52.82%	60.44%	3.06%	0.74%	15.85%	23.02%	15.82%
HH11	52.82%	60.43%	3.06%	0.74%	15.85%	22.84%	15.73%
HH12	52.82%	60.45%	3.06%	0.74%	15.85%	23.07%	15.84%
HH13	52.81%	60.41%	3.05%	0.73%	15.85%	22.50%	15.55%
HH14	52.82%	60.43%	3.06%	0.74%	15.85%	22.86%	15.74%
HH15	52.81%	60.34%	3.05%	0.71%	15.84%	23.31%	15.96%
HH16	52.82%	60.35%	3.05%	0.71%	15.84%	24.05%	16.35%
HH17	52.80%	60.34%	3.05%	0.70%	15.83%	22.74%	15.68%
HH18	52.85%	60.36%	3.06%	0.71%	15.84%	25.65%	17.17%
HH19	52.80%	60.34%	3.05%	0.70%	15.83%	22.78%	15.69%

Table A.3: Comparison with TDI Limits for Adult Receptors							
HH20	52.80%	60.39%	3.05%	0.72%	15.84%	22.31%	15.45%
HH21	52.79%	60.34%	3.05%	0.70%	15.83%	22.16%	15.38%
HH22	52.79%	60.38%	3.05%	0.72%	15.84%	22.03%	15.31%
HH23	52.80%	60.39%	3.05%	0.72%	15.84%	22.23%	15.41%
HH24	52.80%	60.40%	3.05%	0.72%	15.84%	22.35%	15.48%
HH25	52.83%	60.47%	3.06%	0.75%	15.86%	23.38%	16.00%
HH26	52.82%	60.45%	3.06%	0.74%	15.85%	23.12%	15.87%

Table A.4: Comparison with TDI Limits for Child Receptors							
Receptor	Ingestion (% of ID)					Inhalation (% of ID)	
	Cadmium	Chromium	Methyl Mercury	Mercuric Chloride	Nickel	Cadmium	Nickel
MDI of TDI (%)	**138.89%**	**131.33%**	**8.26%**	**1.85%**	**40.00%**	**50.00%**	**33.33%**
Point of maximum impact	139.51%	132.44%	8.46%	2.26%	40.18%	62.22%	39.61%
HH1	138.95%	131.36%	8.28%	1.87%	40.00%	51.90%	34.31%
HH2	139.06%	131.40%	8.30%	1.90%	40.01%	55.09%	35.94%
HH3	139.16%	131.44%	8.32%	1.93%	40.02%	57.94%	37.41%
HH4	138.99%	131.38%	8.29%	1.88%	40.01%	53.14%	34.94%
HH5	138.99%	131.38%	8.29%	1.88%	40.01%	53.14%	34.94%
HH6	139.01%	131.38%	8.29%	1.88%	40.01%	53.57%	35.16%
HH7	138.93%	131.35%	8.27%	1.86%	40.00%	51.20%	33.95%
HH8	138.95%	131.43%	8.28%	1.89%	40.02%	51.12%	33.91%
HH9	138.93%	131.41%	8.27%	1.88%	40.01%	50.87%	33.78%
HH10	138.99%	131.51%	8.29%	1.92%	40.03%	52.00%	34.36%
HH11	138.98%	131.49%	8.29%	1.91%	40.03%	51.78%	34.25%
HH12	138.99%	131.52%	8.29%	1.92%	40.03%	52.07%	34.39%
HH13	138.96%	131.45%	8.28%	1.90%	40.02%	51.35%	34.03%
HH14	138.98%	131.50%	8.29%	1.91%	40.03%	51.80%	34.26%
HH15	138.97%	131.37%	8.28%	1.87%	40.01%	52.37%	34.55%
HH16	139.00%	131.38%	8.29%	1.88%	40.01%	53.31%	35.03%
HH17	138.94%	131.36%	8.27%	1.87%	40.00%	51.66%	34.18%
HH18	139.07%	131.41%	8.30%	1.90%	40.01%	55.31%	36.06%
HH19	138.95%	131.36%	8.27%	1.87%	40.00%	51.70%	34.21%

Table A.4: Comparison with TDI Limits for Child Receptors

HH20	138.95%	131.43%	8.28%	1.89%	40.02%	51.11%	33.91%
HH21	138.92%	131.35%	8.27%	1.86%	40.00%	50.92%	33.81%
HH22	138.93%	131.40%	8.27%	1.88%	40.01%	50.76%	33.73%
HH23	138.94%	131.42%	8.28%	1.88%	40.02%	51.01%	33.85%
HH24	138.95%	131.44%	8.28%	1.89%	40.02%	51.17%	33.93%
HH25	139.01%	131.56%	8.30%	1.93%	40.04%	52.46%	34.60%
HH26	139.00%	131.53%	8.30%	1.92%	40.03%	52.14%	34.43%

Table A.5: Comparison with Total Dioxin TDI Limits for Adult Receptors				
Receptor	**Total Inhalation, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Total Ingestion, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Total uptake, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Comparison (% of limit)**
MDI (% of TDI)				**35.00%**
Point of maximum impact	1.47E-04	4.68E-02	4.69E-02	37.35%
HH1	2.28E-05	1.39E-04	1.62E-04	35.01%
HH2	6.12E-05	3.74E-04	4.35E-04	35.02%
HH3	9.55E-05	5.83E-04	6.78E-04	35.03%
HH4	3.77E-05	2.30E-04	2.68E-04	35.01%
HH5	3.77E-05	2.30E-04	2.68E-04	35.01%
HH6	4.29E-05	2.62E-04	3.05E-04	35.02%
HH7	1.44E-05	8.79E-05	1.02E-04	35.01%
HH8	1.34E-05	4.27E-03	4.28E-03	35.21%
HH9	1.05E-05	3.33E-03	3.34E-03	35.17%
HH10	2.41E-05	7.67E-03	7.70E-03	35.38%
HH11	2.15E-05	6.83E-03	6.85E-03	35.34%
HH12	2.49E-05	7.91E-03	7.94E-03	35.40%
HH13	1.62E-05	5.16E-03	5.18E-03	35.26%
HH14	2.17E-05	6.91E-03	6.93E-03	35.35%
HH15	2.85E-05	1.74E-04	2.02E-04	35.01%
HH16	3.98E-05	2.43E-04	2.83E-04	35.01%
HH17	1.99E-05	1.22E-04	1.42E-04	35.01%
HH18	6.39E-05	3.90E-04	4.54E-04	35.02%
HH19	2.04E-05	1.25E-04	1.45E-04	35.01%
HH20	1.34E-05	4.26E-03	4.28E-03	35.21%

Table A.5: Comparison with Total Dioxin TDI Limits for Adult Receptors				
Receptor	Total Inhalation, (pg WHO-TEQ kg^{-1} bw day^{-1})	Total Ingestion, (pg WHO-TEQ kg^{-1} bw day^{-1})	Total uptake, (pg WHO-TEQ kg^{-1} bw day^{-1})	Comparison (% of limit)
HH21	1.11E-05	6.78E-05	7.89E-05	35.00%
HH22	9.18E-06	2.92E-03	2.93E-03	35.15%
HH23	1.21E-05	3.85E-03	3.87E-03	35.19%
HH24	1.40E-05	4.46E-03	4.48E-03	35.22%
HH25	2.96E-05	9.41E-03	9.44E-03	35.47%
HH26	2.57E-05	8.18E-03	8.21E-03	35.41%

Table A.6: Comparison with Total Dioxin TDI Limits for Adult Receptors				
Receptor	**Total Inhalation, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Total Ingestion, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Total uptake, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Comparison (% of limit)**
MDI (% of TDI)				**90.00%**
Point of maximum impact	1.85E-04	6.51E-02	6.53E-02	93.27%
HH1	2.88E-05	4.66E-04	4.95E-04	90.02%
HH2	7.71E-05	1.25E-03	1.33E-03	90.07%
HH3	1.20E-04	1.95E-03	2.07E-03	90.10%
HH4	4.75E-05	7.70E-04	8.18E-04	90.04%
HH5	4.75E-05	7.70E-04	8.18E-04	90.04%
HH6	5.40E-05	8.75E-04	9.29E-04	90.05%
HH7	1.81E-05	2.94E-04	3.12E-04	90.02%
HH8	1.69E-05	5.95E-03	5.96E-03	90.30%
HH9	1.32E-05	4.63E-03	4.65E-03	90.23%
HH10	3.04E-05	1.07E-02	1.07E-02	90.54%
HH11	2.70E-05	9.51E-03	9.54E-03	90.48%
HH12	3.13E-05	1.10E-02	1.11E-02	90.55%
HH13	2.04E-05	7.19E-03	7.21E-03	90.36%
HH14	2.74E-05	9.62E-03	9.65E-03	90.48%
HH15	3.59E-05	5.81E-04	6.17E-04	90.03%
HH16	5.01E-05	8.12E-04	8.62E-04	90.04%
HH17	2.51E-05	4.07E-04	4.32E-04	90.02%
HH18	8.05E-05	1.31E-03	1.39E-03	90.07%
HH19	2.58E-05	4.17E-04	4.43E-04	90.02%
HH20	1.69E-05	5.94E-03	5.95E-03	90.30%

Table A.6: Comparison with Total Dioxin TDI Limits for Adult Receptors				
Receptor	**Total Inhalation, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Total Ingestion, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Total uptake, (pg WHO-TEQ kg^{-1} bw day^{-1})**	**Comparison (% of limit)**
HH21	1.40E-05	2.27E-04	2.41E-04	90.01%
HH22	1.16E-05	4.07E-03	4.08E-03	90.20%
HH23	1.53E-05	5.37E-03	5.38E-03	90.27%
HH24	1.77E-05	6.22E-03	6.23E-03	90.31%
HH25	3.73E-05	1.31E-02	1.31E-02	90.66%
HH26	3.24E-05	1.14E-02	1.14E-02	90.57%

Table A.7: Basis for the Emission Rate of Dioxins and Furans	
Compound	**WHO-TEF Multiplier[8]**
HeptaCDD, 1,2,3,4,6,7,8-	0.0031
HeptaCDF, 1,2,3,4,6,7,8-	0.0245
HeptaCDF, 1,2,3,4,7,8,9-	0.0287
HexaCDD, 1,2,3,4,7,8-	0.0258
HexaCDD, 1,2,3,6,7,8-	0.0205
HexaCDD, 1,2,3,7,8,9-	0.1704
HexaCDF, 1,2,3,4,7,8-	0.4042
HexaCDF, 1,2,3,6,7,8-	0.0277
HexaCDF, 1,2,3,7,8,9-	0.0277
HexaCDF, 2,3,4,6,7,8-	0.0535
OctaCDD, 1,2,3,4,6,7,8,9-	0.2179
PentaCDD, 1,2,3,7,8-	0.0807
PentaCDF, 1,2,3,7,8-	0.0042
PentaCDF, 2,3,4,7,8-	0.0871
TetraCDD, 2,3,7,8-	0.4395
TetraCDF, 2,3,7,8-	0.0429

[8] Van den Berg et al, 2006

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Annex 6 BAT Assessment

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1 INTRODUCTION

As required by EPR5.01 – Waste Incineration Sector Guidance, this report presents quantitative BAT assessments for acid gas abatement, nitrogen oxides abatement and combustion technologies for the CHP Plant within the Rivenhall IWMF. A quantitative BAT assessment has not been undertaken of any of the other waste treatment/technologies undertaken at the Installation as these are not required in the relevant BAT sector guidance. Qualitative BAT assessment for all installation operations is presented within section 2.6 of the Supporting Information.

Each assessment follows the structure of Technical Guidance Note EPR-H1 and includes comments on all of the environmental parameters mentioned in EPR-H1.

1.1 Assumptions

The maximum operating capacity of the CHP Plant will be 595,000 tonnes per annum. The Installation will have a maximum availability of 8,150 hours per annum. A firing diagram demonstrating the range of fuels to be combusted is presented in Annex 1. As shown in the firing diagram, the CHP facility will be designed to accept RDF within a NCV design range of circa 7-13 MJ/kg.

The CHP Plant will generate up to 49MWe and will have a parasitic load of 5.5MWe[1]. Furthermore, for the purposes of this assessment it has been assumed that there is no export of heat from the CHP Plant.

For the purposes of this report we have undertaken a quantitative assessment of the available technologies for the proposed capacity using data obtained by Fichtner from a range of different projects using the technologies identified within this assessment.

In the operating costs sections, the following unit costs have been assumed:

(1) Water ....£1 per tonne;
(2) Quick lime ....£90 per tonne;
(3) Hydrated lime ....£94 per tonne;
(4) Sand for fluidised bed .... £100 per tonne;
(5) Sodium bicarbonate... £155 per tonne;
(6) Activated carbon .... £650 per tonne;
(7) Ammonia solution (25%) .... £135 per tonne;
(8) Bottom ash processing..£10 per tonne;
(9) Lime APCr disposal .... £125 per tonne;
(10) Sodium bicarbonate APCr disposal .... £150 per tonne;
(11) Landfill tax (in 2013) .... £80 per tonne;
(12) Imported power ....£52 per MWh; and
(13) Electricity revenue...£116 per MWh.

[1] This does not include the electricity which is consumed by the other waste management processes within the Installation.

2 Acid Gas Abatement

2.1 Options Considered

There are currently three technologies widely available for acid gas treatment on waste wood fired plants in the UK, as listed below.

(1) Wet scrubbing, involving the mixing of the flue gases with an alkaline solution of sodium hydroxide or hydrated lime. This has a good abatement performance, but it consumes large quantities of water, produces large quantities of liquid effluent which require treatment, has high capital and operating costs and generates a visible plume. It is mainly used in the UK for hazardous waste incineration plants where high and varying levels of acid gases in the flue gases require the buffering capacity and additional abatement performance of a wet scrubbing system.

(2) Semi-dry, involving the injection of lime as a slurry into the flue gases in the form of a spray of fine droplets. The acid gases are absorbed into the aqueous phase on the surface of the droplets and react with the lime. The fine droplets evaporate as the flue gases pass through the system, cooling the gas. This means that less energy can be extracted from the flue gases in the boiler, making the steam cycle less efficient. The lime and reaction products are collected on a bag filter, where further reaction can take place.

(3) Dry, involving the injection of solid lime or sodium bicarbonate into the flue gases as a powder. The reagent is collected on a bag filter to form a cake and most of the reaction between the acid gases and the reagent takes place as the flue gases pass through the filter cake. In its basic form, the dry system consumes more reagent than the semi-dry system. However, this can be improved by recirculating the flue gas treatment residues, which contain some unreacted lime and reinjecting this into the flue gases.

Wet scrubbing is not considered to be suitable for the CHP Plant, due to the production of a large volume of hazardous liquid effluent, a reduction in the power generating efficiency of the plant and the generation of visible plume.

Semi-dry systems will generate a visible plume in certain climatic conditions. Planning Condition 17 states:

> *No development shall commence until a management plan for the CHP plant to ensure there is no visible plume from the stack has been submitted to and approved in writing by the Waste Planning Authority. The development shall be implemented in accordance with the approved plan.*

Due to the potential formation of visible plume from the stack and the requirements of planning condition 17, a semi-dry system is not considered to be an available technique for the abatement of acid gases

A dry system can easily achieve the emission limits required by the IED and are less likely to generate a visible plume than semi-dry and wet systems. Dry systems are used on a number plants in Europe.

Taking the above into consideration a dry system is considered to be the only available technique for this Installation. Therefore, a dry system is regarded as representing BAT.

3 Nitrogen Oxides Abatement

3.1 Options Considered

Two options have been considered for NOx abatement and are listed below.

(1) Selective Catalytic Reduction (SCR) involves the injection of ammonia solution or urea into the flue gases immediately upstream of a reactor vessel containing layers of catalyst.

(2) Selective Non Catalytic Reduction (SNCR) involves the injection of ammonia solution or urea into the combustion chamber.

Both options include the use of flue gas recirculation (FGR) as an integral part of the combustion control system.

3.2 Environmental Performance

3.2.1 Emissions to Air

The emission limits for nitrogen oxides and ammonia are shown in the Table 3-1.

A long term abated emission concentration of 70 mg/Nm^3 (11% reference oxygen content) is used for SCR for the purposes of this BAT assessment, since this is the level that the technology can achieve on a long term basis. The two SNCR systems, with and without Flue Gas Recirculation (FGR), operate to match the emission requirement of 200 mg/Nm^3.

The unabated emission with FGR is assumed to be 10% lower than the other two cases.

The tonnages of nitrogen oxides removed by the abatement options are also shown.

Table 3-1– Air Emissions, NOx Abatement Options

Parameter	Units	SNCR	SCR
Nitrous oxide	mg/Nm^3	10	10
Ammonia slip	mg/Nm^3	10	10
NO_x, unabated conc.	mg/Nm^3	315	315
NO_x, unabated release rate	tpa	930	930
NO_x, abated conc.	mg/Nm^3	200	70
Abated NO_x releases	tpa	590	210
NO_x emissions removed by abatement	tpa	340	720

For purpose of this assessment, it has been assumed that the long term NOx emissions concentration is 200 mg/m^3 for SNCR. However, SNCR has been demonstrated to achieve a long term abated emission concentration of 180 mg/m^3 as presented in the Waste Incineration BREF. In addition, SCR systems have been demonstrated to 'typically' operate at 70 mg/m^3.

The impact of emissions to air is considered in the Air Dispersion Assessment, attached as Annex 5 to the Environmental Permit application. The following table shows the predicted ground level concentrations for the available options.

Table 3-2 – Air Emissions, NOx Abatement Options			
Abatement System		**SNCR**	**SCR**
Long Term			
Process Contribution (PC)	µg/m³	2.71	0.95
Background	µg/m³	14.89	14.89
Predicted Environmental Contribution (PEC)	µg/m³	17.60	15.84
Air Quality Objective (AQO)	µg/m³	40	40
PC as % of AQO	%	6.78%	2.37%
PEC as % of AQO	%	44.00%	39.60%
Short Term			
Process Contribution (PC)	µg/m³	35.67	12.48
Background	µg/m³	14.89	14.89
Predicted Environmental Contribution (PEC)	µg/m³	65.45	42.26
Air Quality Objective (AQO)	µg/m³	200	200
PC as % of AQO	%	17.84%	6.24%
PEC as % of AQO	%	32.73%	21.13%

It can be seen that there are no predicted exceedences of air quality objectives for any of the options. Using SCR reduces the long term PEC by 4.4% of the air quality objective and the short term PEC by 11.59% of the air quality objective when compared to SNCR.

3.2.2 Emissions to Water

There are no emissions to water from any of the NOx abatement systems.

3.2.3 Photochemical Ozone Creation Potential

Nitrogen dioxide has a photochemical ozone creation potential (POCP) value relative to Ethylene of 2.8 and nitrogen oxide has a POCP value relative to Ethylene of -42.7. Assuming that 10% of NOx is released as NO2 and the rest as NO, the POCP is -22,900 for the SNCR options and -8,000 for the SCR option, meaning that SCR is less favourable. This is because nitrogen oxide converts to nitrogen dioxide in the atmosphere by reacting with ozone, this removing ozone from the atmosphere. Hence, the abatement of NO actually has a negative impact on POCP.

3.2.4 Global Warming Potential

The direct emissions of greenhouse gases are the same for each option, since the carbon dioxide and nitrous oxide emission concentrations are unchanged. However, the energy consumption is different in each option, which would change the power exported from the installation in each case. In particular, SCR imposes an additional pressure drop on the flue gases, leading to an increase in power consumption on the ID Fan. In addition, SCR requires the flue gases to be reheated which reduces the power generated by the turbine.

This means that the reduction in greenhouse gas emissions due to the displacement of power generated by other power stations would be different in each case.

In order to calculate the global warming potential of electricity consumption, the figure of 718 kg carbon dioxide per MWh has been used, as applied in the Greenhouse Gas Assessment presented in Annex 5 of the Environmental Permit application.

Table 3-3 – Global Warming Potential, NOx Abatement Options			
Parameter	**Units**	**SNCR**	**SCR**
Power consumed	kWe	890	1,580
Power not generated	kWe		810
Reduction in power export	MWh p.a.	7,300	19,500
GWP	tpa CO2 eq	5,200	14,000

3.2.5 Raw Materials

The estimated consumption of raw materials for each option is shown below.

Table 3-4 – Raw Materials, NOx Abatement Options			
Parameter	**Units**	**SNCR**	**SCR**
Ammonia solution	tpa	750	620

3.2.6 Waste Streams

There are no waste streams associated with any of the options.

3.3 Costs

The estimated costs associated with each option are presented below. In order for direct comparisons to be made, the costs are presented as annualised costs, with the capital investment and financing costs spread over a 30 year lifetime with a rate of return of 9%, using the method recommended in Technical Guidance Note EPR-H1.

Table 3-5 – Costs, NOx Abatement Options			
Parameter	**Unit**	**SNCR**	**SCR**
Capital Cost	£ p.a.	£2,700,000	£19,000,000
Annualised Capital Cost	£ p.a.	£263,000	£1,849,000
Maintenance	£ p.a.	£54,000	£380,000
Reagents	£ p.a.	£103,000	£85,000
Loss of exported power	£ p.a.	£843,000	£2,253,000
Total Annualised Cost	£ p.a.	£1,263,000	£4,567,000

3.4 Conclusions

The table below compares the two options.

Table 3-6 – Comparison Table, NOx Abatement Options

Parameter	Units	SNCR	SCR
NO_x emissions removed by abatement	tpa	340	720
POCP		-22,900	-8,000
Global Warming Potential	tpa CO_2 eq	5,200	14,000
Ammonia solution	tpa	750	620
Total Annualised Cost	£ p.a.	£1,263,000	£4,567,000

As can be seen from information presented in the Table 3-6, applying SCR to the Installation:

(1) increases the annualised costs by approximately £3.3 million;

(2) abates an additional 380 tonnes of NOx per annum;

(3) reduces the benefit of the facility in terms of the global warming potential by a minimum of 8,000 tonnes of CO_2; and

(4) reduces ammonia consumption by a minimum of approximately 130 tonnes per annum.

This gives an effective additional annual cost of approximately £8,700 per additional tonne of NOx abated. The additional costs associated with an SCR are not considered to represent BAT for the Installation. Therefore, SNCR is considered to represent BAT for the Installation.

4 Reagent Selection

The selection of reagents for acid gas abatement is considered in section 2.2.2.1 of the Supporting Information document submitted as part of the Environmental Permit application. This assessment is expanded below.

4.1 Options Considered

We have not considered reagents for wet scrubbing, since this has been eliminated as a technique in section 2. We have therefore only considered the two alternative reagents for a dry system – lime and sodium bicarbonate.

4.2 Environmental Performance

4.2.1 Emissions to Air

There is no change in emissions to atmosphere between the two reagents. Both would achieve the same level of abatement.

4.2.2 Deposition to Land

Again, there is no change between the two reagents.

4.2.3 Emissions to Water

There are no emissions to water associated with either of the two reagents.

4.2.4 Photochemical Ozone Creation Potential

There would be no change to POCP for either system.

4.2.5 Global Warming Potential

Sodium bicarbonate has a higher optimum reaction temperature than lime, which means that less heat can be recovered in the boiler. However, this can be resolved by recovering additional heat after the acid gas abatement system. Therefore, it has been assumed that there is no impact on global warming potential from this operational difference.

The reaction of hydrogen chloride and sulphur dioxide with sodium bicarbonate results in an emission of carbon dioxide whereas the reaction with lime does not.

4.2.6 Raw Materials

Sodium bicarbonate ($NaHCO_3$) has better solid handling properties and a significantly lower stoichiometric ratio than hydrated lime ($Ca(OH)_2$).

$NaHCO_3$ and $Ca(OH)_2$ react with the acid gases to produce alkaline salts as the following equations illustrate:

$$NaHCO_{3(s)} + HCl_{(g)} \rightarrow NaCl_{(s)} + H_2O_{(g)} + CO_{2(g)} \quad \textbf{(Eq.1)}$$

$$Ca(OH)_{2(s)} + 2HCl_{(g)} \rightarrow CaCl_{2(s)} + 2H_2O_{(g)} \quad \textbf{(Eq.2)}$$

In order to promote the reactions above, excess quantities of sodium bicarbonate or lime will be required. The excess reagent is lost in the residue. The ratio between the quantity of reagent supplied and the minimum required for the reaction is called the "stoichiometric ratio".

For sodium bicarbonate, a stoichiometric ratio of 1.3 is required, whereas for lime, a stoichiometric ratio of around 1.8 is required. This initially appears to be economically advantageous for sodium bicarbonate in comparison to lime. However, due to the higher relative molecular weight, and the fewer molecules of acid gas reacting per molecule of $NaHCO_3$, the overall consumption of sodium bi-carbonate is actually 64% higher than $Ca(OH)_2$ on a mass basis.

The reagent required to abate one kmol of hydrogen chloride was calculated as 109 kg of sodium bicarbonate and 67 kg of lime.

Similarly, the reagent required to abate one kmol of sulphur dioxide was calculated as 218 kg of sodium bicarbonate and 133 kg of lime.

4.2.7 Waste Streams

The stoichiometric ratio indicates that the amount of residue will be higher with the lime option. However, due to the differences in relative molecular weight and the number of acid gas molecules reacting with each absorbent molecule, the hydrated lime system produces a similar amount of residue to the sodium bi-carbonate option.

The residue production rate for abatement of one kmol of hydrogen chloride was calculated as 84 kg for sodium bicarbonate and 85 kg for lime.

Similarly, the residue production rate for abatement of one kmol of sulphur dioxide was calculated as 142 kg for sodium bicarbonate and 136 kg for hydrated lime.

4.3 Conclusions

The use of sodium bicarbonate has a number of advantages:

- Handling of sodium bicarbonate requires much less health and safety considerations/controls than handling of lime. Lime is a corrosive material and requires strict COSHH controls for handling and transfer.
- Sodium bicarbonate is easier to pump than lime.
- Sodium bicarbonate has a smaller residue volume than lime, if in-plant recycling is not employed.

Hence, the use of sodium bicarbonate is considered to represent BAT for this installation.

5 Combustion Techniques

5.1 Options Considered

The available techniques for fuel combustion are reviewed in section 2.6.3.1 of the Supporting Information document submitted with the Environmental Permit application. The assessment has been expanded to provide a cost-benefit analysis of moving grates and fluidised beds.

(1) Moving grates are the leading technology in the UK and Europe for the combustion of biomass and waste fuels. The moving grate comprises an inclined fixed and moving bars (or rollers) or a vibrating grate that will move the fuel from the feed inlet to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all fuel is exposed to the combustion process.

(2) Fluidised beds are designed for the combustion of relatively homogeneous fuels. Wood chips are considered to be suitable for combustion with a fluidised bed.

5.2 Environmental Performance

5.2.1 Emissions to Air

The emissions to atmosphere would not be affected by the choice of combustion technology. Although NOx concentrations from the furnaces would be different, both options would require further abatement to achieve the necessary emission limits. This means that the actual effect would be to change the amount of reagent required to abate the NOx. This is considered in section 5.2.6.

Table 5-1 – NOx emissions, Combustion Techniques

Option	NOx emissions from furnace (expressed at 11% oxygen) (mg/Nm³)
Moving Grate	320-380
Fluidised Bed	250-300

5.2.2 Deposition to Land

Deposition from atmospheric emissions would also be unchanged.

5.2.3 Emissions to Water

There are no emissions to water for either system.

5.2.4 Photochemical Ozone Creation Potential

There would be no change to POCP for either system.

5.2.5 Global Warming Potential

The direct emissions of greenhouse gases are the same for each option, since the carbon dioxide and nitrous oxide emission concentrations are unchanged. However, there are changes in parasitic load and gross power generation. In particular, a fluidised bed installation will have higher parasitic load due to the higher power consumption of the combustion air fan(s), and the presence of additional systems, e.g. the sand and the fly ash separation system.

The difference in power generation and parasitic load means that the reduction in greenhouse gas emissions due to the displacement of power generated by other power stations would be different in each case.

In order to calculate the global warming potential of electricity consumption, the figure of 718 kg carbon dioxide per MWh has been used, as applied in the Greenhouse Gas Assessment presented in Annex 5.

This is shown in the table below. Note that GWP is negative and so a higher figure is better.

Table 5-2 – Global Warming Potential, Combustion Options

Parameter	Units	Grate	Fluidised Bed
Gross power generation	MWh p.a.	399,000	399,000
Parasitic Load	MWh p.a.	5.5	6.05
Net power generation	MWh p.a.	354,000	350,000
Change in GWP	tpa CO_2 eq.	-254,000	-251,000

5.2.6 Raw Materials

The estimated consumption of raw materials for each option is shown below. The unabated NOx emissions a fluidised bed are expected to be lower than a grate system, so ammonia consumption for SNCR will decrease. Fluidised bed boilers also consume sand, which is used as bed material.

Table 5-3– Raw Materials, Combustion Options

Parameter	Units	Grate	Fluidised Bed
Ammonia solution	tpa	750	500
Sand	tpa		6,210

5.2.7 Waste Streams

The three options produce four solid waste streams.

(1) Residual metals within the incoming fuel will be identical for both options and are not considered further.

(2) The bottom ash production is lower for fluidised beds. It is assumed that the bottom ash would be re-used for building aggregate.

(3) Fluidised beds have much greater carry-over of fine particles and, consequently, produce an additional fly ash stream, which is removed in a cyclone before the acid gas abatement reagent is added. This separate fly ash stream could be usable for building aggregate, but this is not certain. For the purposes of this assessment it is assumed that it will need to be sent to a hazardous landfill.

(4) All options produce APCr. The fluidised bed option would generate less APCr because it is assumed that the fly ash will be removed from the gas stream.

(5) The sand that is consumed by fluidised bed boilers leave the as bottom or fly ash. Therefore, the total amount of solid residues is higher for fluidised bed boilers.

The estimated amounts of residues are shown in the table below.

Table 5-4 – Waste Streams, Combustion Options			
Parameter	**Units**	**Grate**	**Fluidised Bed**
Bottom Ash	tpa	145,000	53,570
Fly Ash	tpa		96,700
APC Residues	tpa	16,000	16,000

5.3 Costs

Capital costs are not readily available for the different options.

We would expect a fluidised bed unit to be up to 10-15% more expensive than a grate fired boiler due to the additional fuel preparation equipment, sand dosing and recycling equipment and fly ash separation. This would outweigh some of the savings from reduced quantities of bottom ash being generated.

The estimated costs of operating each system are presented in the table below. It should be noted that this does not allow for increased maintenance costs associated with the fluidised bed option. For the power, we have shown the lost revenue associated with reduced power export compared to the moving grate option.

Table 5-5 – Operating Costs, Combustion Options			
Parameter	**Units**	**Grate**	**Fluidised Bed**
Ammonia solution	£ p.a.	£110,000	£70,000
Sand	£ p.a.		£620,000
Residue disposal	£ p.a.	£4,730,000	£3,830,000
Additional loss of exported power compared to Grate	£ p.a.		£460,000
Total power, reagents and disposal annual cost	£ p.a.	£2,190,000	£2,740,000

5.4 Conclusions

The table below compares the two options.

Table 5-6 – Comparison, Combustion Options			
Parameter	**Units**	**Grate**	**Fluidised Bed**
Change in GWP	tpa CO_2 eq.	-254,000	-251,000
Ammonia solution	tpa	750	500
Total residues	tpa	161,000	166,270
Additional loss of exported power compared to Grate	£ p.a.		£460,000
Total power, reagents and disposal annual cost	£ p.a.	£2,190,000	£2,740,000

Both the grate and fluidised bed will produce similar quantities of ash, although the fluidised bed produces more fly ash.

The lower annualised costs associated with a grate system outweighs the additional material costs and higher ammonia consumption. Furthermore, the grate system will be able to process the varying waste composition compared to a fluidised bed system which requires a consistent and homogenous fuel.

On this basis a grate system is considered to represent BAT for this facility.

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Annex 7 - Odour Management Plan

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RIVENHALL IWMF

ODOUR MANAGEMENT PLAN

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Table of Contents

1 Introduction

The purpose of this document is to detail the provisions which have been taken into account during the design phase of the Rivenhall Integrated Waste Management Facility (IWMF) (the facility) to manage the risk of the operation of the installation leading to an odour nuisance to the public.

As required by Environment Agency Guidance Note: How to Comply with your Environmental Permit, it is acknowledged that Odour Management Plans are mandatory when applying for a permit for an anaerobic digestion (AD) facility and a mechanical biological treatment (MBT) facility, such as those proposed for the facility. This report identifies the odour management controls included in the design for the facility. However, it should be noted that this report will be subject to review following completion of detailed design of the facility.

The facility has been designed in accordance with the requirements of the current odour management guidance, including the following:

- Sector Guidance Note IPPC S5.06: Guidance for the Recovery and Disposal of Hazardous and Non Hazardous Waste, Environment Agency;
- Guidance Note H4: Odour Management, Environment Agency;
- An industry guide for the prevention and control of odours at biowaste processing facilities, The Composting Association; and
- Odour Guidance for Local Authorities, DEFRA, March 2010.

2 Site Location and Description

2.1 The Rivenhall IWMF

Gent Fairhead & Co Limited is proposing to construct and operate the facility. The facility will be located at the former RAF Rivenhall Airfield site.

2.2 The Site

The Site is located on the southeastern edge of a World War II airfield known as Rivenhall Airfield between the villages of Bradwell (northwest 2.6 km), Silver End (southwest 1.1 km), Rivenhall (south 2.3 km), Coggeshall (northeast 2.8 km) and Kelvedon (southeast 3.4 km).

Access to the site will be provided via a private access road from the existing A120.

The former airfield and its immediate surroundings are on a plateau above the River Blackwater. This plateau is currently being excavated and, therefore, under the current planning permission, half of the old airfield will become a restored 'bowl' for continued agricultural use. The airfield was open and exposed and had been used predominantly for agricultural purposes, although extensive sand and gravel extraction and restoration has been undertaken at the Site.

The nearest residential properties within 1 km of the Site are: The Lodge, Allshotts Farm, Bumby Hall, Sheepcotes Farm, Green Pastures Bungalow, Goslings Cottage, Goslings Barn, Goslings Farm, Deeks Cottage, Heron's Farm, Deeks Cottage, Haywards, and Park Gate Farm Cottages.

2.3 Summary of Site Operations

There will be six principal activities to the Rivenhall IWMF, (1) Combined Heat and Power (CHP) Plant; (2) Materials Recycling Facility (MRF); (3) anaerobic digestion (AD) facility; (4) Mechanical Biological Treatment (MBT) facility;(5) A De-inked Paper Pulp Production Facility (Pulp plant); and (6) Wastewater treatment plant (WWTP). The capacities of the treatment processes are as follows:

(1) The CHP plant will have a maximum design capacity to process up to 595,000 tonnes per annum of non-hazardous Solid Recovered Fuel (SRF)[1] and Refuse Derived Fuel (RDF), herein referred to as RDF;

(2) The MRF will have a maximum design capacity to process 300,000 tonnes per annum of direct waste and treated waste materials from the MBT to recover recyclates for transfer off-site, with the residual material being transferred to the CHP facility;

(3) The AD plant will be designed to process up to 30,000 tonnes per annum of food and organic waste, with the resultant biogas being combusted in a CHP engine;

(4) The MBT Plant will have a maximum design capacity to process 170,000 tonnes per annum of waste to produce a non-hazardous RDF, which will be fed into the MRF to recover recyclates prior to treatment as a fuel within the CHP plant;

(5) The Pulp plant will have a maximum design capacity to process 170,000 tonnes per annum of waste paper to produce approximately 85,500 tonnes per annum of recycled and reusable paper pulp; and

(6) The Wastewater Treatment Plant will have a maximum design capacity of 550,000 m^3 per annum of wastewater from the installation.

[1] The planning permissions states as an *Informative* "reference to Solid Recovered Fuel (SRF) for the purposes of this planning permission is considered to be the same as Refuse Derived Fuel (RDF)."

These principal activities will consist of a combination of installation activities (as defined in the Environmental Permitting Regulations) and directly associated activities. In submitting this application it is regarded that the following activities are being applied for, as presented in the Table below:

Type of Activity	Schedule 1 Activity		Description of Activity
Installation	Section 5.1 Part A1, b)	CHP Facility (Line 1)	Incineration of non-hazardous waste with a capacity of greater than 3 tonnes per hour
Installation	Section 5.1 Part A1, b)	CHP Facility (Line 2)	Incineration of non-hazardous waste with a capacity of greater than 3 tonnes per hour
Installation	Section 6.1 Part A1, a)	Pulp plant	Processing of waste paper to produce a recycled paper pulp and a sludge which is suitable to be applied to land as a soil conditioner.
Waste operation		AD facility	The anaerobic digestion of organic waste to produce a biogas which is subsequently combusted in a biogas engine, and a digestate which is suitable to be applied to land as a soil conditioner.
Directly Associated Activities			
Directly Associated Activities		MRF	Processing of residual waste to recover recyclates and produce a fuel which is suitable for combustion within the CHP Plant; and the processing of treated materials from the MBT to recover recyclates and refine the fuel which is suitable for combustion within the CHP Plant
Directly Associated Activities		MBT	The biodrying of incoming waste to reduce the moisture content of the waste to produce a fuel which is suitable for combustion within the CHP Plant. Material which has been treated within the MBT will enter the MRF for the recovery of recyclates and final refinement prior to transfer to the CHP.
Directly Associated Activities		Wastewater Treatment	The treatment and storage of process effluents from the installation prior to re-use within the installation (effluent from the Pulp plant).

As shown in the application forms (Part B1), the anaerobic digestion plant is being applied for as a separate standard rules EP, reference SR2012 No12.

2.3.1 MRF

The purpose of the MRF is to identify and recover recyclates from incoming untreated Municipal Solid Wastes (MSW) and Commercial & Industrial (C&I) wastes, from the shredded and biologically dried output from the MBT plant, and if possible and appropriate to recover further recyclates from incoming refuse derived fuel (RDF) (or solid recovered fuel (SRF)). As the predominant output by volume from the MRF will be RDF destined for the CHP plant, the MRF is deemed to be an RDF manufacturing and/or refinement process. All RDF manufactured at the installation will be transferred to the CHP plant.

The MRF is designed to both mechanically and manually sort recyclable materials from the incoming waste. The identification and separation processes are achieved initially through a mechanical process and subsequently through a manual process for final quality control.

The MRF processing facility is divided into two lines:

(1) Line 1 is for processing the material that comes from the MBT bio-drying vessels.

(2) Line 2 is for processing material that generally comes direct into the facility having undergone no or minimal pre-treatment by way of recyclate removal.

2.3.1.1 Line 1 (from MBT output)

Line 1 is for processing the material that has been pre-treated in the MBT bio-drying vessels.

Following treatment, the bio-dried wastes within the MBT vessels will be picked up by the wheeled front-end loader and tipped into a metering feed hopper at the head of Line 1. The hopper acts as both a reception point for the waste and a way of systematically feeding the waste at a steady state into the treatment process.

Once the materials have passed through the hopper, they pass by conveyor into the trommel, a rotary screening drum that separates materials of different sizes based on its settings of hole sizes. As material passes through the drum, any material that is smaller than the holes in the drum at that point will drop out, thus providing effective separation. The first holes will be set to 50mm, and any material less than 50mm will fall through and be conveyed directly to the temporary storage or holding bay at the end of the line as RDF.

The retained material continues to pass through the trommel over separation holes set at 150mm, and any material less than 150mm will fall through into a hopper feeding a transverse conveyor beneath the trommel. This fraction size of between >50mm <150mm will include the bulk of the metals and plastic bottles. The transverse conveyor will take this material to the ballistic separator shared with Line 2 (outlined in section 2.3.1.2).

The remaining materials will pass out of the end of the trommel underneath an over band magnet to remove any remaining ferrous material and the residual material will be dropped into the RDF bunker.

2.3.1.2 Line 2

Line 2 is for processing material that generally comes direct into the facility having undergone no or minimal off-site pre-treatment by way of recyclate removal. In addition, it will process the 50 mm to 150 mm fraction separated out from Line 1.

Following deposition by the delivery vehicle, a wheeled loading shovel will handle the incoming waste, either initially storing it temporarily in the daily holding bunker, or feeding it directly into the feed hopper at the head of the Line 2. Waste placed into the feed hopper drops onto a shredder that will shred the waste into 300mm particles. This ensures that the waste passes through the process in a uniformed size and that the RDF produced at the end of the line is in accordance with the fuel requirements for combustion within the CHP Plant.

All of the shredded material will then pass along a conveyor into the trommel where the initial separation holes will be set at 50mm. All of the material less than 50mm material will drop through the holes and be conveyed to the RDF bay ready for dispatch.

The remaining material will pass along the trommel to where the next separation holes are set at 150mm. All of the >50mm <150mm will fall through the trommel at this stage and onto a ballistic separator. At this point, the >50mm <150mm material from Line 1 will also be fed in parallel to this ballistic separator

The function of the ballistic separator is to separate out the principal recyclates in 2D and 3D formats. This is achieved by passing the waste materials over a series of parallel inclined rotating plates formed of angled metal paddles. This action enables the 2D flat and flexible materials such as paper and plastic film to rise up the incline but any 3D rigid or rolling materials such as plastic bottles and metal cans will roll back down the incline. Fine items fall through a sieve mesh.

From the ballistic separator, the 2D or flat >50mm<150mm material is conveyed to the RDF dispatch bay. The 3D or non-flat >50mm<150mm material will pass along a conveyor via an over-band magnet and eddy separator to an optical sorter where all of the plastic bottles can be identified. The optical sorter works by reading the different polymer types, colours and shapes. Once these have been identified, an electronic signal is sent to an air jet that expels the bottle as it passes over the jet of air. These materials will be ejected into holding cages ready for baling.

The >150 mm material that had not dropped out of the trommel for conveyance to the ballistic separator continues on to the end of the trommel where it is fed onto a conveyor under an over-band magnet for ferrous extraction and then into a picking cabin. In the picking cabin, operatives will take out the larger recyclables such as paper and rigid plastics. These will be dropped into appropriate holding cages or bunkers beneath the picking station ready for baling.

Following the end of the picking line, the remaining material continues on the conveyor and over a non-ferrous separator to extract non-ferrous metals and under a final over-band magnet to extract any remaining ferrous metals. The ferrous and non-ferrous fractions will be dropped into a holding cage or bunker ready for baling for transfer off-site to a licensed waste management facility.

All remaining materials will be fed by conveyor to drop into the RDF dispatch bay.

2.3.1.3 Recyclate dispatch

The materials that have been separated out for recycling such as paper, card, plastic bottles and metals will be mechanically transferred from each holding cage, on a separate basis, and conveyed to the baler attached to Line 2. The area between the baler and the RDF bunker will be used for the storage of bales (by clamp truck) of the various recyclates awaiting transfer off-site.

Vehicles collecting recyclates material heading for the end market (flat bed bulkers) will collect the bales during day-time operational hours.

2.3.2 MBT

The purpose of the MBT Facility is to receive collected municipal or commercial wastes that require some pre-treatment in order to remove moisture and recyclates (in combination with the adjacent MRF) and to manufacture a RDF suitable for energy recovery in the CHP plant. The MBT may also be employed when appropriate to biologically dry and moisture condition incoming RDF prior to energy recovery in the CHP plant.

The MBT process is designed to take in organic-rich materials that are treated in a series of enclosed vessels. The vessels include individual floor and roof systems that provide for air to be forced through the waste to facilitate the process of biological drying.

The MBT process is modular with each vessel being rectangle in shape. The MBT process is designed for the treatment of up to approximately 170,000 tonnes per annum of waste through the process utilising eight lines with two vessels in each line. The waste will be loaded into each vessel by a front-end loading shovel.

The waste will remain in the vessels for a minimum of 7 days enabling the biological process to occur, during which time the waste will lose up to 12% moisture content. This enables easier extraction of recyclables, particularly plastics and metals, within the mechanical processes in the MRF.

2.3.2.1 MBT Operation

Following deposition by the delivery vehicle, a wheeled loading shovel will handle the incoming waste.

In the event that the incoming waste has not undergone any initial shredding at the customer’s collection or transfer facility, there will be a mobile shredder available in the tipping hall to ensure that all material placed into the MBT vessels is shredded to an appropriate size to be determined during operations; in the order of 150 mm to 300 mm.

The wheeled loading shovel will pick up the waste from the tipping floor or holding bay, pass it through the mobile shredder as required, and place it into one of the MBT vessels as soon as possible after it has arrived at the Installation.

The design of the MBT Vessels is modular and there will be up to 16 vessels installed and in operation. The vessels are made from 3 walls of concrete with a fixed or retractable PVC roof. Approximate dimensions of each vessel are 6.5m internal width, 18m length and 4m internal height. There is a removable metal door at the front. During loading, the metal door is removed and the retractable part of the roof rolled back. The waste will be placed to a height of approximately 3m and initially compacted with the loading shovel.

Each vessel will be designed to hold up to approximately 200 tonnes of waste. When the vessel is full, the door is replaced (using the loading shovel) and, if appropriate, the roof is rolled back over the top of the vessel. The vessel will be effectively sealed at this stage. This minimises the potential for vermin, helps to maintain the heat within the vessel and contains odours or dust during the biological drying process.

A strict regime of temperature and moisture content monitoring will be undertaken for a period of seven days whilst the waste is being treated within the vessel. When the waste has achieved the appropriate moisture content, the vessel will be emptied by a wheeled loading machine and transferred directly through to the MRF feed hopper for further processing.

Depending upon the nature of the waste, and on the output from similar previous practices in the MRF, the operator may decide that there are insufficient recyclates that can be recovered by sending the MBT output through the MRF. If this is the case, the material that exits the MBT, now classified as 'RDF', will be loaded direct onto in-house dump-trucks which will transport the RDF direct to the CHP plant.

2.3.2.2 MBT Process – Temperature and Moisture Content Controls

Although very similar to an in-vessel composting system, normally sited outdoors but in the case of the Installation inside another building, there is no need or intention to create a compost output from the MBT plant. It will be used only for the manufacture of RDF for use in the CHP plant and to enhance the recovery of certain recyclates.

Within the MBT the temperature inside the waste for optimum biological drying conditions is likely to be in the region of 50 to 60°C, but there are no statutory limitations to adhere to.

In order to assist in bio-drying control, and to confirm when the wastes have reached appropriate moisture contents, a number of 2 metre long temperature probes will be inserted through the roofs of the vessels. Each vessel will have a large fan at the back to constantly blow though air and to keep the wastes aerated. Adjustments will be made in air circulation to maintain temperatures at appropriate levels.

Air within the MBT vessels is circulated for an anticipated 75% of the cycle time. A valve on the inlet air side of the fan units will control replenishment volumes of air as needed to control temperatures and moisture. The capacity of the stainless steel fan units is circa 1.5 m^3/sec which in turn is controlled by a speed reducer. The air flow is distributed at ground level through patented air rails which have proven themselves to stay clear and remain unblocked for a service interval of at least 6 months. The oxygen enriched air percolates through the waste and is then sucked back into the fan via pipework mounted on the inside of each vessel roof. There are virtually no emissions from the MBT vessels whilst in this phase of operation.

As the air used within the vessels is fed into and re-circulated on a closed (contained) loop system, the short retention time (up to a maximum of 2 weeks) mitigates the potential creation of an anaerobic environment. Temperature controls will enable the operator to ensure that such anaerobic conditions are not reached.

It is anticipated that moisture modification through the MBT process will be in the order of 10% to 12% reduction over the first week with a maximum potential moisture reduction of 15% over 2 weeks. Moisture modification results in approximately 75% leachate generation and 25% loss to air.

2.3.2.3 MBT Drainage

The enclosed MBT vessels are within the main buildings ("the Western Hangar").

The floor of the MBT area within the MBT Plant will be graded internally for appropriate wastewater control within each vessel and, separately, within the trafficked areas of the remainder of the MBT. The initial tipping area and short-term waste bunkers will be individually drained. The design allows for all surfaces to be regularly washed down and kept clean using fresh water from the Upper Lagoon.

Wastewater or leachate produced through the bio-drying process will be used as a pre-seeded source of process water to support the adjacent AD operation.

2.3.2.4 MBT Air and Dust Control

The closed loop air circulation system within each MBT vessel essentially uses the waste as a biofilter; air is drawn from within the IWMF building through the individual roof of each vessel. Hence, the MBT vessel is held at a negative pressure, which mitigates against the potential for fugitive emissions. In any case, these would not be direct to the external air and the positive ventilation system within the IWMF buildings will collect and treat air emissions arising from the MBT's operation.

The air temperature within each MBT vessel will be maintained at or around 50 to 60^{o}C.

Standard air changes within the MBT building will maintain a good working environment. Any emissions from the process are only released into the building when the vessel front doors are opened following treatment, i.e. as the RDF is removed using the wheeled loading shovel.

Within the MBT area, standard air changes through a positive ventilation system will be required, whereby air is drawn into the building via the front louvres in the building and sucked through dust and carbon filters in order to exhaust clean air to the surrounding atmosphere. Carbon filters will require replacement on a regular basis as required by the particular manufacturer's requirements, expected to be in the region of every 4 to 6 months.

Due to the hard-surface nature of all buildings and roads with in the IWMF, the trafficking by modern road vehicles, and the naturally damp nature of the waste materials being handled, it is not expected that dust will be created in high quantities in the MBT plant. Nevertheless, as with all operational areas of the IWMF, good operational husbandry will be instigated in accordance with the recent HSE guidance relating to the control and mitigation of dust.

2.3.3 Anaerobic Digestion (AD) Plant

The anaerobic digestion (AD) process will comprise a wet pre-treatment and anaerobic digestion system. This is considered to be a proven technology for the proposed waste feedstock, which will comprise separately collected municipal or commercial food wastes and/or other green wastes, herein referred to as mixed organic waste.

2.3.3.1 AD Waste Reception and Mechanical Pre-sorting

Mixed organic waste is delivered to the site and deposited into the AD reception area, where it is taken on a collecting screw conveyor and transferred to the pulpers.

2.3.3.2 Hydromechanical pre-treatment

The hydromechanical pre-treatment consists of two steps:

- dissolution and defibring of the digestible organics into an organic suspension and removal of coarse impurities in a waste pulper; and
- removal of fine impurities in a grit removal system.

2.3.3.3 Waste pulper

Pulping is performed to facilitate three objectives:

- disintegration of organic waste to enhance the subsequent digestion process;
- removal of non-biodegradable contaminants as a "heavy" fraction (stones, large bones, batteries and metallic objects); and

- removal of non-biodegradable contaminants as a "light" fraction (textiles, wood, plastic film, string etc.).

In the waste pulper, process water is added to the waste, which produces a suspension with a water content of approximately 90% (w/w), so that it is able to be pumped and mixed.

The waste pulper is operated in a batch-mode. The batch-mode consists of the following operation steps:

- charging of the pulper;
- dissolving process (defibration of the biowaste);
- pumping out of the biowaste suspension;
- filling with process water;
- heavy fraction discharge; and
- light fraction removal.

The charging of the waste pulper is automated. Once the optimal concentration of solids in the pulper has been reached, the charging with waste is automatically stopped.

The waste pulper is equipped with a special turbine. When it rotates, fluidic forces defibrate, suspend and partly dissolve the digestible organic fraction contained in the waste. Biologically non-degradable substances, such as plastics, textiles, metals, glass etc. are not damaged in the process. These contaminants are separated at the end of the treatment cycle.

After the dissolving process the waste-suspension is extracted through a sieve plate with a perforation limit of 10 mm at the bottom of each pulper by means of a centrifugal pump. The pulp will have a dry solids content of approximately 10 % (w/w).

Before the discharge of the contaminants the pulper is filled with process water. The contaminants retained in the pulper are now separated from the mixture of process water and contaminants on the basis of their different sedimentation characteristics.

At the bottom of the pulper the heavy fraction (glass, sand, stones, batteries, metals etc.) sediments and is removed by means of a trap system from the mixture of process water and contaminants. Before discharge it is rinsed with process water to minimize the remaining content of residual organic substances. With a dewatering screw conveyor, the purified heavy fraction is further cleaned of fine organic particles, then dewatered and transferred to a container.

The light fraction (plastics, textiles, composite materials as well as the hardly or non-digestible organic fraction, e.g. wood etc.) floats in the suspension or rises to its surface. After the separation of the heavy fraction, a gate valve is opened and the light fraction and suspension flushes into the receptacle of the LRS screw. The LRS screw removes and transports the light fraction to a light fraction press to reduce the moisture content. The dewatered light fraction is taken to a container by a conveyor belt. The resulting press water, as well as the excess water at the screw rake, is collected in a drainage system and carried back into the process with a pump.

Processing time of each batch-cycle depends very much on the type of waste and its composition. It is assumed that the cycle time is approximately 60 min for the waste pulper with screw rake.

2.3.3.4 AD Grit Removal System

The pulp withdrawn from the pulper still has a content of heavy fraction particles up to a size of the screen perforation (grit).

First the pulp is pumped into a surge tank. The pulp is withdrawn out of the coned point of the surge tank and is pumped through a grit removal system. The grit removal system mainly consists of a hydrocyclone, a classifying pipe, and a gritbox. Caused by centrifugal forces in the hydrocyclone a sludge enriched with grit is discharged as underflow into the classifying pipe and sediments downwards into the gritbox by occurring a reduction of the content of discharged organics due to a weak counterflow with upstream water. The gritbox is emptied automatically depending on demand.

The pulp is circulated through the grit removal system several times to ensure that all grit is removed from the waste. On completion of the grit removal cycle, the recirculation is stopped and the de-gritted pulp is pumped to the suspension buffer.

2.3.3.5 AD Suspension Buffer

To obtain proper mixing, air from the tank headspace is led after extraction of its condensate buffer to the air compressor suspension buffer, where it is compressed and injected back to the suspension buffer via a central gas lance system at the bottom of the tank. This induces a proper mixing of the tank contents.

Bacterial hydrolysis will commence and consume oxygen, so a certain level of oxygen must be maintained in the injected air, by permitting a very carefully controlled rate of fresh air to the compressor suction, which will suppress the formation of methane and odourous compounds.

The suspension buffer is connected to the waste air treatment system in order to avoid possible bad odours.

2.3.3.6 AD Digester

The pulp is pumped from the suspension buffer to the digesters, where the biogas production will take place. The digester is fed with the means of a digester feeding pump. The feeding process of the digester will be automatic and semi-continuous. It will be fed throughout a twenty-four hour day, seven days a week, for short periods and in frequent intervals by the use of pumps, optimal for the transport of low flowing suspensions containing solids. High liquid level in the digester outlet sump inhibits the digester feed pump.

Part of the biogas produced in the digester is led to one gas compressor per digester where it is compressed and pushed back into the digester via a central gas lance system at the bottom of the digester. The biogas creates bubbles while leaving the gas lances and it increases the water level at the top of the digester. Thus, a significant volume of liquid is displaced which creates a high velocity current in the central part of the digester up to the surface. It continues horizontally towards the perimeter of the digester, moves down close to the wall region to the bottom and then back to the digester's centre. This effect has the capability of mixing all the digester's volume. The high surface velocities avoid the formation of a 'crust' on the surface of the digester.

The temperature of the digester is monitored. The biological process operates at mesospheric temperature conditions, i.e. between 36°C and 38°C, which gives higher operating and disposal safety within the process. A constant temperature will be maintained in the digester by the external recirculation heat exchanger system provided for each digester.

The retention time for the waste will be approximately 18 days, during which the organic dry matter in the digesters will be converted to biogas.

The digested pulp (digestate) is automatically pumped from the digesters to the dewatering station under level control.

2.3.3.7 Sanitation

In accordance with the requirement of PAS 110, the following conditions will be achieved within the anaerobic digestion sanitation process:

- temperature of 70 °C;
- time during which the material is kept at this temperature of 1 hour; and
- maximum particle size of 12 mm.

To achieve the conditions, there are three isolated sanitation tanks of 30 m³ each. While one tank is being loaded and heated up to 70°C, in the second tank the required temperature is being maintained for over 1 hour and finally the third tank is being emptied during this time. This allows for a continuous feeding of the digesters. The third requirement, the 12 mm particle size, will be maintained by the 12 mm sieve on the bottom of the pulper.

2.3.3.8 AD Biogas Cleaning and Combustion

Hydrogen sulphide (H2S) needs to be removed from the biogas produced, in order to avoid corrosion and to reduce sulphur concentrations in the emissions when the biogas is combusted. An external biological desulphurisation will be used to achieve the required values for the valorisation of the biogas in biogas units.

The outgoing biogas is conducted over a condensate trap, which is filled with gravel. In it, the water is partially separated from the biogas. In addition, the gravel heap also serves to retain possibly entrained solid components such as foam particles.

This biogas will be combusted in two biogas gas engines, with a combined electrical output of approximately 1MW.

A gas flare will be used to combust the biogas during periods of plant shutdown or excess biogas production.

2.3.3.9 AD Dewatering

The solid-liquid separation will be used to separate the digestate into a thin liquid fraction with low total solids content and a solid fraction with high total solids content.

The digestate is continuously pumped at a controlled rate from the digesters to dewatering centrifuges.

Prior to entering the centrifuges, if required, the pulp will be conditioned by the addition of polyelectrolyte solution.

The dewatering unit will be operated continuously, to ensure a constant discharge of the digester and maintain the level in the digesters.

The dewatered digestate is placed on a conveyor belt and is transported to a small storage area, which bridges the weekend production. From here it is transported with a front loader to the storage prior to transfer off-site.

The liquid fraction (centrate) is discharged into a small tank and from here it is pumped to the process water tank.

2.3.3.10 AD Digestate Storage Tanks

The remaining digestate, which has not been sent for dewatering, will be pumped to the two Digestate Storage Tanks. The tanks will be equipped with quick coupling systems for the removal of the liquid digestate for its transfer off-site.

2.3.3.11 AD Exhaust Air Collection and Treatment

The AD operating area has been compartmentalised to limit the total volume of air that requires treatment via a biofilter and/or need to be collected and changed through the building's overall ventilation system. This defines areas of 'clean' or 'dirty' air (i.e. 'clean' being air that naturally circulates around contained AD operating systems within an internal environment that requires little or no treatment prior to ventilation; and 'dirty' being areas of the building where waste and digestate, delivery or collection, requires air treatment to mitigate fugitive emissions). By controlling and containing the environment(s) within the AD area it is possible to minimise and mitigate the overall ventilation, air treatment and air changes that are required inside the building.

The AD waste reception and digestate offtake areas require 2 to 3 air changes per hour and are treated through a sealed/contained biofilter located above the 'dirty' area and fed to the CHP for treatment and discharge.

Given the enclosed and contained nature of the AD processes, the remainder of the AD area 'clean' will require 2 to 3 air changes per day. Air within the enclosed process areas of the building will be treated through standard air changes through the integrated ventilation system. Dust and carbon filters are used to exhaust clean air that can be used in other process areas – carbon filters will require replacement on a 4 to 6 month basis.

The environment within the AD halls will be held under negative pressure to control, manage and mitigate the potential for odorous emissions. Doors to the AD area shall remain closed except for those short periods of waste delivery or removal of the reject containers.

2.3.4 CHP

The CHP facility will combust waste comprising predominantly RDF from off-site satellite waste treatment facilities, some RDF produced by the on-site MRF and MBT, and some biological residues from the WWTP. The CHP plant will produce electrical power for use in the CHP plant and other on-site process with excess exported to the local distribution network. Heat will be exported as steam and hot water to on-site processes and for space heating.

The CHP facility will consist of two combustion lines. The thermal capacity of each boiler will be 92 MWth giving a total thermal capacity of the CHP facility of 184 MWth.

The CHP facility will be able to generate up to 50 MWe. With the AD plant in operation and generating 1 MWe, the CHP plant will be limited to 49 MWe as the total site generation is limited to 50 MWe. Normal export is expected to be around 28 MWe, after providing power to the other facilities on site.

The maximum capacity of the CHP facility is 595,000 tonnes per annum.

The CHP facility will be designed to accept RDF within an NCV design range of circa 7-13 MJ/kg. Fluctuations in the delivered NCV may lead to variations in the waste throughput, but this will not exceed 595,000 tonnes per annum of incoming waste.

An indicative process schematic for the CHP plant is presented within Figure 1. A larger version is included in Annex 1.

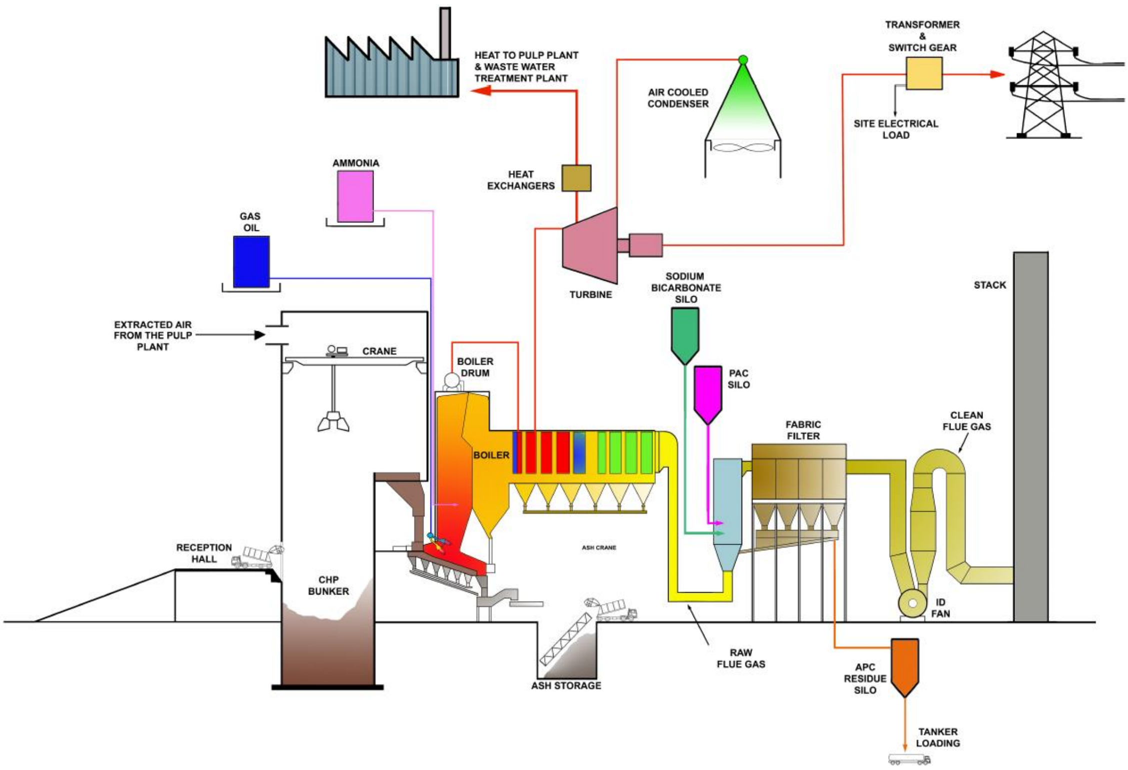

Figure 1 – Indicative CHP Plant Schematic

2.3.4.1 RDF Reception

The RDF storage bunker will have a storage capacity of approximately 8,000 tonnes, which is equivalent to up to 5 days RDF storage capacity. RDF will be stacked by the overhead crane. There will also be some additional storage within the Installation for RDF at the MRF and MBT plants.

The RDF reception area will be a fully enclosed building, maintained under slight negative pressure to minimise the risk of odours, dust or litter from escaping from the building. The vehicles will tip into the bunker from which a grab will transfer RDF to the feed hoppers for the combustion lines.

The grab will also be used to mix the RDF and remove any unsuitable or non-combustible items identified by the operations staff. These items will then be quarantined prior to transfer off-site for disposal at a suitably licensed facility.

Sludge residues from the WWTP will be transferred by site vehicle and tipped into the bunker.

2.3.4.2 Raw materials

The CHP facility will use a variety of raw materials during the combustion and processing of the RDF.

Aqueous ammonia solution will be delivered in sealed tankers and off-loaded via a standard hose connection into a tank with suitable secondary containment. Displaced air will be vented back into the tanker via a filter. In addition the tank will be fitted with an emergency pressure valve which will discharge to atmosphere via a filter.

All liquid chemicals used by the CHP facility will be stored in controlled areas, with secondary containment facilities providing containment for a volume of 110% of the biggest storage container or 25% of the total capacity, whichever is the greater.

Sodium bicarbonate and activated carbon will be delivered to the CHP facility in powder tankers and transferred to separate dedicated storage silos. Both the sodium bicarbonate and activated carbon will be transported pneumatically from the delivery vehicle to the correct storage silo.

Silos will be fitted with high level alarms. The top of the silos will be equipped with a vent fitted with a fabric filter. Cleaning of the filter will be done automatically with compressed air after the filling operation. Filters will be inspected regularly for leaks.

2.3.4.3 Combustion process

The two stream combustion unit, a moving grate design, will ensure continuous mixing of the fuel and hence promote good combustion. In each stream, as the fuel enters the furnace it will pass through a drying zone, a combustion zone and a burnout zone. Primary combustion air will be extracted from within the fuel storage bunker and fed in below the fuel through the grate to promote good combustion.

Secondary combustion air will be injected above the grate where it provides for good mixing and combustion control. Ammonia solution will be injected into the combustion chamber to react with the oxides of nitrogen, chemically reducing them to nitrogen and water.

Auxiliary burners operating on fuel oil will be fitted for start-up sequencing and to maintain temperatures above 850°C for 2 seconds. The oxygen concentration and temperature will be carefully controlled to ensure complete combustion and minimise dioxin emissions.

Bottom ash from the grate will be transported by the grate to the bottom of the hearth and into a water-filled quench pit. A conveyor will then lift the wet ash to the ash storage area in the main tipping hall. It is intended that the ash would be transferred to a suitably licensed waste management facility where it will be processed to produce a substitute aggregate material. If a suitable recovery facility is not available to accept the residue, it may be transferred for disposal in an off-site landfill.

Prior to transfer off-site, bottom ash will be periodically sampled in accordance with the Environment Agency's ash sampling protocol.

A proportion of clean flue gas downstream of the flue gas treatment plant will be recirculated back into the furnace to improve boiler efficiency, reduce NO_x and flue gas volume to the stack. The proportion of recirculated flue gas will depend on the calorific value of the waste and the thermal load at which the incinerator is operated, but is normally expected to be in the range 10 – 20%.

2.3.4.4 Energy recovery

Hot gases from the fuel combustion will pass through a series of heat exchangers and superheaters and finally through a two stage economiser. The first stage of the economiser will be used to preheat feedwater before it is supplied to the boiler and the second stage will be used to heat up condensate and will ensure that the flue gas temperature is the optimum temperature for reaction with sodium bicarbonate. The design of the boilers, following a computerised fluid dynamics assessment, will ensure that the flue gas temperature is quickly reduced through the critical temperature range to minimise the risk of dioxin reformation.

The steam will be fed to a steam turbine which will be used to generate electricity. Steam will be condensed using air cooled condensers.

Steam will be extracted from the steam turbine at various pressures. This will be used to supply heat for internal processes (e.g. deaeration and condensate preheating), plume abatement at the stack and external processes at the Pulp plant (drying, process heating and space heating) and the WWTP (evaporation, effluenct cooling and space heating). Steam pressures will be selected to optimise electrical output and overall plant efficiency. Total heat export from the CHP facility (including plume abatement but excluding internal heat uses at the CHP plant) will normally be in the range 20 – 40 MWth depending on external ambient conditions. External ambient conditions (predominatly temperature) will affect the heat demand for space heating in the Pulp plant and WWTP, and plume abatement at the CHP plant.

Most of the condensate supplied to the Pulp plant will be returned to the CHP plant for re-use in the water-steam cycle. This will minimise the consumption of potable water used for the production of demineralised water for the boiler.

2.3.4.5 Gas cleaning

Flue gases pass from the boiler to the gas cleaning equipment. The flue gases will enter a reaction chamber where sodium bicarbonate reacts with and neutralises the acid gases. Activated carbon will be injected into the duct preceding the bag filter to adsorb (primarily) dioxins, other volatile organic compounds (VOCs), mercury and other trace metals. The sodium bicarbonate injection rate will be controlled by upstream measurement of hydrogen chloride (HCl) thus optimising the efficiency of gas scrubbing and reagent usage.

Nitrogen oxides (NOx) abatement will be achieved by the use of selective non-catalytic reduction (SNCR). The SNCR is based on the injection of ammonia solution into the furnace chambers. NO_x will also be controlled using flue gas recirculation, see 2.3.4.3.

Bag filters will be used to remove the fine ash plus reacted and excess bicarbonate and carbon from the flue gases. The build-up of the latter two on the surface of the filter bags enhances the performance of the system. Reverse pulses of compressed air will be used to remove the accumulated particulate from the bags. These Air Pollution Control residues (APCr) will fall into a collection hopper. Some of the residues will be recirculated back into the process to minimise reagent consumption. The spent residues are conveyed to a dedicated APCr storage silo. The APCr will be collected by sealed tankers and taken to a licensed waste treatment facility.

The cleaned gas will then discharge to atmosphere via a stack, with an approximate height of 35 m above the surrounding ground level and a maximum elevation of 85 mAOD, at an efflux velocity of greater than 15 m/s under normal operating conditions.

2.3.4.6 Ancillary Equipment

Demineralised water is required to compensate for boiler blowdown losses.

Demineralised water will be provided from an on-site water treatment plant.

A standby generation system, which will be fired using gas oil, will be installed to provide sufficient electrical power to safely shut down the CHP facility and other site processes in the event that the electrical grid connection is lost and the turbine is off line and unable to provide electricity to site processes.

The CHP air cooled condensers will provide a source of cooling to condense the steam generated by the thermal treatment processes, and any auxiliary cooling requirements such as air compressors.

Steam from the exhaust of the steam turbine will be condensed in an air-cooled condenser and return to the water-steam cycle. Smaller forced-air coolers will provide cooling for other equipment, e.g. turbine generator and oil systems.

2.3.4.7 Liquid effluent and site drainage

The CHP facility is designed for zero discharge of wastewater. Rain water and waste water from boiler drains, blowdown and the demineralised water treatment plant will be stored and use for quenching boiler bottom ash.

2.3.4.8 Emissions monitoring

Emissions from the stack will be monitored using continuous emissions monitoring systems (CEMS) for: particulates, carbon monoxide (CO), ammonia (NH3), sulphur dioxide (SO2), hydrogen chloride (HCl), oxygen (O2), nitrogen oxides (NOx) and Volatile Organic Compounds (VOCs).

In addition to the continuous monitoring, periodic sampling and measurement will be undertaken for hydrogen fluoride (HF), nitrous oxide (N2O), cadmium (Cd), thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V), dioxins and furans and dioxins like PCBs.

Periodic measurements will be carried out four times in the first year of operation and twice per year thereafter.

The CHP Facility will include a dedicated duty CEMS for each line and a stand-by CEMS which will ensure that there is continuous monitoring data available even if there is a problem with a duty CEMS system.

2.3.5 Pulp Plant

The Pulp plant would be capable of recycling up to 170,000 tpa of recovered printing and writing paper and card, to produce 85,500 tpa of recycled paper pulp which will be transported off-site and used to predominantly manufacture printing and writing paper, white surface packaging and some tissue.

The Pulp plant has been designed and configured to produce recycled pulp suitable for use in the manufacture of writing or printing paper. To achieve this, the quality and purity of the paper and card feedstock imported to the Site must comply with a recognised specification. This would provide the Pulp plant with raw materials suitable for the washing, cleaning, bleaching, mixing and drying operations required to produce the recycled pulp.

Grades (defined by EN643) within High Grade RCP, specifically sorted office papers (SOP/SOW) and White Letter which are largely post-consumer and uncoated papers, and Multigrade (printer waste) which are largely pre-consumer, will be sourced as a feedstock for the Pulp plant.

The proposed specification of the paper and card suitable for treatment within the Pulp plant is defined by EN643.

- EN 643 Group 1: Mixed papers; OCC Packaging; Old News; and Pams.
- EN643 Group 2: Unsold News; Printed, mechanical pulp; Sorted office; Printed, colours, wood-free; Carbonless; and, PE coated.
- EN643 Group 3: Printed lightly, heavily; and, Printed white, coloured.
- EN643 Group 4: Kraft Papers; and Sacks.
- EN643 Group 5: Special Papers; and Liquid packaging board.

Based on the above feedstock, the Pulp plant would prepare a feedstock comprising 75% Sorted Office Paper (SOP), 15% Multigrade and 10% White Letter.

2.05 Sorted Office Papers

Paper, as typically generated by offices, shredded or unshredded, printed, may contain coloured papers, with a minimum 60 % wood-free paper, free of carbon and principally free from carbonless copy paper (ccp)/no carbon required (NCR), less than 10 % unbleached fibres including manila envelopes and file covers, less than 5 % newspapers and packaging.

2.13 Multigrade

A blend of coloured and white letters, coloured wood-free magazines and other wood-free papers and shavings. Free from newsprint but 10 % of other wood containing papers are permitted. May contain 2% paper with plastic layer.

3.05 White Letter

Sorted white wood-free writing papers, originating from office records, free from cash books, carbon paper and non-water soluble adhesives.

In summary, the above is the technical specification for what is generally referred to as high grade 'mixed office waste' in the industry and the Pulp plant will capable of processing this wide range of types of waste papers including high quality graphics paper, photocopying paper, printing and writing etc.

2.3.5.1 Design of waste paper de-inking plants

The four key quality parameters that influence the design of waste paper de-inking plants are:

(1) ink removal;

(2) "Stickies";

(3) brightness; and

(4) ash.

Ink Removal

The quality of ink and dirt removal is measured using a parameter called dirt or speck count: this refers to the number and size of black or coloured spots that are visible to the human eye on the finished paper.

Ink is applied to paper to create an image, either graphic or character. The type of ink and the way it is applied varies. This variability creates a problem in deciding which process should be selected to separate the ink material from the fibre and remove it from the system whilst at the same time retaining as much fibre as possible.

Laser printers produce their image using a powdered ink that is a material bound with a plastic fixative that is melted onto to the paper surface. This has been a problem for a number of earlier designs of de-inking plant because the images are very difficult to release from the cellulose fibre that forms the paper. The proposed plant incorporates equipment and technologies that will remove (or render invisible to the human eye) any residues from laser printing on the fibres.

Virgin pulp fibres do not contain ink particles.

"Stickies"

The term "Stickie" evolved from the papermaking process to describe blobs of sticky material that adhere to and contaminate the papermaking fabrics on which paper is made. If the paper making fabrics were contaminated the paper maker would have to stop the paper making machine and spend time cleaning the fabric or cut the fabric off.

The "Stickie" materials are contained in the waste paper as a variety of adhesives and plastics used in book bindings, self-seal envelopes, self-adhesive labels, and other office applications. Stringent quality control of the incoming waste paper would minimise the inclusion of the other contraries such as plastics and metal staples.

Brightness

Consumers like to have bright products because it suggests clean, sterile, healthy, modern, etc. and consequently a large amount of effort and cost is incurred to make things look "bright".

Brightness is measured using a number of techniques but generally they work on the principle of shining light onto the product and measuring the quantity of reflected rays; the higher the brightness the larger number of reflected rays.

The Pulp plant would incorporate a modern two stage brightening process incorporating oxidative and reductive chemical processes to increase the brightness of the final product in order to approach the brightness achieved with virgin pulp.

Ash

Ash is a term used by the paper makers to describe how much non-fibre material is in the product. The measurement is made from the complete combustion of a sample of the paper in a ceramic furnace by measuring the ash that is left after the paper has burned.

Ash is typically made up of minerals such as China Clays used in the production of the paper.

There are other parameters that are important to the paper makers but not largely influenced by the de-ink plant design. These parameters are the average fibre length and the ability of water to flow through the fibres which can affect the quality of the final product. These parameters are generally inherited from the waste paper fed into the de-inking plant.

2.3.5.2 Pulp plant process overview

A simplified process flow diagram for the Pulp plant is presented below.

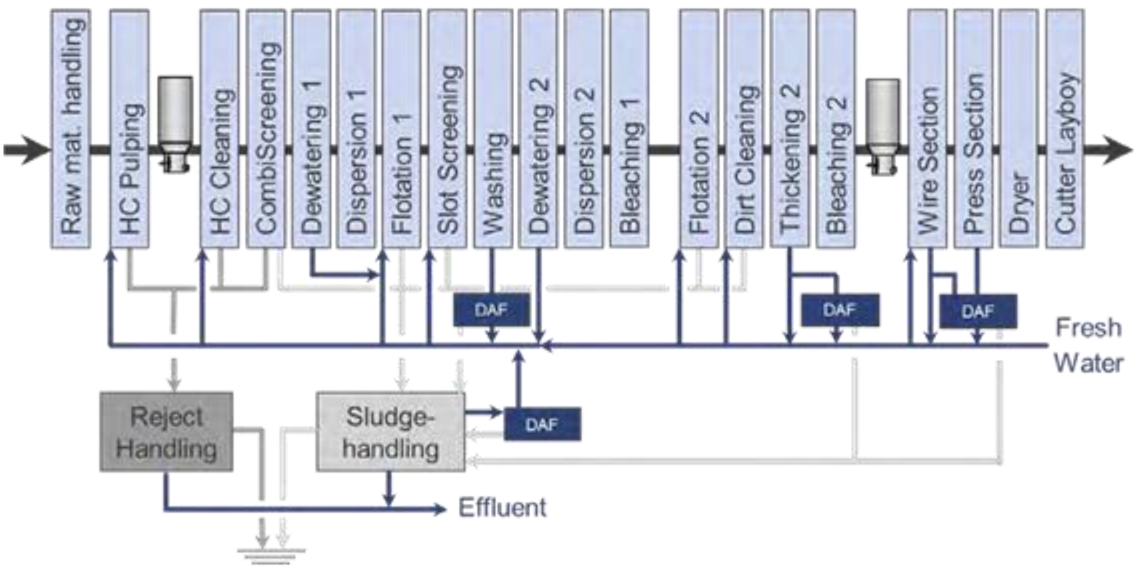

Figure 2 – Pulp Process Flow Diagram

2.3.5.3 Paper reception and pre-sorting

High grade mixed office waste paper and other high grade waste papers would be delivered to the installation and unloaded in the reception hall. Paper will typically be delivered in baled form, but the reception hall can also receive paper in loose form i.e. delivered within ejector trailers. Forklifts with debaling equipment and front end loaders would transfer the paper feedstock to a feeding hopper that would evenly distribute the paper onto a feed conveyor. At this point the paper feedstock to the Pulp plant would be joined with paper recovered from the mixed dry recyclable and/or similar pre-sorted or separated mixed commercial wastes MRF.

2.3.5.4 Pulping

Waste paper would be fed by conveyor into the pulper.

Water is heated to a temperature of approximately 80°C using a direct steam inductor and added to the pulper under flow control. The amount of water added is determined by the desired pulping consistency (i.e. ratio of water to solid matter). Typically, the likely paper feed would be approximately 90% solids whereas the ideal pulping consistency is 15% to ensure maximum fibre to fibre contact is achieved in order to loosen the ink from the paper fibres.

Additives would be applied to raise the pH to approximately 10 to create the right conditions for the fibres to swell and soften.

At the end of the pulping cycle, the fibrous mixture or 'stock' from the pulper would pass through a perforated screen. The fibrous mixture will be diluted to 5% consistency before being pumped to the high consistency cleaner.

The un-pulpable contaminants, (i.e. plastic covers, large staples and pieces of metal that have not been previously removed) are screened out and discharged on to a conveyor and fed to a standing open ro-ro container. The Ro-Ro container would be transported by the on-site truck to feed the rejected materials either into the MRF for further screening, separation and recovery or into the CHP bunker to be mixed with the incoming RDF feedstock and used within the CHP plant.

2.3.5.5 High consistency cleaner

The high consistency cleaners are designed to remove small heavy contaminants such as glass, stones, staples, paper clips etc. from the paper fibre stock using a centrifuge. These contaminants are periodically removed and discharged into a chute where any water is removed and collected for recirculation. The contaminants are sent back into the MRF for further screening, separation and recovery or mixed with the RDF feedstock and used within the CHP plant.

The remaining feedstock (pulp) within the high consistency cleaners is then fed into a coarse screening system.

2.3.5.6 Coarse screening

The coarse screening system would screen and remove from the feedstock plastic and other flat contaminants larger than 2 mm in diameter, whilst minimising the loss of the pulp fibre. Rejected materials from the coarse screening process would be recirculated and fed back into the high consistency cleaners.

Coarse screening is a three stage process comprising two primary coarse screens (one would be operational whilst the other would be on standby), one secondary coarse screen and one tertiary coarse screen.

Materials passing through the three stage coarse screening process would be fed into the pre-screening system.

2.3.5.7 Pre-screening

The pre-screening system would remove spherical and cuboid debris (i.e. glue, melted plastic and latex based sticky materials) from the pulp together with other contaminants larger than 0.18 mm in size. Rejected materials from the pre-screening process would be discharged to a sludge silo for further treatment.

Pre-screening is a three stage process comprising one primary screen, one secondary screen and one tertiary screen, all fitted with slotted screening baskets.

Materials passing through the three stage pre-screening process would be fed into the main floatation system.

2.3.5.8 Main floatation

The main floatation system removes ink, ash and other hydrophilic contaminants using surfactant and soap based chemicals whilst minimising fibre loss.

Main floatation consists of a two stage washing system comprising one primary floatation cell with six chambers and a secondary floatation cell with four chambers.

The materials from the pre-screening system are diluted down to 1.2% solids and pumped into the first (of six) chambers in the primary floatation cell through a distribution system designed to prevent turbulent flow. Each chamber would be fitted with a specially designed air distributor to liberate entrained air from the mixture in the form of bubbles.

The chemical reaction which takes place within the primary floatation cell would attract small particles of ink to the surface of the chamber in the form of bubbles. The bubbles create a foam on the surface of the primary floatation cell. Water levels within each primary floatation cell would be continuously monitored to allow the foam to overflow into a collecting chamber.

The primary floatation cells are operated on a sequence of batch processes, whereby, once the pulp has been washed in one chamber, it is pumped into the next chamber where the washing process starts again. After passing through all six chambers the cleaned pulp feedstock is fed into the low consistency primary forward cleaning system.

The foam from the primary floatation cells would contain inert materials and some pulp fibres. This would be collected in a chamber, sprayed with water and diluted into a slurry and pumped into the secondary floatation system.

The secondary floatation process is identical to that taking place in the primary floatation cells. However, the resultant foam is collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.9 Low consistency forward cleaning

The low consistency forward cleaning system uses four cone shaped centrifuges to separate cellulose fibres (paper fibres) from the de-inked pulp.

The forces that act within the centrifuge direct the materials that have a specific density higher than that of cellulous fibre to the internal wall of the centrifuge and rejected through a nozzle at the bottom. These residues would be collected and fed into the next centrifuge.

Cellulose fibres and other lightweight materials that are discharged through the top of the first centrifuge would be transferred to the fine screening system. It should be noted that materials discharged through the top of any other centrifuge would be recirculated through the system to ensure consistency and purity of the cellulose fibre recovered by the low consistency forward cleaning system.

The residues from the low consistency forward cleaning system would be collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.10 Fine screening

The fine screening system uses four filter screens to remove spherical and cuboid debris (i.e. any remaining glue, melted plastic and latex based sticky materials) from the de-inked pulp larger than 0.15 mm in size. Rejected materials from the fine screening process would be discharged to a sludge silo for further treatment.

Fine screening is a four stage process comprising two primary fine screens, one secondary fine screen and one tertiary fine screen all fitted with slotted screening baskets.

Materials passing through the four stage fine screening process would be fed into the thick washing system.

2.3.5.11 Thick washing

The thick washing system is designed to wash fillers, ash and fines from the de-inked pulp. The washed fibres would be pumped or transported by screw conveyors into the dispersing system.

The water used within the thick washer (containing the fillers, ash and fines) would be pumped to a washer filtrate storage tank. Following filtration the water collected from the storage tank would be pumped to the first loop water clarification system.

2.3.5.12 Dispersing

The dispersing system is used to develop the fibre quality. The disperser would loosen the brittle plastic based inks found on laser printed paper and resin or varnish based inks that are found on specialist publications such as quality publications, brochures and reports.

Steam is used to heat the disperser and chemicals are added to bleach colours from the fibres.

Once treated within the disperser the pulp is pumped into a post floatation system.

2.3.5.13 First loop water clarification

The first loop water clarification system would be used to aerate and clarify the water discharged from the thick washer. Aeration would cause solid particles to float to the surface, where they are collected and pumped to the sludge silo for further treatment. The clarified water resulting from the first loop water clarification system would be reused within the Pulp plant.

2.3.5.14 Post floatation

The post floatation system works in a similar manner to that of the primary floatation system to remove and loosen ink using surfactant and soap based chemicals whilst minimising fibre loss. However, the post floatation process would use one primary floatation cell with four chambers and a secondary floatation cell with three chambers.

After passing through all four chambers within the primary floatation cell, the cleaned pulp feedstock is fed into the low consistency high and low cleaning system, and foam from the secondary floatation cells would be collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.15 Low consistency high and low density cleaning

The low consistency high and low density cleaning system uses a further bank of two cone shaped centrifuges (operating in forward and reverse) to separate long and short cellulose fibres from the de-inked pulp.

Materials passing through the centrifuges would be fed into the disc thickener, whilst the residues would be collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.16 Disc thickener

The disk thickener is a multi disc filter unit which would be used to remove water from remaining pulp slurry by collecting the cellulose fibres from the solution over a very fine mesh.

Once fed into the disc thickener, the pulp slurry would rotate slowly causing the fibres to accumulate on the surface of the filter discs whilst the remaining water filters through the filter mesh. The dewatered fibres would be removed and discharged into a chute at a consistency of approximately 10% solids. The fibres are then pumped to the second stage dispersing system.

Water that filters through the disc thickener is collected and pumped to the second loop clarifier for clarification and use for dilution.

2.3.5.17 Second stage dispersing

The second stage dispersing system works in a similar manner to that of the dispersing system to further develop the quality of the fibre. The second stage disperser would loosen the remaining inks, resins and varnishes from the fibre.

Steam is used to heat the second stage disperser and additives applied to bleach the fibres.

Once treated within the second stage disperser the thickened fibrous pulp would be transported by a conveyor into reductive bleaching tower.

2.3.5.18 Second loop water clarification

The second loop water clarification system would be used to aerate and clarify the water discharged from the disc thickener. Aeration would cause solid particles to float to the surface which are collected and pumped to the sludge silo for further treatment. The clarified water resulting from the second loop water clarification system would be recirculated and reused within Pulp plant.

2.3.5.19 Reductive bleaching

The reductive bleaching system comprises a specially designed down-flow tower. The thickened fibrous pulp would be fed by the screw conveyor into a rotating distributor at the top of the bleaching tower and rotated using an electric motor. The distributor creates an even distribution of fibrous pulp within the tower to create a plug flow. As the pulp progresses down the tower bleaching chemicals are added to develop the brightness of the fibre.

As the pulp reaches the bottom of the tower the fibres are removed and fed into the final floatation system.

2.3.5.20 Final floatation

The final floatation system works in a similar manner to that of the primary and post floatation systems to remove and loosen any remaining ink. The final floatation process would use one primary floatation cell with four chambers and a secondary floatation cell with three chambers.

After passing through all four chambers within the final floatation cell the cleaned pulp feedstock is fed into the final disc thickener, and foam from secondary floatation cells would be collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.21 Final disc thickener

The final disc thickener works in a similar manner to that of the disc thickener system and comprises a multi disc filter unit which would be used to remove water from remaining fibrous pulp.

The dewatered fibres would be removed and discharged into a chute at a consistency of approximately 8% solids. The fibres are then pumped into a storage tower and fed into the pulp drying and baling system.

2.3.5.22 Final pulp drying and baling

The final stage of the process would be the dewatering, drying and baling of the recycled fibrous pulp.

The pulp drying and dewatering system will comprise a four stage process whereby the recycled pulp is fed into a headbox under pressure from the storage tower and passed through a parallel opening (slice) onto the forming section.

Within the forming section, the pulp is fed onto a continuous moving mesh belt. Here the pulp is dewatered by gravity and vacuum suction to 55% solid content. From here the web of wet pulp is conveyed via a pick up roll into the press section.

Within the press section, the web of pulp is squeezed under pressure through two rollers to further dewater and prepare the dewatered pulp (which is in a sheeted form) for the final stage of the drying process.

The web of pulp moves from the press section into the dryer section where it is dried by warm air convection as it passes through three vertical stages: intense drying at high temperature, high air speed and high air pressure; high evaporation drying at a medium temperature, medium air speed and medium air pressure; and, finally, exit drying at low temperature, low air speed and low air pressure.

At the end of the exit drying stage the web of pulp is at 87% to 90% solid content. The dried and recycled pulp sheet is passed from the exit dryer and baled either for temporary storage within the pulp store or direct to the vehicle loading bay for export from the installation.

2.3.5.23 Sludge drying

Sludge (principally China Clay and small pulp fibre) produced by the pulping process will be dried prior to export from site to be used as a soil improvement material.

The sludge will be fed through a screw press and steam-heated tube dryer to reduce its moisture content from 50% to 35%. Water arising from the sludge drying process will be fed to the WWTP for treatment, recirculation and reuse.

By reducing the moisture content of the sludge, vehicle movements associated with its collection and export from site will be minimized, and increase its reuse as a soil improvement material.

2.3.6 Wastewater Treatment Plant (WWTP)

The wastewater treatment plant (WWTP) will consist of the following seven treatment stages:

(1) course and fine screens;
(2) roughing and polishing dissolved air floatation (DAF);
(3) lime soda softening;
(4) sand filtration;
(5) membrane treatment – reverse osmosis;
(6) DAF and precipitator sludge collection; and

(7) dewatering.

2.3.6.1 Coarse and fine screens

The course and fine screens will remove larger particles including 'Stickies' that are troublesome in downstream process plant and can interfere with flotation and settlement.

Collected screenings will be removed from the screen face by a wiper screw auger and will deposited in an adjacent wheelie bin. In the event of failure of one unit, the entire flow can be accommodated and the level of treatment maintained by the remaining packaged screening unit.

2.3.6.2 Roughing and polishing dissolved air floatation (DAF)

The incoming effluent will have total suspended solids of up to 710 mg/l and a temperature of up to 50°C. The high temperature reduces the solubility of oxygen in water and therefore limits the amount of air that can be saturated in the air dissolving tube. This combined with a high incoming suspended solids leads to a less than ideal solids/air bubble ratio and less than ideal separation performance.

Therefore there is a second stage of polishing DAFs. The bulk of the suspended solids removal will take place in the roughing DAFs with the polishing DAFs operating at a much improved solids/air bubble ratio and providing an overall much improved separation performance.

The double DAF arrangement will allow for operation of each stage at differing pH which will be optimised to improve silica and organics separation.

Each stage of DAF is provided with a rapid mix weir for the addition of ferric chloride and flocculation tanks with a retention time of approx. 20 minutes and the facility for the addition of polyelectrolyte. This will encourage finer particles and colloidal organic matter to agglomerate and form larger and more easily separable floc that will be floated and removed. Depending on the precise composition of the organic matter and the percentage that is in colloidal form rather than fully dissolved, useful reductions in chemical oxygen demand (COD) can be achieved.

Therefore the design of the DAFs is optimised to achieve the maximum physiochemical separation possible which is intrinsically the lowest cost form of treatment.

2.3.6.3 Lime soda softening

After the roughing and polishing DAF plant where ferric chloride coagulant will be dosed, the effluent will be dosed with hydrated lime which will be supplemented with additional ferric chloride to further aid reduction in the de-inking solids and to improve the mobility of settled carbonate sludge.

2.3.6.4 Sand filtration

Clarified water from the lime soda softening precipitators will be subject to sand filtration to remove any solids carry-over. A bank of four pressure down-flow filters will capture any suspended solids in the sand media bed. On increase in head-loss, each filter will in turn be subject to an air, air and water, and water only backwash.

Solids removed will be returned to the calamity / balance tank where they will be pumped to the DAFs for solids separation.

The combination of double DAF, lime soda softening and filtration will remove as much of the residual ink, and greatly reduce the scaling and fouling potential of the pre-treated effluent. Only organic matter in particulate form that is able to float or settle will be removed and therefore soluble organic matter and its associated COD will be unaffected.

The pre-treatment plant will generate an effluent that has much reduced fouling potential on the membrane separation plant where bulk removal of soluble COD and dissolved salts will take place.

2.3.6.5 Membrane treatment – reverse osmosis

Four stages of reverse osmosis (RO) will be used to achieve the water quality requirements.

The product / permeate from each stage becomes the feed to the following stage, and the quality of the permeate progressively improves such that by the final fourth stage the desired treatment objectives are comfortably achieved.

The concentrate or reject from each stage is passed back to the feed of the preceding stage such that eventually all the concentrate / reject is amalgamated as a single discharge from the first stage.

Stage-one: High shear oscillating RO

The first stage is a high shear oscillating RO membrane plant.

Shear waves produced on the membrane surface keep the colloidal material in suspension, thereby minimizing fouling and prevent precipitating salts from accumulating on the membrane surface as scale. As a result, high throughput and water recoveries above that of a conventional membrane system can be achieved.

The device employs torsional oscillation at a rate of 50 times per second (50 Hertz) at the membrane surface to inhibit diffusion polarization of suspended colloids. The suspended colloids are held in suspension, where a tangential cross flow washes them away.

The high frequency oscillations impart a shear to the surface of the membrane to mitigate fouling and scaling. The membrane module houses a stack of flat membrane sheets (filter pack) in a plate and frame-type configuration.

It is possible to vary both frequency and amplitude to get the surface clean from suspended particulates and colloids. The sinusoidal shear waves of the membranes push the incoming particles from the surfaces and back into the bulk phase, resulting in a membrane surface clear for filtration.

The system consists of four components: a driving system that generates the oscillations, a membrane module, a torsion spring that transfers the oscillations to the membrane module, and an oscillation control system.

The high shear oscillating membrane system is not limited by the solubility of minerals or the presence of suspended solids. It can be used in the same applications as crystallizers or brine concentrators and is capable of high recoveries (up to 90%).

Stage two/three/four: Conventional spiral wound RO systems

The second, third and fourth stages comprise conventional RO treatment mounted horizontally in pressure vessels and arranged on skids.

2.3.6.6 Treated effluent storage and pumping

Treated permeate from the final stage of the RO system is discharge via a hydrophore vessel and official sampling point into 3 treated water tanks constructed in concrete. The total volume provides for a residence time of over 1.5 days at the design flow rate of 85 m^3/h.

Cleaned and treated water will be recirculated and reused within the Pulp plant to provide a zero liquid discharge (or closed loop) waste water treatment system.

2.3.6.7 RO reject evaporator

The reject from the RO process will be transferred to the WWTP evaporator.

Condensate or product from the system is liberated steam which has been condensed from wastewater vapour and recovered through mechanical vapour recompression.

Solid rejects/sludge arising from the evaporator will be mixed with the RDF within the CHP plant.

2.3.6.8 DAF and precipitator sludge collection & dewatering

Floated sludge from the roughing and polishing DAFs is collected in a sludge sump and is pumped to the common inlet of a filter press.

Sludge from each precipitator is pumped directly to a gravity thickening tank. The sludge settles into a hopper at the base of the gravity thickening tank. The clear supernatant will overflow and flow via gravity to the calamity / balancing tanks where it is recycled back into the main treatment plant flow.

Settled sludge that has collected at the base of the gravity thickening tank is pumped directly to a filter press. DAF sludge will be blended in line for co-pressing with the precipitator sludge.

The filter press is a conventional plate and frame type with a pneumatic power 'squeeze cycle' which will ensure a high quality and consistently dry cake is produced with approx. 30% dry solids content. If required, a polyelectrolyte will be dosed to flocculate the incoming solids and improve the filtration of the sludge.

Solid rejects/sludge arising from the WWTP process will be mixed with RDF within the CHP plant.

2.3.7 Ancillary Activities

2.3.7.1 Building Ventilation

The building ventilation system will provide abatement of odours from each of the waste treatment processes.

(1) CHP plant bunker;

(2) Pulp plant;

(3) AD plant; and

(4) MRF and MBT plant.

CHP plant

The waste bunker will be maintained at a negative pressure. In maintaining negative pressure in the bunker it will prevent odour escaping from the waste bunker area.

Air from the waste bunker will be extracted from the bunker area and fed in below the fuel through the grate in the CHP Plant to promote good combustion. The high temperatures within the combustion chamber will destroy any odours within the air.

Pulp plant

The process area within the Pulp plant which may generate odours is the sludge area. Air from the sludge area will be ventilated to the bunker within the CHP plant. On this basis, this area will be maintained at a negative pressure.

AD plant

The AD plant has been compartmentalised into 'clean' or 'dirty' air (i.e. 'clean' being air that naturally circulates around contained systems within an internal environment that requires little or no treatment prior to ventilation; or, 'dirty' being areas of the building where waste and digestate, delivery or collection, requires air treatment to mitigate fugitive emissions). Therefore, the building ventilation systems will only be required to 'manage' the odorous air from the 'dirty' areas.

Air from 'clean' areas will be treated through the building ventilation system, with carbon and dust filters removing dust and any odours from the air prior to release to atmosphere via louvres in the building.

Air from the 'dirty' areas will be extracted and treated within a biofilter. The treated air from the biofilter will then be released via the site stack.

MRF and MBT plant

The closed loop air circulation system within each MBT vessel essentially uses the waste as a biofilter; air is drawn from the building through the individual roof of each vessel. Hence, the vessel is contained at a negative pressure, which mitigates against the potential for fugitive emissions. In any case, these would not be direct to the external air and the mechanical ventilation system in the building will take care of such emissions as described below.

The air temperature within each vessel will be maintained between 50 to 60°C.

Standard air changes within the MBT building will maintain a good working environment. Any emissions from the process are only released into the waste processing area when the vessel front doors are opened following treatment – i.e. as the RDF is removed using the wheeled loading shovel.

Within the MBT area, standard air changes through a positive ventilation system will be required, whereby air is drawn into the building via the front louvres in the building and sucked through dust and carbon filters in order to exhaust clean air to the surrounding atmosphere. Carbon filters will require replacement on a regular basis as required by the particular manufacturer's requirements, expected to be in the region of every 4 to 6 months.

In terms of dust control, this is not expected to be a difficult operational concern. Due to the hard-surface nature of all buildings and roads with in the IWMF, the trafficking by modern road vehicles, and the naturally damp nature of the waste materials being handled, it is not expected that dust will be created in high quantities in the MBT plant. Nevertheless, as with all operational areas within the installation, good operational husbandry will be instigated in accordance with the recent HSE guidance relating to the control and mitigation of dust ("Construction Dust: Inspection & Enforcement Guidelines 2014" HSE).

2.3.7.2 Auxiliary Power

Back-up diesel generators will be available to safely shut down the different waste treatment facilities in case of loss of grid connection for the installation.

2.3.7.3 Water Abstraction

Abstraction of water from the River Blackwater is covered by a separate abstraction licence (AN/037/0031/001). The abstraction from the River Blackwater will be used to maintain the supply of process water within the on-site lagoon system.

2.3.7.4 Site Drainage

Water which is abstracted form the River Blackwater will be pumped into the on-site storage lagoon. The lagoon will provide a storage facility for water to be used within the process.

Uncontaminated surface water run-off from building roofs and areas of hardstanding will be discharged into the lagoon.

3 REVIEW OF POTENTIAL SOURCES, PATHWAYS AND RECEPTORS

The issue of sources, pathways, and receptors has been covered in the Air Dispersion Modelling Assessment, submitted within Annex 5 of the Environmental Permit Application.

3.1 Odour Sources

An odour is the organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances. It is a property of odorous substances that make them perceptible to our sense of smell. The term odour refers to the stimuli from a chemical compound that is volatilised in air. Odour is our perception of that sensation and we interpret what the odour means. Odours may be perceived as pleasant or unpleasant. The main concern with odour is its ability to cause a response in individuals that is considered to be objectionable or offensive.

Odours have the potential to trigger strong reactions for good reason. Pleasant odours can provide enjoyment and prompt responses such as those associated with appetite. Equally, unpleasant odours can be useful indicators to protect us from harm such as the ingestion of rotten food. These protective mechanisms are learnt throughout our lives. Whilst there is often agreement about what constitutes pleasant and unpleasant odours, there is a wide variation between individuals as to what is deemed unacceptable and what affects our quality of life.

An odorant is a substance which stimulates a human olfactory system so that an odour is perceived. Odorants may be a single chemical but more typically are a complex mixture of compounds and can also be associated with fine particulates. This complex mix often makes reliable "chemical" analysis or measurement at source difficult.

Typically, odours are detected at very low concentrations of chemicals and compounds in air. The human nose is very sensitive with on average over 5 million scent receptors. Humans can detect concentrations as low as a few parts per billion (ppb), or less in air.

The potential point source releases of odour from the facility are:

- the main stack which emits combustion gases from the CHP plant; the biogas gas engines; and ventilation air from the pulp plant and AD plants; and
- the biogas flare.

Identified possible sources of fugitive emissions of odour are:

- waste delivery vehicles;
- the MRF waste reception and process;
- the MBT waste reception and process;
- the AD process, in three sections:
    - (1) waste reception;
    - (2) AD process; and
    - (3) digestate storage;
- biogas storage;
- the CHP waste bunker;
- the ash storage area;
- the Pulp plant sludge storage area; and
- the WWTP.

3.2 Pathways

Odours emitted from the sources identified are emitted to air and have the potential to be conveyed to nearby receptors via transfer through the air.

The extent to which odour is detectable downwind and the intensity and character of such odours is dependent upon the following factors:

- The nature and magnitude of odorous emissions released from the source.
- Wind direction and wind speed.
- Atmospheric turbulence (vertical and horizontal) and the level of dilution and dispersion odours undergo as they travels downwind.

All of these factors can exhibit substantial variation over time.

3.3 Receptors

3.3.1 Sensitive Receptors

The identification of potentially sensitive receptors has been conducted on the basis that the level of exposure to odours that is likely to generate annoyance in residential premises (i.e. people's homes) tends to be considerably lower than the levels which may generate annoyance at commercial premises where higher tolerance to odour exposure can generally be expected.

The general approach to the Air Dispersion Modelling was to evaluate the highest predicted process contribution to ground level concentrations. In addition, the predicted process contribution at a number of sensitive receptors was evaluated. These sensitive receptors are listed in Table 1.

Table 1 – Sensitive Receptors

ID	Receptor Name	Location		Distance from the Stack (m)
		X	Y	
D1	Sheepcotes Farm (Hanger No.1)	581564.6	220328.3	882
D2	Wayfarers Site	582557.4	220185.4	260
D3	Allshot's Farm (Scrap Yard)	582892.6	220458.3	452
D4	Haywards	583235.7	221162.6	1088
D5	Herons Farm	582443.0	221378.3	960
D6	Gosling's Farm	581426.9	221380.9	1399
D7	Curd Hall Farm	583261.7	221708.3	1528
D8	Church (adjacent to Bradwell Hall)	581832.3	222157.9	1844
D9	Bradwell Hall	581837.5	222319.1	1995
D10	Rolphs Farmhouse	580675.8	220512.8	1769
D11	Silver End / Bower Hall / Fossil Hall	581286.5	219730.6	1345
D12	Rivenhall Pl/Hall	581860.9	219104.3	1437
D13	Parkgate Farm / Watchpall Cottages	582336.5	219195.2	1228
D14	Ford Farm / Rivenhall Cottage	582697.7	218597.5	1839
D15	Porter's Farm	583391.6	219242.0	1511
D16	Unknown Building 1	583131.7	219462.9	1178
D17	Bumby Hall / The Lodge / Polish Site (Light Industry)	582947.2	220115.2	589
D18	Footpath 8, Receptor 1 (East of Site)	582660.7	220977.1	600
D19	Footpath 8, Receptor 2 (East of Site)	582597.0	220688.5	311
D20	Footpath 8, Receptor 3 (East of Site)	582609.1	220564.0	221

Table 1 – Sensitive Receptors				
ID	Receptor Name	Location		Distance from the Stack (m)
		X	Y	
D21	Footpath 8, Receptor 4 (East of Site)	582627.3	220497.2	201
D22	Footpath 8, Receptor 5 (East of Site)	582590.9	220415.2	149
D23	Footpath 8, Receptor 6 (East of Site)	582761.0	220217.8	376
D24	Footpath 8, Receptor 7 (East of Site)	583016.1	220026.5	695
D25	Footpath 35, Receptor 1 (North of Site)	582861.2	220843.4	597
D26	Footpath 35, Receptor 2 (North of Site)	582454.2	221013.5	595
D27	Footpath 35, Receptor 3 (North of Site)	582032.1	221162.3	850
D28	Footpath 31, Receptor 1 (North west of Site)	581877.2	220958.8	782
D29	Footpath 31, Receptor 2 (North west of Site)	581740.6	220764.5	783
D30	Footpath 31, Receptor 3 (North west of Site)	581379.2	220548.8	1071
D31	Footpath 7, Receptor 1 (South east of Site)	582505.9	220117.6	307
D32	Footpath 7, Receptor 2 (South east of Site)	582757.9	220066.0	473
D33	Footpath 7, Receptor 3 (South east of Site)	582967.5	219959.7	697
D34	Footpath 7, Receptor 4 (South east of Site)	583167.9	220372.7	727
D35	Footpath 7, Receptor 5 (South east of Site)	583301.5	220725.0	912
D36	Elephant House (Street Sweepings)	582368.7	220189.0	241
D37	Green Pastures Bungalow	581249.9	221176.1	1413
D38	Deeks Cottage	582873.4	221255.1	941
D39	Woodhouse Farm	582583.9	220617.9	245
D40	Gosling Cottage / Barn	581508.4	221305.5	1288
D41	Felix Hall / The Clock House / Park Farm	584578.8	219574.9	2297
D42	Glazenwood House	579980.5	222134.8	3001
D43	Bradwell Hall	580570.6	222802.9	3032
D44	Perry Green Farm	580899.7	221973.3	2190
D45	The Granary / Porter Farm / Rook Hall	584106.2	218964.5	2209
D46	Grange Farm	584888.0	222222.0	3039
D47	Coggeshall	585070.0	222839.0	3573

4 Odour Management and Control Measures

4.1 Monitoring

Routine olfactory inspection of the site will be conducted during operational hours by trained operators. During the inspection a walk-around of the installation boundary, as identified in Appendix A, will be conducted and observations made concerning the type and nature of any odours detected, including the likely source. This monitoring will be recorded and incorporated into the site management arrangements.

If it is deemed that excessive odour is detected at the installation boundary, then the source of the odour will be investigated. Once the source and cause of the odour has been identified, appropriate mitigation measures to abate the odour will be implemented.

4.2 Control Measures

All waste recovery, recycling and treatment operations within the installation will take place within environmentally controlled buildings. This design and operational control feature will result in all potential odorous environments being held under negative air pressure, thereby minimising the potential for odour from the installation.

4.2.1 Point Source Odorous Emissions

The point source odorous emissions from the facility will be from the following sources:

- the CHP plant;
- the AD biogas engine;
- ventilation air from the pulp plant;
- ventilation air from the AD plant; and
- the AD biogas flare.

4.2.1.1 CHP

Emissions from the CHP plant will be released from the main stack.

The Industrial Emissions Directive (IED) requires that any combustion gases passing through an EfW plant must experience a temperature of 850°C or more for at least two seconds. Subsequently, the flue gases pass through a flue gas treatment (FGT) system, which includes bag filters to reduce the particulate content of the flue gas.

Due to the high temperature experienced by the gases, most odorous chemicals would be destroyed. Any surviving odorous chemicals may become trapped on the bag filters.

Ammonia solution is introduced into the furnace as part of the FGT process, which converts into ammonia during the process, and there may be some occasional "ammonia slip" during operation. However, this is covered by the Air Dispersion Modelling, and has been shown to be within air pollution emission limits, which are far lower than the limits that would be required for odour control.

4.2.1.2 AD Biogas engines

Combustion gases from the combustion of biogas within the biogas engines will be released from the main stack.

A biological desulphurisation unit will be used to remove sulphur from the biogas prior to combustion within the biogas engines. The high temperatures experienced by the gases in the engines will destroy odorous chemicals before the gases are sent up the stack.

4.2.1.3 Ventilation air from the AD plant

The AD operating area has been compartmentalised (inside the building) to limit the total volume of air that requires treatment via a biofilter and/or collected and changed through the buildings overall ventilation system. This defines areas of 'clean' or 'dirty' air (i.e. 'clean' being air that naturally circulates around contained AD operating systems within an internal environment that requires little or no treatment prior to ventilation; or, 'dirty' being areas of the building where waste and digestate, delivery or collection, requires air treatment to mitigate fugitive emissions). By controlling and containing the environment(s) within the AD area it is possible to minimise and mitigate the overall ventilation, air treatment and air changes that are required inside the building.

The AD waste reception and digestate offtake areas require 2 to 3 air changes per hour and is treated through a sealed/contained biofilter located above the 'dirty' area and released via the stack.

Given the enclosed and contained nature of the AD processes, the remainder of the AD area 'clean' will require 2 to 3 air changes per day. Air within the enclosed process areas of the building will be treated through standard air changes through the integrated ventilation system. Dust and carbon filters are used to exhaust clean air that can be used in other process areas – carbon filters will require replacement on a 4 to 6 month basis.

The environment within the AD halls will be held under negative pressure to control, manage and mitigate the potential for odorous emissions. Doors to the AD area shall remain closed except for those short periods of waste delivery or removal of the reject containers.

4.2.1.4 Ventilation air from the Pulp plant

Ventilation air from the clean air environment within the pulp plant - the white coat operational environment - will be collected and vented as part of the Pulp plants normal 'clean air' ventilation system. This ventilation air will be will be released via a flue within the stack. The ventilation air will behave a high moisture content, and will be cooled within a series of heat exchangers

4.2.1.5 Biogas flare

The biogas flare will not cause any odour issues for the same reason as was explained for the biogas engines in Section 4.2.1.2.

4.2.2 Fugitive Odorous Emissions

4.2.2.1 Waste Delivery Vehicles

All waste will be delivered to the Installation in covered vehicles, which will contain any fugitive emissions within the delivery vehicles.

4.2.2.2 MRF waste reception and process

The MRF waste reception and process is located inside an enclosed area kept under negative pressure. Air extracted from the MRF area will be treated via carbon filters and particulate filters to remove odour to a significantly low level.

4.2.2.3 MBT waste reception and process

The closed loop air circulation system within each MBT vessel uses the waste as a biofilter; air is drawn from within the building through the individual roof of each MBT vessel. Hence, the MBT vessel is held at a negative pressure, which mitigates against the potential for fugitive emissions. In any case, these would not be direct to the external air and the positive ventilation system within the building will collect and treat air emissions arising from the operation of the MBT facility.

The air temperature within each MBT vessel will be maintained at or around 50 to 60 ^{o}C.

Standard air changes within the MBT building will maintain a good working environment. Any emissions from the process will only be released into the building when the MBT vessel doors are opened following treatment, i.e. as the RDF is removed using the wheeled loading shovel.

Within the MBT area, standard air changes through a positive ventilation system will be required, whereby air is drawn into the building via the front louvres in the building and sucked through dust and carbon filters in order to exhaust clean air to the surrounding atmosphere. Carbon filters will require replacement on a regular basis as required by the particular manufacturer’s requirements, expected to be in the region of every 4 to 6 months.

4.2.2.4 Biogas storage

Biogas will be stored in an air-tight gas bag, which will prevent the biogas from being released. This will prevent potential fugitive release of biogas.

4.2.2.5 CHP waste bunker

An induced draught (ID) fan will be used to maintain the waste bunker at negative pressure. This will ensure that no odours are able to escape the building.

The CHP facility operators will employ bunker management procedures (mixing and periodic emptying and cleaning) to avoid the development of anaerobic conditions in the waste bunker, which could generate further odorous emissions.

During periods of planned maintenance for the CHP plant, both streams will be shut down at the same time. Bunker management will aim to reduce the amount of material in the waste bunker before shutdown. The doors of the waste chutes will be closed to contain any odour. Misting sprays may be used to reduce odour from the waste storage area.

If one stream is forced into an unplanned shutdown, the other stream is able to continue incinerating waste. The ID fan of the one running stream will be able to create a negative pressure within the bunker prevent odorous releases.

We consider it unlikely that both CHP streams would be shutdown simultaneously for long periods of time (longer than a week). For short periods when both streams are down, the doors of the waste chutes within the waste reception area will be closed to contain any odour. However, if both streams are down for longer periods, the bunker will be emptied by unloading the material into refuse vehicles and transferred off-site to a suitably licensed waste management facility.

4.2.2.6 Ash storage area

Incinerator bottoms ash (IBA) is the product of incineration of RDF. This means that it will have reached a temperature of 850^{o}C or higher during combustion for at least two seconds, and that it will have a Loss on Ignition (LOI) of less than 5% or a Total Organic Carbon of less than 3%, as required by the IED. Therefore no organic or putrescible solid material would be present within the IBA. Consequently there will be no odour from the ash storage area.

4.2.2.7 Sludge storage area

The sludge storage area will contain the following residues from the Pulp plant:

- Spherical and cuboid debris (i.e. glue, melted plastic and latex based sticky materials) together with other contaminants larger than 0.18 mm in size from the pre-screening, and spherical and cuboid debris larger than 0.15mm from the fine screening systems.
- Foam made up of small ink particles from the secondary floatation process of the main, post and final floatation systems.
- The high density material residues separated in the centrifuges in the low consistency forward cleaning system.
- Floating solid particles removed from the de-inked pulp from the first loop and second loop water clarifications after aeration.
- Residues from low consistency high and low density cleaning system.

The sludge storage area will be will be enclosed and kept under negative pressure. Air extracted from the sludge area is vented to the CHP waste bunker. Air in the waste bunker is induced into the furnace where it is used as primary combustion air. As explained previously in Section 4.2.1.1, the high temperatures reached in the furnace mean that odours are destroyed in the furnace.

If there is a planned shutdown of the CHP, the paper pulping plant will be required to shutdown prior to the CHP shutdown.

If one CHP stream is forced into an unplanned shutdown, the other stream is able to provide the negative pressure to extract from the pulp plant into the CHP bunker and prevent odour releases.

If both streams of the CHP plant are required to enter into an unplanned shutdown, the Pulp storage area will be contained and any odour generating material will be transferred offsite to a suitably licenced waste management facility.

4.2.2.8 WWTP

The WWTP will process all process effluents generated by the installation. The WWTP uses a reverse osmosis technology which will prevent any potential fugitive emissions of odour. The WWTP process takes place inside air tight vessels preventing any odorous materials that enter the WWTP from releasing their odour.

Sludge produced by the waste water treatment process will be dewatered prior to transfer off-site to be spread to land as soil conditioner.

5 Abnormal Events

Table 2 shows possible abnormal events, and planned responses in the event of these occurrences.

Table 2 – Abnormal Events and Response Measures

Event	Location	Likely effect	Response measures
Severely odorous wastes received	MRF and MBT reception areas	Increase in odour within MBT/MRF building while severely odorous waste is present, any fugitive emissions would become more serious.	Treatment of this waste will be prioritised to reduce the duration of time in stored within the tipping area. Direct transfer to the CHP Plant for incineration will be considered. Additional deliveries of waste from the waste producer may be suspended. Reject any waste which is believed to be odorous and does not comply with the waste acceptance procedures.
Failure of the MRF and MBT ventilation system through carbon and particle filters	MRF	Increase in odour within MRF areas, which would increase concentrations of fugitive odour emissions.	Maintenance engineers would be sent to rectify the failure. Operations would be suspended until the problem is rectified.
	MBT	Increase in odour within MBT area, which would increase concentrations of fugitive odour emissions.	Maintenance engineers would be sent to rectify the failure. Deliveries would be suspended until the problem is rectified. The doors and roofs to the MBT vessels provide a seal which would be maintained to reduce odour releases.
Failure of the AD ventilation system through biofilters	AD and digestate storage	Increase in odour within AD area, which would increase concentrations of fugitive odour emissions.	Maintenance engineers would be sent to rectify the failure. Operations would be suspended until the problem is rectified.
Failure of an EfW ID fan	CHP	Increase odours within the Tipping Hall and reception areas.	Maintenance engineers sent to rectify the failure. One line will continue to operate maintaining the Tipping Hall and reception areas under negative pressure.

Table 2 – Abnormal Events and Response Measures

Event	Location	Likely effect	Response measures
Failure of both EfW ID fans	CHP	Increase odours within the Tipping Hall and reception areas.	Maintenance engineers sent to rectify the failure. Pulping operations would be suspended until the problem is rectified.
Failure of the pulp plant sludge storage ventilation system	Pulp plant	Increase odours within the Tipping Hall and reception areas.	Maintenance engineers sent to rectify the failure. The pulp plant would be contained to prevent odours from being released from the storage area.
Development of anaerobic conditions in waste storage areas	MRF tipping area	Increase odours within the MRF tipping area and reception areas.	Wastes will be removed on a first-in, first-out principle and the waste will be regularly mixed to avoid the development of anaerobic conditions.
	MBT tipping area	Increase odours within the MBT tipping area and reception areas.	Wastes will be removed on a first-in, first-out principle and the waste will be regularly mixed to avoid the development of anaerobic conditions.
	AD tipping area	Increase odours within the AD tipping area and reception areas.	Wastes will be removed on a first-in, first-out principle and the waste will be regularly mixed to avoid the development of anaerobic conditions.
	EfW waste bunker	Increase odours within the MT Tipping Hall and reception areas.	Wastes will be removed on a first-in, first-out principle and the waste will be regularly mixed to avoid the development of anaerobic conditions.
Leak of sludge from WWTP	WWTP	Localised increase in odour specific to the leak point	Maintenance engineers sent to rectify the leak.
Plant breakdown	Any location	Risk of increased impact from any area of site where normal operations are affected during and after the breakdown	A supply of critical spares will be maintained on site. The site will employ maintenance engineers to enact any repairs. If spares or engineers are not available, the relevant operations and their predecessors in the process will be suspended if necessary to prevent significant increase in odour emissions.

6 ODOUR ACTION PLANS/CONTINGENCIES

6.1 Odour Complaint Investigation

The following actions will be taken on receipt of an external odour complaint.

- Any complaints received at the site will be logged in the sites incident reporting system. The Environment Agency will be informed as soon as possible after a complaint has been received.
- The site management will be given the details of the odour complaint as soon as possible, including the location, nature, time, and date of the complaint.
- If complaints are received, a "sniff test" will be conducted by suitably trained personnel in the area from which the complaint is received. In order to assess the presence of any odours, and the odour characteristics and intensity. Where possible, the likely cause of the odour will be identified.
- For all complaints, reference will be made to the site activities at the time of the complaints, and further onsite investigations will be conducted to determine whether any abnormal operation are (or were) occurring. The following key potential causes of abnormal odour emissions will be investigated:
    (1) Is the waste arriving in appropriate vehicles?
    (2) Are there any unusual characteristics evident in the waste on site (composition, age, condition etc.)?
    (3) Are operations in 'normal operation'?
    (4) Are the extraction and ventilation systems (through the stack; the biogas flare; the induced draught through the CHP Plant; and building ventilation) working properly?
    (5) Are there any unusual activities taking place off site?
- Once the cause of the odour has been established, appropriate actions will be immediately implemented (see Section 6.2), and actions devised to prevent a reoccurrence of the incident.
- Feedback will be given to all complainants on the findings of any investigations if they are known, and a summary will be provided of any remedial measures taken to rectify odour problems and ensure that the problem has been suitably resolved. The complainant will be asked if the perceived problem is still occurring to measure any improvement achieved.
- Gent Fairhead and Co Limited will submit a short factual report to the Environment Agency detailing:
    (1) the complaint(s) received;
    (2) the investigations conducted;
    (3) the findings of those investigations;
    (4) whether the complaint was substantiated;
    (5) any remedial measures implemented; and
    (6) any ongoing improvement actions to be implemented.
- Records of all complaints, subsequent investigations, and remedial actions will be retained on site for a minimum of five years. The site management will ensure that records are readily retrievable, and maintained as fit for retention. As applicable, records will be stored in accordance with the Data Protection Act 1998.

6.2 Action plans

In the event that an odour complaint is proven to be justified and attributable to operations undertaken at the facility, or a 'non-conformance' occurs, a defined action plan will be implemented. The following odour 'non conformances' have been identified for the site:

- abnormal odour emissions occur;
- significant odour is detected onsite that is believed to pose a risk of offsite odour impact; and
- significant site odour is detected off-site during the "sniff testing" exercise.

In the event that any of the above occurs, the following actions shall be taken:

- If not previously undertaken, a walk-around of the entire site and a review of the activities undertaken at the facility will be conducted in order to identify the likely cause(s) of the odour.
- Upon identification of the likely odour source(s), appropriate corrective and preventative measures will be identified and implemented, depending on the outcome of the investigations. The measures will consider, but not be limited to the following.
  (1) Suspension of receipt of highly odorous waste in the relevant waste reception areas and the closure of all doors until excessively odorous wastes are processed or removed from site.
  (2) Suspension of future receipt of the odorous waste stream until confirmed acceptable.
  (3) Review of the effectiveness of waste acceptance, reception and handling procedures to avoid the formation of anaerobic conditions in waste storage areas.
  (4) Review of all process parameters (temperature, moisture, oxygen availability) to ensure all composting/maturation processes are under control. Implementation of corrective actions to restore parameters to desired levels.
  (5) In the case where anaerobic conditions occur within the MBT process and excessive odours are generated, the aeration rate will be increased, and odorous materials will be removed from site or returned to the MBT tipping area for reprocessing if necessary.

Details of any odour 'non-conformances' including the nature of the incident, results of investigations, action taken and any required amendments to the OMP will be made available to the Environment Agency on request.

7 Liaison & Document Review

7.1 Liaison

As required by the third Schedule of the Section 106 Agreement, Gent Fairhead and Co Limited has developed an IWMF Site Liaison Group.

The IWMF Site Liaison Group is intended to give interested parties an opportunity to discuss any matters arising from the operation of the facility. The principal function of the IWMF Liaison Group is to offer local residents and interested parties an opportunity to discuss any matters arising from IWMF's operations, rather than debate its detailed design and development.

The Group comprises representatives of Essex County Council, Braintree District Council, the Environment Agency, Rivenhall, Silver End, Bradwell, Coggeshall, Kelvedon and Feering Parish Councils, and the local Community Group

The IWMF Site Liaison Group will meet periodically and will be used to disseminate information relating to the operation of the IWMF to interested stakeholders. The Group will offer the opportunity to review and address local environmental concerns associated with the operation of the IWMF operations.

Gent Fairhead and Co Limited will report to the IWMF Site Liaison Group on the findings and preventative actions of any investigations into odour complaints received.

7.2 Review requirement and timescale

The odour management plan will be formally reviewed by Gent Fairhead and Co Limited initially six months after the commencement of operations, and from then on an annual basis to ensure that the controls described are effective and reflect best available techniques. In addition the OMP will be reviewed following any relevant changes in site operations or procedures that are likely to have implications from an odour generation/impact perspective.

Any required changes to the conditions set out within this document shall be formally agreed with the Environment Agency prior to their implementation.

Appendix A – Installation Boundary Drawing

ALL INFORMATION ON THIS DRAWING IS INDICATIVE ONLY, AND MAY BE SUBJECT TO FURTHER DESIGN DEVELOPMENT.

DO NOT SCALE

NOTES:

INSTALLATION BOUNDARY

REV.	DETAILS OF REVISION	DRAWN	CHKD	DATE
R2	PRELIMINARY	DTW	JRS	14.09.15
R1	PRELIMINARY	DTW	JRS	11.09.15

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SITE: RIVENHALL IWMF

PROJECT: EP APPLICATION

TITLE: INSTALLATION BOUNDARY

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RIVENHALL IWMF
NON-TECHNICAL SUMMARY

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1 INTRODUCTION

1.1 The Application

Gent Fairhead & Co Limited is proposing to construct and operate the Rivenhall Integrated Waste Management Facility (IWMF). The Rivenhall IWMF (herein referred to as the Installation) will be located at the former RAF Rivenhall Airfield site. The Installation will comprise the following treatment processes:

- A Materials Recycling Facility (MRF);
- An anaerobic digestion (AD) facility;
- A Mechanical Biological Treatment (MBT) facility;
- A De-inked Paper Pulp Production Facility (Pulp plant);
- Combined Heat and Power (CHP) Plant; and
- Water treatment plant.

To be able to operate the facility an Environmental Permit (EP), will be required from the Environment Agency (EA). This document is a Non-Technical Summary of the information submitted in support of the EP application.

1.2 The Site

The Rivenhall IWMF is located on the southeastern edge of a World War II airfield known as Rivenhall Airfield between the villages of Bradwell (northwest 2.6 km), Silver End (southwest 1.1 km), Rivenhall (south 2.3 km), Coggeshall (northeast 2.8 km) and Kelvedon (southeast 3.4 km).

Access to the site will be provided via a private access road from the existing A120.

The former airfield and its immediate surroundings are on a plateau above the River Blackwater. This plateau is currently being excavated and, therefore, under the current planning permission, half of the old airfield will become a restored 'bowl' for continued agricultural use. The airfield was open and exposed and had been used predominantly for agricultural purposes, although extensive sand and gravel extraction and restoration has been undertaken at the site.

The nearest residential properties within 1 km of the Site are: The Lodge, Allshotts Farm, Bumby Hall, Sheepcotes Farm, Green Pastures Bungalow, Goslings Cottage, Goslings Barn, Goslings Farm, Deeks Cottage, Heron's Farm, Deeks Cottage, Haywards, and Park Gate Farm Cottages.

1.3 The Application and the Listed Activities

There will be six principal activities undertaken at the Installation, (1) Combined Heat and Power (CHP) Plant; (2) Materials Recycling Facility (MRF); (3) anaerobic digestion (AD) facility; (4) Mechanical Biological Treatment (MBT) facility;(5) A De-inked Paper Pulp Production Facility (Pulp plant); and (6) Wastewater treatment plant (WWTP). The capacities of the treatment processes are as follows:

(1) The CHP plant will have a maximum design capacity to process up to 595,000 tonnes per annum of non-hazardous Solid Recovered Fuel (SRF)[1] and Refuse Derived Fuel (RDF), herein referred to as RDF;

[1] The planning permissions states as an *Informative* "reference to Solid Recovered Fuel (SRF) for the purposes of this planning permission is considered to be the same as Refuse Derived Fuel (RDF)."

(2) The MRF will have a maximum design capacity to process 300,000 tonnes per annum of direct waste and treated waste materials from the MBT to recover recyclates for transfer off-site, with the residual material being transferred to the CHP facility;

(3) The AD plant will be designed to process up to 30,000 tonnes per annum of food and organic waste, with the resultant biogas being combusted in a CHP engine;

(4) The MBT Plant will have a maximum design capacity to process 170,000 tonnes per annum of waste to produce a non-hazardous RDF to be treated as a fuel within the CHP plant. The RDF from the MBT will be fed into the MRF to recover recyclates prior to treatment within the CHP;

(5) The Pulp plant will have a maximum design capacity to process 170,000 tonnes per annum of waste paper to produce approximately 85,500 tonnes per annum of recycled and reusable paper pulp; and

(6) The Wastewater Treatment Plant will have a maximum design capacity of 550,000 m^3 per annum of wastewater from the installation.

1.3.1 CHP plant

The CHP facility will combust waste comprising predominantly RDF from off-site satellite waste treatment facilities, some RDF produced by the on-site MRF and MBT, and some biological residues from the WWTP. The CHP plant will produce electrical power for use in the CHP plant and other on-site process with excess exported to the local distribution network. Heat will be exported as steam and hot water to on-site processes and for space heating.

The CHP facility will consist of two combustion lines. The thermal capacity of each boiler will be 92 MWth giving a total thermal capacity of the CHP facility of 184 MWth. The CHP facility will be designed to accept RDF with- a NCV design range of circa 7-13 MJ/kg. Fluctuations in the delivered NCV will lead to variations in the mass throughput of waste.

The CHP facility will be able to generate up to 50 MWe. With the AD plant in operation and generating 1 MWe, the CHP plant will be limited to 49 MWe. Normal export is expected to be around 28 MW.

The maximum capacity of the CHP facility is 595,000 tonnes per annum.

1.3.2 MRF

The purpose of the MRF is to identify and recover recyclates from incoming untreated Municipal Solid Wastes (MSW) and Commercial & Industrial (C&I) wastes, from the shredded and biologically dried output from the MBT plant, and if possible and appropriate to recover further recyclates from incoming refuse derived fuel (RDF) (or solid recovered fuel (SRF)). As the predominant output by volume from the MRF will be RDF destined for the CHP plant, the MRF is deemed to be an RDF manufacturing and/or refinement process. All RDF manufactured at the installation will be transferred to the CHP plant.

The MRF is designed to both mechanically and manually sort recyclable materials from the incoming waste. The identification and separation processes are achieved initially through a mechanical process and subsequently through a manual process for final quality control.

The MRF processing facility is divided into two lines:

(1) Line 1 is for processing the material that comes from the MBT bio-drying vessels.

(2) Line 2 is for processing material that generally comes direct into the facility having undergone no or minimal pre-treatment by way of recyclate removal.

1.3.3 AD plant

The anaerobic digestion (AD) process will comprise a wet pre-treatment and anaerobic digestion system. This is considered to be a proven technology for the proposed waste feedstock, which will comprise separately collected municipal or commercial food wastes and/or other green wastes, referred to as mixed organic waste. The AD plant has been applied for as a standard rules EP (SR2012 No12), refer to Form B1.

1.3.4 MBT

The purpose of the MBT Facility is to receive collected municipal or commercial wastes that require some pre-treatment in order to remove moisture and recyclates (in combination with the adjacent MRF) and to manufacture a RDF suitable for energy recovery in the CHP plant. The MBT may also be employed when appropriate to biologically dry and moisture condition incoming RDF prior to energy recovery in the CHP plant.

The MBT process is designed to take in organic rich materials that are treated in a series of enclosed vessels. The vessels include individual floor and roof systems that provide for air to be forced through the waste to facilitate the process of biological drying.

The MBT process is modular with each vessel being rectangle in shape. The MBT process is designed for the treatment of up to approximately 170,000 tonnes per annum of waste through the process utilising eight lines with two vessels in each line. The waste will be loaded into each vessel by a front-end loading shovel.

The waste will remain in the vessels for a minimum of 7 days enabling the biological process to occur, during which time the waste will lose up to 12% moisture content. This enables easier extraction of recyclables, particularly plastics and metals, within the mechanical processes in the MRF.

1.3.5 Pulp plant

The Pulp plant would be capable of recycling up to 170,000 tpa of recovered printing and writing paper and card, to produce 85,500 tpa of recycled paper pulp which will be transported off-site and used to predominantly manufacture printing and writing paper, white surface packaging and some tissue.

The Pulp plant has been designed and configured to produce recycled pulp suitable for use in the manufacture of writing or printing paper. To achieve this, the quality and purity of the paper and card feedstock imported to the Site must comply with a recognised specification. This would provide the Pulp plant with raw materials suitable for the washing, cleaning, bleaching, mixing and drying operations required to produce the recycled pulp.

Grades (defined by EN643) within High Grade RCP, specifically sorted office papers (SOP/SOW) and White Letter which are largely post-consumer and uncoated papers, and Multigrade (printer waste) which are largely pre-consumer will be sourced as a feedstock for the Pulp plant.

1.3.6 Wastewater treatment plant

The wastewater treatment plant (WWTP) will consist of the following seven treatment stages:

(1) course and fine screens;
(2) roughing and polishing dissolved air floatation (DAF);
(3) lime soda softening;
(4) sand filtration;
(5) membrane treatment – reverse osmosis;
(6) DAF and precipitator sludge collection; and

(7) dewatering.

The treated water from the wastewater treatment plant will be stored in the on-site storage lagoon for reuse as process water within the Installation.

2 Details of the Proposed Facility

2.1 Raw Materials and Feedstocks

The Installation will utilize a number of different chemicals and raw materials within the different waste treatment processes. The chemicals and raw materials used at the site will include the following:

(1) hydrogen peroxide;
(2) sodium hydroxide;
(3) sodium silicate
(4) sodium bicarbonate;
(5) activated carbon;
(6) ammonia solution;
(7) gas oil;
(8) recycled paper; and
(9) hydrochloric acid solution.

These will be supplied to standard specifications offered by different suppliers. All chemicals will be handled in accordance with COSHH Regulations as part of the quality assurance procedures and full product data sheets will be available.

Periodic reviews of all materials used will be made in the light of new products and developments. Any significant change of material, where it may have an impact on the environment, will not be made without firstly assessing the impact and seeking approval from the EA.

Gent Fairhead will maintain a detailed inventory of raw materials used at the Installation and will have procedures for the regular review of developments in raw materials used within the different waste treatment processes.

Process water for the operation of the IWMF will be abstracted from the River Blackwater under an existing Abstraction Licence (Serial Number AN/037/0031/001).

2.2 Emissions

2.2.1 Emissions to Air

All point source emissions to air will be released from the main stack, except for the AD flare. Detailed air dispersion modelling of emissions from the stack has been undertaken, which has demonstrated that the impact of emissions to air will not have a significant impact on local air quality.

All emissions to air will comply with any relevant emission limits in the IED and other relevant Air Quality Guidance.

2.2.2 Emissions to Water

The Installation will give rise to surface water run-off from roads, vehicle parking areas, building roofs, hard-standings and hard landscaped areas. Surface water run-off from these areas will be discharged into the Upper Lagoon. The lagoon will be used for the storage of water to be used as process water within the installation.

There will not be any discharges of process effluent to water from the Installation. The facility has been designed as a 'Zero liquid discharge' facility.

- Water for use within the IWMF will be pumped from Upper Lagoon and fed into the Pulp Plant to support and supplement the Installation's Zero Liquid Discharge (or Closed Loop) waste water treatment system.

- Water from the Pulp Plant, together with water from the other processes within the Installation, will be cleaned and treated to an exceptionally high standard through the WWTP.
- Allowing for water losses through the WWTP cleaned and treated water will be recirculated and reused within the Pulp Plant or the nearby lagoon network to provide a Zero Liquid Discharge (or Closed Loop) waste water treatment system.

It is not currently proposed to discharge water from the Installation into the River Blackwater, as all process effluents will be treated within the WWTP prior to re-use. In the event that it was necessary to discharge the treated effluent from the WWTP into the River Blackwater, an application for this discharge would need to be submitted to the Environment Agency. This would be submitted as a separate application, and is not being applied for within this EP application.

2.2.3 Emissions to Sewer

There will be no discharges to sewer from the Installation.

2.2.4 Odour

The installation will be operated in accordance with an odour management plan.

2.3 Monitoring

There will be continuous monitoring of emissions to air from the CHP plant for oxygen, carbon monoxide, hydrogen chloride, sulphur dioxide, nitrogen oxides, ammonia, VOCs, and particulates will be undertaken for the flue gases from the CHP plant. Other pollutants will be monitored by spot measurements at regular intervals. All continuous emissions measurements will be recorded and operators will be alerted if emissions to air approach the permitted limits.

Monitoring of emissions from the AD gas engines will be undertaken in accordance with the requirements of the standard rules EP.

The results of all emissions monitoring will be reported to the EA.

Solid residues generated by the plant will be sampled on a regular basis to assess bottom ash burnout and to monitor the levels of specified pollutants.

Process monitoring will be undertaken for each of the waste treatment processes. All processes will utilize modern control systems, which incorporate the latest advances in control and instrumentation technology. These will be used to control operations and optimize the waste treatment processes.

2.4 Technology Selection

The processes have been designed against the background of a detailed assessment of the prevailing environmental conditions at the site location, in order that the objectives of the Industrial Emissions Directive (IED) are met. Best Available Techniques will be employed at the Installation to minimize its impact on the local environment.

BAT Assessments have been undertaken for all waste treatment processes. These have demonstrate that the proposed techniques to be employed at the Installation will represent BAT in accordance with the relevant BAT guidance notes.

2.5 Management

To ensure effective management of the installation Gent Fairhead will develop a documented management system that clearly defines the facility’s management structure, as well as setting out the roles and responsibilities of everyone working at the installation.

FICHTNER
Consulting Engineers Limited

GENT FAIRHEAD & CO

RIVENHALL

DISPERSION MODELLING ASSESSMENT

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Management Summary

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged to undertake a Dispersion Modelling Assessment to support the Environmental Permit and Section 72 planning application for the Rivenhall Integrated Waste Management Facility. The proposals include a Combined Heat and Power (CHP) plant, Materials Recovery Facility, Anaerobic Digester, Mechanical Biological Treatment plant, Pulp Facility and Water Treatment Plant. The principal fuel for the CHP plant will be waste. Therefore the Facility will be required to comply with the Industrial Emissions Directive (IED) and the limits on emissions to air will be based on those outlined in Annex VI of the IED for an incinerator. This will include limits on emissions of oxides of nitrogen, sulphur dioxide, heavy metals and dioxins and furans, as well as other substances.

The assessment has been carried out in a number of stages.

(1) Review of Legislation

In the UK, the levels of pollution in the atmosphere are controlled by a number of European Directives, which have been fully implemented, and by the National Air Quality Strategy. These have led to the setting of a number of Air Quality Objectives (AQOs) for the most significant pollutants, such as oxides of nitrogen and particulate matter. The AQOs are set at a level well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups.

For other pollutants, the Environment Agency sets control levels, called Environmental Assessment Levels, based on work by the World Health Organisation and other national and international bodies.

The Environment Agency sets Critical Levels for the protection of ecosystems. In addition it is noted that deposition of nitrogen and acid gases can cause nutrification and acidification of habitats. The Air Pollution Information System provides Critical Loads for different habitats which consider the existing pollution loading for the site.

(2) Review of Ambient Air Quality

Monitoring information collected by the UK Government and by local authorities has been used to assess the current levels of pollutants in the atmosphere close to the Facility.

Where local monitoring data is not available, conservative estimates based on national UK monitoring results have been used as a background concentration.

(3) Identification of Sensitive Receptors

When assessing the impact of the development, the assessment considers the point of maximum impact as a worst-case. In addition, the impact has been assessed at a number of identified sensitive receptors including the closest houses and footpaths, all European statutory designated ecological sites within 10km, and all UK statutory and locally designated ecological sites within 2km of the Facility.

(4) Dispersion Modelling of Emissions

The ADMS 5.1 dispersion model is routinely used for air quality assessments to the satisfaction of local authorities and the Environment Agency. The model uses weather data from the local area was used to predict the spread and movement of the exhaust gases from the stack for each hour over a five year period. The model takes account of wind speed, wind direction, temperature, humidity and the amount of cloud cover, as all of these have an influence on the dispersion of emissions. The model also takes account of the effects of buildings and terrain on the movement of air.

Emissions from the CHP Plant have been assumed to comply with the limits prescribed within Chapter VI of the IED and emissions from the gas-fired boilers have been assumed to comply with the limits prescribed within Environment Agency guidance notes for emissions for gas engines. These sources will emit to atmosphere via a common wind shield. In addition this wind shield will include stacks for the exhaust air from the pulp plant, and the AD biofilter. Although there will be no combustion gases from these additional sources, the temperature of the release is much lower than the CHP and will impact upon the buoyancy of the plume. The exhaust air from the pulp plant and the bioflter has been included to ensure any reduction is buoyancy is considered in the assessment.

To set up the model, it has been assumed that the each item of plant operates for the whole year and releases emissions at the emission limit all the time. In reality, this is very conservative as the Facility will run below the emission limit and will be offline for part of the year for maintenance.

The model was used to predict the ground level concentration of pollutants on a long term and short term basis across a grid of points. In addition concentrations were predicted at the identified sensitive receptors.

(5) Approach and Assessment of Impact on Air Quality – Protection of Human Health

The impact of air quality on human health has been assessed using a standard approach.

a) The Environment Agency has stated that the contribution to air quality can be screened out as 'insignificant' if the short term contribution is less than 10% of the air quality objective and the long term contribution is less than 1% of the air quality objective. These screening criteria have been applied initially.

b) For those pollutants which are not screened out, the background concentration has been reviewed to see if there is any potential for any exceedences of an assessment level.

The impact of many pollutants on human health can be screened out as 'insignificant'. For those which cannot be screened out, the background concentrations are low and there is little chance of significant pollution.

The Environment Agency approach to assessing the impact of metals has been used which considers the risk of exceeding the EAL based on the existing background levels and contribution from the Facility. Using this approach there is no risk of exceeding the EAL.

(6) Approach and Assessment of Impact on Air Quality – Protection of Ecosystems

The impact of air quality on ecosystems has been assessed using a standard approach.

a) The Environment Agency has stated that, if the contribution within an entire protected site is less than 1% of the long-term and less than 10% of the short term benchmark, the emissions are not significant and it can be concluded no likely significant effect either alone and in-combination with other sources of pollutants, irrespective of background levels.

b) If the process contribution at European and UK designated sites is greater than 1% of the relevant long-term, or 10% of the short term benchmark, but the total predicted concentration including background levels is less than 70% of the relevant benchmark, the Environment Agency has stated that the emissions are not likely to have a significant effect.

c) If the process contribution at locally designated sites is less than the relevant benchmark, the Environment Agency has stated that the emissions are not likely to have a significant effect.

The impact of the deposition of nitrogen and acid gases on sensitive habitats has been assessed using a standard approach.

a) It has been assumed that all items of plant operate at the emission limits for the entire year whereas actual operational emission concentrations will be lower and the plant will be offline for maintenance purposes.

b) It has been assumed that all habitats are present at the point of greatest impact.

c) The impact has been calculated based on the maximum predicted concentration over a 5-year period at each ecological site and applying conservative deposition assumptions from the Environment Agency.

d) The results have been compared to habitat specific Critical Loads.

No European or UK designated site have been identified as requiring consideration within this air quality assessment.

A number of non-statutory designated sites have been identified within 2km of the Facility. An assessment, based on broad habitat types, has concluded that the impact of emissions on these sites is not significant. This conclusion has been drawn because the PC is less than 100% of the Critical Level or Load.

(7) Plume Visibility

A CHP Management Plan for Plume Abatement has been developed to discharge the existing planning conditions for the Facility. A feedforward mechanism will be used to adjust the temperature of the exhaust air from the pulp plant based on a set of meteorological parameters. The implementation of the proposed operating regimes will increase the buoyancy of the emissions and lead to increased dispersion of emissions. This has not been taken into account in this Dispersion Modelling Assessment, so the results presented are conservative.

In summary, a comprehensive assessment of the impact of the proposed Integrated Waste Management Facility with a single stack has shown that the proposals would not have a significant impact on local air quality, the general population or the local community.

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1 INTRODUCTION

1.1 Background

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged to undertake a Dispersion Modelling Assessment to support the planning and Environmental Permit application for the proposed Rivenhall Integrated Waste Management Facility (IWMF).

Planning permission was granted on 02 March 2010 by the Secretary of State, following a Public Inquiry, for an Integrated Waste Management Facility at Rivenhall Airfield, Essex, C5 9DF, in accordance with application reference ESS/37/08/BTE, dated 28 August 2008. An amendment to the planning permission was granted on 26 March 2015 (ref: ESS/55/14/BTE).

Detailed design work has now been undertaken and an application is being made for an Environmental Permit to operate the Facility. In addition a minor variation to the planning application is being made to reflect the updates to the scheme as part of the detailed design work.

There will be six principal activities to the Rivenhall IWMF:

(1) A Combined Heat and Power (CHP) plant consisting of 2 streams with the potential to process up to 595,000 tonnes per annum of non-hazardous Solid Recovered Fuel (SRF) and Refuse Derived Fuel (RDF);

(2) A Materials Recovery Facility (MRF) designed to process approximately 300,000 tonnes per annum of waste to recover recyclates for transfer off-site, with the residual material being transferred to the Mechanical Biological Treatment (MBT) Facility;

(3) An Anaerobic Digester (AD) plant designed to process up to 30,000 tonnes per annum of food and organic waste, with the resultant biogas being combusted in a CHP engine;

(4) An MBT Plant designed to process approximately 170,000 tonnes per annum of waste to produce a non-hazardous waste derived fuel (SRF/RDF) to be incinerated as a fuel within the CHP plant;

(5) A Pulp Plant designed to process approximately 170,000 tonnes per annum of waste paper to produce approximately 85,500 tonnes per annum of paper pulp; and

(6) A Water Treatment Plant to process wastewater from the installation.

Of the above activities the CHP and AD gas engines will produce emissions to atmosphere which will be regulated by the Environment Agency. The pulp plant includes a drying process which will result in a moist exhaust which will need to be emitted to atmosphere. A system to condense moisture from the pulp plant exhaust prior to it being emitted to atmosphere is proposed. The proposals also include a building ventilation system to provide abatement of odours from each of the waste treatment processes. This ventilation system will include a biofilter to process the 'dirty' AD air prior to emitting to atmosphere.

The planning permission restricts the Facility to having a single stack, emissions from all sources need to emit to atmosphere via a common wind shield. Therefore, the main stack will include emissions from the following sources:

(1) Exhaust gases from the CHP plant (two streams);

(2) Exhaust air from the pulp plant;

(3) Exhaust gases from the two AD gas engines; and

(4) Exhaust from the bio-filter.

Due to the nature of the feedstock the Facility will require an Environmental Permit to operate which will include limits on emissions to air based on those outlined in Annex VI of the IED for waste incineration plants. This will include limits on emissions of oxides of nitrogen, sulphur dioxide, heavy metals and dioxins and furans. This assessment considers the impact of the pollutants potentially released from the Facility on human health and ecosystems.

A separate Human Health Risk Assessment has been undertaken to assess the pathway intake of these pollutants and impacts compared to the Tolerable Daily Intakes (TDIs).

When considering the impact on ecosystems the predicted atmospheric concentrations have been compared to the Critical Levels for the protection of ecosystems. Deposition of emissions over a prolonged period can have nitrification and acidification impacts. An assessment of the long term deposition of pollutants has been undertaken and the results compared to the habitat specific Critical Loads.

1.2 Structure of Report

This report has the following structure.

- National and international air quality legislation and guidance, and local planning policies which relate to air quality, are considered in section 2.
- The assessment methodology is outlined in section 3.
- The current levels of ambient air quality are described in section 4.
- Section 5 highlights residential properties and ecological receptors in the vicinity of the proposed development.
- The inputs used for the dispersion model are contained within section 6.
- A sensitivity analysis of the model inputs are contained within section 7.
- Section 8 presents the assessment methodology and results of the impact of emissions at human sensitive receptors.
- Section 9 presents the assessment methodology and results of the assessment of the impact of emissions including their long term deposition at ecological sites.
- Section 11 presents the analysis of the effect the implementation of the CHP Management Plan for Plume Abatement will have on the predicted impacts.
- The conclusions of the assessment can be found in section 13.
- The Appendices include illustrative figures and detailed results tables.

2 LEGISLATION

2.1 European legislation

European air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides new air quality objectives for fine particulates. The consolidated Directives include:

- Directive 99/30/EC – the First Air Quality "Daughter" Directive – which sets ambient air limit values for nitrogen dioxide and oxides of nitrogen, sulphur dioxide, lead and particulate matter;
- Directive 2000/69/EC – the Second Air Quality "Daughter" Directive – which sets ambient air limit values for benzene and carbon monoxide; and
- Directive 2002/3/EC – the Third Air Quality "Daughter" Directive – which seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The fourth daughter Directive – 2004/107/EC - was not included within the consolidation. It sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.2 UK legislation

Directives 2008/50/EC and 2004/107/EC are transposed under UK Law into the Air Quality Standards Regulations (2010).

The UK Air Quality Strategy (2007) is the method of implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland.

The Air Quality Strategy defines "standards" and "objectives" in paragraph 17:

"For the purposes of the strategy

- *standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems*
- *objectives are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedences, within a specified timescale."*

The status of the objectives is clarified in paragraph 22, which also emphasises the importance of European Directives.

"The air quality objectives in the Air Quality Strategy are a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except in as far as these mirror any equivalent legally binding limit values in EU legislation. Where UK standards or objectives are the sole consideration, there is no legal obligation upon regulators, to set Emission Limit Values (ELVs) any more stringent than the emission levels associated with the use of Best Available Techniques (BAT) in issuing permits under the PPC Regulations. This aspect is dealt with fully in the PPC Practical Guides."

3 Air Quality Standards, Objectives and Guidelines

In the UK, air quality standards and objectives (AQOs) for major pollutants are described in The Air Quality Strategy (AQS).

The Environment Agency includes Environmental Assessment Levels (EALs) for other pollutants in Environmental Agency Horizontal Guidance Note H1 - Annex F. The long term and short term EALs from this document have been used when the Air Quality Strategy does not contain relevant objectives.

Both AQOs and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups.

Standards and objectives for the protection of sensitive ecosystems and habitats are also contained within Environmental Agency Horizontal Guidance Note H1 - Annex F.

3.1 Nitrogen dioxide

All combustion processes produce nitric oxide (NO) and nitrogen dioxide (NO_2), known by the general term of nitrogen oxides (NOx). In general, the majority of the NOx released is in the form of NO, which then reacts with ozone in the atmosphere to form nitrogen dioxide. Of the two compounds, nitrogen dioxide is associated with adverse effects on human health, principally relating to respiratory illness. The World Health Organisation (WHO) has stated that "many chemical species of nitrogen oxides exist, but the air pollutant species of most interest from the point of view of human health is nitrogen dioxide".

The major sources of NOx in the UK are road transport and power stations. According to the most recent annual report from the National Atmospheric Emissions Inventory (NAEI), road transport accounted for 37% of UK emissions, with power stations accounting for a further 27%. High levels of NOx in urban areas are almost always associated with high traffic densities.

The AQS includes two objectives to be achieved by 31st December 2005. Both of these objectives are included in the Air Quality Directive, with an achievement date of 1st January 2010.

- A limit for the one-hour mean of 200 µg/m^3, not to be exceeded more than 18 times a year (equivalent to the 99.79th percentile).
- A limit for the annual mean of 40 µg/m^3.

In addition, the AQS includes objectives for the protection of sensitive vegetation and ecosystems of 30 µg/m^3 for the annual mean, and 75 µg/m^3 for the daily mean concentration of nitrogen oxides.

3.2 Sulphur dioxide

Sulphur dioxide is predominantly released by the combustion of fuels containing sulphur. Around 68% of UK emissions in 2004 were associated with power stations, with much of the remainder associated with other combustion processes. Emissions of sulphur dioxide have reduced by 87% since 1970, due to a reduction in the number of coal fired combustion plants, the installation of flue gas desulphurisation plants on a number of large coal-fired power stations and the reduction in sulphur content of liquid fuels.

The AQS contains three objectives for the control of sulphur dioxide:

- A limit for the 15 minute mean of 266 µg/m^3, not to be exceeded more than 35 times a year (the 99.9th percentile) to be achieved by 31st December 2005.
- A limit for the one hour mean of 350 µg/m^3, not to be exceeded more than 24 times a year (the 99.73rd percentile) to be achieved by 31st December 2004.
- A limit for the daily mean of 125 µg/m^3, not to be exceeded more than 3 times a year (the 99.2nd percentile) to be achieved by 31st December 2004.

The hourly and daily objectives are included in the Air Quality Directive.

In addition, the AQS includes two objectives for the protection of vegetation and ecosystems. These are a concentration of 20 µg/m^3 (reduced to 10 µg/m^3 where lichens or bryophytes are present) as an annual mean and as a winter average.

3.3 Particulate matter

Concerns over the health impact of solid matter suspended in the atmosphere tend to focus on particles with a diameter of less than 10 µm, known as PM_{10}s. These particles have the ability to enter and remain in the lungs. Various epidemiological studies have shown increases in mortality associated with high levels of PM_{10}s, although the underlying mechanism for this effect is not yet understood. Significant sources of PM10s are road transport (22%), quarrying (16%) and stationary combustion (34%).

The AQS includes two objectives for PM_{10}s to be achieved by the end of 2004, both of which are included in the Air Quality Directive.

- A limit for the annual mean of 40 µg/m^3, to be achieved by 2004.
- A daily limit of 50 µg/m^3, not to be exceeded more than 35 times a year (the 90.4th percentile) to be achieved by 2004.

The previous AQS included some provisional objectives for 2010. These have been replaced by an exposure reduction objective for $PM_{2.5}$s in urban areas and a target value for $PM_{2.5}$s of 25 µg/m^3 as an annual mean. This target value is included in the Air Quality Directive.

3.4 Carbon monoxide

Carbon monoxide is produced by the incomplete combustion of fuels containing carbon. By far the most significant source is road transport, which produces 67% of the UK's emissions. Carbon monoxide can interfere with the processes that transport oxygen around the body, which can prove fatal at very high levels.

Concentrations in the UK are well below levels at which health effects can occur. The AQS includes the following objective for the control of carbon monoxide, which is also included in the Air Quality Directive:

- A limit for the 8-hour running mean of 10 mg/m^3, to be achieved by 1st January 2005.

3.5 Hydrogen chloride

There are no AQOs for hydrogen chloride contained within the AQS. However Environment Agency Horizontal Guidance Note H1 Annex F defines the short term EAL as 750 µg/m^3. There is no long-term EAL.

3.6 Hydrogen fluoride

There are no AQOs for hydrogen fluoride contained within the AQS. However Environment Agency Horizontal Guidance Note H1 Annex F defines the short term EAL as 160 µg/m^3 and the long term EAL as 16 µg/m^3.

Appendix B to Annex F of the Environment Agency Horizontal Guidance Note H1 also provides Critical Levels for the protection of vegetation and ecosystems of 5 µg/m^3 as a daily mean and 0.5 µg/m^3 as a weekly mean concentration of hydrogen fluoride.

3.7 Ammonia

There are no AQOs for ammonia contained within the AQS. However Environment Agency Horizontal Guidance Note H1 Annex F defines the short term EAL as 2,500 µg/m^3 and the long term EAL as 180 µg/m^3.

In addition, Appendix B to Annex F of the Environment Agency Horizontal Guidance Note H1 also provides Critical Levels for the protection of vegetation and ecosystems. These are a concentration of 3 µg/m^3 as an annual mean, reduced to 1 µg/m^3 where lichens or bryophytes are present.

3.8 Metals

Lead is the only metal included in the AQS. Lead can have many health effects, including effects on the synthesis of haemoglobin, the nervous system and the kidneys. Emissions of lead in the UK have declined by 98% since 1970, due principally to the virtual elimination of leaded petrol.

The AQS includes objectives to limit the annual mean to 0.5 µg/m^3 by the end of 2004 and to 0.25 µg/m^3 by the end of 2008. Only the first objective is included in the Air Quality Directive.

The fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes target values for arsenic, cadmium and nickel. However, the preamble to the Directive makes it clear that the use of these target values is relatively limited. Paragraph (5) states:

> *"The target values would not require any measures entailing disproportionate costs. Regarding industrial installations, they would not involve measures beyond the application of best available techniques (BAT) as required by Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (5) and in particular would not lead to the closure of installations. However, they would require Member States to take all cost-effective abatement measures in the relevant sectors."*

And paragraph (6) states:

> *"In particular, the target values of this Directive are not to be considered as environmental quality standards as defined in Article 2(7) of Directive 96/61/EC and which, according to Article 10 of that Directive, require stricter conditions than those achievable by the use of BAT."*

Although these target values have been included in the assessment, it is important to note that the application of the target values would not have an effect on the design or operation of Facility. The Facility will be designed in accordance with BAT and will include cost effective methods for the abatement of arsenic, cadmium and nickel, including the injection of activated carbon and a fabric filter.

Emissions limits have been set in Environmental Permits for similar facilities for a number of heavy metals which do not have air quality standards associated with them. The EALs for these metals, and lead, are summarised in Table 3.1.

Table 3.1: Environmental Assessment Levels (EALs) for Metals			
Metal	Daughter Directive Target Level (µg/m³)	EALs (µg/m³)	
		Long Term	Short Term
Arsenic	0.006	0.003	-
Antimony	-	5	150
Cadmium	0.005	0.005	-
Chromium (II & III)	-	5	150
Chromium (VI)	-	0.0002	-
Cobalt	-	-	-
Copper	-	10	200
Lead	-	0.25	-
Manganese	-	0.15	1500
Mercury	-	0.25	7.5
Nickel	0.020	0.020	-
Thallium	-	-	-
Vanadium	-	5	1

The EALs in Appendix B to Annex F of the Environment Agency Horizontal Guidance Note H1 take into account the guidelines for metals and metalloids in ambient air for the protection of human health produced by EPAQS in 2009.

3.9 Volatile Organic Compounds (VOCs)

A variety of VOCs could be released from the stack, of which benzene and 1,3-butadiene are included in the AQS and monitored at various stations around the UK. The AQS includes the following objectives for the running annual mean:

- Benzene 5 µg/m³, to be achieved by 2010.
- 1,3-butadiene 2.25 µg/m³, to be achieved by 2003.

There are no short-term AQO/EALs for either benzene or 1,3-butadiene.

3.10 Dioxins and furans

Dioxins and furans are a group of organic compounds with similar structures, which are formed as a result of combustion in the presence of chlorine. Principal sources include steel production, power generation, coal combustion and uncontrolled combustion, such as bonfires. The Municipal Waste Incineration Directive and UK legislation imposed strict limits on dioxin emissions in 1995, with the result that current emissions from incineration of municipal solid waste in the UK in 1999 were less than 1% of the emissions from waste incinerators in 1995. The Waste Incineration Directive, now included in the IED, imposes even lower limits, reducing the limit to one tenth of the previously permitted level.

One dioxin, 2,3,7,8-TCDD, is a definite carcinogen and a number of other dioxins and furans are considered to be possible carcinogens. A tolerable daily intake (TDI) for Dioxins, furans and dioxins like PCBs has been recommended by the Committee on the Toxicity of Chemicals in Food, Consumer Products and the Environment of 2 pg I-TEQ per kg bodyweight per day.

Dioxins are not normally compared with set EALs, but the probable ingestion rates of dioxins by different groups of people is considered as part of the Human Health Risk Assessment contained as a separate document within the application.

3.11 Polychlorinated biphenyl (PCBs)

PCBs have high thermal, chemical and electrical stability and were manufactured in large quantities in the UK between the 1950s and mid 1970s. Commercial PCB mixtures, which contained a range of dioxin-like and non-dioxin like congeners, were sold under a variety of trade names, the most common in the UK being the Aroclor mixtures. UK legislative restrictions on the use of PCBs were first introduced in the early 1970s.

Although now banned from production current atmospheric levels of PCBs are due to the ongoing primary anthropogenic emissions (e.g. accidental release of products or materials containing PCBs), volatilisation from environmental reservoirs which have previously received PCBs (e.g. sea and soil) or incidental formation of some congeners during the combustion process.

There are no AQOs for PCBs contained within the AQS. However Environment Agency Horizontal Guidance Note H1 Annex F defines the short term EAL as 6 $\mu g/m^3$ and the long term EAL as 0.2 $\mu g/m^3$.

A number of PCBs are considered to possess dioxin like toxicity and are known as dioxin-like PCBs. The total intake from dioxins, furans and dioxins like PCBs is compared to the TDI for dioxins, furans and dioxin like PCBs as part of the Human Health Risk Assessment contained as a separate document within the application.

3.12 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are members of a large group of organic compounds widely distributed in the atmosphere. The best known PAH is benzo[a]pyrene (B[a]P). The AQS included an objective to limit the annual mean of B[a]P to 0.25 ng/m^3 by the end of 2010. This goes beyond the requirements of European Directives, since the fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes a target value for benzo(a)pyrene of 1 ng/m^3 as an annual mean.

3.13 Summary

Table 3.2 summarises the air quality objectives and guidelines used in the air quality assessment. The sources for each of the values can be found in the preceding sections.

Table 3.2: Air Quality Standards (AQS) and Environmental Assessment Levels (EALs)

Pollutant	Limit Value ($\mu g/m^3$)	Averaging Period	Frequency of Exceedences
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)
	40	Annual	-
Sulphur dioxide	266	15 minutes	35 times per year (99.9th percentile)
	350	1 hour	24 times per year (99.73rd percentile)
	125	24 hours	3 times per year (99.18th percentile)

Table 3.2: Air Quality Standards (AQS) and Environmental Assessment Levels (EALs)

Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41th percentile)
	40	Annual	-
Particulate matter ($PM_{2.5}$)	25	Annual	-
Carbon monoxide	10,000	8 hours, running	-
Hydrogen chloride	750	1 hour	-
Hydrogen fluoride	160	1 hour	-
	16	Annual	-
Ammonia	2,500	1 hour	-
	180	Annual	-
Lead	0.25	Annual	-
Benzene	5.00	Annual	-
1,3-butadiene	2.25	Annual, running	-
PCBs	6	1-hour	-
	0.2	Annual	-
PAHs	0.00025	Annual	-

Table 3.3 Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Concentration ($\mu g/m^3$)	Measured as
Nitrogen oxides (as nitrogen dioxide)	75	Daily mean
	30	Annual mean
Sulphur dioxide	10	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystems integrity
	20	Annual mean for all higher plants
Hydrogen fluoride	<5	Daily mean
	<0.5	Weekly mean
Ammonia	1	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystems integrity
	3	Annual mean for all higher plants

4 Baseline Air Quality

The Facility is located to the south-east of the disused airfield known as Rivenhall airfield, in rural Essex approximately 3.4km south east of Kelvedon. Reference should be made to Figure 1 which shows the site location. In this section, we have reviewed the baseline air quality and defined appropriate background concentrations to be used within this assessment.

4.1 Air quality review and assessment

As required under Section 82 of the Environment Act (1995) (Part IV), local authorities are required to undertake an ongoing exercises to review air quality within their area of jurisdiction. The closest Air Quality Management Area (AQMA) is located in Chelmsford approximately 15 to the south-east of the Facility. Due to the distance to the closest AQMAs it is not likely that the emissions from the Facility would have any measureable impact on any designated AQMA.

4.2 National modelling – mapped background data

In order to assist local authorities with their responsibilities under Local Air Quality Management, the Department for the Environment Food and Rural Affairs (DEFRA) provides modelled background concentrations of pollutants throughout the UK on a 1 km by 1 km grid. This model is based on known pollution sources and background measurements and is used by local authorities in lieu of suitable monitoring data. Mapped background concentrations were downloaded for the grid squares containing the Facility and immediate surroundings. A summary is presented within Table 4.1.

In addition, mapped atmospheric concentrations of ammonia are available from DEFRA throughout the UK on a 5 km by 5 km grid. Mapped ammonia background concentrations were downloaded for the grid square containing the Facility, as presented within Table 4.1.

Table 4.1: Mapped Background Data – at Facility

Pollutant	Annual Mean Concentration (µg/m^3)	Dataset
Nitrogen dioxide (1)	12.29	2011 mapped background dataset
Oxides of nitrogen (1)	17.88	2011 mapped background dataset
Sulphur dioxide (1)	3.53	2001 mapped background dataset
Particulate matter (as PM_{10}) (1)	19.20	2011 mapped background dataset
Particulate matter (as $PM_{2.5}$) (1)	11.96	2011 mapped background dataset
Carbon monoxide (1)	254	2001 mapped background dataset
Benzene (1)	0.31	2001 mapped background dataset
1,3-butadiene (1)	0.13	2001 mapped background dataset
Ammonia (2)	1.48	2012 mapped background dataset

Notes:

(1) 1km x 1km grid square centred upon 582500, 220500

(2) 5km x 5km grid square centred upon 580000, 220000

The mapped background data is calibrated against monitoring data. For instance, the 2011 mapped background concentrations are based on 2011 meteorological data and are calibrated against monitoring undertaken in 2011. As a conservative approach where mapped background data is used the concentration for the year against which the data was validated has been used for the purpose of this assessment. This eliminates any potential uncertainties over anticipated trends in future background concentrations.

Background concentrations will vary over the modelling domain area therefore the maximum mapped background concentration within the modelling domain has been calculated as presented in Table 4.2.

Table 4.2: Mapped Background Data – Maximum within Modelling Domain

Pollutant	Annual Mean Concentration (µg/m^3)	Dataset
Nitrogen dioxide	14.89	2011 mapped background dataset
Oxides of nitrogen	22.01	2011 mapped background dataset
Sulphur dioxide	3.65	2001 mapped background dataset
Particulate matter (as PM_{10})	19.58	2011 mapped background dataset
Particulate matter (as $PM_{2.5}$)	12.47	2011 mapped background dataset
Carbon monoxide	267	2001 mapped background dataset
Benzene	0.35	2001 mapped background dataset
1,3-butadiene	0.14	2001 mapped background dataset
Ammonia	1.48	2011 mapped background dataset

4.3 AURN and LAQM monitoring data

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of the DEFRA this includes automatic monitoring of oxides of nitrogen, nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and particulates. No AURN sites have been identified within 20km of the Facility.

In addition to the national AURN, local authorities undertake monitoring of a range of pollutants as part of the LAQM review process. A review of the monitoring undertaken by Braintree District Council as part of their LAQM commitments has shown that they monitor for nitrogen dioxide concentrations at 12 sites using diffusion tubes. Of these only 3 are not classified as roadside sites and classified as either urban centre or urban background locations. A summary of the monitoring data from these sites is presented in the following table.

Table 4.3: Nitrogen Dioxide Diffusion Tubes – Braintree District Council					
Site	**Mapped Bg - 2011**	**2010**	**2011**	**2012**	**2013**
Braintree 1N – Blamford House, London Rd	15.6	36.7	34.3	30.1	36.6
Braintree 5N – The While Hart Hotel, Coggeshall Road	15.9	25.8	25.6	25.5	25.3
Braintree 4N – Beckers Green Road	15.3	21.1	21.2	21.0	22.8
Halstead 1 – Church yard, Colchester Road	15.2	31.5	31.5	30.7	30.0
Hadfield Peverel A12	21.2	45.6	49.5	44.7	50.5
Kelvedon High Street, Kelvedon	14.9	30.0	29.1	32.5	32.8
Bradwell – the Street, Bradwell	13.8	43.5	41.8	38.6	38.1
Braintree – Railway Street	15.7	32.4	28.8	29.2	29.5
Braintree – Stilemans Wood	15.3	32.6	37.1	33.2	28.1
Witham – Chipping Hill	22.4	50.3	47.1	47.0	45.8
Rivenahll Hotel A12	19.4	55.3	56.0	49.8	51.8
Rivenahll Foxden A12	19.4	50.5	53.2	49.8	51.8

Due to the rural nature of the area where impacts are predicted and the lack of rural baseline monitoring the maximum mapped background concentration within the modelling domain has been used as the background concentration for the purpose of this assessment. The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.4 Hydrogen chloride

Hydrogen chloride is measured on behalf of DEFRA as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. This consolidates the previous Acid Deposition Monitoring Network (ADMN), and National Ammonia Monitoring Network (NAMN). The closest monitoring station is located at London Cromwell Road approximately 60km to the south-east of the Facility. A summary of the data from all background and rural sites in the UK is presented in Table 4.4.

Table 4.4: Hydrogen Chloride Monitoring – UKEAP				
	Annual Mean Concentration (µg/m^3)			
	2011	**2012**	**2013**	**2014**
Min of all UK sites	0.10	0.14	0.15	0.10
Max of all UK sites	0.72	0.44	0.50	0.45
Average of all UK sites	0.29	0.27	0.31	0.25
Notes: *Data for each site downloaded from the DEFRA website.*				

In lieu of any local monitoring, the maximum monitored at any site has been used for the purpose of this assessment (0.72 µg/m^3 – 2011). The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.5 Hydrogen fluoride

Baseline concentrations of hydrogen fluoride are not measured locally or nationally, since these are not generally of concern in terms of local air quality. However, the EPAQS report 'Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects' contains some estimates of baseline levels, reporting that measured concentrations have been in the range of 0.036 µg/m^3 to 2.35 µg/m^3.

In lieu of any local monitoring, the maximum measured baseline hydrogen fluoride concentration has been used for the purpose of this assessment as a conservative estimate. The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.6 Ammonia

Ammonia is also measured as part of the UKEAP project and the closest site is located at London Crowell Road. In lieu of any local monitoring the maximum mapped background over the modelling domain as presented in Table 4.2 has been used for the purpose of this assessment. The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.7 Volatile Organic Compounds

As part of the Automatic and Non-Automatic Hydrocarbon Network, benzene and 1,3-butadiene concentrations are measured at sites co-located with the AURN across the UK. The closest monitoring sites are located in London. In lieu of any local monitoring the maximum mapped background over the modelling domain as presented in Table 4.2 has been used for the purpose of this assessment. The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.8 Metals

Metals are measured as part of the Rural Metals and UK Urban/Industrial Networks (previously the Lead, Multi-Element and Industrial Metals Networks). A summary of the maximum average monitored concentrations at rural sites across the UK is presented in Table 4.5.

Table 4.5: Heavy Metals Monitoring – Maximum Annual Mean from Rural Sites

Metal	Annual Mean EAL (ng/m³)	Annual Mean Conc. (ng/m³)			Max as % of EAL
		2012	2013	2014	
Antimony	5,000	-	-	-	-
Arsenic	3	0.78	0.81	-	26.96%
Cadmium	5	0.19	0.20	-	3.91%
Chromium	5,000	0.99	1.32	-	0.03%
Cobalt	-	-	-	-	-
Copper	10,000	4.44	4.28	-	0.04%
Manganese	150	2.52	3.49	-	2.33%
Mercury	250	1.20	1.38	-	0.55%
Nickel	20	1.05	1.43	-	7.17%
Lead	250	7.16	8.38	-	3.35%
Thallium	-	-	-	-	-
Vanadium	5,000	1.44	1.75	-	0.03%

Notes:
Mercury is based on the monitored mercury in PM10.
To date no data is available for 2014.

As shown, the concentrations monitored over the last 3 years at rural sites were significantly lower than the EALs. In lieu of any local rural monitoring, the maximum annual average monitored metal concentration from rural sites across the UK between 2012 and 2013 has been used as the background concentration within this assessment.

4.9 Dioxins, furans and polychlorinated biphenyl (PCBs)

Dioxins, furans and PCBs are monitored on a quarterly basis at a number of urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. London Nobel House is the closest monitoring site with data from the most recent year. A summary of dioxin and furan and PCB concentrations from all monitoring sites across the UK is presented in Table 4.6.

Table 4.6: Dioxin, Furan and PBCs Monitoring Results - National

Site	Annual Mean Dioxin and Furans Conc. (fg/TEQ/m^3)			Annual Mean PCBs Conc. (pg/m^3)		
	2008	2009	2010	2008	2009	2010
London	10.94	41.44	38.60	164.18	317.94	254.90
Manchester	18.99	14.21	14.21	133.42	168.38	185.28
Auchencorth*	6.44	0.56	5.01	12.12	44.66	37.40
Middlesbrough	23.98	-	-	138.43	-	-
High Muffles*	1.73	9.38	2.76	20.08	109.94	141.50
Hazelrigg*	3.67	13.49	8.03	14.52	89.18	110.00
Stoke Ferry	-	-	-	-	-	-
Weybourne*	-	22.82	2.49	-	44.66	21.30
UK Average	10.96	16.98	11.85	80.46	129.13	125.06

Notes:

** rural site*

As shown, the concentrations vary significantly between sites and years. As no site is located in close proximity to the Facility, the maximum monitored concentration from a rural site has been used as the background concentration within this assessment (22.82 fg/TEQ/m^3 for dioxins and furans (Weybourne 2009) and 141.50 pg/m^3 for PCBs (High Muffles 2010)). The choice of background will be considered further if the impact of the Facility cannot be screened out as insignificant.

4.10 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are monitored as part of the PAH network. The closest background monitoring site is located at Crystal Palace, London. For the purpose of this assessment, benzo(a)pyrene is considered as this is the only PAH which an AQO has been set. A summary of benzo(a)pyrene concentrations from all background monitoring sites within the UK is presented in Table 4.7. Any exceedences of the EAL are highlighted.

Table 4.7: Benzo(a)pyrene Monitoring - National					
Site	**Quantity**	**AQO (ng/m^3)**	**Annual Mean Concentration (ng/m^3)**		
			2009	**2010**	**2011**
National Non-Automatic Monitoring					
Background	Min	0.25	0.04	0.03	0.02
	Max	0.25	1.80	2.00	1.30
	Average	0.25	0.41	0.48	0.33
Number of background sites exceeding EC Target Value (1 ng/m^3)			4	5	2
Number of background sites exceeding EC Upper Assessment Threshold (0.6 ng/m^3)			5	5	5
Number of background sites exceeding EC Lower Assessment Threshold (0.4 ng/m^3)			5	5	5
Notes: *Monitoring from 2012 to 2014 not available at the time of writing this report.*					

In lieu of any local monitoring the maximum monitored concentration from a background site has been used (2.00 ng/m^3 – 2010). The choice of background will be investigated if the impact of the Facility cannot be screened out as insignificant.

4.11 Summary

Table 4.8 outlines the values for the annual average background concentrations that have been used to evaluate the impact of the Facility. As noted in the background analysis the mapped background slightly underestimates the monitored concentration. The maximum mapped background concentration for any grid square within the modelling domain is greater than any background concentration monitored. Therefore for the purpose of this assessment the maximum mapped background concentration has been used. Further analysis of the background concentration has been undertaken where impacts cannot be screened out as 'insignificant'. In addition the impact at all identified monitoring locations within the modelling domain has been quantified.

Table 4.8: Summary of Background Concentrations			
Pollutant	**Annual Mean Concentration**	**Units**	**Justification**
Nitrogen dioxide	14.89	$\mu g/m^3$	2011 mapped background dataset maximum grid square within the modelling domain.
Oxides of nitrogen	22.01	$\mu g/m^3$	
Sulphur dioxide	3.65	$\mu g/m^3$	2001 mapped background dataset maximum grid square within the modelling domain.
Particulate matter (as PM_{10})	19.58	$\mu g/m^3$	2011 mapped background dataset maximum grid square within the modelling domain.
Particulate matter (as $PM_{2.5}$)	12.47	$\mu g/m^3$	
Carbon monoxide	267	$\mu g/m^3$	2001 mapped background dataset maximum grid square within the modelling domain.
Hydrogen chloride	0.72	$\mu g/m^3$	Maximum over the past 4 years from all UK monitoring sites.
Hydrogen fluoride	2.35	$\mu g/m^3$	Maximum measured baseline hydrogen fluoride concentration as presented in the EPAQS report.
Ammonia	1.48	$\mu g/m^3$	Maximum mapped background concentration within the modelling domain – 2011 dataset.
Benzene	0.35	$\mu g/m^3$	Maximum mapped background concentration within the modelling domain – 2001 dataset.
1,3-butadiene	0.14	$\mu g/m^3$	
Mercury	1.38	ng/m^3	The maximum monitored metal concentration from at a rural site between 2012 and 2013.
Cadmium	0.20	ng/m^3	
Arsenic	0.81	ng/m^3	
Antimony	-	ng/m^3	
Chromium	1.32	ng/m^3	
Cobalt	-	ng/m^3	
Copper	4.44	ng/m^3	
Manganese	3.49	$2ng/m^3$	
Lead	8.38	ng/m^3	
Nickel	1.43	ng/m^3	
Vanadium	1.75	ng/m^3	
Dioxins and furans	22.82	fg/m^3	The maximum monitored metal concentration from at a rural site between 2008 to 2010
Polychlorinated biphenyl (PCBs)	141.5	pg/m^3	
Benzo(a)pyrene (PaB)	2.00	ng/m^3	Maximum monitored concentration from a background site between 2009 and 2011.

5 Sensitive Receptors

5.1 Human sensitive receptors

The general approach to the assessment is to evaluate the highest predicted process contribution to ground level concentrations. In addition, the predicted process contribution at a number of sensitive receptors has been evaluated. These sensitive receptors are displayed in Figure 1 of Appendix A and listed in Table 5.1.

Table 5.1: Sensitive Receptors

ID	Receptor Name	Location		Distance from the Stack (m)
		X	Y	
D1	Sheepcotes Farm (Hanger No.1)	581564.6	220328.3	882
D2	Wayfarers Site	582557.4	220185.4	260
D3	Allshot's Farm (Scrap Yard)	582892.6	220458.3	452
D4	Haywards	583235.7	221162.6	1088
D5	Herons Farm	582443.0	221378.3	960
D6	Gosling's Farm	581426.9	221380.9	1399
D7	Curd Hall Farm	583261.7	221708.3	1528
D8	Church (adjacent to Bradwell Hall)	581832.3	222157.9	1844
D9	Bradwell Hall	581837.5	222319.1	1995
D10	Rolphs Farmhouse	580675.8	220512.8	1769
D11	Silver End / Bower Hall / Fossil Hall	581286.5	219730.6	1345
D12	Rivenhall Pl/Hall	581860.9	219104.3	1437
D13	Parkgate Farm / Watchpall Cottages	582336.5	219195.2	1228
D14	Ford Farm / Rivenhall Cottage	582697.7	218597.5	1839
D15	Porter's Farm	583391.6	219242.0	1511
D16	Unknown Building 1	583131.7	219462.9	1178
D17	Bumby Hall / The Lodge / Polish Site (Light Industry)	582947.2	220115.2	589
D18	Footpath 8, Receptor 1 (East of Site)	582660.7	220977.1	600
D19	Footpath 8, Receptor 2 (East of Site)	582597.0	220688.5	311
D20	Footpath 8, Receptor 3 (East of Site)	582609.1	220564.0	221
D21	Footpath 8, Receptor 4 (East of Site)	582627.3	220497.2	201
D22	Footpath 8, Receptor 5 (East of Site)	582590.9	220415.2	149
D23	Footpath 8, Receptor 6 (East of Site)	582761.0	220217.8	376
D24	Footpath 8, Receptor 7 (East of Site)	583016.1	220026.5	695
D25	Footpath 35, Receptor 1 (North of Site)	582861.2	220843.4	597
D26	Footpath 35, Receptor 2 (North of Site)	582454.2	221013.5	595
D27	Footpath 35, Receptor 3 (North of Site)	582032.1	221162.3	850
D28	Footpath 31, Receptor 1 (North west of Site)	581877.2	220958.8	782

Table 5.1: Sensitive Receptors				
ID	**Receptor Name**	**Location**		**Distance from the Stack (m)**
		X	**Y**	
D29	Footpath 31, Receptor 2 (North west of Site)	581740.6	220764.5	783
D30	Footpath 31, Receptor 3 (North west of Site)	581379.2	220548.8	1071
D31	Footpath 7, Receptor 1 (South east of Site)	582505.9	220117.6	307
D32	Footpath 7, Receptor 2 (South east of Site)	582757.9	220066.0	473
D33	Footpath 7, Receptor 3 (South east of Site)	582967.5	219959.7	697
D34	Footpath 7, Receptor 4 (South east of Site)	583167.9	220372.7	727
D35	Footpath 7, Receptor 5 (South east of Site)	583301.5	220725.0	912
D36	Elephant House (Street Sweepings)	582368.7	220189.0	241
D37	Green Pastures Bungalow	581249.9	221176.1	1413
D38	Deeks Cottage	582873.4	221255.1	941
D39	Woodhouse Farm	582583.9	220617.9	245
D40	Gosling Cottage / Barn	581508.4	221305.5	1288
D41	Felix Hall / The Clock House / Park Farm	584578.8	219574.9	2297
D42	Glazenwood House	579980.5	222134.8	3001
D43	Bradwell Hall	580570.6	222802.9	3032
D44	Perry Green Farm	580899.7	221973.3	2190
D45	The Granary / Porter Farm / Rook Hall	584106.2	218964.5	2209
D46	Grange Farm	584888.0	222222.0	3039
D47	Coggeshall	585070.0	222839.0	3573

5.2 Sensitive ecological receptors

A study was undertaken to identify the following sites of ecological importance in accordance with Environment Agency Horizontal Guidance H1:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the Facility (or 15 km coal- or oil- fired power station);
- Sites of Special Scientific Interest (SSSIs) within 2 km of the Facility; and
- National Nature Reserves (NNR), Local Nature Reserves (LNRs), local wildlife sites and ancient woodlands within 2 km of the Facility.

Some large emitters may be required to screen to 10 km or 15 km for SSSIs.

A screening distance of 10km has been used for all SACs, SPAs, Ramsar sites and 2km for all SSSIs. These sensitive ecological receptors are listed in Table 5.2 and displayed in Figure 2 of Appendix A. A review of the citation and APIS website for each site has been undertaken to determine if lichens are an important part of the ecosystem's integrity for the purposes of determining the relevant Critical Level for the habitat.

Table 5.2: Sensitive Ecological Receptors				
Site	**Location (m)**		**Distance from the Main Stack at Closest Point (km)**	**Lichens identified as present within APIS database**
	x	**y**		
European designated sites (within 10km)				
None identified	-	-	-	-
UK designated sites (SSSIs) (within 2km)				
None identified	-	-	-	-
Locally designated sites (within 2km)				
Blackwater Plantation	582771	222096	1.7	-
Maxeys Spring	582665	219976	0.5	-
Storeys Wood	581817	220983	0.8	-
Upney Wood	583407	220241	1.0	-
Link's Wood	580439	221089	2.1	-
Park House Meadow	581075	222308	2.3	-

6 Dispersion Modelling Methodology

6.1 Selection of model

Detailed dispersion modelling was undertaking using the model ADMS 5.1, developed and supplied by Cambridge Environmental Research Consultants (CERC). This is a new generation dispersion model, which characterises the atmospheric boundary layer in terms of the atmospheric stability and the boundary layer height. In addition, the model uses a skewed Gaussian distribution for dispersion under convective conditions, to take into account the skewed nature of turbulence. The model also includes modules to take account of the effect of buildings and complex terrain.

ADMS is routinely used for modelling of emissions for planning and Environmental Permitting purposes to the satisfaction of the Environment Agency and Local Authorities.

6.2 Model inputs

As noted all point source emissions from the Facility will emit to atmosphere via stacks contained within a common windshield. The effect of this is to have one visible stack. Emissions from this stack will include the two CHP lines, exhaust air from the pulp plant, the two AD gas engines, and the AD biofilter. The following sections detail the source and emissions data for each item of plant.

6.2.1 Source and emissions data – CHP

The principal inputs to the model with respect to the emissions to air from the CHP are presented in Table 6.1. This data has been provided by HZI (the technology provider).

Table 6.1: Source Data – EFW

Item	Unit	CHP (per stream)
Stack diameter	m	2.3
Flue Gas Conditions		
Temperature	°C	182.29
Exit moisture content	% v/v	18.11%
Exit oxygen content	% v/v dry	6.69%
Reference oxygen content	% v/v dry	11%
Volume at reference conditions (dry, ref O2)	Nm^3/s	51.36
	Nm^3/h	184,902
Volume at actual conditions	Am^3/s	73.93
	Am^3/h	266,138
Flue gas exit velocity	m/s	17.8
Moisture content	kg/kg	0.1308
Specific heat capacity (Cp)	J/°C/kg	1130
Molar mass	g	28.20

Emissions from the CHP have been assumed to comply with the limits prescribed within Chapter VI Part 3 of the IED.

Table 6.2: Emissions Data – CHP (per stream) – Daily Emission Limit Values

Pollutant	Conc. (mg/Nm³)	Release Rate (g/s)
Oxides of nitrogen (as NO_2)	200	10.272
Sulphur dioxide	50	2.568
Carbon monoxide	50	2.568
Particulates	10	0.514
Hydrogen chloride	10	0.514
Volatile organic compounds (as TOC)	10	0.514
Hydrogen fluoride	1	0.051
Ammonia	10	0.514
Cadmium and thallium	0.05	2.568 mg/m³
Mercury	0.05	2.568 mg/m³
Other metals	0.5	25.681 mg/m³
Benzo(a)pyrene (PaHs)	0.105 µg/Nm³	5.393 µg/s
Dioxins and furans	0.1 ng/Nm³	5.136 ng/s
PCBs	0.005 mg/Nm³	256.81 mg/s

NOTES:

All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.

As a worst-case it has been assumed that the entire PM emissions consist of either PM10 or PM2.5 for comparison with the relevant AQOs.

The highest recorded emission concentration of B[a]P from the Environment Agency's public register was 0.105 µg/m³, or 0.000105 mg/m³ (dry, 11% oxygen, 273K). This has been assumed to be the emission concentration for the Facility.

Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co),copper Cu), manganese (Mn), nickel (Ni) and vanadium (V).

The Waste Incineration BREF provides a range of values for PCB emissions to air from European municipal waste incineration plants. This states that the annual average total PCBs is less than 0.005 mg/Nm³ (dry, 11% oxygen, 273K). In lieu of other available data, this has been assumed to be the emission concentration for the Facility.

In addition to the limits shown in Table 6.2, the IED also details half hourly average limits for a number of pollutants. It should be noted that if the CHP continually operated at these limits the daily limits would be exceeded. The CHP will be designed to achieve the limits shown in Table 6.2 and as such will only operate at the shorter term limits for short periods on rare occasions.

The CHP is designed to operate at full capacity and it is not anticipated to have significant changes in loading. Therefore it is appropriate to base the assessment on the design point of the system.

Table 6.3: Emissions Data – CHP (per stream) – Half Hourly Emission Limit Values		
Pollutant	**Conc. (mg/Nm³)**	**Release Rate (g/s)**
Oxides of nitrogen (as NO_2)	400	20.545
Sulphur dioxide	200	10.272
Carbon monoxide	100	5.136
Particulates	30	1.541
Hydrogen chloride	60	3.082
Volatile organic compounds (as TOC)	20	1.027
Hydrogen fluoride	4	0.205
NOTES: All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K		

6.2.2 Source and emissions data – Pulp Plant

The principal inputs to the model with respect to the emissions to air from the pulp plant are presented in Table 6.4.

Table 6.4: Source Data – Pulp Plant		
Item	**Unit**	**Pulp Plant**
Stack diameter	m	2.2
Flue Gas Conditions		
Temperature	°C	30.54
Exit moisture content	% v/v	1.83
Exit oxygen content	% v/v dry	20.56
Volume at actual conditions	Am^3/s	53.84
	Am^3/h	184,902
Flue gas exit velocity	m/s	14.2
Moisture content	kg/kg	0.0116
Specific heat capacity (Cp)	J/°C/kg	1016
Molar mass	g	28.76

The air from the pulp plant will not include any combustion gases and as such no emissions have been included in the model. The source has been included to ensure the effect of emitting to atmosphere with the other sources is considered.

6.2.3 Source and emissions data – gas engines

In addition to the CHP, the AD Facility will include two 450kWe gas engines. The principal inputs to the model with respect to the emissions to air from the AD gas engines are presented in Table 6.5.

Table 6.5: Source Data – AD Gas Engines		
Item	**Unit**	**Gas Engines (per engine) x 2**
Stack diameter	m	0.3
Flue Gas Conditions		
Temperature	°C	250
Exit moisture content	% v/v	14.37
Exit oxygen content	% v/v dry	6.00
Reference oxygen content	% v/v dry	5.00
Volume at reference conditions (dry, ref O2)	Nm^3/s	0.43
	Nm^3/h	1,531
Volume at actual conditions	Am^3/s	1.01
	Am^3/h	3,653
Flue gas exit velocity	m/s	14.4
Moisture content	kg/kg	0.1000
Specific heat capacity (Cp)	J/°C/kg	1135
Molar mass	g	28.44

Emissions from the gas engines have been assumed to comply with the limits prescribed within Environment Agency standard rules permit SR2012 No. 12 Anaerobic digestion facility including use of resultant biogas.

Table 6.6: Emissions Data – Gas Engines – Daily Emission Limit Values		
Pollutant	**Conc. (mg/Nm^3)**	**Release Rate (g/s)**
Oxides of nitrogen (as NO_2)	500	0.213
Sulphur dioxide	350	0.149
Carbon monoxide	1400	0.595
VOCs	1000	0.425
NOTES: All emissions are expressed at reference conditions of dry gas, 5% oxygen, 273.15K.		

It is noted that the above emissions are daily averages. EPR 1.01 provides emission limits on a daily basis and states that hourly averages should not exceed 200% of the daily limit. This assumption has been used for the gas engines. It should be noted that if the gas engines continually operated at the higher level the daily limit would be exceeded. The boilers will be designed to achieve the limits shown in Table 6.6 and as such will only operate at the shorter term limits for short periods on rare occasions.

Table 6.7: Emissions Data – Gas Boilers – Half Hourly Emission Limit Values		
Pollutant	**Conc. (mg/Nm³)**	**Release Rate (g/s)**
Oxides of nitrogen (as NO_2)	1000	0.425
Sulphur dioxide	700	0.298
Carbon monoxide	2800	1.191
VOCs	2000	0.851
NOTES: All emissions are expressed at reference conditions of dry gas, 5% oxygen, 273.15K		

6.2.4 Source and emissions data – AD biofilter

The principal inputs to the model with respect to the emissions to air from the AD biofilter are presented in Table 6.8.

Table 6.8: Source Data – AD Bio-filter		
Item	**Unit**	**AD Bio-filter**
Stack diameter	m	1.2
Flue Gas Conditions		
Temperature	°C	30.54
Exit moisture content	% v/v	1.00
Exit oxygen content	% v/v dry	20.95%
Volume at actual conditions	Am^3/s	17.08
	Am^3/h	61,500
Flue gas exit velocity	m/s	15.1
Moisture content	kg/kg	0.006
Specific heat capacity (Cp)	J/°C/kg	1011
Molar mass	g	28.86
Odour concentration	OU_E/m^3	3000
Odour release rate	OU_E/s	150,550

The air from the AD biofilter will not include any combustion gases and as such no emissions have been included in the model. The source has been included to ensure the effect of emitting to atmosphere with the other sources is considered.

6.2.5 Meteorological data and surface characteristics

The impact of meteorological data was taken into account by using weather data from Stansted Airport for the years 2009 – 2013. Stansted Airport is approximately 30km from the Facility. Other sources of weather data include Southend on Sea, but this is likely to be effected by the presence of the coastline. Stansted Airport is located at a similar altitude to the Rivenhall site. Although the Rivenhall site is in a more rural location than Stansted Airport this has been taken into account in the model inputs.

The periods 2009 to 2013 was chosen as this was the full set of data available at the time of starting to the air quality modelling. The Environment Agency recommends that 5 years of data are used to take into account inter-annual fluctuations in weather conditions. Therefore, using 5 years from 2009 to 2013 rather than 2010 to 2014 is not anticipated to affect the results significantly. Wind roses for each year can be found in Figure 3.

The surface roughness length can be selected in ADMS for both the site and the meteorological site. The surface roughness has been set to 0.3m for both the dispersion and meteorological site. This value is appropriate for agricultural areas and is considered representative of both the dispersion and meteorological site.

The Monin-Obukov length for the site and meteorological site can be specified in ADMS. This provides a measure of the stability of the atmosphere and indicates the height above which convective turbulence (i.e. thermal) is more important than mechanical (i.e. friction). This allows for the effect of the urban heat island, to prevent the atmosphere from ever becoming very stable, to be simulated within the model. The Monin-Obukov length of the modelling domain was taken to be 1 m which is the value appropriate for rural sites. The Monin-Obukov length of the meteorological data was taken to be 30 m which is the value appropriate for Stansted Airport. This difference in Monin-Obukov length has been used to account for the more rural setting of the Rivenhall site than Stansted Airport.

6.2.6 Modelling domain

Modelling has been undertaken over a 4.5 km x 4.5 km grid with a spatial resolution of 45m. The maximum grid spacing in each is less than 1.5 times the stack height in accordance with the Environment Agency modelling rule of thumb. Reference should be made to Figure 5 for a graphical representation of the modelling domain site and terrain file used.

Table 6.9: Modelling Domain

Grid	Domain
Grid Spacing (m)	53
Grid Points	101
Grid Start X	579750
Grid Finish X	585050
Grid Start Y	217750
Grid Finish Y	223050

6.2.7 Terrain

It is recommended that, where gradients within 500 m of the modelling domain are greater than 1 in 10, the complex terrain module within ADMS (FLOWSTAR) should be used. A review of the local area has deemed that the effect of terrain should be taken into account in the modelling. As such the terrain function in ADMS has been used. A terrain file with a grid resolution of 64 x 64 has been used. For sensitive receptors outside the modelling domain (i.e. all the ecological receptors), a terrain file has not been used due to the size of the terrain file which would be needed and the limitation of the calculation grid. Reference should be made to Figure 5 for a graphical representation of the modelling domain site and terrain file used.

6.2.8 Buildings

The presence of adjacent buildings can significantly affect the dispersion of the atmospheric emissions in various ways:

- Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.
- The rise and trajectory of the plume may be depressed slightly by the flow distortion. This downwash leads to higher ground level concentrations closer to the stack than those which would be present without the building.

The Environment Agency[1] recommends that buildings should be included in the modelling if they are both:

- Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and
- Taller than 40% of the stack.

A review of the site layout has been undertaken and the details of the applicable buildings are presented in Table 6.10. The building is to be located within the quarry and as such the height of the building (and stack) has been calculated based on the difference from the ground level outside of the quarry to the top of the building. For example the height of the main building is 60.75 m AOD, however the height of the surrounding land is ~50 m AOD. As such the building height has been set to 10.75 m.

A site plan showing which buildings have been contained in the model is presented in Figure 4 of Appendix A.

Table 6.10: Building Details

Buildings	Centre Point		Height (m)	Length (m)	Width (m)	Angle (°)
	X (m)	Y (m)				
Main Building	582287	220485	10.75	247	205	40

6.3 Chemistry

The plant will release nitric oxide (NO) and nitrogen dioxide (NO_2) which are collectively referred to as NOx. In the atmosphere, a proportion of nitric oxide will be converted to nitrogen dioxide in a reaction with ozone which is influenced by solar radiation. Since the air quality objectives are expressed in terms of nitrogen dioxide, it is important to be able to assess the conversion rate of nitric oxide to nitrogen dioxide.

Ground level NOx concentrations have been predicted through dispersion modelling. Nitrogen dioxide concentrations reported in the results section assume 70% conversion from NOx to nitrogen dioxide for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario in the Environment Agency methodology. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

6.4 Background concentrations

Background concentrations for the assessment have been derived from monitoring as presented previously in Table 4.8.

[1] AQTAG06 – Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air – January 2013.

For short term averaging periods the background concentration has been assumed to be twice the long term ambient concentration following the Environment Agency Horizontal Guidance Note H1 methodology.

7 Sensitivity Analysis

7.1 Surface roughness

The sensitivity of the results to surface roughness length has been considered by running the model with a range of surface roughness lengths for the dispersion site.

The following parameters were kept constant:

- Stack height – 35 m – (85m AOD);
- Source – all sources;
- Buildings – included;
- Terrain – included; and
- Met data year – 2010.

Table 7.1 presents the combined contribution to the ground level concentration of the emissions of oxides of nitrogen at the point of maximum impact.

Table 7.1: Surface Roughness Sensitivity

Surface roughness (m)	Max annual mean NOx process contribution	Max 1-hour mean NOx process contribution
0.2 – agricultural areas (min)	1.77	56.03
0.3 – agricultural areas (max)	1.94	57.43
0.5 – Parklands and open suburbia	2.19	59.74
1.0 – Cities and large towns	2.61	61.28

As shown, increasing the surface roughness leads to the predicted concentration at the point of maximum impact increasing for long and short term averages. The surface roughness of 0.3 m is most representative of agricultural environments like the wider area and has therefore been used within this assessment.

7.2 Sensitivity to operating below the design point

Dispersion modelling has been undertaken based on the emission parameters presented in the tables contained in Section 6.2. These are based on the design point for the Facility. The Facility would be operated as a commercial and therefore it is beneficial for the Facility to operate at full capacity. If loading does fall below the design point the volumetric flow rate and the exit velocity of the exhaust gases would reduce. The effect of this would to decrease the quantity of pollutants emitted but also to reduce the buoyancy of the plume due to momentum. The reduction in buoyancy, which would lead to reduced dispersion, would be more than offset by the decrease in the amount of pollutants being emitted, so that the impact of the plant when running below the design point would be reduced.

8 Dispersion Modelling Results

8.1 Screening

The Environment Agency Horizontal Guidance Note H1 states that:

"process contributions can be considered insignificant if:

- *the long term process contribution is <1% of the long term environmental standard; and*
- *the short term process contribution is <10% of the short term environmental standard."*

Predicted process contributions have been compared to the AQO/EALs provided in Section 3. Where the emissions of a particular pollutant cannot be considered to be 'insignificant', the predicted concentrations have been evaluated further.

In addition the following screening criteria are outlined in the Environment Agency guidance document "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012":

- Long-term Process Contribution (PC) <1% and Short-term Process Contribution (PC) <10%; or
- Long-term and Short-term Predicted Environmental Concentration (PEC) <100% (taking likely modelling uncertainties into account).

For screening purposes only, the Environment Agency methodology assumes that chromium (VI) comprises 20% of the total background chromium.

Where the impact is within these parameters, the Environment Agency concludes that there is no risk of exceeding the EAL.

8.2 Results

As discussed in Section 6.2, emissions from the Facility will be subject to emission limits. This section details the impact of the Facility assuming all items of plant operate for the entire year at the emission limits which were outlined in Section 6.2.

As identified in Section 6.2 the exhaust air from the pulp plant, and the AD biofilter will vent to atmosphere via within the same wind shield as the CHP and gas engines exhaust. Although there will be no combustion gases within the exhaust from the pulp plant or the biofilter, the temperature of the release is much lower than the CHP and will impact upon the buoyancy of the plume. The exhaust air from the pulp plant and the bioflter has been included to ensure any reduction is buoyancy is considered in the assessment.

Table 8.1 presents the results of the dispersion modelling of emissions from the Facility at the point of maximum impact and compares these results with the AQO/EALs presented in Table 3.2. Impacts which cannot be screened out as 'insignificant' are highlighted. This maximum impact has been calculated based on 100% operation of the CHP and AD gas engines. All short term impacts have been calculated based on operation of the CHP and AD gas engines at the short term emission limits concurrently during the worst-case weather conditions for dispersion. This is a highly conservative assumption.

Table 8.1: Dispersion Modelling Results – All Sources

Pollutant	Quantity	Units	AQO /EAL	Bg Conc.	Process Contribution (PC) at Point of Greatest Impact						Max as % of AQO /EAL	PEC (PC +Bg)	PEC as % of AQO /EAL
					2009	2010	2011	2012	2013	Max			
Nitrogen dioxide	Annual mean	µg/m³	40	14.89	1.90	1.36	2.71	2.05	1.86	2.71	6.79%	17.60	44.01%
	99.79th%ile of hourly means(1)	µg/m³	200	29.78	34.64	31.14	35.67	34.14	17.62	35.67	17.83%	65.45	32.72%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	7.30	6.45	5.51	8.31	6.65	6.56	8.31	6.65%	15.61	12.49%
	99.73rd%ile of hourly means(1)	µg/m³	350	7.30	47.88	44.21	50.34	48.16	49.22	50.34	14.38%	57.64	16.47%
	99.9th%ile of 15 min. means(1)	µg/m³	266	7.30	55.36	51.98	56.25	54.27	56.37	56.37	21.19%	63.67	23.94%
PM_{10}s	Annual mean	µg/m³	40	19.58	0.13	0.10	0.19	0.14	0.13	0.19	0.48%	19.77	49.43%
	90.41th%ile of daily means	µg/m³	50	39.16	0.47	0.40	0.68	0.53	0.53	0.68	1.36%	39.84	79.68%
$PM_{2.5}$s	Annual mean	µg/m³	25	12.47	0.13	0.10	0.19	0.14	0.13	0.19	0.76%	12.66	50.64%
Carbon monoxide	8 hour running mean(1)	µg/m³	10,000	534.00	14.67	14.81	15.16	14.84	19.14	19.14	0.19%	553.14	5.53%
Hydrogen chloride	Hourly mean(1)	µg/m³	750	1.44	18.10	16.88	18.15	18.24	3.11	18.24	2.43%	19.68	2.62%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.01	0.02	0.01	0.01	0.02	0.12%	2.37	14.81%
	Hourly mean(1)	µg/m³	160	4.70	1.21	1.13	1.21	1.22	0.21	1.22	0.76%	5.92	3.70%
Ammonia	Annual mean	µg/m³	180	1.48	0.13	0.10	0.19	0.14	0.13	0.19	0.11%	1.67	0.93%
	Hourly mean	µg/m³	2,500	2.96	3.02	2.82	3.03	3.04	3.11	3.11	0.12%	6.07	0.24%
VOCs (as benzene)	Annual mean	µg/m³	5	0.35	0.24	0.17	0.35	0.26	0.24	0.35	6.95%	0.70	13.95%

Table 8.1: Dispersion Modelling Results – All Sources														
Pollutant	Quantity	Units	AQO /EAL	Bg Conc.	Process Contribution (PC) at Point of Greatest Impact						Max as % of AQO /EAL	PEC (PC +Bg)	PEC as % of AQO /EAL
					2009	2010	2011	2012	2013	Max			
VOCs (as 1,3-butadiene)	Annual mean	μg/m³	2.25	0.14	0.24	0.17	0.35	0.26	0.24	0.35	15.44%	0.49	21.66%
Mercury	Annual mean	ng/m³	250	1.38	0.66	0.48	0.95	0.72	0.65	0.95	0.38%	2.33	0.93%
	Hourly mean	ng/m³	7,500	2.76	15.10	14.08	15.13	15.21	15.55	15.55	0.21%	18.31	0.24%
Cadmium	Annual mean	ng/m³	5	0.20	0.66	0.48	0.95	0.72	0.65	0.95	19.01%	1.15	23.01%
	Hourly mean	ng/m³	-	0.40	15.10	14.08	15.13	15.21	15.55	15.55	-	15.95	-
Dioxins	Annual mean	fg/m³	-	22.82	1.33	0.95	1.90	1.44	1.30	1.90	-	24.72	-
PCBs	Annual mean	ng/m³	200	0.14	0.07	0.05	0.10	0.07	0.07	0.10	0.05%	0.24	0.12%
	Hourly mean	ng/m³	6,000	0.28	1.51	1.41	1.51	1.52	1.56	1.56	0.03%	1.84	0.03%
PAHs	Annual mean	pg/m³	250	2000.00	1.39	1.00	2.00	1.51	1.37	2.00	0.80%	2002.00	800.80%
Other metals	Annual mean	ng/m³	-	-	6.64	4.76	9.51	7.19	6.52	9.51	See metals assessment		
	Hourly mean	ng/m³	-	-	150.97	140.77	151.34	152.09	155.52	155.52			

Notes:
(1) Based on operation of all items of plant at the ST ELV
(2) Based on operation of the EfW at the long term ELV and the gas boilers at the daily ELV

As shown in Table 8.1, the process contribution from the Facility does not cause an exceedence of the AQO for any pollutant. The only exceedence is predicted for PAHs, but the process contribution from the Facility can be screened out as 'insignificant' and the exceedence occurs as a result of the existing background concentration. For 24-hour PM_{10} the PEC is greater than 70% but it has been assumed that the background concentration is 2 times the annual mean background concentration as per Environment Agency H1 Annex F guidance. LAQM.TG(09) methodology states that to calculate the 90.4%ile of 24-hour particulate matter the annual mean concentration should be used (not 2 times as per Annex F). If we use the LAQM.TG(09) approach the PEC is predicted to be 40.52% of the AQO.

The predicted impact cannot be screened out as 'insignificant' for the following pollutants:

- Annual mean nitrogen dioxide process contributions;
- 99.79%ile 1-hour mean nitrogen dioxide process contributions;
- 99.73rd%ile of hourly means sulphur dioxide process contributions;
- 99.9th%ile of 15 min. means sulphur dioxide process contributions;
- Annual mean VOCs (as benzene) process contributions; and
- Annual mean VOCs (as 1,3-butadiene) process contributions; and
- Annual mean cadmium process emissions.

The impacts of all other pollutants can be screened out as 'insignificant' and further assessment is not required.

Analysis of the background concentrations has shown that the PEC is predicted to be less than 70% of the AQO/EAL for all long term impacts which are not screened out as insignificant.

This assessment is considered highly conservative as it assumes that:

- the CHP Facility and AD gas boilers operates concurrently at the long term or short term emission limit for the entire year;
- the entire VOC emissions are assumed to consist of benzene or 1,3-buitadiene; and
- cadmium is released at the combined emission limit for cadmium and thallium, while monitoring from waste facilities has indicated concentrations of cadmium are usually about 8% of the limit.

8.3 Nitrogen dioxide

The maximum predicted impact of annual mean nitrogen dioxide emissions is 6.79% of the AQO. This impact cannot be screened out as 'insignificant' using the Environment Agency H1 screening criteria. Analysis of the mapped background concentration has shown that background concentrations are relatively low and the PEC is predicted to be less than 50% of the AQO. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted annual mean concentrations as a result of emissions from the Facility. This assumes all items of plant operate for 100% of the time at the long term emission limit values.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of annual mean nitrogen dioxide emissions at a sensitive receptor is 6.6% of the AQO. This receptor is representative of a location along the footpath to the north of the site. The maximum predicted impact of annual mean nitrogen dioxide emissions at a location of long term exposure (i.e. a residential property) is 4.4% at Haywards. At all receptors the PEC is predicted to be less than 50%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

The maximum predicted impact of 99.79%ile 1-hour mean nitrogen dioxide emissions is 17.83% of the AQO. This impact cannot be screened out as 'insignificant' using the Environment Agency H1 screening criteria. Analysis of the mapped background has shown that background concentrations are relatively low and the PEC is predicted to be less than 35% of the AQO. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted 99.79%ile 1-hour mean concentrations as a result of emissions from the Facility. This assumes all items of plant operate for 100% of the time at the short term emission limit values. As such is considered worst-case as it assumes both plants operate at the short term emission limit concurrently and this operation coincides with the worst case weather conditions for dispersion.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of annual mean nitrogen dioxide emissions at a sensitive receptor is 16.1% of the AQO. This receptor is representative of a location along the footpath to the north of the site. At all receptors the PEC is predicted to be less than 35%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

8.4 Sulphur dioxide

The maximum predicted impact of hourly and 15-minute mean sulphur dioxide emissions is 14.38% and 21.19% of the AQO respectively. This impact cannot be screened out as 'insignificant' using the Environment Agency H1 screening criteria. Analysis of the mapped background has shown that background concentrations are relatively low and the PEC is predicted to be less than 25% of the AQO. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted 99.73 %ile of hourly mean and 99.9%ile of 15-minute mean sulphur dioxide concentrations as a result of emissions from the Facility. This assumes all items of plant operate for 100% of the time at the short term emission limit values. As such is considered worst-case as it assumes both plants operate at the short term emission limit concurrently and this operation coincides with the worst case weather conditions for dispersion.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of hourly and 15-minute mean sulphur dioxide emissions at a sensitive receptors is 13.1% and 20.5% of the AQO respectively. At all receptors the PEC is predicted to be less than 25%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

8.5 Volatile organic compounds

The maximum predicted impact of annual mean VOC emissions cannot be screened out as 'insignificant'. If it is assumed that the entire VOCs emissions consist of only benzene the impact is 6.95% of the AQO and if it is assumed the entire VOCs emissions consist of only 1,3-butadiene the impact is 15.44% of the AQO. Analysis of the mapped background has shown that background concentrations are relatively low and the PEC is predicted to be less than 25% of the AQO in both cases. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted annual mean VOC concentrations as a result of emissions from the Facility assuming the emissions consist of only benzene or 1,3-butadiene. This assumes all items of plant operate for 100% of the time at the long term emission limit values.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of annual mean VOC emissions at a sensitive receptors assuming the entire VOC emissions consist of only benzene or 1,3-butadiene is 6.8% and 15.0% of the AQO respectively. At all receptors the PEC is predicted to be less than 25%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

8.6 Cadmium

The maximum predicted impact of annual mean cadmium emissions is 19.01% of the EAL. This impact cannot be screened out as 'insignificant' using the Environment Agency H1 screening criteria. Analysis of the background data has shown that background concentrations are relatively low and the PEC is predicted to be less than 25% of the EAL. This is not a significant impact. Reference should be made to the plot files in Appendix A which show the predicted annual mean concentrations as a result of emissions from the Facility. This assumes all items of plant operate for 100% of the time at the long term emission limit values.

The detailed receptor results tables presented in Appendix B show that the maximum predicted impact of annual mean cadmium emissions at a sensitive receptor is 18.5% of the AQO. This receptor is representative of a location along the footpath to the north of the site. The maximum predicted impact of annual mean nitrogen dioxide emissions at a location of long term exposure (i.e. a residential property) is 12.3% at Haywards. At all receptors the PEC is predicted to be less than 25%. Therefore it is not likely that emissions will cause an exceedence of the AQO. This is not a significant impact.

This assumes that the cadmium is released at the combined emission limit for cadmium and thallium. Monitoring from waste facilities has indicated that concentrations of cadmium are usually about 8% of the year. If this assumption is applied, the predicted process contribution at the point of maximum impact is only 1.5% of the EAL, and the maximum impact at a sensitive receptor representing long term exposure (a residential property) is 1.0% of the EAL. This is not a significant impact.

8.7 Metals – at point of maximum impact

There is a single emission limit for nine Group 3 metals (arsenic, antimony, chromium, cobalt, copper, lead, manganese, nickel and vanadium). The impact of these metals has been assessed using the three stage screening methodology outlined in the Environment Agency guidance document "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012".

8.7.1 Stage 1

Using the Environment Agency methodology, the first stage is to predict the impact of each metal, assuming each metal is emitted at 100% of the emission level, and compare against the EALs outlined in Table 3.1.

Table 8.2 displays the results of the first stage screening methodology for long term impacts of metals. Any exceedences of the Environment Agency screening criteria are highlighted.

Table 8.2: Heavy Metal Screening Assessment - Step 1 – Long Term						
Metal	**EAL (ng/m^3)**	**Background Conc. (ng/m^3)**	**Process Contribution**		**PEC**	
			Conc. (ng/m^3)	**As % of EAL**	**Conc. (ng/m^3)**	**As % of EAL**
Arsenic	3	0.81	9.51	316.86%	10.32	343.86%
Antimony	5,000	-	9.51	0.19%	-	-
Chromium	5,000	1.32	9.51	0.19%	10.83	0.22%
Chromium (VI)	0.2	0.26	9.51	4752.88%	9.77	4884.88%
Cobalt	-	-	9.51	-	-	-
Copper	10,000	4.44	9.51	0.10%	13.95	0.14%
Lead	250	8.38	9.51	3.80%	17.89	7.15%
Manganese	150	3.49	9.51	6.34%	13.00	8.66%
Nickel	20	1.43	9.51	47.53%	10.94	54.68%
Vanadium	5,000	1.75	9.51	0.19%	11.26	0.23%

Using the first stage screening methodology, the PCs of arsenic, chromium (VI), lead, manganese and nickel are predicted to be greater than 1% of the EAL. However, only the PEC for arsenic and chromium (VI) is predicted to be greater than 100% of the EAL. The assessment methodology states that the PEC should take into account of modelling uncertainty. For lead, manganese and nickel the PEC is less than 60% which means that, even when taking into account of any modelling uncertainty, it is expected that the PEC will remain below the EAL. Arsenic and chromium (VI) have been progressed to the second stage of assessment.

The PC for all other metals is less than 1% and the PEC is less than 100% of the EAL and so these can be screened out from further assessment. It is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution and progression to the second stage of assessment is not necessary.

Table 8.3 presents the results of the first stage screening methodology for short term impacts of metals.

Table 8.3: Heavy Metal Screening Assessment - Step 1 – Short Term						
Metal	EAL (ng/m³)	Background Conc. (ng/m³)	Process Contribution		PEC	
			Conc. (ng/m³)	As % of EAL	Conc. (ng/m³)	As % of EAL
Arsenic	-	1.62	155.52	-	157.14	-
Antimony	150,000	-	155.52	0.10%	-	-
Chromium	150,000	2.64	155.52	0.10%	158.16	0.11%
Chromium (VI)	-	0.53	155.52	-	156.05	-
Cobalt	-	-	155.52	-	-	-
Copper	200,000	8.88	155.52	0.08%	164.40	0.08%
Lead	-	16.76	155.52	-	172.28	-
Manganese	1,500,000	6.98	155.52	0.01%	162.50	0.01%
Nickel	-	2.86	155.52	-	158.38	-
Vanadium	1,000	3.50	155.52	15.55%	159.02	15.90%

Using the stage 1 screening methodology, the PEC for all metals, except vanadium, is less than 100% and so the short term impact of all metals can be screened out from further assessment. The PC for vanadium is greater than 10%, but the PEC is less than 16%. Therefore, even when taking into account any modelling uncertainty, it is expected that the PEC will remain below the EAL. It is therefore not necessary to progress short term vanadium emissions to the second stage of assessment.

8.7.2 Stage 2

The second stage of the assessment is to consider a worst case scenario based on currently operating plant, assuming each metal comprises 11% of the total group (i.e. a process contribution of 9.51 ng/m³ apportioned equally across the nine metals).

It is assumed for this worst case screening that the proportion of chromium (VI) to total chromium is 20% as suggested as a worst case by the Expert Panel on Air Quality Standards (EPAQS) paper on Metals and Metalloids.

The results of the second stage assessment are shown below. Any exceedences of the Environment Agency screening criteria are highlighted.

Table 8.4: Heavy Metal Screening Assessment - Step 2 – Long Term						
Metal	EAL (ng/m³)	Background Conc. (ng/m³)	Process Contribution		PEC	
			Conc. (ng/m³)	As % of EAL	Conc. (ng/m³)	As % of EAL
Arsenic	3.00	0.81	1.06	35.21%	1.87	62.21%
Chromium (VI)	0.20	0.26	1.06	528.10%	1.32	660.10%

As shown, although the PC for arsenic is greater than 1% as a worst case scenario, the PEC is well below 100% of the EAL. As such it is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution and progression to the third stage of assessment for emissions of arsenic is not necessary.

As shown, assuming the entire chromium emissions are in the hexavalent form (chromium VI), emissions cannot be screened out using the worst case scenario. Therefore, additional consideration has to be given to the assumptions used in assessing the impact of this pollutant.

8.7.3 Stage 3

The third stage of the assessment is to consider site specific assumptions.

Percentages lower than 11% of the IED ELV

The Facility will incorporate a flue gas treatment system to remove heavy metals from the gas stream. This flue gas treatment system is similar to that in use at other UK waste combustion facilities and, as such, we would expect the performance of the proposed flue gas treatment system to be as effective in removing heavy metals as the same system employed at a typical facility.

An analysis of monitoring of metal emissions from 10 Municipal Waste Incinerators in England and Wales is presented in Appendix B of "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012". This is reproduced in the following table.

Table 8.5: Monitoring Data from Municipal Waste Incinerators

Pollutant	Measured Concentration as % of IED Group 3 Limit		
	Mean	Max	Min
Antimony	0.66%	2.30%	0.02%
Arsenic	0.14%	0.60%	0.06%
Chromium	2.18%	10.42%	0.08%
Cobalt	0.08%	0.78%	0.04%
Copper	1.54%	3.26%	0.50%
Lead	3.16%	7.36%	0.06%
Manganese	3.44%	7.30%	0.30%
Nickel	4.40%	27.24%	0.00%
Tin	0.48%	0.48%	0.48%
Vanadium	0.06%	0.20%	0.04%
Total (calculated)	**16.14%**	**59.94%**	**1.58%**

NOTES:
Nickel concentration is greater than 11% is due to one single measurement outlier. The average is around 4% of the Group ELV.

As shown, the total chromium emissions are a maximum of 10.42% of the limit; this includes some contribution from chromium (VI).

The Environment Agency guidance also provides an analysis of chromium (VI). Due to the very small amounts of chromium (VI) emitted from municipal waste incinerators, this has been undertaken based on analysis of APC residues. This is reproduced in the following table.

Table 8.6: Chromium VI Analysis from APC Residues		
	Effective Cr(VI) Emission Concentration (mg/Nm³, 11% ref oxygen content	% of IED Limit for Total Metals
Mean	3.5×10^{-5}	0.0070%
Minimum	2.3×10^{-6}	0.0005%
Maximum	1.3×10^{-4}	0.0260%

As shown, the maximum chromium (VI) emissions are very low at 0.026% of the total Group ELV.

The Facility will process the same type of fuel as the plants considered within the Environment Agency guidance note and will include conventional gas clean up mechanisms. Therefore, it is appropriate to assume that the Facility would not have greater emissions of metals than the plants considered within the Environment Agency guidance note.

The results of the third stage assessment are presented in the following table, taking into account the likely emissions based on the maximum monitored concentrations from existing MSW incineration facilities. Any exceedences of the Environment Agency screening criteria are highlighted.

Table 8.7: Heavy Metal Screening Assessment - Step 3 – Long Term – Likely Emissions						
Metal	EAL (ng/m³)	Background Conc. (ng/m³)	Process Contribution		PEC	
			Conc. (ng/m³)	As % of EAL	Conc. (ng/m³)	As % of EAL
Chromium (VI)	0.20	0.26	1.24E-03	0.62%	0.27	132.62%

As shown, assuming the Facility performance will be similar to other UK waste incineration facilities, the PC is less than 1% of the EAL at the point of maximum impact. Therefore, there is little potential for significant pollution as a result of emissions of chromium (VI), even when taking likely modelling uncertainties into account.

8.7.4 Summary of metals screening

At the point of maximum impact the long term and short term impact of emissions of metals have been screened using the Environment Agency screening criteria, and it is considered that there is no risk of exceeding any EAL for these heavy metals as a result of emissions from the Facility.

9 Impact at Ecological Receptors

This section provides an assessment of the impact of the operation of the Facility at the identified ecological receptors.

9.1 Screening

The Environment Agency have produced Operational Instruction documents which explain how to assess aerial emissions from new or expanding Integrated Pollution Prevention and Control (IPPC) regulated industry applications, issued under the Environmental Permitting Regulations. The process to follow to satisfy the requirements of the Conservation of Habitats and Species Regulations 2010, Countryside and Rights of Way (CRoW) Act 2000, and the Environment Agency's wider duties under the Environment Act 1995 and the Natural Environment and Rural Communities Act 2006 (NERC06) is outlined.

Operational Instruction 67_12 "Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation" provides the following risk based screening criteria for nature conservation sites.

Table 9.1: Screening Criteria

Threshold	European Sites	SSSIs	NNR, LNR, LWS, ancient woodland
Y (% threshold long-term)	1	1	100
Y (% threshold short-term)	10	10	100
Z (% threshold)	70	70	100
NOTES: Short term considers both daily and weekly			

Where:

- Y is the long term process contribution calculated (PC) as a percentage of the relevant Critical Level or Load; and
- Z is the long term predicted environmental concentration (PEC) calculated as a percentage of the relevant Critical Level or Load.

Operational Instruction 66-12 states:

- If PC < Y% Critical Level and Load then emissions from the application are not significant, and
- If PEC < Z% Critical Level and Load it can be concluded 'no likely significant effect' (alone and in-combination).

AQTAG 17 – "Guidance on in combination assessments for aerial emissions from EPR permits" states that:

> *"Where the maximum process contribution (PC) at the European site(s) is less than the Stage 2 de-minimis threshold of the relevant critical level or load, the PC is considered to be inconsequential and there is no potential for an alone or in-combination effects with other plans and projects."*

Consultation with the Environment Agency has confirmed that the "Stage 2 de-minimis threshold" is the criteria outlined in Operational Instruction 67_12 outlined above.

9.2 Atmospheric emissions - Critical Levels

In addition to the objectives for the protection of human health, the AQS includes Critical Levels for the protection of ecosystems as presented in Table 3.3.

Predicted process contributions have been compared to the Critical Levels for the protection of ecosystems. Where the emissions of a particular pollutant are greater than 1% of the long term or 10% of the short term Critical Level, further assessment has been undertaken.

For the purpose of the ecological assessment the APIS mapped background dataset has been used.

9.3 Deposition of emissions – Critical Loads

The Air Pollution Information System (APIS) provides Critical Loads for nature conservation sites at risk from acidification and nitrogen deposition (eutrophication).

An assessment has been made for each habitat feature identified in APIS for the specific site. The search by location tool has been used to identify the feature habitats then the search by location tool to find the habitat specific Critical Load for the specific grid (i.e. the point of maximum impact with the designated site). If the impact of process emissions upon nitrogen or acid deposition is greater than 1% of the Critical Load, further assessment has been undertaken.

APIS does not include site specific Critical Loads for non-designated sites. In lieu of this the search by location function of APIS has been used. The Critical Loads are based on a broad habitat type and location.

9.3.1 Nitrogen deposition – eutrophication

A search has been undertaken on for each of the ecological receptors identified in Table 5.2. Appendix C summarises the Critical Loads for nitrogen deposition and background deposition rates as detailed in APIS for each habitat identified.

The impact of the Facility has been assessed against these Critical Loads for nitrogen deposition.

9.3.2 Acidification

The APIS Database contains a maximum critical load for sulphur (CLmax), a minimum critical load for nitrogen (CLminN) and a maximum critical load for nitrogen (CLmaxN). These components define the critical load function. Where the acid deposition flux falls within the area under the critical load function, no exceedences are predicted.

A search has been undertaken on for each of the ecological receptors identified in Table 5.2. Each site has a number of habitats, each with different Critical Loads. Appendix C summaries the Critical Loads for acidification and background deposition rates as detailed in APIS for each identified habitat.

The impact of the Facility has been assessed against these Critical Load functions. Where a critical load function for acid deposition is not available, the total nitrogen, sulphur and hydrogen chloride deposition has been presented and compared with the background concentration.

9.3.3 Calculation methodology – nitrogen deposition

The impact of deposition has been assessed using the methodology detailed within the Habitats Directive AQTAG 6 (March 2014). The steps to this method are as follows.

(1) Determine the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site.

(2) Calculate the dry deposition flux (µg/m^2/s) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 9.2.

(3) Convert the dry deposition flux into units of kgN/ha/yr using the conversion factors presented in Table 9.2.

(4) Compare this result to the nitrogen deposition Critical Load.

Table 9.2: Deposition Factors

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m^2/s to kg/ha/year)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0
Sulphur dioxide	0.0120	0.024	157.7
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

9.3.3.1 Acidification

Deposition of nitrogen, sulphur, hydrogen chloride and ammonia can cause acidification and should be taken into consideration when assessing the impact of the Facility.

The steps to determine the acid deposition flux are as follows.

(1) Determine the dry deposition rate in kg/ha/yr of nitrogen, sulphur, hydrogen chloride and ammonia using the methodology outlined in Section 9.3.3.

(2) Apply the conversion factor for N outlined in Table 9.3 to the nitrogen and ammonia deposition rate in kg/ha/year to determine the total keq N/ha/year.

(3) Apply the conversion factor for S to the sulphur deposition rate in kg/ha/year to determine the total keq S/ha/year.

(4) Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the dry keq Cl/ha/year.

(5) Determine the wet deposition rate of HCl in kg/ha/yr by multiplying the model output by the factors presented in Table 9.2.

(6) Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the wet keq Cl/ha/year.

(7) Add the contribution from S to HCl dry and wet and treat this sum as the total contribution from S.

(8) Plot the results against the Critical Load functions.

The March 2014 version of the AQTAG 6 document states that, for installations with an HCl emission, the process contribution of HCl, in addition to S and N, should be considered in the acidity Critical Load assessment. The H^+ from HCl should be added to the S contribution (and treated as S in the APIS tool). This should include the contribution of HCl from wet deposition.

Consultation with AQMAU confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. When modelling wet deposition the “falling drop” method has been used which includes plume depletion. The initial pH for droplets above the plume was selected as 5.6.

Table 9.3: Conversion Factors	
Pollutant	**Conversion Factor (kg/ha/year to keq/ha/year)**
Nitrogen	Divide by 14
Sulphur	Divide by 16
Hydrogen chloride	Divide by 35.5

The process contribution has been calculated using the APIS formula:

Where PEC N Deposition < CLminN:

PC as % of CL function = PC S deposition / CLmaxS

Where PEC N Deposition > CLminN:

PC as % of CL function = (PC S + N deposition) / CLmaxN

9.4 Results – statutory designated sites – emissions

No statutory designated sites have been identified within the Environment Agency H1 screening distance.

9.5 Results – non-statutory designated sites – emissions

As identified in Section 5.2, there are a number of non-statutory designated sites within 2km of the Facility. The impact of emissions at these locally designated sites has been quantified and the results compared against the Critical Levels presented in Table 3.3. The highest predicted process contributions to ground level concentrations at the identified ecological receptors are presented in Table 9.4.

As shown the PC is not predicted to exceed the Critical Level at any of the locally-designated sites. Therefore, emissions from the Facility at locally designated sites are not significant. Plot files of the maximum process concentration over the 5 years of weather data and a figure showing the location of ecological receptors is provided in Appendix A.

Table 9.4: Impact of Emissions at Non-Statutory Designated Sensitive Ecological Receptors												
Site	**Oxides of Nitrogen**				**Sulphur Dioxide**		**Hydrogen Fluoride**				**Ammonia**	
	Daily		**Annual**		**Annual**		**Daily**		**Weekly**		**Annual**	
	Conc. μg/m³	**As % of CL**	**Conc. μg/m³**	**As % of CL**	**Conc. μg/m³**	**As % of CL**	**Conc. ng/m³**	**As % of CL**	**Conc. ng/m³**	**As % of CL**	**Conc. ng/m³**	**As % of CL**
Critical Level	**75**	**-**	**30**	**-**	**20**	**-**	**5**	**-**	**0.5**	**-**	**3**	**-**
Non-statutory designated sites (within 2km)												
Blackwater Plantation	7.85	10.46%	0.58	1.94%	0.15	0.75%	38.48	0.77%	13.73	2.75%	28.54	0.95%
Storeys Wood	26.38	35.18%	1.15	3.84%	0.30	1.49%	129.34	2.59%	32.70	6.54%	56.52	1.88%
Maxey's Spring	18.01	24.01%	0.78	2.60%	0.20	1.01%	88.27	1.77%	24.87	4.97%	38.30	1.28%
Upney Wood	11.67	15.56%	1.00	3.35%	0.26	1.30%	57.20	1.14%	16.35	3.27%	49.25	1.64%
Link's Wood	7.48	9.98%	0.28	0.92%	0.07	0.36%	36.68	0.73%	11.81	2.36%	13.56	0.45%
Park House Meadow	4.79	6.39%	0.27	0.89%	0.07	0.35%	23.48	0.47%	7.01	1.40%	13.11	0.44%
Screening Criteria	-	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**

9.6 Results – non statutory designated sites – deposition

APIS does not include site specific Critical Loads for non-statutory designated sites. In lieu of this the search-by-location function of APIS has been used. The broad habitat type has been assumed.

The highest predicted levels of nitrogen and acid deposition are presented in Appendix D. Where process contributions are greater than 100%, or the PEC is greater than 100% of the Critical Load these are highlighted.

The maximum nitrogen deposition PC at a non-statutory designated site is predicted to be 6.73% and the maximum acid deposition is predicted to be 35.61% of the respective Lower Critical Loads. Therefore, the impact of emissions from the Facility at locally designated sites is not significant.

9.7 Summary of impact at ecological receptors

As a result of the habitats screening exercise a number of ecologically sensitive sites were identified which needed considering within the Air Quality Assessment. A summary of the impact at each site is provided below:

No European or UK designated sites have been identified as requiring consideration within this air quality assessment.

A number of non-statutory designated sites have been identified within 2km of the Facility. APIS does not include site specific Critical Loads for non-statutory designated sites. In lieu of this the search-by-location function of APIS has been used. The broad habitat type has been assumed. The assessment has concluded that emissions are not significant. This conclusion has been drawn because the PC is less than 100% of the Critical Level or Load.

10 Odour Assessment

An Odour Management Plan has been developed for the Environmental Permit application. This shows that there will be a building ventilation system to manage odorous emissions from the CHP plant bunker, the pulp plant, the AD plant, the MRF and MBT plant. Odorous air will either be used as combustion air or be vented to atmosphere via the main stack following treatment within the AD biofilter. The following section details the impact of the odorous emissions from the AD biofilter.

10.1 Evaluation Criteria

There is no specific legislation regarding acceptable or unacceptable odour levels. The primary means of regulation is through the concept of Statutory Nuisance under Part III of the Environmental Protection Act 1990 and under the Environmental Permitting Regulations, where odour is a type of pollution to be regulated. In both cases, the objective of regulation is to ensure that there is no cause for annoyance.

Odours are characterised in terms of European odour units, OU, and odour concentrations, OU_E/m^3.

- The OU strength of a release is the number of times the mixture must be diluted, at standard temperature and pressure, to reach the detection limit. A release of 1 OU can be detected by half of the members of an olfactory panel.
- One OU_E is the mass of a pollutant that, when evaporated into 1 m^3 of odourless gas, has the same odour nuisance as 1 OU of reference odorant.

The Environment Agency have published a guidance note on odour assessment, entitled Technical Guidance Note H4. In Appendix 4 to Part 1 of this document, the Environment Agency recommends some indicative odour exposure criteria for ground level concentrations of mixtures of odorant, below which there would be "no reasonable cause for annoyance". For "highly offensive odours", including those from activities involving putrescible waste, the criterion is 1.5 ouE/m^3 as the 98th percentile of hourly averages. This has been used as the evaluation criterion for the odour assessment.

10.2 Methodology

The detailed flue gas dispersion modelling was carried out using the computer model ADMS 5.1, as for the main dispersion modelling. For odour modelling, it is assumed that the odour is caused by a substance which disperses in the atmosphere, in the same way that any other pollutant (such as dust or sulphur dioxide) disperses.

10.3 Results

The highest predicted odour concentrations from the AD biofilter are shown in the following table. As with the combustion emissions the buoyancy of the AD biofilter odour emissions will be increased when it is released with the other warmer emissions sources such as the CHP and the AD gas engines. Therefore this analysis has considered normal operations when all items of plant are operating and any scenario in which only the AD biofilter is operating.

Table 10.1: Summary of Impact of Plume Visibility Operating Scenarios		
Weather data year	Maximum 98th %ile 1-hour Odour (OU_E/m^3)	
	Normal Operations	Only AD Biofilter Operating
2009	0.26	1.09
2010	0.23	1.13
2011	0.28	1.06
2012	0.26	1.08
2013	0.26	1.01
Max all years	0.28	1.13

NOTES:
Normal operations assumes all plant operates and the exhaust from the pulp plant is emitted at 30°C.

As shown under normal operations the other sources provide additional buoyancy to the emissions from the biofilter promoting dispersion. In both cases the 98th percentile of odour concentrations at the point of maximum impact is less than 1.5 OU_E/m^3. Therefore, it can be concluded that there would be "no reasonable cause for annoyance" from odour from the proposed operation of the AD biofilter under normal or abnormal operations.

11 Plume Visibility

Planning permission was granted on 02 March 2010 by the Secretary of State for an Integrated Waste Management Facility at Rivenhall Airfield, Essex, C5 9DF, in accordance with application reference ESS/37/08/BTE, dated 28 August 2008. This was subject to a number of conditions including condition 17 which states:

> *"No development shall commence until a management plan for the CHP plant to ensure there is no visible plume from the stack has been submitted to and approved in writing by the Waste Planning Authority. The development shall be implemented in accordance with the approved plan."*

An amendment to the planning permission was granted on 26 March 2015 (ref: ESS/55/14/BTE). This included the same condition relating to the requirement to submit a management plan. A CHP Management Plan for Plume Abatement has been developed to discharge the above planning condition (document ref: S1552-0700-0008RSF). This is supported by a Plume Visibility Analysis report.

A feedforward mechanism will be used to adjust the temperature of the exhaust air from the pulp plant based on a set of meteorological parameters. These parameters have been determined based on the results of the dispersion model.

The following four operating conditions will be implemented for the emissions from the pulp plant:

(1) June to September – no additional heating – release at 30°C

(2) October to May – heating using low pressure steam – release at 130°C

(3) October to May – additional heating using high pressure steam – release at 210°C when the ambient temperatures is less than 4°C, wind speed is less than 9 m/s and the relative humidity is greater than 70%.

(4) October to May – additional heating using high pressure steam – release at 260°C when the ambient temperature is less than -1°C, wind speed is less than 8 m/s and the relative humidity is greater than 83%.

The implementation of the above operating regimes will impact upon the buoyancy of the emissions and thus the impact of emissions at ground level. As the mixed exhaust air from the pulp plant is heated additional buoyancy will be provided aiding the dispersion of pollutants. The following table presents a summary of the maximum impact of process emissions of nitrogen dioxide for each scenario (the model inputs are taken from the CHP Management Plan for Plume Management (document ref: S1552-0700-0008RSF).

Table 11.1: Summary of Impact of Plume Visibility Operating Scenarios

Operating scenario	Process Contribution (µg/m^3) at point of maximum impact	
	Annual Mean	Max 1-hour
1	2.71	61.59
2	2.25	54.76
3	1.94	50.62
4	1.82	48.53

NOTES:
Analysis based on 2009 weather data

As shown the implementation of the heating of the exhaust from the pulp plant increases buoyancy and reduces the ground level impact of emissions. Therefore the results presented in this Dispersion Modelling Report are still valid, and in fact are overly conservative, when the CHP Management Plan for Plume Abatement is implemented.

12 Flare

The operation of the flare has not been implicitly modelled as part of this Dispersion Modelling Assessment for the following reasons:

(1) The gas system has been designed such that the auxiliary flare will only be used for short periods of time during maintenance of gas engines.

(2) The Standard Rules Permit SR2010No15 for anaerobic digestion plants does not set emission limits for an auxiliary gas flare that is to be used infrequently.

(3) The auxiliary gas flare will be designed to meet the requirements for landfill gas flares (which state that the flue gas must be maintained at or above 1,000°C for at least 0.3 seconds).

(4) The emissions from the gas engines have been overestimated, as the period of maintenance and breakdown has not been taken into account when calculating the annual average ground level concentrations.

13 Conclusions

This Dispersion Modelling Assessment has been undertaken to support the Environmental Permit and updated planning application for the Rivenhall Integrated Waste Management Facility.

This assessment has included a review of baseline pollution levels, dispersion modelling of emissions and determination of the significance of the impact of these emissions on local air quality.

(1) The review of background monitoring data and DEFRA modelled data has been undertaken to determine the most suitable concentrations for use in the assessment. Where background monitoring is available this has been used in preference to modelled data.

(2) The methodology used in the assessment of the impact on air quality of the proposals uses a number of conservative assumptions. These include the following:

   a) The Facility will be applying BAT for the control of emissions and comply with the emission limits outlined in the IED for a waste incineration plant;

   b) It is assumed that the Facility will continually operate at the proposed limits whereas, in practice, this will not be the case and actual emissions will be less than the limits;

   c) It has been assumed that all items of plant operate concurrently at the short term emission limit values when determining short term impact to ensure the worst-case is accounted for where all items could be operating during adverse meteorological conditions for dispersion;

   d) It has been assumed that all items of plant operate concurrently at the daily emission limit values when determining long term impacts; and

   e) The maximum ground level concentrations are considered in each case. These concentrations occur in small areas; in general, the concentration will be much lower.

(3) In relation to the impact on ecologically sensitive sites, it has been assumed that all items of plant operate at the emission limits for the entire year as a worst-case. Even with this highly conservative assumption we conclude that:

   a) No UK or European designated sites have been identified within the H1 screening distance, and have not been considered in this assessment.

   b) At all locally designated sites emissions are not likely to have a significant impact.

In summary, the proposed Facility would not have a significant impact on local air quality, the general population or the local community.

Appendix A - Figures

Figure 1: Site Location and Human Sensitive Receptors

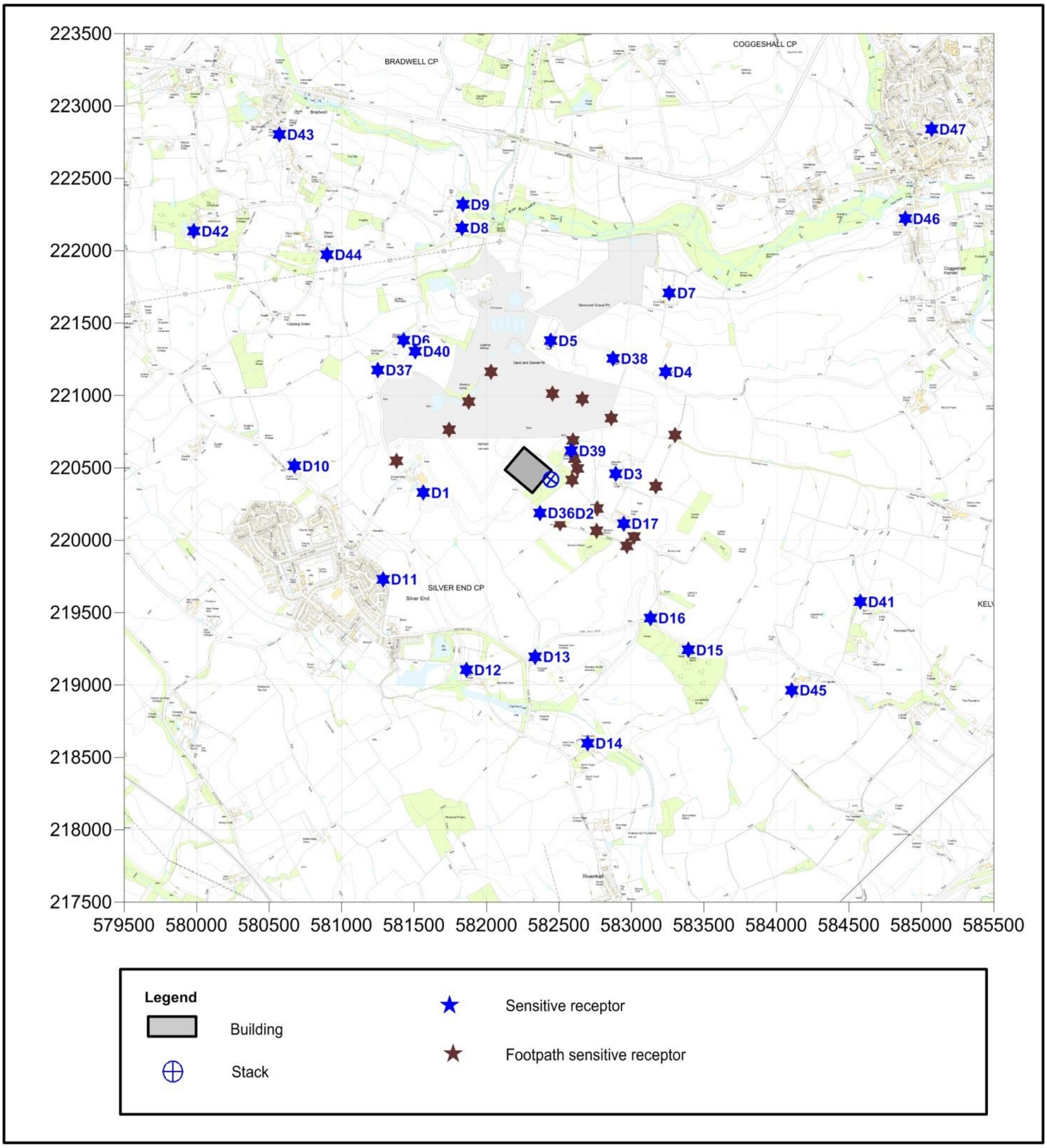


Figure 2: Sensitive Ecological Receptors

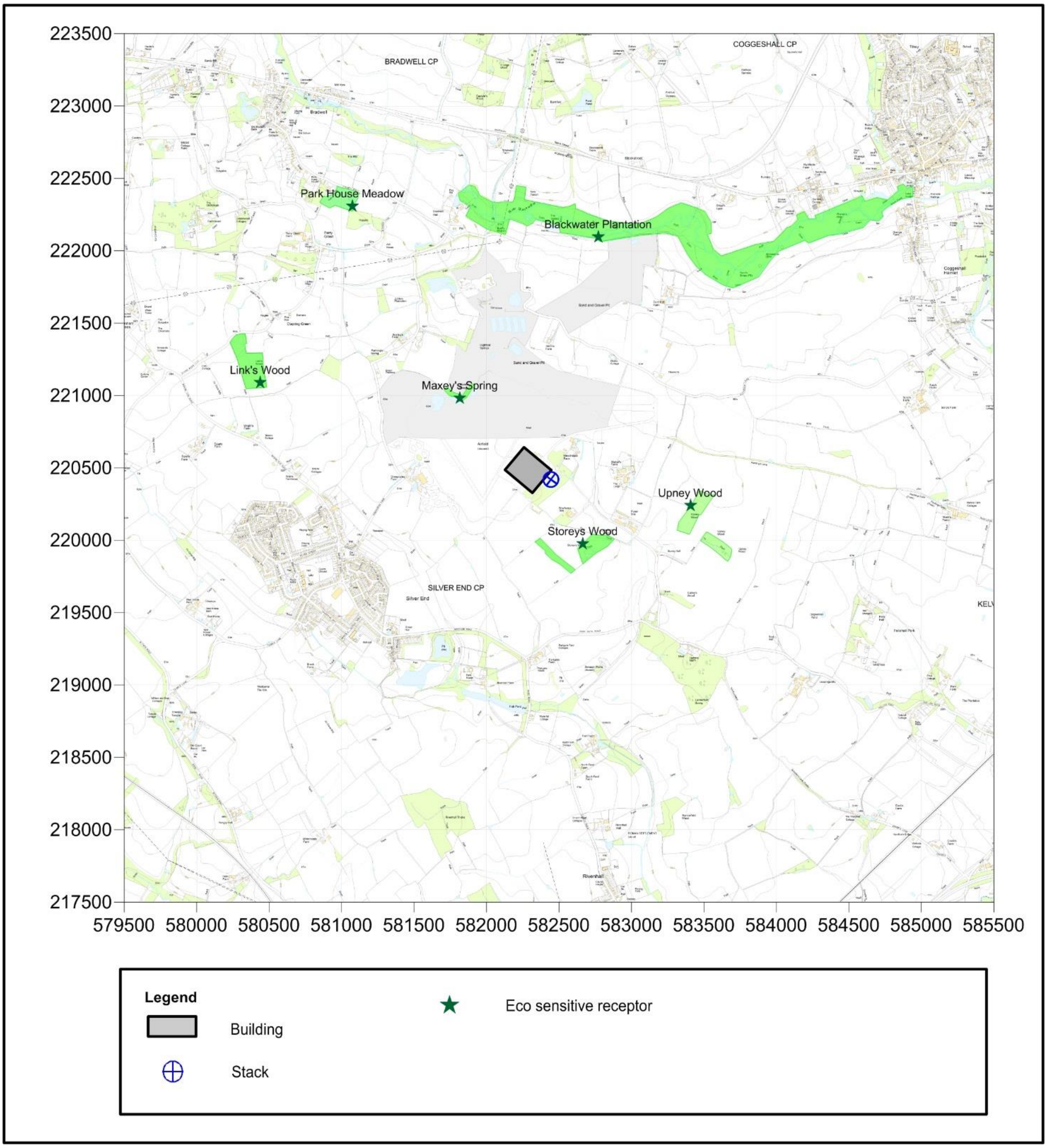
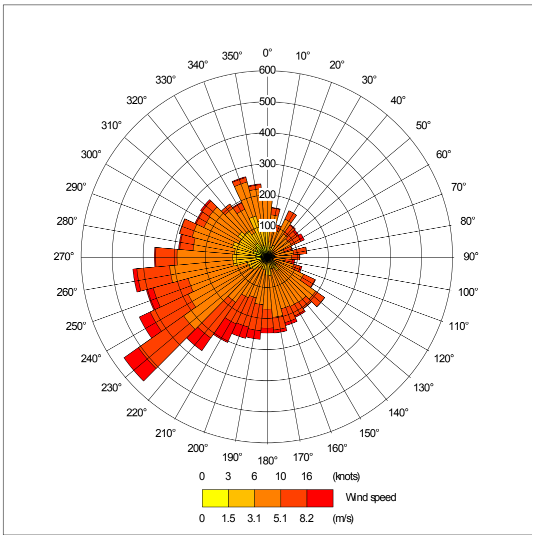
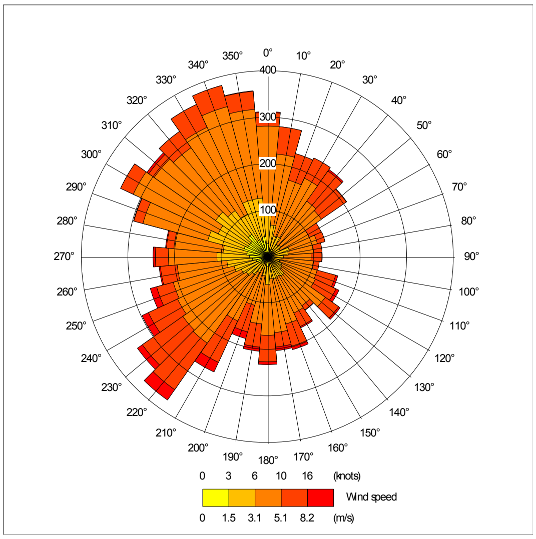


Figure 3: Wind Roses

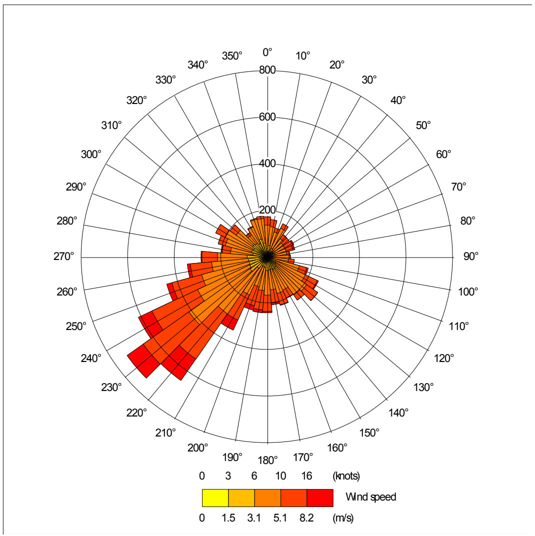
Stansted Airport 2009



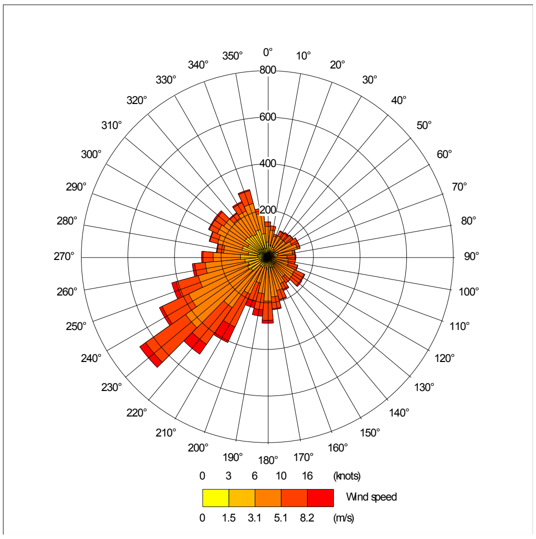
Stansted Airport 2010



Stansted Airport 2011



Stansted Airport 2012



Stansted Airport 2013

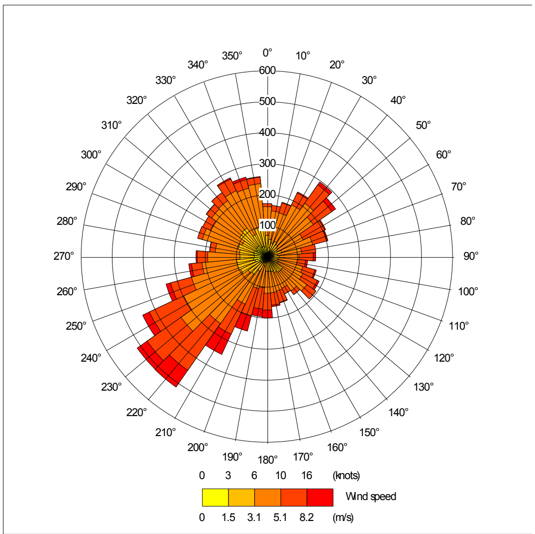


Figure 4: Building Layout

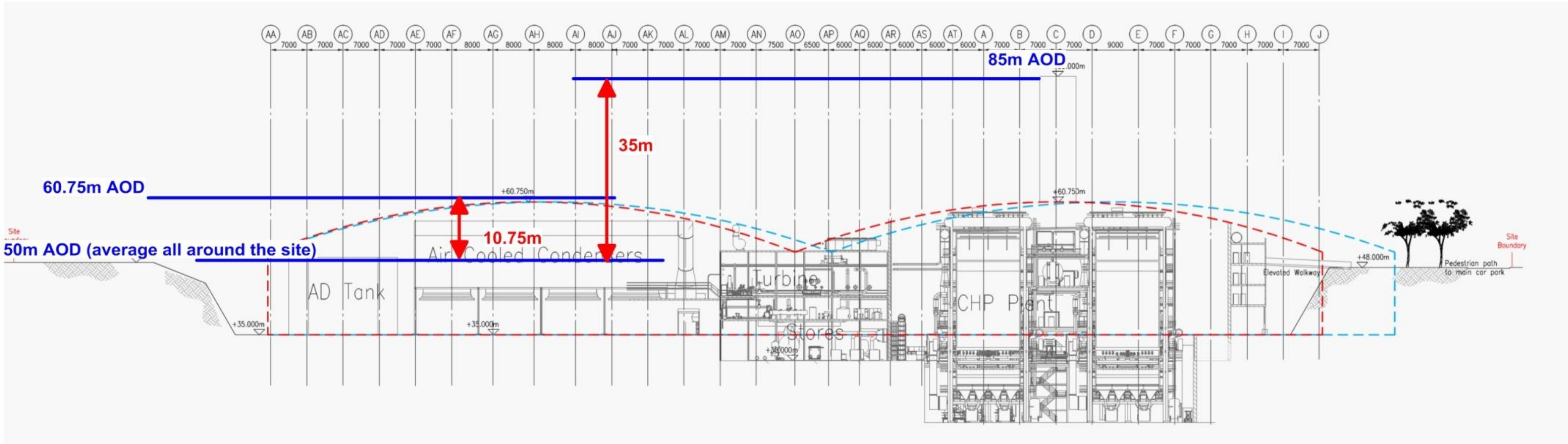


Figure 5: Site, Modelling Domain and Terrain Extents

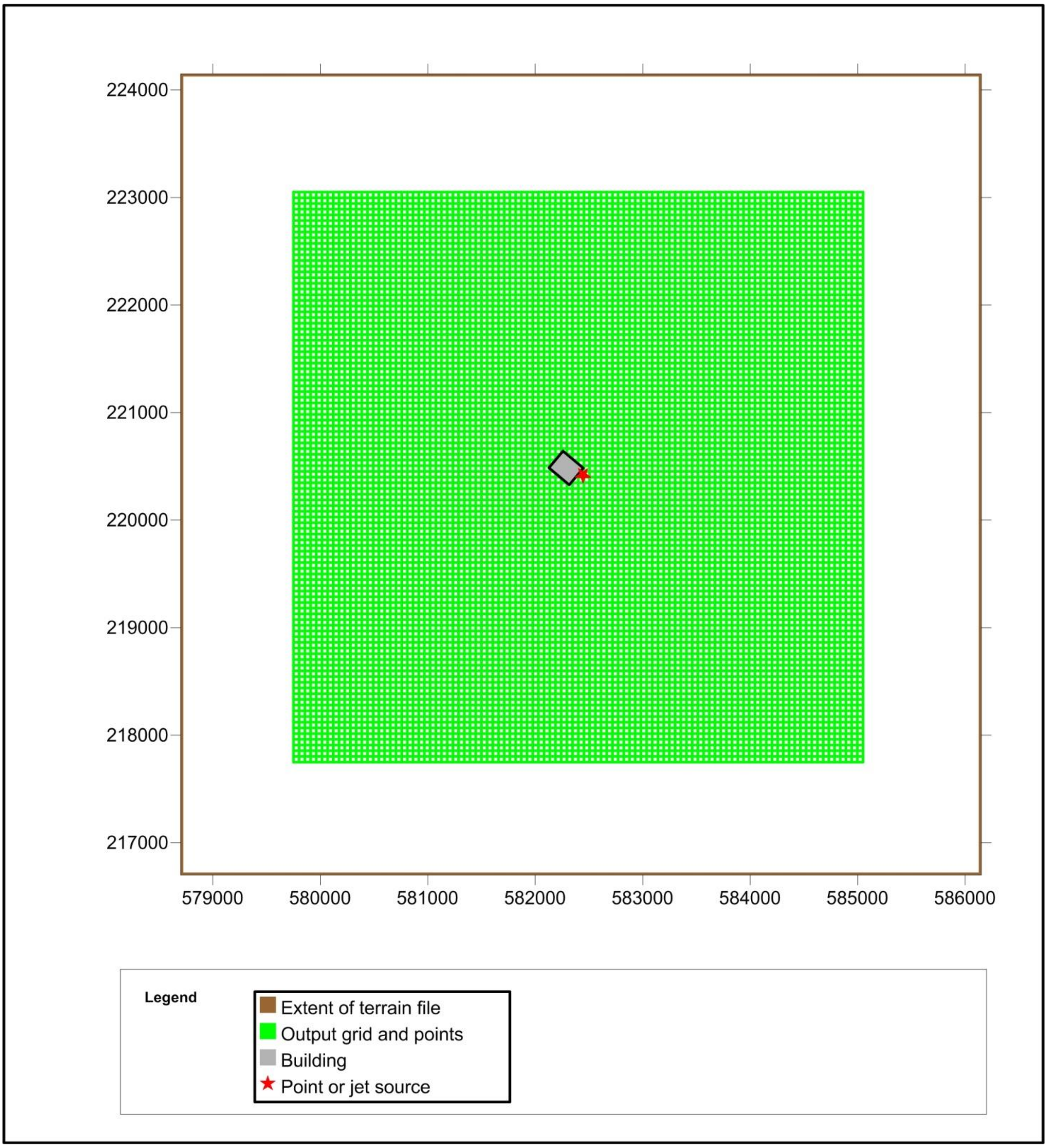
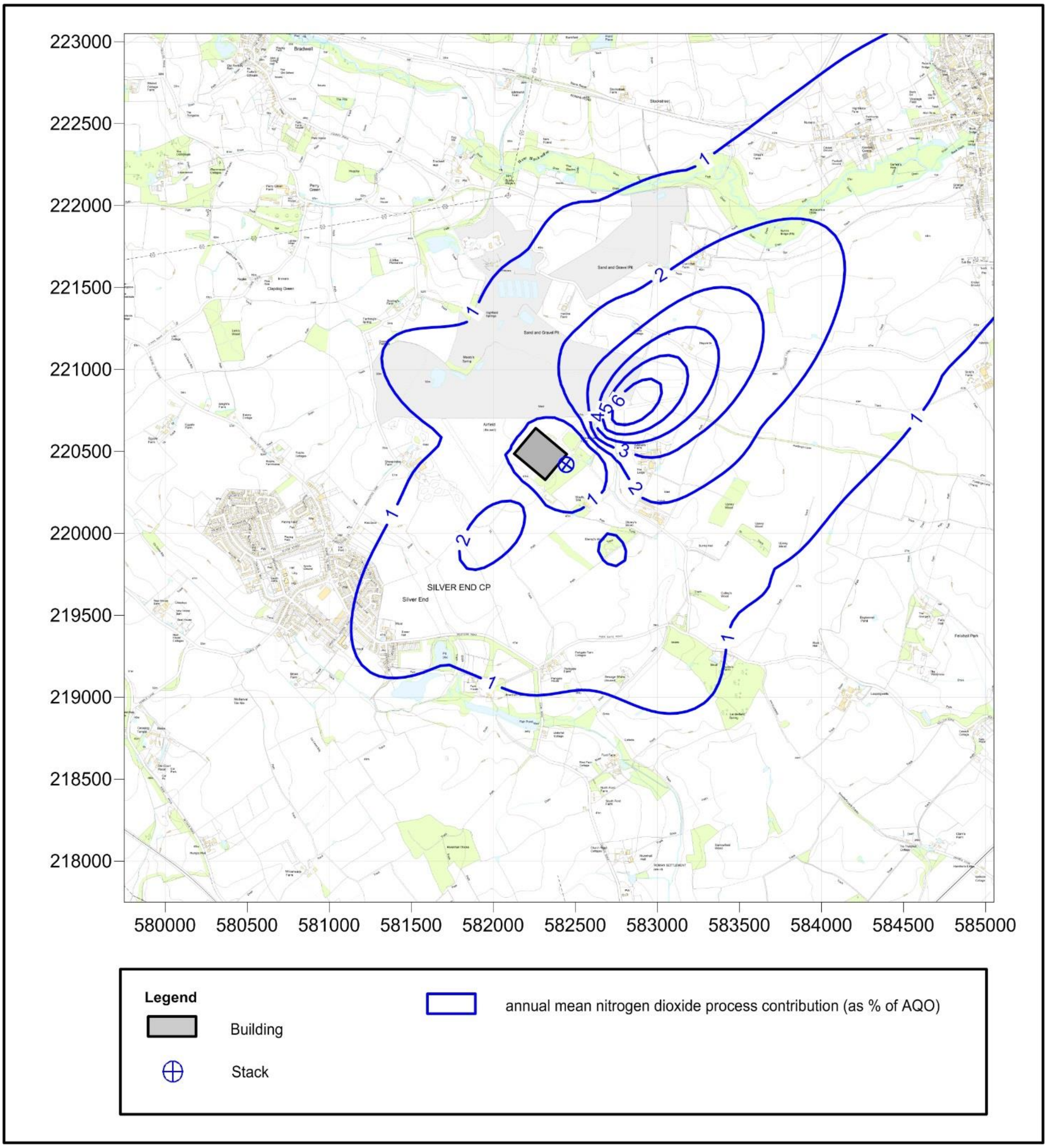
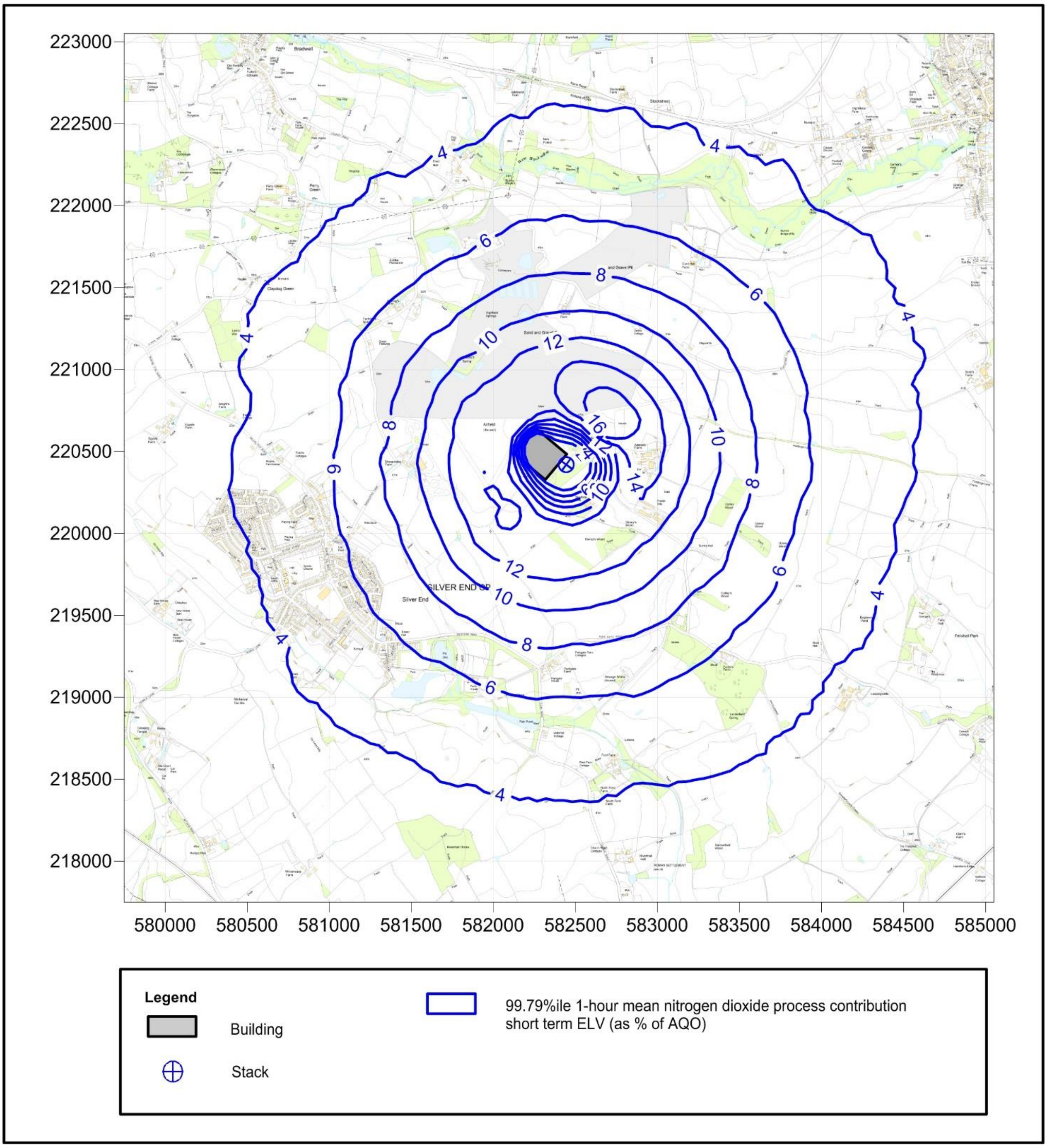


Figure 6: Annual Mean Nitrogen Dioxide Process Contribution (as a % of AQO) – Max All Years



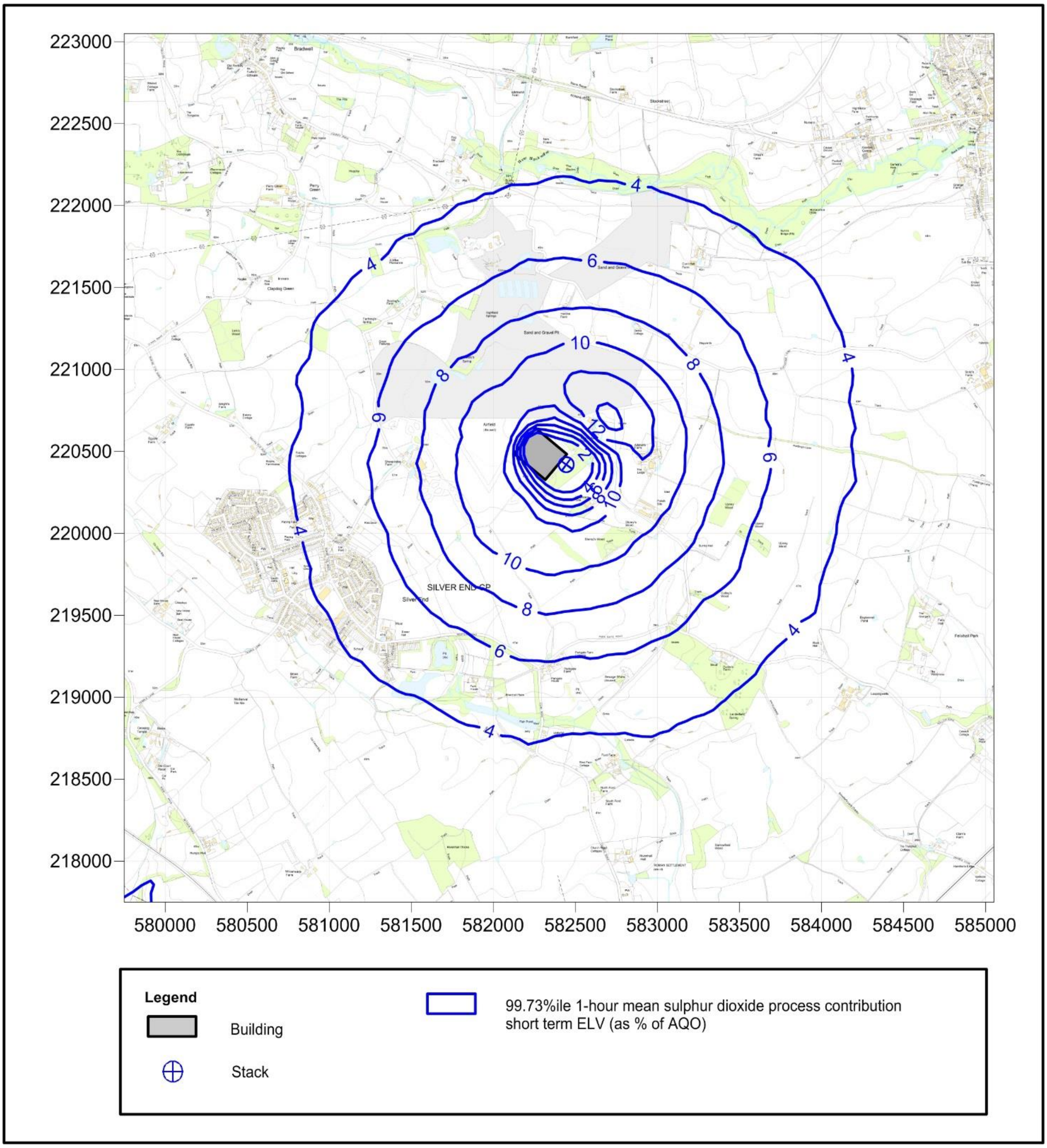
Assumes 100% operation of the all items of plant.

Figure 7: 99.79%ile 1-hour Mean Nitrogen Dioxide Process Contribution (as a % of AQO) – Max All Years



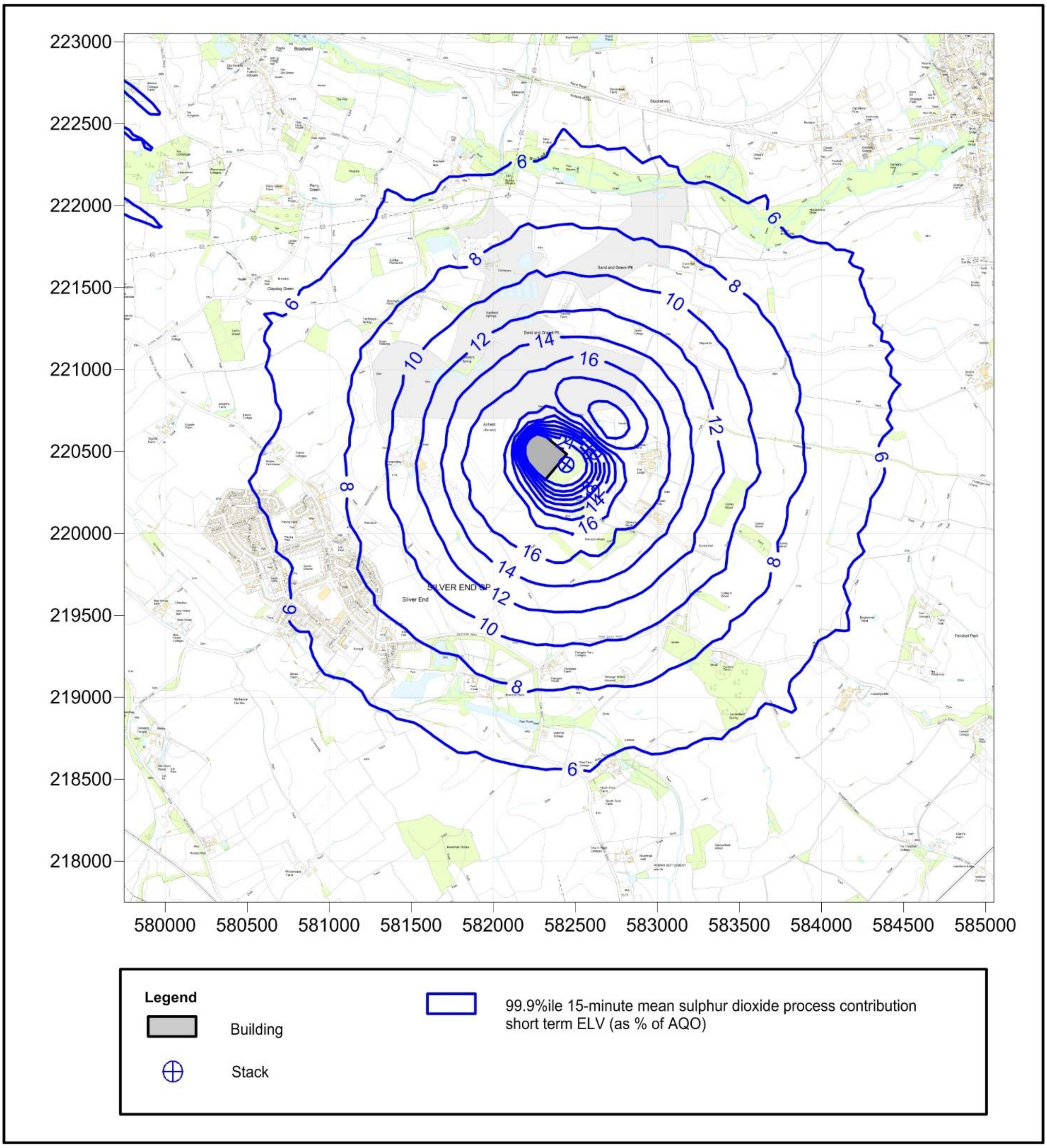
Assumes 100% operation of the all items of plant at the short term ELVs.

Figure 8: 99.73%ile 1-hour Mean Sulphur Dioxide Process Contribution (as a % of AQO) – Max All Years



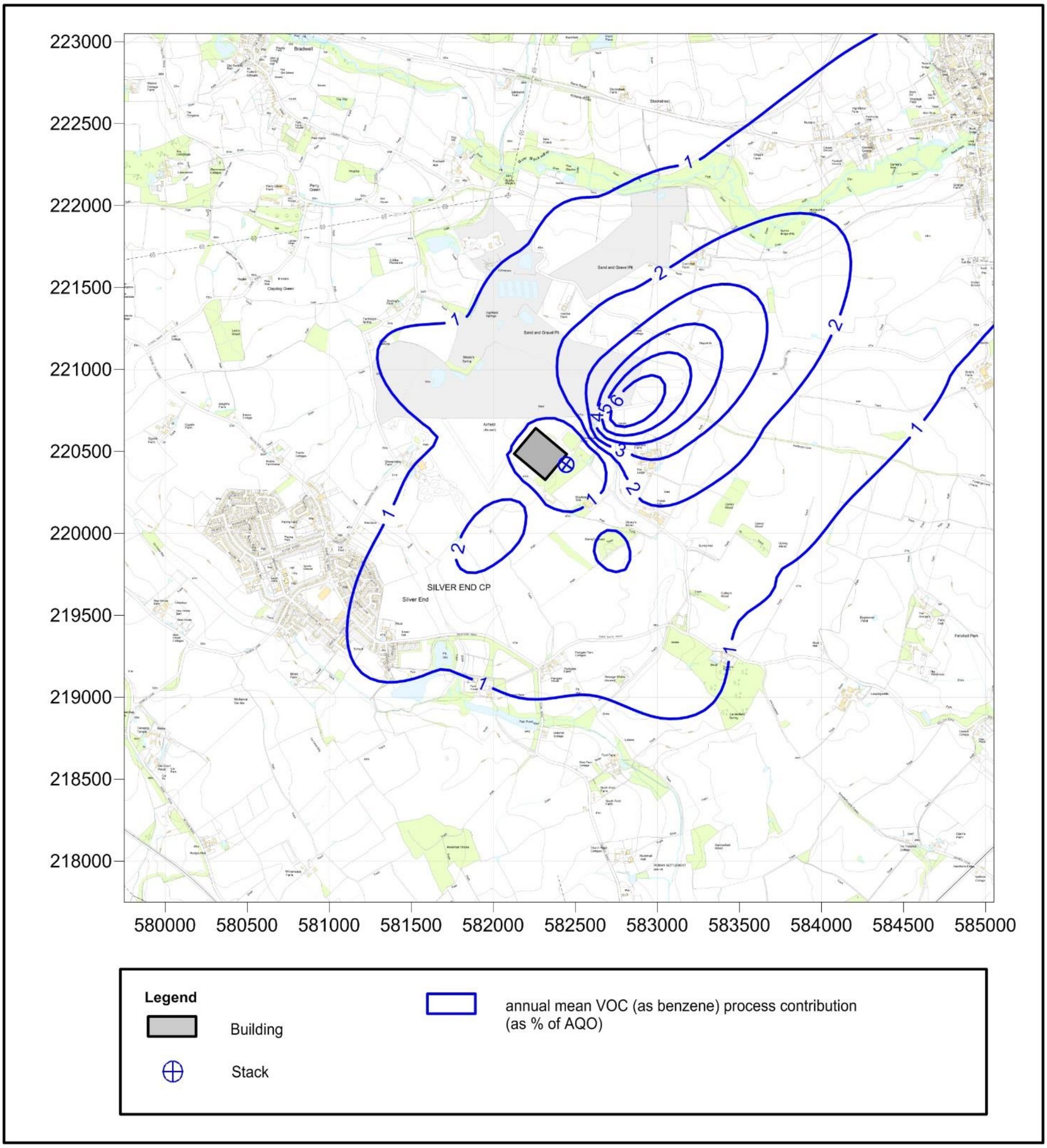
Assumes 100% operation of the all items of plant at the short term ELVs.

Figure 9: 99.9%ile 15-minute Mean Sulphur Dioxide Process Contribution (as a % of AQO) – Max All Years



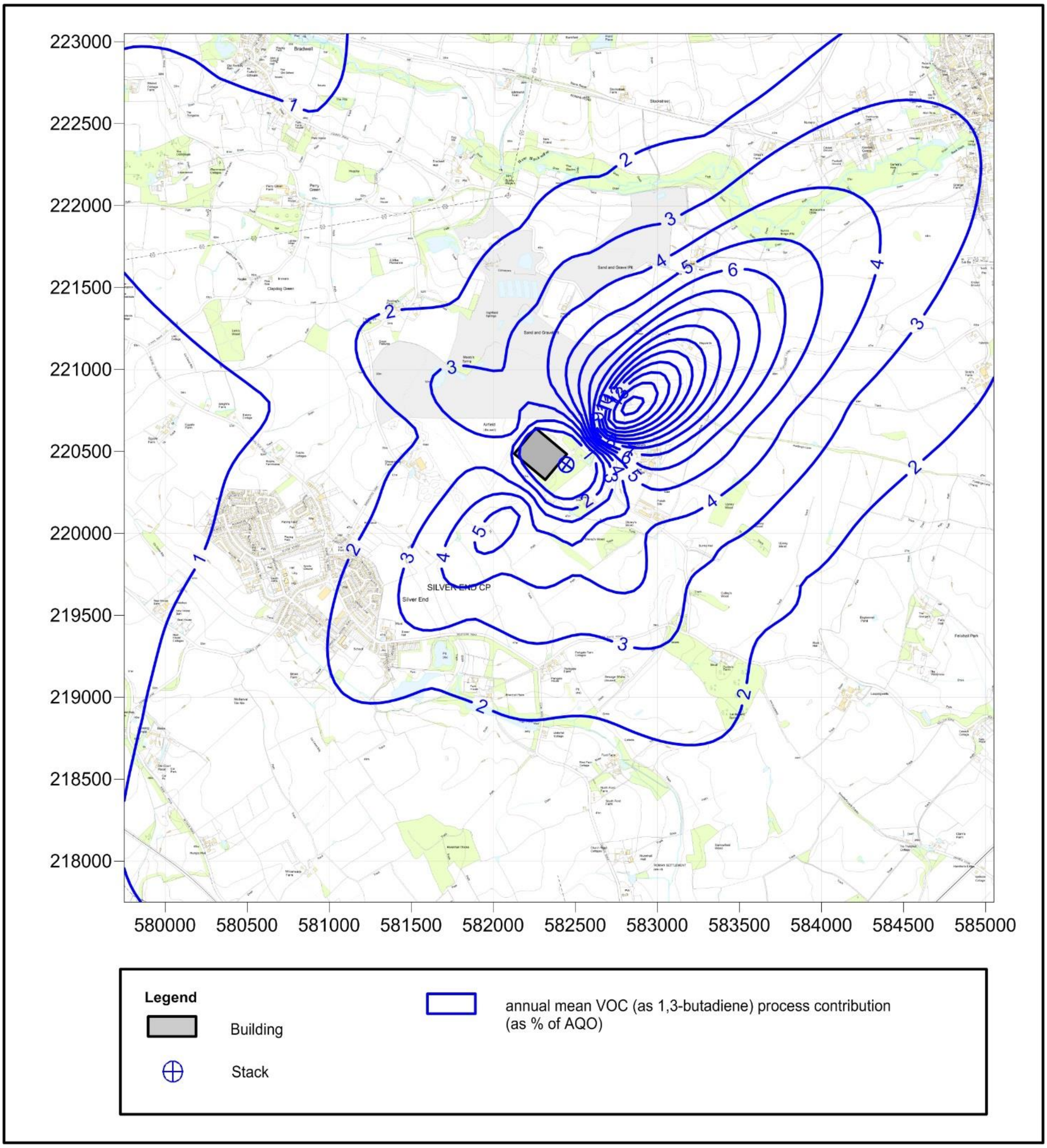
Assumes 100% operation of the all items of plant at the short term ELVs.

Figure 10: Annual Mean VOCs (as benzene) Process Contribution (as a % of AQO) – Max All Years



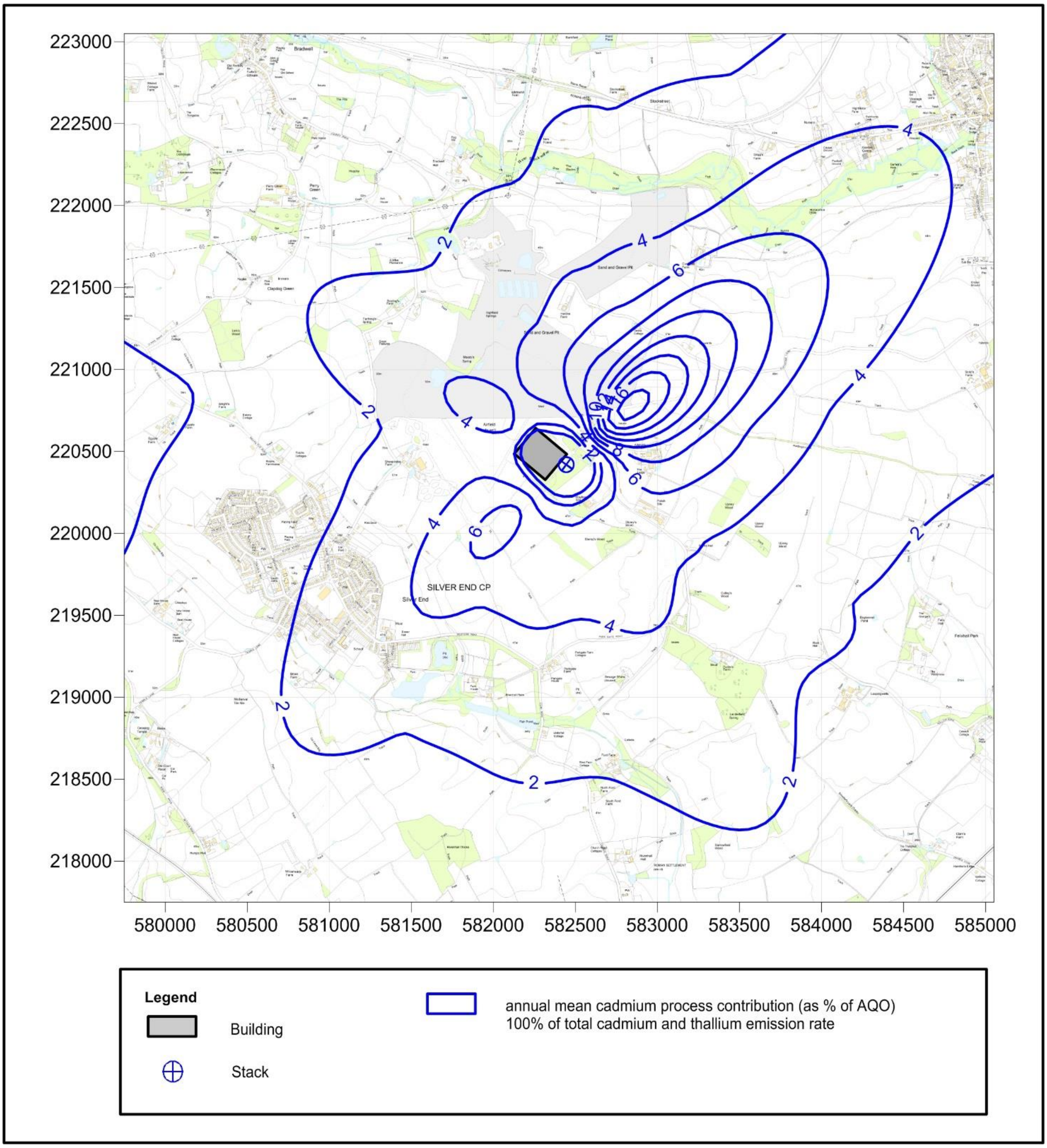
Assumes 100% operation of the all items of plant.

Figure 11: Annual Mean VOCs (as 1,3-butadiene) Process Contribution (as a % of AQO) – Max All Years



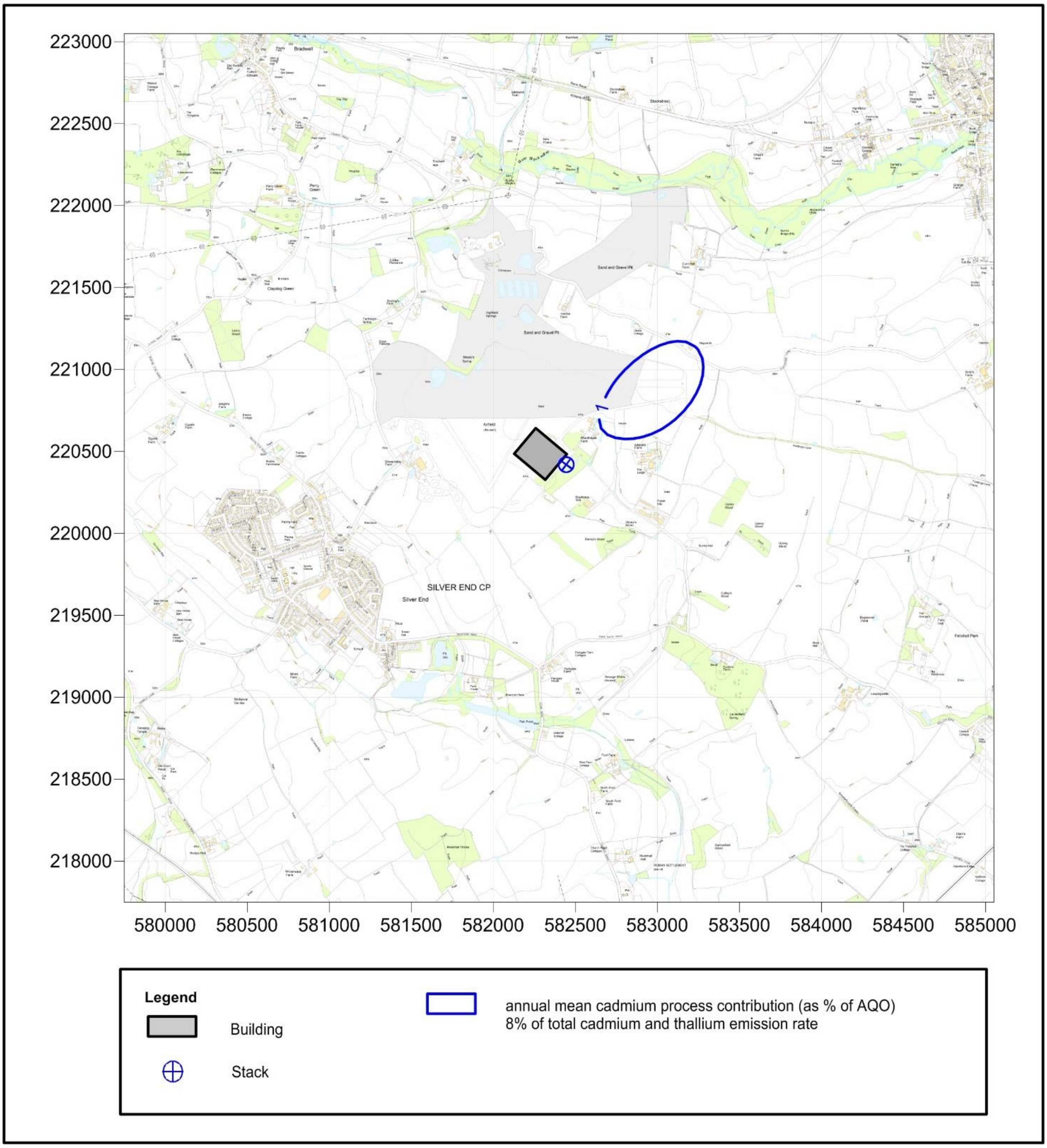
Assumes 100% operation of the all items of plant.

Figure 12: Annual Mean Cadmium Process Contribution (as a % of AQO) – Max All Years



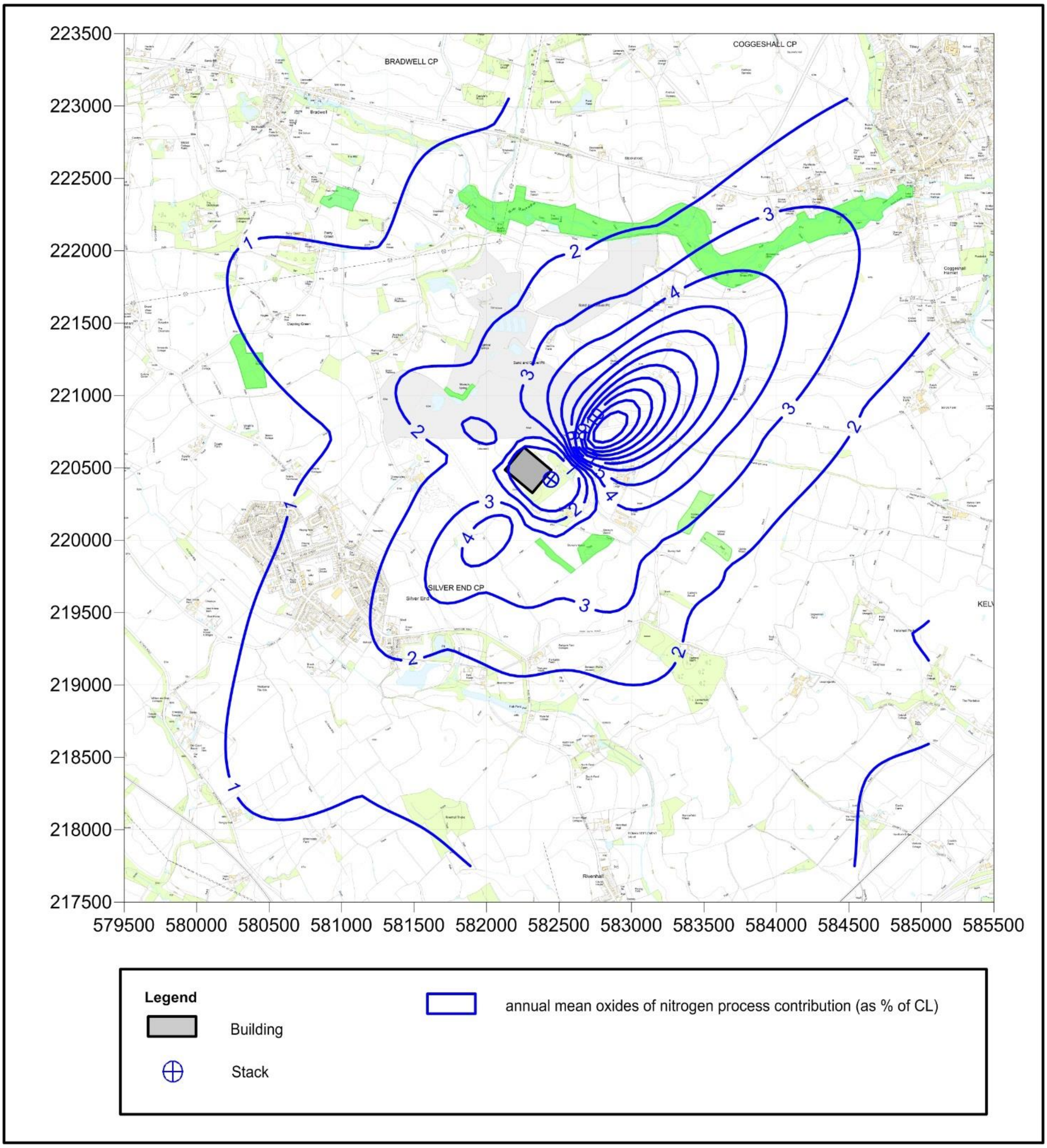
Assumes emissions of Cadmium are 100% of the combined cadmium and thallium ELV.

Figure 13: Annual Mean Cadmium Process Contribution (as a % of AQO) – Max All Years



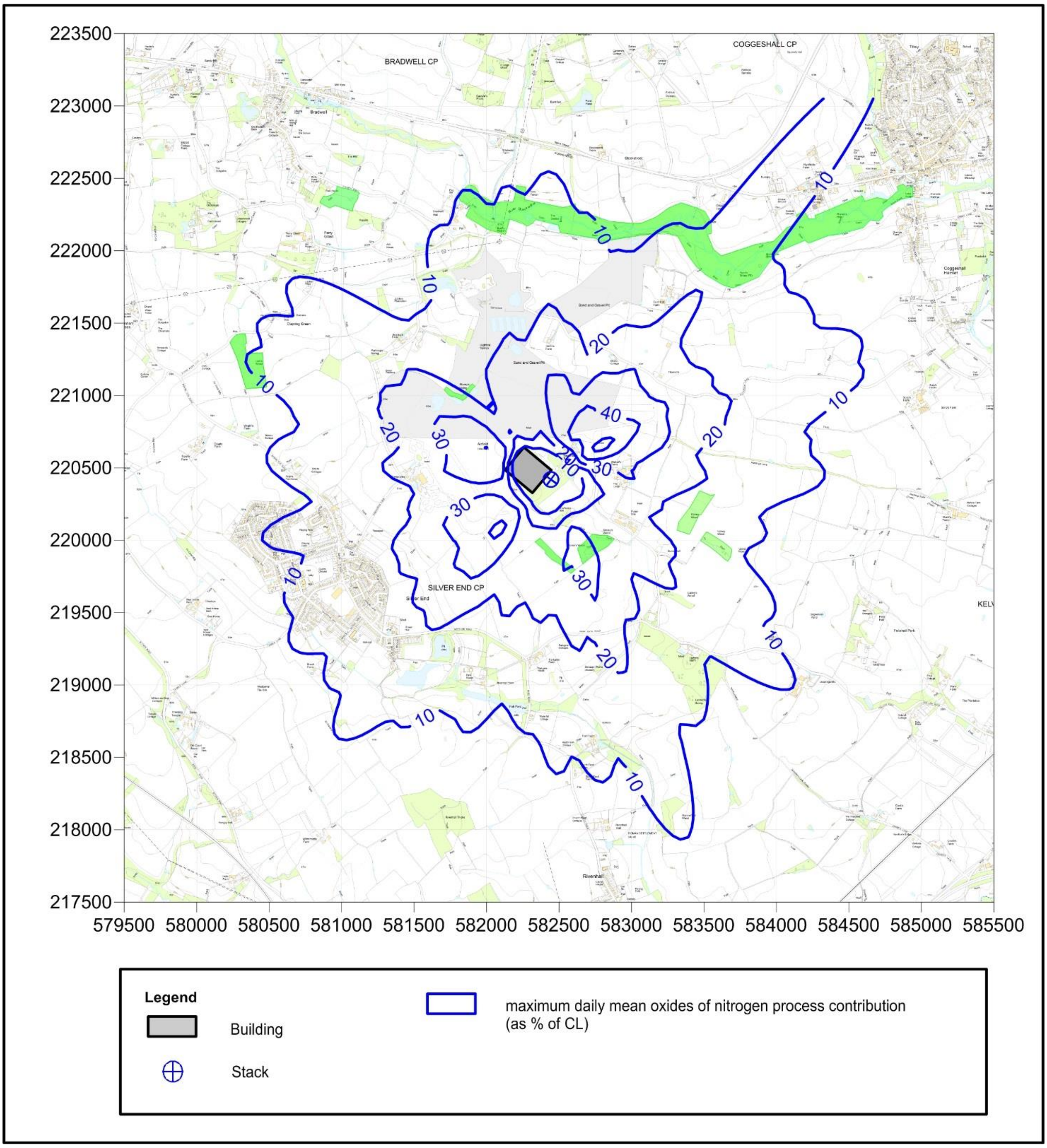
Assumes emissions of Cadmium are 8% of the combined cadmium and thallium ELV.

Figure 14: Annual Mean Oxides of Nitrogen Process Contribution (as a % of CL) – Max All Years



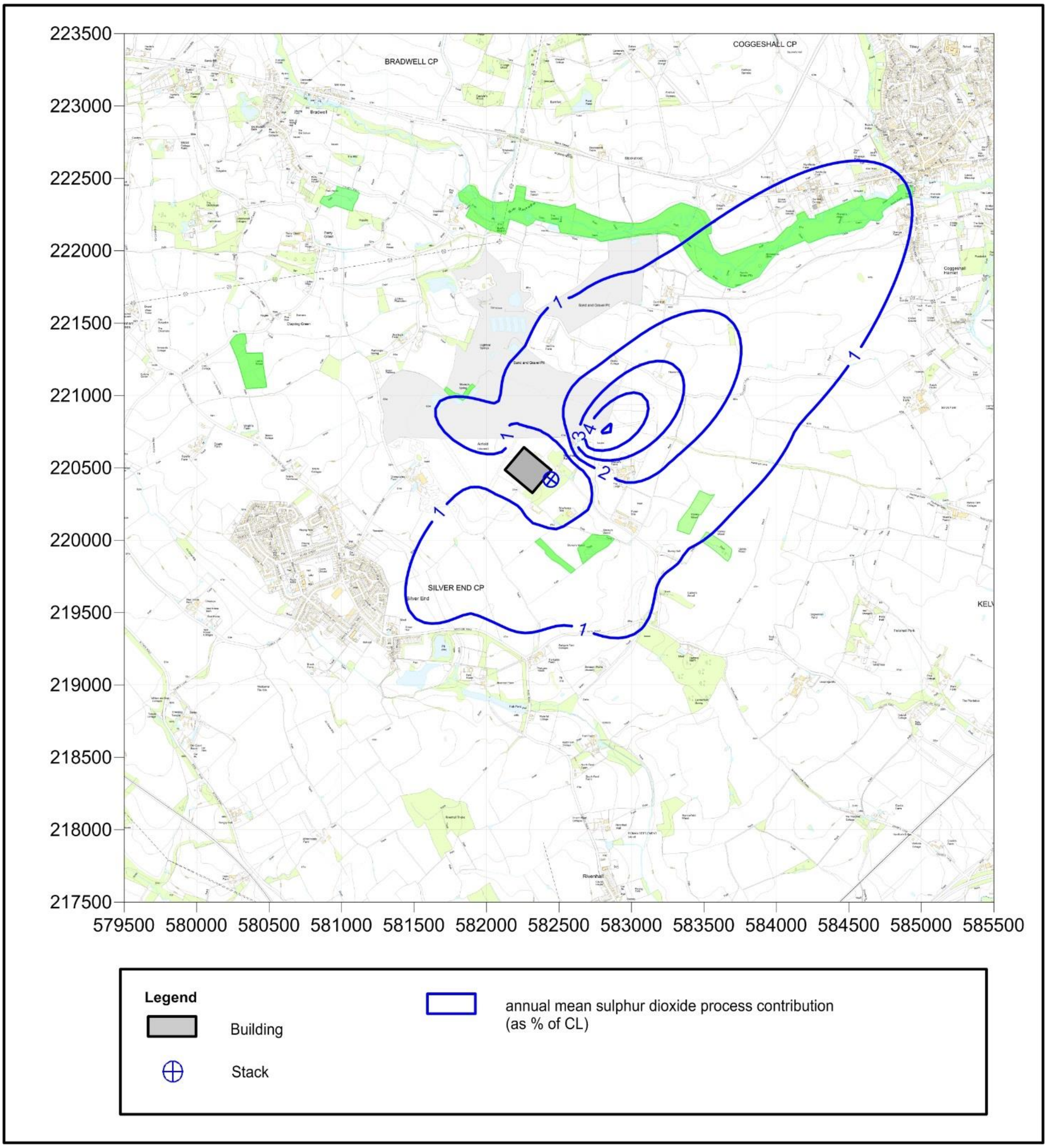
Assumes 100% operation of the all items of plant.

Figure 15: Max Daily Mean Oxides of Nitrogen Process Contribution (as a % of CL) – Max All Years



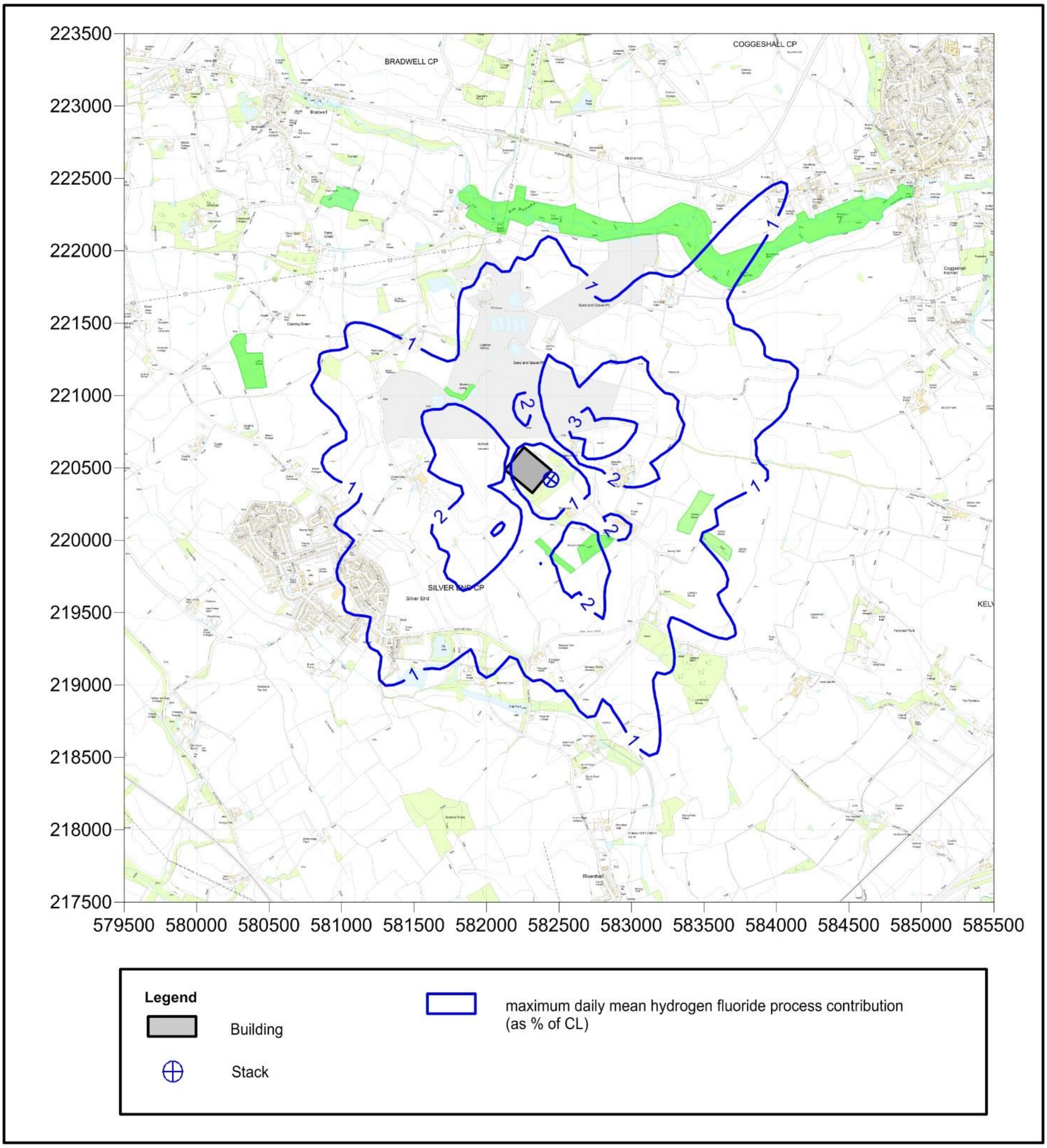
Assumes 100% operation of the all items of plant.

Figure 16: Annual Mean Sulphur Dioxide Process Contribution (as a % of CL) – Max All Years



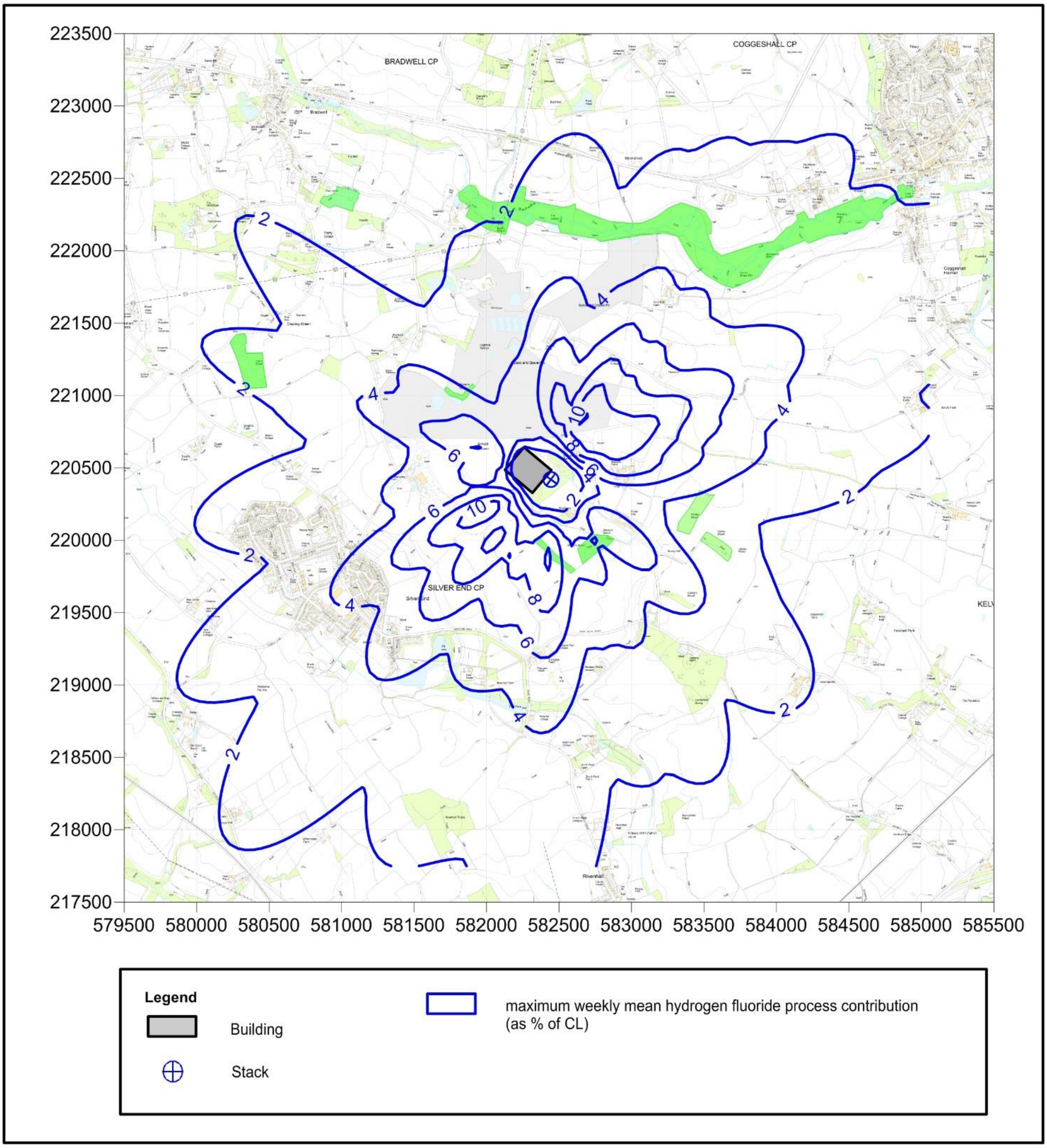
Assumes 100% operation of the all items of plant.

Figure 17: Max Daily Mean Hydrogen Fluoride Process Contribution (as a % of CL) – Max All Years



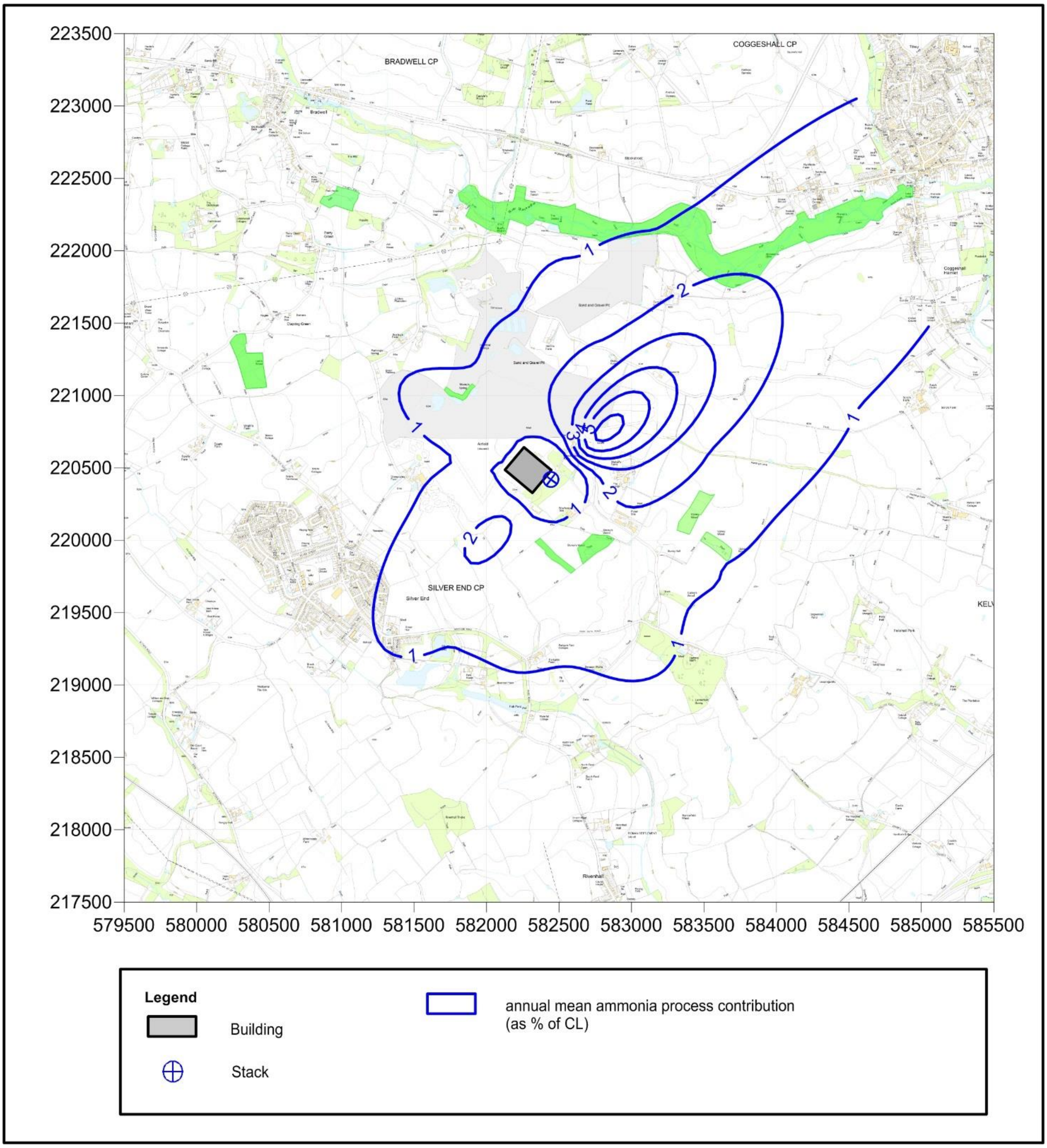
Assumes 100% operation of the all items of plant.

Figure 18: Max Weekly Mean Hydrogen Fluoride Process Contribution (as a % of CL) – Max All Years



Assumes 100% operation of the all items of plant.

Figure 19: Annual Mean Ammonia Process Contribution (as a % of CL) – Max All Years



Assumes 100% operation of the all items of plant.

Appendix B – Detailed Results at Sensitive Receptors

Table B.1: Annual Mean Nitrogen Dioxide Impact at Sensitive Receptors

Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	0.43	1.1%	15.32	38.3%
Wayfarers Site	0.34	0.9%	15.23	38.1%
Allshot's Farm (Scrap Yard)	1.16	2.9%	16.05	40.1%
Haywards	1.75	4.4%	16.64	41.6%
Herons Farm	0.68	1.7%	15.57	38.9%
Gosling's Farm	0.35	0.9%	15.24	38.1%
Curd Hall Farm	0.82	2.1%	15.71	39.3%
Church (adjacent to Bradwell Hall)	0.27	0.7%	15.16	37.9%
Bradwell Hall	0.25	0.6%	15.14	37.8%
Rolphs Farmhouse	0.20	0.5%	15.09	37.7%
Silver End / Bower Hall / Fossil Hall	0.44	1.1%	15.33	38.3%
Rivenhall Pl/Hall	0.39	1.0%	15.28	38.2%
Parkgate Farm / Watchpall Cottages	0.47	1.2%	15.36	38.4%
Ford Farm / Rivenhall Cottage	0.30	0.7%	15.19	38.0%
Porter's Farm	0.41	1.0%	15.30	38.2%
Unknown Building 1	0.53	1.3%	15.42	38.6%
Bumby Hall / The Lodge / Polish Site (Light Industry)	0.73	1.8%	15.62	39.0%
Footpath 8, Receptor 1 (East of Site)	1.31	3.3%	16.20	40.5%
Footpath 8, Receptor 2 (East of Site)	1.23	3.1%	16.12	40.3%
Footpath 8, Receptor 3 (East of Site)	0.87	2.2%	15.76	39.4%
Footpath 8, Receptor 4 (East of Site)	0.42	1.0%	15.31	38.3%
Footpath 8, Receptor 5 (East of Site)	0.05	0.1%	14.94	37.4%
Footpath 8, Receptor 6 (East of Site)	0.62	1.5%	15.51	38.8%
Footpath 8, Receptor 7 (East of Site)	0.69	1.7%	15.58	39.0%
Footpath 35, Receptor 1 (North of Site)	2.64	6.6%	17.53	43.8%
Footpath 35, Receptor 2 (North of Site)	0.89	2.2%	15.78	39.5%
Footpath 35, Receptor 3 (North of Site)	0.50	1.2%	15.39	38.5%
Footpath 31, Receptor 1 (North west of Site)	0.57	1.4%	15.46	38.6%
Footpath 31, Receptor 2 (North west of Site)	0.57	1.4%	15.46	38.7%
Footpath 31, Receptor 3 (North west of Site)	0.31	0.8%	15.20	38.0%
Footpath 7, Receptor 1 (South east of Site)	0.44	1.1%	15.33	38.3%

Table B.1: Annual Mean Nitrogen Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 2 (South east of Site)	0.74	1.8%	15.63	39.1%
Footpath 7, Receptor 3 (South east of Site)	0.68	1.7%	15.57	38.9%
Footpath 7, Receptor 4 (South east of Site)	0.96	2.4%	15.85	39.6%
Footpath 7, Receptor 5 (South east of Site)	1.38	3.4%	16.27	40.7%
Elephant House (Street Sweepings)	0.28	0.7%	15.17	37.9%
Green Pastures Bungalow	0.37	0.9%	15.26	38.2%
Deeks Cottage	1.16	2.9%	16.05	40.1%
Woodhouse Farm	0.95	2.4%	15.84	39.6%
Gosling Cottage / Barn	0.38	0.9%	15.27	38.2%
Felix Hall / The Clock House / Park Farm	0.25	0.6%	15.14	37.8%
Glazenwood House	0.21	0.5%	15.10	37.7%
Bradwell Hall	0.17	0.4%	15.06	37.6%
Perry Green Farm	0.23	0.6%	15.12	37.8%
The Granary / Porter Farm / Rook Hall	0.26	0.6%	15.15	37.9%
Grange Farm	0.55	1.4%	15.44	38.6%
Coggeshall	0.47	1.2%	15.36	38.4%
NOTES: Assumes 100% operation of all items of plant				

Table B.2: 99.79%ile of 1-hour Mean Nitrogen Dioxide Impact at Sensitive Receptors				
Receptor	**Process Contribution**		**Predicted Environmental Concentration**	
	µg/m³	**As % of AQO**	**µg/m³**	**As % of AQO**
Sheepcotes Farm (Hanger No.1)	19.98	10.0%	49.76	24.9%
Wayfarers Site	16.43	8.2%	46.21	23.1%
Allshot's Farm (Scrap Yard)	29.45	14.7%	59.23	29.6%
Haywards	17.91	9.0%	47.69	23.8%
Herons Farm	19.56	9.8%	49.34	24.7%
Gosling's Farm	12.59	6.3%	42.37	21.2%
Curd Hall Farm	12.06	6.0%	41.84	20.9%
Church (adjacent to Bradwell Hall)	9.00	4.5%	38.78	19.4%
Bradwell Hall	8.32	4.2%	38.10	19.0%
Rolphs Farmhouse	9.24	4.6%	39.02	19.5%
Silver End / Bower Hall / Fossil Hall	13.09	6.5%	42.87	21.4%
Rivenhall Pl/Hall	11.79	5.9%	41.57	20.8%
Parkgate Farm / Watchpall Cottages	14.51	7.3%	44.29	22.1%
Ford Farm / Rivenhall Cottage	8.87	4.4%	38.65	19.3%
Porter's Farm	11.42	5.7%	41.20	20.6%
Unknown Building 1	15.15	7.6%	44.93	22.5%
Bumby Hall / The Lodge / Polish Site (Light Industry)	25.95	13.0%	55.73	27.9%
Footpath 8, Receptor 1 (East of Site)	29.52	14.8%	59.30	29.7%
Footpath 8, Receptor 2 (East of Site)	32.29	16.1%	62.07	31.0%
Footpath 8, Receptor 3 (East of Site)	22.78	11.4%	52.56	26.3%
Footpath 8, Receptor 4 (East of Site)	13.15	6.6%	42.93	21.5%
Footpath 8, Receptor 5 (East of Site)	3.47	1.7%	33.25	16.6%
Footpath 8, Receptor 6 (East of Site)	26.44	13.2%	56.22	28.1%
Footpath 8, Receptor 7 (East of Site)	24.06	12.0%	53.84	26.9%
Footpath 35, Receptor 1 (North of Site)	30.25	15.1%	60.03	30.0%
Footpath 35, Receptor 2 (North of Site)	28.17	14.1%	57.95	29.0%
Footpath 35, Receptor 3 (North of Site)	21.08	10.5%	50.86	25.4%
Footpath 31, Receptor 1 (North west of Site)	22.71	11.4%	52.49	26.2%
Footpath 31, Receptor 2 (North west of Site)	22.60	11.3%	52.38	26.2%
Footpath 31, Receptor 3 (North west of Site)	16.29	8.1%	46.07	23.0%
Footpath 7, Receptor 1 (South east of Site)	20.03	10.0%	49.81	24.9%
Footpath 7, Receptor 2 (South east of Site)	26.08	13.0%	55.86	27.9%
Footpath 7, Receptor 3 (South east of Site)	23.77	11.9%	53.55	26.8%

Table B.2: 99.79%ile of 1-hour Mean Nitrogen Dioxide Impact at Sensitive Receptors

Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	24.71	12.4%	54.49	27.2%
Footpath 7, Receptor 5 (South east of Site)	20.96	10.5%	50.74	25.4%
Elephant House (Street Sweepings)	14.77	7.4%	44.55	22.3%
Green Pastures Bungalow	12.73	6.4%	42.51	21.3%
Deeks Cottage	20.49	10.2%	50.27	25.1%
Woodhouse Farm	25.27	12.6%	55.05	27.5%
Gosling Cottage / Barn	13.89	6.9%	43.67	21.8%
Felix Hall / The Clock House / Park Farm	7.03	3.5%	36.81	18.4%
Glazenwood House	6.66	3.3%	36.44	18.2%
Bradwell Hall	5.87	2.9%	35.65	17.8%
Perry Green Farm	7.74	3.9%	37.52	18.8%
The Granary / Porter Farm / Rook Hall	7.58	3.8%	37.36	18.7%
Grange Farm	6.59	3.3%	36.37	18.2%
Coggeshall	6.16	3.1%	35.94	18.0%

NOTES:
Assumes 100% operation of all items of plant at the short term ELVs

Table B.3: 99.73%ile of 1-hour Mean Sulphur Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	28.46	8.1%	35.76	10.2%
Wayfarers Site	22.04	6.3%	29.34	8.4%
Allshot's Farm (Scrap Yard)	41.65	11.9%	48.95	14.0%
Haywards	25.57	7.3%	32.87	9.4%
Herons Farm	27.82	7.9%	35.12	10.0%
Gosling's Farm	17.87	5.1%	25.17	7.2%
Curd Hall Farm	17.28	4.9%	24.58	7.0%
Church (adjacent to Bradwell Hall)	12.68	3.6%	19.98	5.7%
Bradwell Hall	11.62	3.3%	18.92	5.4%
Rolphs Farmhouse	13.06	3.7%	20.36	5.8%
Silver End / Bower Hall / Fossil Hall	18.61	5.3%	25.91	7.4%
Rivenhall Pl/Hall	16.79	4.8%	24.09	6.9%
Parkgate Farm / Watchpall Cottages	20.80	5.9%	28.10	8.0%
Ford Farm / Rivenhall Cottage	12.60	3.6%	19.90	5.7%
Porter's Farm	16.29	4.7%	23.59	6.7%
Unknown Building 1	21.60	6.2%	28.90	8.3%
Bumby Hall / The Lodge / Polish Site (Light Industry)	36.76	10.5%	44.06	12.6%
Footpath 8, Receptor 1 (East of Site)	42.18	12.1%	49.48	14.1%
Footpath 8, Receptor 2 (East of Site)	45.83	13.1%	53.13	15.2%
Footpath 8, Receptor 3 (East of Site)	31.20	8.9%	38.50	11.0%
Footpath 8, Receptor 4 (East of Site)	17.67	5.0%	24.97	7.1%
Footpath 8, Receptor 5 (East of Site)	3.76	1.1%	11.06	3.2%
Footpath 8, Receptor 6 (East of Site)	36.82	10.5%	44.12	12.6%
Footpath 8, Receptor 7 (East of Site)	33.81	9.7%	41.11	11.7%
Footpath 35, Receptor 1 (North of Site)	43.46	12.4%	50.76	14.5%
Footpath 35, Receptor 2 (North of Site)	39.68	11.3%	46.98	13.4%
Footpath 35, Receptor 3 (North of Site)	29.74	8.5%	37.04	10.6%
Footpath 31, Receptor 1 (North west of Site)	31.78	9.1%	39.08	11.2%
Footpath 31, Receptor 2 (North west of Site)	31.95	9.1%	39.25	11.2%
Footpath 31, Receptor 3 (North west of Site)	23.29	6.7%	30.59	8.7%
Footpath 7, Receptor 1 (South east of Site)	27.63	7.9%	34.93	10.0%
Footpath 7, Receptor 2 (South east of Site)	36.32	10.4%	43.62	12.5%
Footpath 7, Receptor 3 (South east of Site)	33.71	9.6%	41.01	11.7%

Table B.3: 99.73%ile of 1-hour Mean Sulphur Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	34.76	9.9%	42.06	12.0%
Footpath 7, Receptor 5 (South east of Site)	29.82	8.5%	37.12	10.6%
Elephant House (Street Sweepings)	19.37	5.5%	26.67	7.6%
Green Pastures Bungalow	18.16	5.2%	25.46	7.3%
Deeks Cottage	29.30	8.4%	36.60	10.5%
Woodhouse Farm	34.69	9.9%	41.99	12.0%
Gosling Cottage / Barn	19.65	5.6%	26.95	7.7%
Felix Hall / The Clock House / Park Farm	9.94	2.8%	17.24	4.9%
Glazenwood House	9.28	2.7%	16.58	4.7%
Bradwell Hall	8.07	2.3%	15.37	4.4%
Perry Green Farm	10.62	3.0%	17.92	5.1%
The Granary / Porter Farm / Rook Hall	10.61	3.0%	17.91	5.1%
Grange Farm	9.26	2.6%	16.56	4.7%
Coggeshall	8.65	2.5%	15.95	4.6%
NOTES: Assumes 100% operation of all items of plant at the short term ELVs				

Table B.4: 99.9%ile of 15-min Mean Sulphur Dioxide Impact at Sensitive Receptors

Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	32.20	12.1%	39.50	14.9%
Wayfarers Site	29.44	11.1%	36.74	13.8%
Allshot's Farm (Scrap Yard)	46.77	17.6%	54.07	20.3%
Haywards	29.44	11.1%	36.74	13.8%
Herons Farm	31.58	11.9%	38.88	14.6%
Gosling's Farm	21.53	8.1%	28.83	10.8%
Curd Hall Farm	20.48	7.7%	27.78	10.4%
Church (adjacent to Bradwell Hall)	16.35	6.1%	23.65	8.9%
Bradwell Hall	14.79	5.6%	22.09	8.3%
Rolphs Farmhouse	16.50	6.2%	23.80	8.9%
Silver End / Bower Hall / Fossil Hall	22.22	8.4%	29.52	11.1%
Rivenhall Pl/Hall	20.48	7.7%	27.78	10.4%
Parkgate Farm / Watchpall Cottages	23.77	8.9%	31.07	11.7%
Ford Farm / Rivenhall Cottage	15.66	5.9%	22.96	8.6%
Porter's Farm	19.91	7.5%	27.21	10.2%
Unknown Building 1	25.00	9.4%	32.30	12.1%
Bumby Hall / The Lodge / Polish Site (Light Industry)	41.50	15.6%	48.80	18.3%
Footpath 8, Receptor 1 (East of Site)	45.61	17.1%	52.91	19.9%
Footpath 8, Receptor 2 (East of Site)	54.63	20.5%	61.93	23.3%
Footpath 8, Receptor 3 (East of Site)	37.93	14.3%	45.23	17.0%
Footpath 8, Receptor 4 (East of Site)	24.36	9.2%	31.66	11.9%
Footpath 8, Receptor 5 (East of Site)	7.66	2.9%	14.96	5.6%
Footpath 8, Receptor 6 (East of Site)	42.84	16.1%	50.14	18.8%
Footpath 8, Receptor 7 (East of Site)	38.76	14.6%	46.06	17.3%
Footpath 35, Receptor 1 (North of Site)	46.21	17.4%	53.51	20.1%
Footpath 35, Receptor 2 (North of Site)	44.79	16.8%	52.09	19.6%
Footpath 35, Receptor 3 (North of Site)	34.32	12.9%	41.62	15.6%
Footpath 31, Receptor 1 (North west of Site)	36.55	13.7%	43.85	16.5%
Footpath 31, Receptor 2 (North west of Site)	36.27	13.6%	43.57	16.4%
Footpath 31, Receptor 3 (North west of Site)	26.80	10.1%	34.10	12.8%
Footpath 7, Receptor 1 (South east of Site)	35.11	13.2%	42.41	15.9%
Footpath 7, Receptor 2 (South east of Site)	42.77	16.1%	50.07	18.8%
Footpath 7, Receptor 3 (South east of Site)	38.23	14.4%	45.53	17.1%

Table B.4: 99.9%ile of 15-min Mean Sulphur Dioxide Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	39.13	14.7%	46.43	17.5%
Footpath 7, Receptor 5 (South east of Site)	33.42	12.6%	40.72	15.3%
Elephant House (Street Sweepings)	25.84	9.7%	33.14	12.5%
Green Pastures Bungalow	21.44	8.1%	28.74	10.8%
Deeks Cottage	32.81	12.3%	40.11	15.1%
Woodhouse Farm	43.18	16.2%	50.48	19.0%
Gosling Cottage / Barn	23.57	8.9%	30.87	11.6%
Felix Hall / The Clock House / Park Farm	13.53	5.1%	20.83	7.8%
Glazenwood House	14.57	5.5%	21.87	8.2%
Bradwell Hall	12.99	4.9%	20.29	7.6%
Perry Green Farm	14.12	5.3%	21.42	8.1%
The Granary / Porter Farm / Rook Hall	14.40	5.4%	21.70	8.2%
Grange Farm	14.15	5.3%	21.45	8.1%
Coggeshall	13.81	5.2%	21.11	7.9%

NOTES:
Assumes 100% operation of all items of plant at the short term ELVs

Table B.5: Annual Mean VOCs (as Benzene) Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	0.06	1.1%	0.41	8.1%
Wayfarers Site	0.04	0.9%	0.39	7.9%
Allshot's Farm (Scrap Yard)	0.15	3.0%	0.50	10.0%
Haywards	0.22	4.5%	0.57	11.5%
Herons Farm	0.09	1.7%	0.44	8.7%
Gosling's Farm	0.04	0.9%	0.39	7.9%
Curd Hall Farm	0.11	2.1%	0.46	9.1%
Church (adjacent to Bradwell Hall)	0.03	0.7%	0.38	7.7%
Bradwell Hall	0.03	0.6%	0.38	7.6%
Rolphs Farmhouse	0.02	0.5%	0.37	7.5%
Silver End / Bower Hall / Fossil Hall	0.06	1.1%	0.41	8.1%
Rivenhall Pl/Hall	0.05	1.0%	0.40	8.0%
Parkgate Farm / Watchpall Cottages	0.06	1.2%	0.41	8.2%
Ford Farm / Rivenhall Cottage	0.04	0.8%	0.39	7.8%
Porter's Farm	0.05	1.0%	0.40	8.0%
Unknown Building 1	0.07	1.4%	0.42	8.4%
Bumby Hall / The Lodge / Polish Site (Light Industry)	0.09	1.9%	0.44	8.9%
Footpath 8, Receptor 1 (East of Site)	0.17	3.3%	0.52	10.3%
Footpath 8, Receptor 2 (East of Site)	0.16	3.2%	0.51	10.2%
Footpath 8, Receptor 3 (East of Site)	0.11	2.2%	0.46	9.2%
Footpath 8, Receptor 4 (East of Site)	0.05	1.1%	0.40	8.1%
Footpath 8, Receptor 5 (East of Site)	0.01	0.1%	0.36	7.1%
Footpath 8, Receptor 6 (East of Site)	0.08	1.6%	0.43	8.6%
Footpath 8, Receptor 7 (East of Site)	0.09	1.8%	0.44	8.8%
Footpath 35, Receptor 1 (North of Site)	0.34	6.8%	0.69	13.8%
Footpath 35, Receptor 2 (North of Site)	0.11	2.3%	0.46	9.3%
Footpath 35, Receptor 3 (North of Site)	0.06	1.3%	0.41	8.3%
Footpath 31, Receptor 1 (North west of Site)	0.07	1.4%	0.42	8.4%
Footpath 31, Receptor 2 (North west of Site)	0.07	1.5%	0.42	8.5%
Footpath 31, Receptor 3 (North west of Site)	0.04	0.8%	0.39	7.8%
Footpath 7, Receptor 1 (South east of Site)	0.06	1.1%	0.41	8.1%
Footpath 7, Receptor 2 (South east of Site)	0.09	1.9%	0.44	8.9%
Footpath 7, Receptor 3 (South east of Site)	0.09	1.7%	0.44	8.7%

Table B.5: Annual Mean VOCs (as Benzene) Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	0.12	2.4%	0.47	9.4%
Footpath 7, Receptor 5 (South east of Site)	0.18	3.5%	0.53	10.5%
Elephant House (Street Sweepings)	0.04	0.7%	0.39	7.7%
Green Pastures Bungalow	0.05	1.0%	0.40	8.0%
Deeks Cottage	0.15	3.0%	0.50	10.0%
Woodhouse Farm	0.12	2.4%	0.47	9.4%
Gosling Cottage / Barn	0.05	1.0%	0.40	8.0%
Felix Hall / The Clock House / Park Farm	0.03	0.6%	0.38	7.6%
Glazenwood House	0.03	0.5%	0.38	7.5%
Bradwell Hall	0.02	0.4%	0.37	7.4%
Perry Green Farm	0.03	0.6%	0.38	7.6%
The Granary / Porter Farm / Rook Hall	0.03	0.7%	0.38	7.7%
Grange Farm	0.07	1.4%	0.42	8.4%
Coggeshall	0.06	1.2%	0.41	8.2%

NOTES:
Assumes 100% operation of all items of plant
Assumes all VOCs are consist only of benzene

Table B.6: Annual Mean VOCs (as 1,3-butadiene) Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	0.06	2.4%	0.20	8.7%
Wayfarers Site	0.04	2.0%	0.18	8.2%
Allshot's Farm (Scrap Yard)	0.15	6.6%	0.29	12.8%
Haywards	0.22	10.0%	0.36	16.2%
Herons Farm	0.09	3.8%	0.23	10.1%
Gosling's Farm	0.04	2.0%	0.18	8.2%
Curd Hall Farm	0.11	4.7%	0.25	10.9%
Church (adjacent to Bradwell Hall)	0.03	1.5%	0.17	7.7%
Bradwell Hall	0.03	1.4%	0.17	7.6%
Rolphs Farmhouse	0.02	1.1%	0.16	7.3%
Silver End / Bower Hall / Fossil Hall	0.06	2.5%	0.20	8.7%
Rivenhall Pl/Hall	0.05	2.2%	0.19	8.4%
Parkgate Farm / Watchpall Cottages	0.06	2.6%	0.20	8.9%
Ford Farm / Rivenhall Cottage	0.04	1.7%	0.18	7.9%
Porter's Farm	0.05	2.3%	0.19	8.5%
Unknown Building 1	0.07	3.0%	0.21	9.3%
Bumby Hall / The Lodge / Polish Site (Light Industry)	0.09	4.1%	0.23	10.4%
Footpath 8, Receptor 1 (East of Site)	0.17	7.4%	0.31	13.7%
Footpath 8, Receptor 2 (East of Site)	0.16	7.0%	0.30	13.2%
Footpath 8, Receptor 3 (East of Site)	0.11	4.9%	0.25	11.2%
Footpath 8, Receptor 4 (East of Site)	0.05	2.4%	0.19	8.6%
Footpath 8, Receptor 5 (East of Site)	0.01	0.3%	0.15	6.5%
Footpath 8, Receptor 6 (East of Site)	0.08	3.5%	0.22	9.7%
Footpath 8, Receptor 7 (East of Site)	0.09	3.9%	0.23	10.2%
Footpath 35, Receptor 1 (North of Site)	0.34	15.0%	0.48	21.2%
Footpath 35, Receptor 2 (North of Site)	0.11	5.1%	0.25	11.3%
Footpath 35, Receptor 3 (North of Site)	0.06	2.8%	0.20	9.0%
Footpath 31, Receptor 1 (North west of Site)	0.07	3.2%	0.21	9.4%
Footpath 31, Receptor 2 (North west of Site)	0.07	3.3%	0.21	9.5%
Footpath 31, Receptor 3 (North west of Site)	0.04	1.8%	0.18	8.0%
Footpath 7, Receptor 1 (South east of Site)	0.06	2.5%	0.20	8.7%
Footpath 7, Receptor 2 (South east of Site)	0.09	4.2%	0.23	10.4%
Footpath 7, Receptor 3 (South east of Site)	0.09	3.9%	0.23	10.1%

Table B.6: Annual Mean VOCs (as 1,3-butadiene) Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	0.12	5.4%	0.26	11.7%
Footpath 7, Receptor 5 (South east of Site)	0.18	7.8%	0.32	14.1%
Elephant House (Street Sweepings)	0.04	1.6%	0.18	7.8%
Green Pastures Bungalow	0.05	2.1%	0.19	8.3%
Deeks Cottage	0.15	6.6%	0.29	12.8%
Woodhouse Farm	0.12	5.4%	0.26	11.6%
Gosling Cottage / Barn	0.05	2.1%	0.19	8.4%
Felix Hall / The Clock House / Park Farm	0.03	1.4%	0.17	7.6%
Glazenwood House	0.03	1.2%	0.17	7.4%
Bradwell Hall	0.02	1.0%	0.16	7.2%
Perry Green Farm	0.03	1.3%	0.17	7.5%
The Granary / Porter Farm / Rook Hall	0.03	1.5%	0.17	7.7%
Grange Farm	0.07	3.1%	0.21	9.3%
Coggeshall	0.06	2.7%	0.20	8.9%

NOTES:
Assumes 100% operation of all items of plant
Assumes all VOCs are consist only of 1,3-butadiene

Table B.7: Annual Mean Cadmium Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	μg/m³	As % of AQO	μg/m³	As % of AQO
Sheepcotes Farm (Hanger No.1)	0.15	3.0%	0.35	7.0%
Wayfarers Site	0.12	2.4%	0.32	6.4%
Allshot's Farm (Scrap Yard)	0.41	8.1%	0.61	12.1%
Haywards	0.61	12.3%	0.81	16.3%
Herons Farm	0.24	4.7%	0.44	8.7%
Gosling's Farm	0.12	2.4%	0.32	6.4%
Curd Hall Farm	0.29	5.8%	0.49	9.8%
Church (adjacent to Bradwell Hall)	0.09	1.9%	0.29	5.9%
Bradwell Hall	0.09	1.7%	0.29	5.7%
Rolphs Farmhouse	0.07	1.4%	0.27	5.4%
Silver End / Bower Hall / Fossil Hall	0.15	3.1%	0.35	7.1%
Rivenhall Pl/Hall	0.14	2.7%	0.34	6.7%
Parkgate Farm / Watchpall Cottages	0.16	3.3%	0.36	7.3%
Ford Farm / Rivenhall Cottage	0.10	2.1%	0.30	6.1%
Porter's Farm	0.14	2.8%	0.34	6.8%
Unknown Building 1	0.19	3.7%	0.39	7.7%
Bumby Hall / The Lodge / Polish Site (Light Industry)	0.25	5.1%	0.45	9.1%
Footpath 8, Receptor 1 (East of Site)	0.46	9.2%	0.66	13.2%
Footpath 8, Receptor 2 (East of Site)	0.43	8.6%	0.63	12.6%
Footpath 8, Receptor 3 (East of Site)	0.30	6.1%	0.50	10.1%
Footpath 8, Receptor 4 (East of Site)	0.15	2.9%	0.35	6.9%
Footpath 8, Receptor 5 (East of Site)	0.02	0.4%	0.22	4.4%
Footpath 8, Receptor 6 (East of Site)	0.22	4.3%	0.42	8.3%
Footpath 8, Receptor 7 (East of Site)	0.24	4.8%	0.44	8.8%
Footpath 35, Receptor 1 (North of Site)	0.92	18.5%	1.12	22.5%
Footpath 35, Receptor 2 (North of Site)	0.31	6.3%	0.51	10.3%
Footpath 35, Receptor 3 (North of Site)	0.17	3.5%	0.37	7.5%
Footpath 31, Receptor 1 (North west of Site)	0.20	4.0%	0.40	8.0%
Footpath 31, Receptor 2 (North west of Site)	0.20	4.0%	0.40	8.0%
Footpath 31, Receptor 3 (North west of Site)	0.11	2.2%	0.31	6.2%
Footpath 7, Receptor 1 (South east of Site)	0.15	3.1%	0.35	7.1%
Footpath 7, Receptor 2 (South east of Site)	0.26	5.2%	0.46	9.2%
Footpath 7, Receptor 3 (South east of Site)	0.24	4.8%	0.44	8.8%

Table B.7: Annual Mean Cadmium Impact at Sensitive Receptors				
Receptor	Process Contribution		Predicted Environmental Concentration	
	µg/m³	As % of AQO	µg/m³	As % of AQO
Footpath 7, Receptor 4 (South east of Site)	0.33	6.7%	0.53	10.7%
Footpath 7, Receptor 5 (South east of Site)	0.48	9.7%	0.68	13.7%
Elephant House (Street Sweepings)	0.10	2.0%	0.30	6.0%
Green Pastures Bungalow	0.13	2.6%	0.33	6.6%
Deeks Cottage	0.41	8.1%	0.61	12.1%
Woodhouse Farm	0.33	6.7%	0.53	10.7%
Gosling Cottage / Barn	0.13	2.6%	0.33	6.6%
Felix Hall / The Clock House / Park Farm	0.09	1.7%	0.29	5.7%
Glazenwood House	0.07	1.4%	0.27	5.4%
Bradwell Hall	0.06	1.2%	0.26	5.2%
Perry Green Farm	0.08	1.6%	0.28	5.6%
The Granary / Porter Farm / Rook Hall	0.09	1.8%	0.29	5.8%
Grange Farm	0.19	3.8%	0.39	7.8%
Coggeshall	0.17	3.3%	0.37	7.3%

NOTES:
Assumes 100% operation of all items of plant
Assumes entire cadmium and thallium emissions are consist only of cadmium

Appendix C – APIS Critical Loads

Table C.1: N Deposition Critical Loads - APIS					
Site	**Habitat type**	**NCL Class**	**Lower Critical Load (kgN/ha/yr)**	**Upper Critical Load (kgN/ha/yr)**	**Background (kgN/ha/yr)**
European designated sites (within 10km)					
None identified					
UK designated sites (within 2km)					
None identified					
Non-statutory designated sites (within 2km)					
Blackwater Plantation	Broadleaved, mixed and yew woodland	Broadleaved deciduous woodland	10	20	37.24
Storeys Wood	Broadleaved, mixed and yew woodland	Broadleaved deciduous woodland	10	20	37.24
Maxey's Spring	Calcareous grassland	Sub-atlantic semi-dry calcareous grassland	15	25	19.46
	Neutral grassland	Low and medium altitude hay meadows	20	30	19.46
Upney Wood	Broadleaved, mixed and yew woodland	Broadleaved deciduous woodland	10	20	37.24
Link's Wood	Broadleaved, mixed and yew woodland	Broadleaved deciduous woodland	10	20	37.24
Park House Meadow	Calcareous grassland	Sub-atlantic semi-dry calcareous grassland	15	25	19.46
	Neutral grassland	Low and medium altitude hay meadows	20	30	19.46

Table C.1: Acid Deposition Critical Loads - APIS							
Site	**Broad habitat type**	**Acidity Class**	**Min Critical Load Function (keq/ha/yr)**			**Maximum Background (keq/ha/yr)**	
			ClminN	**CLmaxN**	**ClmaxS**	**N**	**S**
European designated sites							
UK designated sites							
Non-statutory designated sites							
Blackwater Plantation	Broadleaved, mixed and yew woodland	Broadleafed/Coniferous unmanaged woodland	0.14	1.71	1.57	2.66	0.25
Storeys Wood	Broadleaved, mixed and yew woodland	Broadleafed/Coniferous unmanaged woodland	0.14	1.71	1.57	2.66	0.25
Maxey's Spring	Calcareous grassland	Calcareous grassland (using base cation)	0.85	4.75	3.89	1.39	0.2
	Neutral grassland	Calcareous grassland (using base cation)	0.85	4.75	3.89	1.39	0.2
Upney Wood	Broadleaved, mixed and yew woodland	Broadleafed/Coniferous unmanaged woodland	0.14	1.71	1.57	2.66	0.25
Link's Wood	Broadleaved, mixed and yew woodland	Broadleafed/Coniferous unmanaged woodland	0.14	1.71	1.57	2.66	0.25
Park House Meadow	Calcareous grassland	Calcareous grassland (using base cation)	0.85	4.75	3.89	1.39	0.2
	Neutral grassland	Calcareous grassland (using base cation)	0.85	4.75	3.89	1.39	0.2

Appendix D – Deposition Results Tables

Table D.1: Annual Mean Process Contribution Used for Dry Deposition Analysis				
Site	**Annual Mean Process Contribution (µg/m³)**			
	Nitrogen Dioxide	**Sulphur Dioxide**	**Hydrogen Chloride**	**Ammonia**
European Designated Sites				
None identified				
UK Designated Sites				
None identified				
Non-statutory designated sites				
Blackwater Plantation	0.4076	0.1509	0.0285	0.0285
Storeys Wood	0.8070	0.2988	0.0565	0.0565
Maxey's Spring	0.5469	0.2025	0.0383	0.0383
Upney Wood	0.7033	0.2603	0.0493	0.0493
Link's Wood	0.1936	0.0717	0.0136	0.0136
Park House Meadow	0.1872	0.0693	0.0131	0.0131

Table D.2: Annual Mean Process Contribution Used for Wet Deposition Analysis	
Site	**Annual Mean Wet Deposition (ng/m²/s)**
European Designated Sites	
None identified	
UK Designated Sites	
None identified	
Non-statutory designated sites	
Blackwater Plantation	0.0287
Storeys Wood	0.0567
Maxey's Spring	0.0385
Upney Wood	0.0488
Link's Wood	0.0136
Park House Meadow	0.0132

Table D.3: Deposition Calculation – Grassland - Maximum								
Site	Dry Deposition (kg/ha/yr)				Wet Deposition (kg/ha/yr)	Total N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
	Nitrogen Dioxide	Sulphur Dioxide	Hydrogen Chloride	Ammonia	Hydrogen Chloride		N	S
European designated sites								
None identified								
UK designated sites								
None identified								
Non-statutory designated sites								
Blackwater Plantation	0.059	0.286	0.219	0.148	8.806	0.207	0.015	0.266
Storeys Wood	0.116	0.565	0.433	0.294	17.403	0.410	0.029	0.526
Maxey's Spring	0.079	0.383	0.294	0.199	11.807	0.278	0.020	0.357
Upney Wood	0.101	0.493	0.378	0.256	14.975	0.357	0.026	0.453
Link's Wood	0.028	0.136	0.104	0.070	4.179	0.098	0.007	0.126
Park House Meadow	0.027	0.131	0.101	0.068	4.038	0.095	0.007	0.122

Table D.3: Deposition Calculation – Woodland - Maximum								
Site	Dry Deposition (kg/ha/yr)				Wet Deposition (kg/ha/yr)	Total N Deposition (kgN/ha/yr)	Acid Deposition keq/ha/yr	
	Nitrogen Dioxide	Sulphur Dioxide	Hydrogen Chloride	Ammonia	Hydrogen Chloride		N	S
European designated sites								
None identified								
UK designated sites								
None identified								
Non-statutory designated sites								
Blackwater Plantation	0.117	0.571	0.525	0.222	8.806	0.340	0.024	0.284
Storeys Wood	0.232	1.131	1.040	0.440	17.403	0.673	0.048	0.561
Maxey's Spring	0.158	0.766	0.705	0.298	11.807	0.456	0.033	0.380
Upney Wood	0.203	0.985	0.906	0.384	14.975	0.586	0.042	0.483
Link’s Wood	0.056	0.271	0.249	0.106	4.179	0.161	0.012	0.135
Park House Meadow	0.054	0.262	0.241	0.102	4.038	0.156	0.011	0.130

Table D.5: Detailed Results – Nitrogen Deposition - Maximum								
Site	Habitat	Deposition Velocity	Process Contribution			Predicted Environmental Concentration		
			PC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL	PEC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL
European designated sites								
None identified								
UK designated sites								
None identified								
Non-statutory designated sites								
Blackwater Plantation	Broadleaved, mixed and yew woodland	Woodland	3.40E-01	3.40%	1.70%	37.580	375.80%	187.90%
Storeys Wood	Broadleaved, mixed and yew woodland	Woodland	6.73E-01	6.73%	3.36%	37.913	379.13%	189.56%
Maxey's Spring	Calcareous grassland	Grassland	2.78E-01	1.85%	1.11%	19.738	131.58%	78.95%
	Neutral grassland	Grassland	2.78E-01	1.39%	0.93%	19.738	98.69%	65.79%
Upney Wood	Broadleaved, mixed and yew woodland	Woodland	5.86E-01	5.86%	2.93%	37.826	378.26%	189.13%
Link's Wood	Broadleaved, mixed and yew woodland	Woodland	1.61E-01	1.61%	0.81%	37.401	374.01%	187.01%
Park House Meadow	Calcareous grassland	Grassland	9.51E-02	0.63%	0.38%	19.555	130.37%	78.22%
	Neutral grassland	Grassland	9.51E-02	0.48%	0.32%	19.555	97.78%	65.18%

Table D.6: Detailed Results – Acid Deposition								
Site	Habitat	Deposition Velocity	Process Contribution			Predicted Environmental Concentration		
			N (keq/ha/yr)	S (keq/ha/yr)	% of Min CL Function	N (keq/ha/yr)	S (keq/ha/yr)	% of CL Function
European designated sites								
None identified								
UK designated sites								
None identified								
Non-statutory designated sites								
Blackwater Plantation	Broadleaved, mixed and yew woodland	Woodland	2.43E-02	2.84E-01	18.01%	2.684	0.534	188.19%
Storeys Wood	Broadleaved, mixed and yew woodland	Woodland	4.81E-02	5.61E-01	35.61%	2.708	0.811	205.79%
Maxey's Spring	Calcareous grassland	Grassland	1.98E-02	3.57E-01	7.92%	1.410	0.557	41.40%
	Neutral grassland	Grassland	1.98E-02	3.57E-01	7.92%	1.410	0.557	41.40%
Upney Wood	Broadleaved, mixed and yew woodland	Woodland	4.19E-02	4.83E-01	30.72%	2.702	0.733	200.89%
Link's Wood	Broadleaved, mixed and yew woodland	Woodland	1.15E-02	1.35E-01	8.55%	2.672	0.385	178.72%
Park House Meadow	Calcareous grassland	Grassland	6.79E-03	1.22E-01	2.71%	1.397	0.322	36.18%
	Neutral grassland	Grassland	6.79E-03	1.22E-01	2.71%	1.397	0.322	36.18%

Revised Notice - Application Ref: ESS/55/14/BTE

ESSEX COUNTY COUNCIL

TOWN AND COUNTRY PLANNING ACT 1990 (as amended)
Town and Country Planning (Development Management Procedure) (England) Order 2010

In pursuance of the powers exercised by it as County Planning Authority, Essex County Council has considered an application to carry out the following development:

Removal of condition 28 (restricting geographical source of Solid Recovered Fuel) and condition 30 (restricting geographical source of waste paper and card) attached to planning permission ESS/41/14/BTE to allow importation of Solid Recovered Fuel and waste paper and card without constraint as to the geographical source of the material. Planning permission ESS/41/14/BTE being for "An Integrated Waste Management Facility comprising:

- **Anaerobic Digestion Plant treating mixed organic waste, producing biogas converted to electricity through biogas generators;**
- **Materials Recovery Facility for mixed dry recyclable waste to recover materials e.g. paper, plastic, metals;**
- **Mechanical Biological Treatment facility for the treatment of residual municipal and residual commercial and industrial wastes to produce a solid recovered fuel;**
- **De-inking and Pulping Paper Recycling Facility to reclaim paper;**
- **Combined Heat and Power Plant (CHP) utilising solid recovered fuel to produce electricity, heat and steam; extraction of minerals to enable buildings to be partially sunken below ground level within the resulting void;**
- **visitor/education centre;**
- **extension to existing access road;**
- **provision of offices and vehicle parking;**
  and associated engineering works and storage tanks.

at Rivenhall Airfield, Coggeshall Road (A120), Braintree

and in accordance with the said application and the plan(s) accompanying it, hereby gives notice of its decision to GRANT PERMISSION FOR the said development subject to compliance with the following conditions and reasons:

1 The development hereby permitted shall be begun before the 2 March 2016. Not less than 30 days prior notification of commencement of the development shall be given in writing to the Waste Planning Authority.

Reason: To comply with section 91 of the Town and Country Planning Act 1990 (as amended).

2 The development hereby permitted shall only be carried out in accordance with planning application ECC ref ESS/37/08/BTE (PINS Ref. APP/Z1585/V/09/2104804) dated 26 August 2008 (as amended) and drawing numbers:

Drawing number	**Drawing title**
1-1	Land Ownership & Proposed Site Plan
1-2	Proposed Planning Application Area
1-4	Access Road Details
1-5A	Typical Arrangement and Architectural Features of the eRCF
1-8	Schematic Arrangement of Woodhouse Farm
1-9	eRCF Simplified Process Flow
1-10	eRCF Integrated Process Flow
3-3	Site Plan Layout
3-8C	eRCF General Arrangement
3-12C	eRCF Detailed Cross-Sections
3-14A	eRCF Upper Lagoon & Wetland Shelf
3-16	Services Plan
3-19B	eRCF General Arrangement
8-6	Landscape Mitigation Measures
IT569/SK/06	Proposed Improvements to Site Access Road Junction with Church Road
IT569/SK/07	Proposed Improvements to Site Access Road Junction with Ash Lane
19-2B	Tree Survey
19-3B	The Constraints and Protection Plan
19-5	eRCF Base Plan Woodhouse Farm

As amended by Non-Material Amendment application reference ESS/37/08/BTE/NMA2 dated 4 September 2012, accompanied by letter from Berwin Leighton Paisner dated 29 August 2012 and email dated 18 September 2012 as approved by the Waste Planning Authority on 25 October 2012.

As amended by planning application reference ESS/44/14/BTE dated 5 August 2014, accompanied by letter from Holmes & Hills dated 5 August 2014, report entitled “Business development since obtaining planning permission” dated August 2014, report “Changes in the Case for Need since September 2009” dated August 2014 and letters from Honace dated 5 August 2014 and Golder Associates dated 4 August 2014 and granted by the Waste Planning Authority on 4 December 2014.

As amended by planning application reference ESS/55/14/BTE dated 12 December 2014, accompanied by letter from Holmes & Hills LLP dated 12 December 2014, SLR report “Justification for Removal of Fuel Sourcing Conditions” Rev 4” dated December 2014 and letter from Honace dated 5 August 2014 and Golder Associates dated 4 August 2014.

And in accordance with any non-material amendment(s) as may be subsequently approved in writing by the Waste Planning Authority and except as varied by the following condition(s):

<u>Reason</u>: *For the avoidance of doubt as to the nature of the development hereby permitted, to ensure development is carried out in accordance with the approved application drawings, details (except as varied by other conditions), to ensure that the development is carried out with the minimum harm to the local environment and in accordance with* MLP policies P1, S1, S10, S11, S12, DM1, DM2 and DM3, WLP policies W3A, W4A, W4B, W4C, W7A, W7C, W7G, W8A, W10B, W10E, W10F and W10G, BCS policies CS5, CS7, CS8 and CS9 and BDLP policies RLP 36, RLP 49, RLP 54, RLP 62, RLP 63, RLP 64, RLP 65, RLP 71, RLP 72, RLP 80, RLP 81, RLP 84, RLP 87, RLP 90, RLP 100, RLP 105 and RLP 106.

3 The total number of Heavy Goods Vehicle (HGV[1]) movements associated with the excavation of materials (i.e. overburden, sand, gravel, and boulder clay) and import and/or export of materials associated with the operation of the completed Integrated Waste Management Facility (IWMF[2])hereby permitted shall not exceed the following limits:

404 movements 202 in and 202 out per day (Monday to Friday);
202 movements 101 in and 101 out per day (Saturdays);

and shall not take place on Sundays, Public or Bank Holidays, except for clearances from Household Waste Recycling Centres between 10:00 and 16:00 hours as required by the Waste Disposal Authority and previously approved in writing by the Waste Planning Authority. No HGV movements shall take place outside the hours of operation authorised in Conditions 34 & 36 of this permission.

[1] An HGV shall be defined as having a gross vehicle weight of 7.5 tonnes or more
[2]IWMF shall be defined as the buildings, structures and associated plant and equipment for the treatment of waste at the site.

<u>Reason</u>: *In the interests of highway safety, safeguarding local amenity and to comply with MLP policies S1, S10 and DM1, WLP policies W4C, W8A and W10E and BDLP policies RLP 36 and RLP 90.*

4 The total number of HGV vehicle movements associated with the construction of the IWMF (including deliveries of building materials) when combined with the maximum permitted vehicle movements under Condition 3 shall not exceed the following limits:
404 movements 202 in and 202 out per day (Monday to Sunday).
No HGV movements shall take place outside the hours of operation authorised in Condition 35 of this permission.

<u>Reason</u>: *In the interests of highway safety, safeguarding local amenity and to comply with MLP policies S1, S10 and DM1, WLP policies W4C, W8A*

and W10E and BDLP policies RLP 36 and RLP 90.

5 A written record of daily HGV movements into and out of the site shall be maintained by the operator from commencement of the development and kept for the previous 2 years and shall be supplied to the Waste Planning Authority within 14 days of a written request. The details for each vehicle shall include the identity of the vehicle operator, the type and size of the vehicle, the vehicle registration number, and an indication of whether the vehicle is empty or loaded.

Reason: In the interests of highway safety, safeguarding local amenity and to comply with MLP policies S1, S10 and DM1, WLP policies W4C, W8A and W10E and BDLP policies RLP 36, RLP62 and RLP 90.

6 No development shall commence until full details of the extended access road and the layout of the cross-over points (both temporary and permanent) where the access road, both existing and proposed, crosses public footpaths, as shown on the Definitive Map and Statement of Public Rights of Way have been submitted to and approved in writing by the Waste Planning Authority. The extended access road and cross-over points shall be implemented in accordance with the approved details.

Reason: In the interests of highway safety, safeguarding local amenity and to comply with MLP policies S1, S10 and DM1, WLP policies W4C, W8A, W10E and W10G *and BDLP policies RLP 36, RLP 49 and RLP 90.*

7 No works on the construction of the IWMF shall commence until the access road extension and widening and all footpath cross-over points have been constructed.

Reason: In the interests of highway and pedestrian safety, safeguarding local amenity and to comply with MLP policies S1, S10 and DM1, WLP policies W4C, W8A, W10E and W10G *and BDLP policies RLP 36 RLP 49 and RLP 90.*

8 No vehicles shall access or egress the site except via the access onto the Coggeshall Road (A120 trunk road) junction as shown on application drawing Figure 1-2.

Reason: In the interests of highway safety, safeguarding local amenity and to comply with MLP policies S1, S10 and DM1, WLP policies W4C, W8A, W10E and W10G *and BDLP policies RLP 36, RLP 49 and RLP 90.*

9 No vehicles shall park on the haul road between the A120 and Ash Lane.

Reason: In the interests of highway safety, safeguarding local amenity and to comply with MLP policies S1, S10 and DM1, WLP policies W4C, W8A, W10E and W10G *and BDLP policies RLP 36, RLP 49 and RLP 90.*

10 No development or preliminary groundworks shall take place until a written scheme and programme of archaeological investigation and recording has been submitted to and approved in writing by the Waste Planning Authority. The scheme and programme of archaeological investigation and recording shall be implemented prior to the commencement of the development hereby permitted or any preliminary groundworks.

Reason: To ensure that any archaeological interest has been adequately investigated and recorded prior to the development taking place and to comply with MLP policies S10 and DM1, WLP policy W10E and BDLP policies RLP105 and RLP 106.

11 No airfield buildings and/or structures shall be demolished until the Level 3 survey in accordance with the 2006 English Heritage Guidance entitled “Understanding Historic Buildings: A Guide to Good Recording Practice” of the airfield buildings and/or structures has been completed.

Reason: To ensure that any heritage interest has been adequately investigated and recorded prior to the development taking place and to comply with MLP policies S10 and DM1, WLP policy W10E and in accordance with the NPPF.

12 No ecological management works affecting the moat adjacent to Woodhouse Farm shall commence until details of the proposed works and proposed water supply for the moat and a timescale for its implementation have been submitted to and approved in writing by the Waste Planning Authority. The works to the moat and water supply arrangements shall be implemented in accordance with the details approved.

Reason: To make appropriate provision for conserving and enhancing the natural environment within the approved development, in the interests of biodiversity and to protect the setting of the Woodhouse Farm Listed Buildings and in accordance with MLP policies S10 and DM1, WLP policy W10E, BCS policy CS5, CS8 and CS9 and BDLP policies RLP 80,RLP 84 and RLP 100.

13 No development shall commence until details of signage, telecommunications equipment and lighting within the Woodhouse Farm complex (comprising Woodhouse Farmhouse, the Bakehouse, and the listed pump together with the adjoining land outlined in green on Plan 1 (which can be found in the S106 agreement) have been submitted to and approved in writing by the Waste Planning Authority. The signage, telecommunications equipment and lighting shall be implemented in accordance with the details approved.

Reason: To protect the setting of the Listed Buildings and in the interest of visual amenity and to comply with MLP policy DM1, WLP policies, W8A W10B and W10E, BCS policy CS9 and BDLP policies RLP 36, RLP 65, RLP 90 and RLP 100.

14 No development shall commence until details of the design of the stack serving the IWMF have been submitted to and approved in writing by the Waste Planning Authority. The details to be submitted shall include:
(a) elevations, sections and plan views to appropriate scales and construction details;
(b) samples of the finish of the stack to provide a mirrored reflective surface; and
(c) information on the effect of weathering on the proposed stack material or how the effect of weathering is to be assessed by, for example the location on the site of examples of proposed materials which will be exposed to the elements and details of how the stack would be maintained to retain the quality of the surface of these materials.
The stack shall be constructed and maintained in accordance with the details approved.

Reason: In the interest of visual amenity and to protect the countryside and to comply with WLP policies W8A, W10B and W10E and BCS policy CS5, BDLP policies RLP 36, RLP 65 and RLP 90.

15 No development shall commence until design details and samples of the external construction materials, colours and finishes of the external cladding of the IWMF buildings and structures, and design and operation of the vehicle entry and exit doors, have been submitted to and approved in writing by the Waste Planning Authority. The development shall be implemented in accordance with the details and samples approved.

Reason: For the avoidance of doubt, in the interests of visual and landscape amenity and to comply with WLP policies W8A, W10B, W10E and BCS policy CS5 and BDLP policy RLP 90.

16 Not used

17 No development shall commence until a management plan for the CHP plant to ensure there is no visible plume from the stack has been submitted to and approved in writing by the Waste Planning Authority. The development shall be implemented in accordance with the approved plan.

Reason: In the interest of visual amenity, to protect the countryside and to comply with WLP policies W8A, W10B and W10E and BCS policy CS5 and BDLP policies RLP 36, RLP 65 and RLP 90.

18 No construction of the IWMF shall commence until details of the green roofs proposed for the IWMF have been submitted to and approved in writing by the Waste Planning Authority. The green roofs shall be implemented in accordance with the details approved.

Reason: In the interests of visual and landscape amenity and enhancement of ecological biodiversity and to comply with WLP policies W8A, W10B and W10E, BCS policy CS8 and BDLP policies RLP 80, RLP 84 and RLP 90.

19 No works to install process equipment or plant within the IWMF shall commence until details of the IWMF process layout and configuration have been submitted to and approved in writing by the Waste Planning Authority. The development shall be implemented in accordance with the approved details.

Reason: To ensure the layout and configuration of the process equipment and plant would not give rise to impacts not assessed as part of the application and Environmental Statement and to protect local amenity and to comply with WLP policies W8A, W10B and W10E, BCS policy CS5 and BDLP policies RLP 36, RLP 62 and RLP 90.

20 No development shall commence until details of the construction compounds and parking of all vehicles and plant and equipment associated with the extraction of materials and the construction of the IWMF have been submitted to and approved in writing with the Waste Planning Authority. The details shall include location, means of enclosure and surfacing. The compounds and parking shall be implemented in accordance with the approved details.

Reason: In the interest of visual amenity, to protect biodiversity and the countryside and to comply with MLP policies S10 and DM1, WLP policies W8A, W10B, W10E and BCS policies CS5 and CS8 and BDLP policies RLP 36, RLP 65, RLP 80 and RLP 90.

21 No beneficial occupation of the IWMF shall commence until details of the provision to be made for and the marking out of parking spaces for cars, HGVs and any other vehicles that may use the IWMF have been submitted to and approved in writing by the Waste Planning Authority. The parking provision and marking out shall be implemented in accordance with the approved details. The parking areas shall be retained and maintained permanently for manoeuvring and parking. No HGVs shall park in the parking area adjacent to Woodhouse Farm complex except in relation to deliveries for the uses at Woodhouse Farm complex.

Reason: In the interest of visual amenity, to protect biodiversity and the countryside and to comply with WLP policies W8A, W10B, W10E, BCS policies CS5 and CS8 and BDLP policies RLP 36, RLP 65, RLP 80, RLP 84 and RLP 90.

22 No development shall commence until a detailed scheme for foul water management, including details of the design and operation of the foul water system for the IWMF and Woodhouse Farm complex has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the details approved prior to the commencement of operation of the IWMF.

Reason: To minimise the risk of pollution on ground and surface water, to minimise the risk of flooding and to comply with WLP policies W4A, W4B, W8A and W10E and BLP policies RLP 36, RLP 62, RLP 71 and RLP 72.

23 No development shall commence until a detailed scheme for surface water drainage and ground water management, including details of water flows between the Upper Lagoon and the New Field Lagoon has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details.

<u>Reason:</u> *To minimise the risk of pollution on ground and surface water, to minimise the risk of flooding and to comply with WLP policies W4A, W4B, W8A and W10E and BLP policies RLP 36, RLP 62, RLP 71, RLP 72 and RLP90.*

24 No excavation shall commence until a scheme of ground water monitoring for the site has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall identify the locations for the installation of boreholes to monitor groundwater and the frequency of monitoring. The scheme shall be implemented in accordance with the details approved prior to the commencement of excavations on the site.

<u>Reason:</u> *To minimise the risk of pollution to ground and surface water and to comply with MLP policies MLP S1, S10 and DM1, WLP policies W4A, W4B, W8A and W10E and BLP policies RLP 36, RLP 62, RLP 71 and RLP 72.*

25 No development shall commence until an investigation to identify whether the site is contaminated has been carried out and details of the findings including any land remediation and mitigation measures necessary should contamination be identified. The development shall be implemented in accordance with the approved details including any remediation and mitigation identified.

<u>Reason:</u> *To minimise the risk of pollution to ground and surface water, to minimise the risk of flooding and to comply with MLP policies MLP S1, S10 and DM1, WLP policies W4A, W4B, W8A and W10E and BLP policies RLP 36, RLP 62, RLP 64, RLP 71 and RLP 72.*

26 The market de-inked paper pulp plant shall only source its heat steam and energy from the IWMF with the exception of periods of start-up and maintenance and repair of the IWMF.

<u>Reason:</u> *To ensure the market de-inked paper pulp plant only remains at the site as a direct consequence of its co-location with the IWMF and to protect the countryside from inappropriate development and to comply with WLP policies W8A and W7G and BCS policy CS5.*

27 No waste, except pre-sorted waste paper and card and Solid Recovered Fuel, shall be brought on to the site other than that arising from within the administrative area of Essex and Southend-on-Sea. Records indicating the origin of all waste consignments and tonnages brought to the site shall be kept and made available for inspection by the Waste Planning Authority for

at least 2 years after receipt of the waste. The records shall be made available to the Waste Planning Authority within 14 days of a written request.

<u>Reason:</u> *In the interests of the environment by assisting the Essex and Southend-on-Sea waste planning authorities to become self-sufficient for managing the equivalent of the waste arising in their administrative areas, ensuring that the waste is transported in accordance with the proximity principle, minimising pollution and minimising the impact upon the local environment and amenity and to comply with WLP policies W3A, W3C and W10E.*

28 Deleted

29 No waste other than those waste materials defined in the application shall enter the site for processing or treatment in the IWMF plant. No more than 853,000tpa of Municipal Solid Waste and/or Commercial and Industrial Waste shall be imported to the site.

<u>Reason:</u> *To ensure the scale of the facility would not give rise to impacts not assessed as part of the planning application and Environmental Statement and to protect local amenity and to comply with WLP policies W3A, W8A and W10E, BCS policy CS5 and BDLP policies RLP 36, RLP 62 and RLP 90.*

30 Deleted

31 No waste brought onto the site shall be deposited, handled, stored, composted or otherwise processed outside the IWMF buildings and structures.

<u>Reason</u>*: To ensure minimum disturbance from operations, to avoid nuisance to local amenity and to comply with WLP policies W3A, W8A and W10E, BCS policy CS5 and BDLP policies RLP 36, RLP 62 and RLP 90.*

32 All waste materials shall be imported and exported from the site in enclosed, containerised or sheeted vehicles.

<u>Reason</u>*: To ensure minimum nuisance from operations on local amenity, particularly litter and odour and to comply with WLP policies W3A, W8A and W10E, BCS policy CS5 and BDLP policies RLP 36, RLP 62 and RLP 90.*

33 No vehicle shall leave the IWMF site without first having been cleansed of all loose residual mineral or waste materials from the vehicle’s body and chassis.

<u>Reason</u>*: In the interests of highway safety, safeguarding local amenity and to comply with WLP policies W3A, W4C, W8A and W10E and BDLP policies RLP 36 and RLP 90.*

34 No removal of soils or excavation of overburden, boulder clay, sand and gravel shall be carried out other than between the following hours:

07:00-18:30 hours Monday to Friday; and,
07:00 -13:00 hours Saturdays;
and shall not take place on Sundays, Bank and Public Holidays except for water pumping, environmental monitoring and occasional maintenance of machinery, unless temporary changes are otherwise approved in writing by the Waste Planning Authority.

<u>Reason</u>: In the interests of limiting the effects on local amenity, to control the impacts of the development and to comply with MLP policies S1, S10 and DM1, WLP policies W10E and W10F and BDLP policies RLP 36, RLP 62 and RLP 90.

35 The construction works (including deliveries of building materials) for the development hereby permitted shall only be carried out between 07:00-19:00 hours Monday to Sunday and not on Bank and Public Holidays except for occasional maintenance of machinery, unless temporary changes are otherwise approved in writing by the Waste Planning Authority.

<u>Reason</u>: In the interests of limiting the effects on local amenity, to control the impacts of the development and to comply with MLP policies S1, S10 and DM1, WLP policies W10E and W10F and BDLP policies RLP 36 RLP 62 and RLP 90.

36 No waste or processed materials shall be imported or exported from any part of the IWMF other than between the following hours:
07:00 and 18:30 hours Monday to Friday; and,
07:00 and 13:00 hours on Saturdays,
and not on Sundays, Public or Bank Holidays except for clearances from Household Waste Recycling Centres on Sundays and Bank and Public Holidays between 10:00 and 16:00 hours as required by the Waste Disposal Authority and previously approved in writing by the Waste Planning Authority.

<u>Reason</u>: In the interests of limiting the effects on local amenity, to control the impacts of the development and to comply with WLP policies W10E and W10F and BDLP policies RLP 36, RLP 62 and RLP 90.

37 No development shall commence until visible, legible and durable British Standard signs have been erected on both sides of the access road at the point where footpaths as shown on the Definitive Map, cross the access road to warn pedestrians and vehicles of the intersection. The signs shall read: ‘CAUTION: PEDESTRIANS CROSSING’ and ‘CAUTION: VEHICLES CROSSING’ and shall be maintained for the duration of the development.

<u>Reason</u>: In the interest of the safety of all users of both the Right of Way and the haul road and to comply with MLP policies S1, DM1, WLP policies W3A, W4C, W8A, W10E and W10G and BDLP policies RLP 36, RLP 49,

RLP 62 and RLP 90

38 Except for temporary operations, as defined in Condition 42, between the hours of 07:00 and 19:00 the free field Equivalent Continuous Noise Level (LAeq 1 hour) at noise sensitive properties adjoining the Site, due to operations in the Site, shall not exceed the LAeq 1 hour levels set out in the following table:

Noise Sensitive Properties Location	Criterion dB LAeq 1 hour
Herring's Farm	45
Deeks Cottage	45
Haywards	45
Allshot's Farm	47
The Lodge	49
Sheepcotes Farm	45
Greenpastures Bungalow	45
Goslings Cottage	47
Goslings Farm	47
Goslings Barn	47
Bumby Hall	45
Parkgate Farm Cottages	45

Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface facing the site and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

Reason: In the interests of residential and local amenity and to comply with MLP policies S1, S10, DM1, WLP policies W3A, W8A, W10E, W10F and BDLP policies RLP 36, RLP 62 and RLP 90.

39 The free field Equivalent Continuous Noise Level (LAeq 1 hour) shall not exceed 42 dB(A) LAeq 1hour between the hours of 19:00 and 23:00, as measured or predicted at noise sensitive properties, listed in Condition 38, adjoining the site. Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface facing the site and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

Reason: In the interests of residential and local amenity and to comply with WLP policies W3A, W8A, W10E, W10F and BDLP policies RLP 36, RLP 62 and RLP 90.

40 The free field Equivalent Continuous Noise Level (LAeq 1 hour) shall not exceed 40 dB(A) LAeq 5min between the hours of 23:00 and 07:00, as measured and/or predicted at 1 metre from the façade facing the site at noise sensitive properties, listed in Condition 38, adjoining the site.

Reason: In the interests of residential and local amenity and to comply with

WLP policies W3A, W8A, W10E, W10F and BDLP policies RLP 36, RLP 62 and RLP 90.

41 Noise levels shall be monitored at three monthly intervals at up to five of the locations, listed in Condition 38, as agreed with the Waste Planning Authority. The results of the monitoring shall include the LA90 and LAeq noise levels, the prevailing weather conditions, details of the measurement equipment used and its calibration and comments on the sources of noise which control the noise climate. The survey shall be for four separate 15 minute periods, two during the working day 0700 and 1830, and two during the evening/night time 18:30 to 07:00 hours, the results shall be kept by the operating company during the life of the permitted operations and a copy shall be supplied to the Waste Planning Authority. After the first year of operation of the IWMF, the frequency of the monitoring may be modified by agreement with the Waste Planning Authority.

<u>Reason</u>*: In the interests of residential and local amenity and to comply with MLP policies S1, S10, DM1, WLP policies W3A, W8A, W10E, W10F and BDLP policies RLP 36, RLP 62 and RLP 90.*

42 For temporary operations at the site in relation to the excavation of materials, the free field noise level at sensitive properties, listed in Condition 38, adjoining the site shall not exceed 70dB LAeq 1 hour, due to operations on the site. Temporary operations shall not exceed a total of eight weeks in any continuous 12 month period for work affecting any noise sensitive property. Not less than 5 days written notice shall be given to the Waste Planning Authority in advance of the commencement of any temporary operation. Temporary operations shall include site preparation, bund formation and removal, site stripping and restoration, and other temporary activity as may be agreed, in advance of works taking place, with the Waste Planning Authority.

<u>Reason</u>*: In the interests of amenity and to comply with MLP policies S1, S10, DM1, WLP policies W3A, W8A, W10E, W10F and BDLP policies RLP 36, RLP 62 and RLP 90.*

43 No lighting for use during excavation of materials or construction of the IWMF within the site shall be erected or installed until details of the location, height, design, sensors and luminance have been submitted to and approved in writing by the Waste Planning Authority. The lighting details shall be such that no lighting shall exceed 5 lux maintained average luminance. The lighting details with respect to excavation of materials shall be such that the lighting shall not be illuminated outside the hours of 0700 and 1830 Monday to Friday and 0700 and 1300 Saturday and at no time on Sundays, Bank or Public Holidays except for security and safety lighting activated by sensors. The lighting details with respect to construction of the IWMF shall be such that the lighting shall not be illuminated outside the hours of 0700 and 1900 Monday to Sunday and at no time on, Bank or Public Holidays except for security and safety lighting activated by sensors. The details shall ensure the lighting is designed to minimise the potential

nuisance of light spillage from the boundaries of the site. The lighting shall thereafter be erected, installed and operated in accordance with the approved details.

<u>Reason</u>: In the interests of residential and local amenity and protection of the environment and in the interest of protecting biodiversity and in the interests of highway safety and to comply with MLP policies S1, S10, S12, DM1, WLP policies W3A, W8A, W10E and W10F, BCS policies CS5 and CS8 and BDLP policies RLP 36, RLP 62, RLP 65 and RLP 90.

44 No lighting for use during operation of the IWMF within the site shall be erected or installed until details of the location, height, design, sensors, times and luminance have been submitted to and approved in writing by the Waste Planning Authority. The lighting details shall be such that no lighting shall exceed 5 lux maintained average luminance. The lighting details shall be such that the lighting shall not be illuminated outside the hours of 0700 and 1830 Monday to Friday and 0700 and 1300 Saturday and at no time on Sundays, Bank or Public Holidays except for security and safety lighting activated by sensors. The details shall ensure the lighting is designed to minimise the potential nuisance of light spillage from the boundaries of the site. The lighting shall thereafter be erected, installed and operated in accordance with the approved details.

<u>Reason</u>: In the interests of residential and local amenity and protection of the environment and in the interest of protecting biodiversity, in the interests of highway safety and to comply with MLP policies S1, S10, S12, DM1, WLP policies W3A, W8A, W10E and W10F, BCS policies CS5 and CS8 and BDLP policies RLP 36, RLP 62, RLP 65 and RLP 90.

45 No development shall commence until a detailed phasing scheme for the construction of the access road for the creation of the retaining wall around the site of the IWMF and extraction of the minerals from the site has been submitted to and approved in writing by the Waste Planning Authority. The development shall be carried out in accordance with the approved phasing scheme.

<u>Reason</u>: In the interests of residential and local amenity and protection of the environment and in the interest of protecting biodiversity, in the interests of highway safety and to comply with MLP policies S1, S10, S12, DM1, WLP policies W3A, W8A, W10E and W10F, BCS policies CS5 and CS8 and BDLP policies RLP 36, RLP 62, RLP 65 and RLP 90.

46 No development shall commence until details of soil handling, soil storage and machine movements and the end use of soils have been submitted to and approved in writing by the Waste Planning Authority. The development shall be carried out in accordance with the details approved.

<u>Reason</u>: To minimise structural damage and compaction of the soil and ensure sustainable use of surplus soils and to aid in the restoration and planting of the site and to comply with MLP policies S1, S10 and DM1 and

WLP policies W3A and W10E.

47 Unless otherwise agreed in writing by the Waste Planning Authority, no topsoil, subsoil and/or soil making material shall be stripped or handled unless it is in a dry and friable condition[3] and no movement of soils shall take place:
During the months November to March (inclusive);

(a) When the upper 50 mm of soil has a moisture content which is equal to or greater than that at which the soil becomes plastic, tested in accordance with the 'Worm Test' as set out in BS1377:1977, 'British Standards Methods Test for Soils for Civil Engineering Purposes'; or
(b)When there are pools of water on the soil surface.

[3] The criteria for determining whether soils are dry and friable involves an assessment based on the soil's wetness and lower plastic limit. This assessment shall be made by attempting to roll a ball of soil into a thread on the surface of a clean glazed tile using light pressure from the flat of the hand. If a thread of 15cm in length and less than 3mm in diameter can be formed, soil moving should not take place until the soil has dried out. If the soil crumbles before a thread of the aforementioned dimensions can be made, then the soil is dry enough to be moved.

Reason: To minimise structural damage and compaction of the soil and to aid in the restoration and planting of the site and to comply with MLP policies S1, S10 and DM1 and WLP policies W3A and W10E.

48 No minerals processing other than dry screening of excavated sand and gravel or in the reformation of levels using Boulder or London Clays shall take place within the site.

Reason: To ensure that there are no adverse impacts on local amenity from the development not previously assessed in the planning application and Environmental Statement and to comply with MLP policies S1, S10, DM1 and DM3, WLP policies W3A, W8A and W10E, BCS policy CS5 and BDLP policies RLP 36, RLP 62 and RLP 90.

49 Any fuel, lubricant or/and chemical storage vessel whether temporary or not shall be placed or installed within an impermeable container with a sealed sump and capable of holding at least 110% of the vessel's capacity. All fill, draw and overflow pipes shall be properly housed within the bunded area to avoid spillage. The storage vessel, impermeable container and pipes shall be maintained for the duration of the development.

Reason: To minimise the risk of pollution to water courses and aquifers and to comply with MLP policies S1, S10 and DM1, WLP policies W3A, W4A, W4B, W8A, and W10E and BDLP policies RLP 36 and RLP 62.

50 Prior to the commencement of development, details of any temporary or permanent site perimeter fencing shall be submitted to and approved in writing by the Waste Planning Authority. The fencing shall be erected in accordance with the details approved.

Reason: In the interest of visual amenity, to protect the countryside and to comply with MLP policies S10 and DM1, WLP policy W10E and BCS policies CS5 and BDLP policies RLP 36, RLP 65 and RLP 90.

51 (a) No development shall take place until a scheme and programme of measures for the suppression of dust, have been submitted to and approved in writing by the Waste Planning Authority. The scheme shall include the suppression of dust caused by the moving, processing and storage of soil, overburden, stone and other materials within the site during excavation of materials and construction of the IWMF

(b) No beneficial occupation of the IWMF shall commence until a scheme and programme of measures for the suppression of dust, have been submitted to and approved in writing by the Waste Planning Authority. The scheme shall include:

(i) The suppression of dust caused by handling, storage and processing of waste; and
(ii) Dust suppression on haul roads, including speed limits.
In relation each scheme provision for monitoring and review.

The development shall be implemented in accordance with the approved schemes and programme for the duration of the development hereby permitted.

Reason: To reduce the impacts of dust disturbance from the site on the local environment and to comply with MLP policies S1, S10, DM1, WLP policies W3A, W8A and W10E and BDLP policies RLP 36, RLP 62 and RLP 90.

52 (a) No development shall commence until details of measures to control any fugitive odour from the excavation of materials and construction of the IWMF have been submitted to and approved in writing by the Waste Planning Authority the measures shall be implemented as approved.
(b) No beneficial occupation of the IWMF shall commence until details of equipment required to control any fugitive odour from the handling/storage/processing of waste have been submitted to and approved in writing by the Waste Planning Authority. The details shall be implemented as approved.

Reason: In the interests of local amenity and to comply with WLP policies W3A, W8A and W10E and BDLP policies RLP 36, RLP 62 and RLP 90.

53 An ecological survey shall be undertaken such that it is no more than 2 years old by the date of commencement of development, this survey shall

update the information contained within the Environmental Statement and submitted and approved on 27 July 2011 in accordance with condition 53 of planning permission Ref. APP/Z1585/V/09/2104804 (ECC ref ESS/37/08/BTE). The information approved was letter dated 19 May 2011 from Golder Associates with accompanying form Ecology report dated October 2010. The updated ecology report shall be used to assess the impact of the development and if required mitigation measures as set out within the Environmental Statement updated and amended to mitigate any impacts. Prior to the commencement of development, the ecological survey assessment of impact and any updated and amended mitigation shall be submitted to and approved in writing by the Waste Planning Authority. Any updated or amended mitigation shall be carried out in accordance with the approved details.

Reason: To make appropriate provision for conserving and enhancing the natural environment, in the interests of biodiversity and in accordance with MLP policies S10 and DM1, WLP policies W8A and W10E, BCS policy CS8 and BDLP policies RLP 80, RLP 81 and RLP 84.

54 No development shall commence until an habitat management plan including details of the proposed management and mitigation measures described in the Environmental Statement (amended) and the Habitat Management Plan dated May 2011 [as amended by emails from Golder Associates dated 13 July 2011 (18:22) and attachment and 18 July 2011 (15:30) and attachment] submitted in May 2011 in accordance with condition 54 of planning permission Ref. APP/Z1585/V/09/2104804 (ECC ref ESS/37/08/BTE) and approved on 27 July 2011 has been submitted to and approved in writing by the Waste Planning Authority. The amended plan shall include:

(i) Description and evaluation of the features to be managed;
(ii) Ecological trends and constraints on site that may influence management;
(iii) Aims and objectives of management;
(iv) Appropriate management options for achieving aims and objectives;
(v) Prescriptions for management actions;
(vi) Preparation of a work schedule (including a 5 year project register, an annual work plan and the means by which the plan will be rolled forward annually)
(vii) Personnel responsible for implementation of the plan; and,
(viii) Monitoring and remedial/contingencies measures triggered by monitoring.

The development shall be implemented in accordance with the approved amended plan.

Reason: To make appropriate provision for conserving and enhancing the natural environment, in the interests of biodiversity and in accordance with MLP policies S10 and DM1, WLP policies W8A and W10E, BCS policy CS8 *and BDLP policies RLP 80, RLP 81 and RLP 84.*

55 No demolition, excavation works or removal of hedgerows or trees shall be undertaken on the site during the bird nesting season [1 March to 30 September inclusive] except where a suitably qualified ecological consultant has confirmed that such construction etc. should not affect any nesting birds. Details of such written confirmations shall be sent to the Waste Planning Authority 14 days prior to commencement of the works.

Reason: To make appropriate provision for conserving and enhancing the natural environment, in the interests of biodiversity and in accordance with MLP policies S10 and DM1, WLP policies W8A and W10E, BCS policy CS8 and BDLP policies RLP 80, RLP 81 and RLP 84.

56 Only one stack shall be erected on the site to service all elements of the IWMF. The height of the stack shall not exceed 85 m Above Ordnance Datum.

Reason: In the interest of visual amenity, to protect the countryside and to comply with WLP policies W8A and W10E, BCS policy CS5 and BDLP policies RLP 36, RLP 65 and RLP 90.

57 No development shall commence until details and a timetable for implementation for all bunding and planting have been submitted to and approved in writing by the Waste Planning Authority. The planting details shall include species, sizes, spacing and protection measures. The bunding details shall include shape and angles of slope and depth of soils. The scheme shall be implemented within the first available planting season (October to March inclusive) following commencement of the development hereby permitted in accordance with the approved details and maintained thereafter in accordance with Condition 58 of this permission. The bunding and planting details and timetable for implementation shall be implemented in accordance with the approved details.

Reason: To comply with section 197 of the Town and Country Planning Act 1990 (as amended), to improve the appearance of the site in the interest of visual amenity, to protect the countryside and to comply with MLP policies S10 and DM1, WLP policies W8A and W10E, BCS policies CS5 and CS8 and BDLP policies RLP 36, RLP 62, and RLP 90.

58 Any tree or shrub forming part of the retained existing vegetation or the planting scheme approved in connection with the development that dies, is damaged, diseased or removed within the duration of 5 years during and after the completion of construction of the IWMF, shall be replaced during the next available planting season (October-March inclusive) with a tree or shrub to be agreed in advance in writing by the Waste Planning Authority.

Reason: To comply with section 197 of the Town and Country Planning Act 1990 (as amended), to improve the appearance of the site in the interest of visual amenity, to protect the countryside and to comply with MLP policies

S10 and DM1, WLP policies W8A and W10E, BCS policies CS5 and CS8 and BDLP policies RLP 36, RLP 62 and RLP 90.

59 No development shall commence until details of tree retention and protection measures have been submitted to and approved in writing by the Waste Planning Authority. The details shall include indications of all existing trees, shrubs and hedgerows on the site and on the immediate adjoining land together with measures for their protection and the approved scheme shall be implemented in accordance with the details approved.

<u>Reason</u>: *In the interest of visual amenity, to ensure protection for the existing natural environment, including adjacent TPO woodland and to comply with MLP policies S10 and DM1, WLP policies W8A and W10E, BCS policies CS5 and CS8 and BDLP policies RLP 80, RLP 81 and RLP 90.*

60 No development shall commence until a scheme for the management and watering of trees adjacent to the retaining wall surrounding the IWMF for the period of the excavation of materials and construction of the IWMF, and throughout the first growing season after completion of construction where necessary, has been submitted to and approved in writing by the Waste Planning Authority. The management and watering of trees shall be carried out in accordance with the scheme approved.

<u>Reason</u>: *In the interest of visual amenity, to ensure protection for the existing natural environment, including adjacent TPO woodland and to comply with MLP policies S10 and DM1, WLP policies W8A and W10E, BCS policies CS5 and CS8 and BDLP policies RLP 80, RLP 81and RLP 90.*

61 No beneficial use of Woodhouse Farm shall commence until details of the layout of the adjacent parking area including hard and soft landscaping and lighting have been submitted to and approved in writing by the Waste Planning Authority. The parking area shall be provided in accordance with the details approved prior to beneficial use of Woodhouse Farm.

<u>Reason</u>: *To protect the setting of the Listed Buildings and in the interest of visual amenity and to comply with MLP policy DM1, WLP policies W8A and W10E, BCS policy CS9 and BDLP policies RLP 36, RLP 65, RLP 90 and RLP 100.*

62 Prior to commencement of development, details of traffic calming measures designed to reduce the speed of traffic using the access road in the vicinity of the River Blackwater so as to protect potential crossing places for otters and voles, shall be submitted to and approved in writing by the Waste Planning Authority. The traffic calming measures shall be provided in accordance with the details approved.

<u>Reason:</u> To make appropriate provision for conserving and enhancing the natural environment within the approved development, in the interests of biodiversity and in accordance with MLP policies S10 and DM1, WLP

policies W8A and W10E, BCS policy CS8 and BDLP policy RLP 84.

63 Prior to commencement of development, details of the lining and signing of the crossing points of the access road with Church Road and Ash Lane shall be submitted to and approved in writing with the Waste Planning Authority. The lining and signing shall require users of the access road to "Stop" rather than "Give Way". The details shall be implemented as approved.

<u>Reason</u>*: In the interests of highway safety, safeguarding local amenity and to comply with MLP policies S1 and DM1, WLP policies W4C, W8A, W10E and W10G and BDLP policies RLP 36 and RLP 49.*

64 No development shall take place until a written scheme and programme of historic building recording for Woodhouse Farm and buildings (including Bakehouse & pump) has been submitted to and approved in writing by the Mineral Planning Authority. The written scheme and programme of historic building recording shall be implemented prior to the commencement of any demolition, works or conversion of any kind taking place at Woodhouse Farm and buildings as part of this permission.

<u>Reason</u>*: To ensure that any heritage interest has been adequately investigated and recorded prior to the development taking place and to comply with MLP policies S10 and DM1, WLP policy W10E, BCS policy CS9 and BDLP policy RLP 100 and the NPPF.*

INFORMATIVES

- This planning permission is subject to a legal agreement
- Reference to Solid Recovered Fuel (SRF) for the purposes of this planning permission is considered to be the same as Refuse Derived Fuel (RDF)

Reason for Approval

Subject to the imposition of the attached conditions, the proposal is acceptable having been assessed in the light of all material considerations, including weighting against the following policies of the development plan:

Essex & Southend Waste Local Plan adopted 2001

W3A – Waste Strategy
W3C – Receipt of Essex wastes only

Statement of Reasons

The planning policy justification for the imposition of conditions 28 and 30 relied upon national and regional planning policy that has now either been changed or abolished. Whilst nationally there continues to be an objective to be self-sufficient for waste disposal and recovery (Waste Regulations 2011), waste should where possible be treated or disposed of at the nearest appropriate facility (rWFD) and in line with the proximity principle, however recognising that new facilities will need to serve catchment areas large enough to secure the economic viability of the plant.

The applicant has shown through a review of planning permissions for similar EfW facilities and paper reprocessing facilities that no other similar facilities are constrained as to the source of their materials, such that it would be unreasonable to impose such constraints on the Rivenhall Facility and would potentially undermine the viability of the facility contrary to policy with the NPPW.

The applicant has shown through analysis of waste data that there is C & I waste suitable for use as SRF/RDF in the CHP/EfW facility arising within the East of England and surroundings areas, such that the Rivenhall facility would likely reduce the amount of waste going to landfill pushing waste management up the Waste Hierarchy in accordance with the NPPW. In addition, it has been shown that currently RDF is passing through Essex to Essex ports, RDF which could potentially be intercepted/redirected (subject to contracts) to the IWMF at Rivenhall reducing waste miles and seeing the RDF generate energy within the UK rather than being exported for use on the Continent and there by contributing to achieving the aim of national self-sufficiency with respect to waste management and increased energy recovery from waste. This is also consistent with the Waste Regulations as geographic circumstances have been taken into account.

The applicant has evidenced that there would not be over provision of EfW capacity in the East of England and the WPAs own evidence being complied to inform the emerging Replacement Waste Local Plan indicates that if the Rivenhall and/or Stanway major waste management facilities are not developed other waste management facilities would be likely to be required.

Similarly it has been shown that waste paper and card is currently being exported for reprocessing which could be reprocessed at Rivenhall and the facility would not be competing with existing waste paper reprocessing facilities, as the Rivenhall facility is aimed at a higher quality paper production than the currently being manufactured in the south and east of England.

The NPPF requires that there is a presumption in favour of sustainable development, the Rivenhall facility would result in the diversion of waste away from landfill and see reprocessing of recovered paper and card pushing waste management up the waste hierarchy in accordance with the NPPW.

It is also recognised within the NPPW that new facilities may need to serve larger catchment areas to be economic viable. It is therefore concluded that the proposals would still give rise to sustainable development and there is now is no planning policy justification to withhold planning permission and the conditions should be deleted

There are no other policies or other material considerations which are overriding or warrant the withholding of permission.

THE CONSERVATION OF HABITATS AND SPECIES REGULATIONS 2010 (as amended)

The proposed development would not be located adjacent to a European site. Therefore, it is considered that an Appropriate Assessment under Regulation 61 of The Conservation of Habitats and Species Regulations 2010 is not required.

STATEMENT OF HOW THE LOCAL AUTHORITY HAS WORKED WITH THE APPLICANT IN A POSITIVE AND PROACTIVE MANNER

The Waste Planning Authority has engaged with the applicant prior to submission of the application, advising on the validation requirements and likely issues.

Throughout the determination of the application, the applicant has been kept informed of comments made on the application and general progress. Additionally, the applicant has been given the opportunity to address any issues with the aim of providing a timely decision.

Dated: 26 March 2015

COUNTY HALL
CHELMSFORD

Signed:

Andrew Cook - Director for Operations, Environment and Economy

IMPORTANT - ATTENTION IS DRAWN TO THE NOTES ON THE NEXT PAGE

NOTES

TOWN AND COUNTRY PLANNING ACT 1990

NOTIFICATION TO BE SENT TO AN APPLICANT WHEN A LOCAL PLANNING AUTHORITY REFUSE PLANNING PERMISSION OR GRANT IT SUBJECT TO CONDITIONS

Appeals to the Secretary of State

• If you are aggrieved by the decision of your local planning authority to refuse permission for the proposed development or to grant it subject to conditions, then you can appeal to the Secretary of State under section 78 of the Town and Country Planning Act 1990.

• If you want to appeal against your local planning authority's decision then you must do so within 6 months of the date of this notice.

• If this is a decision that relates to the same or substantially the same land and development as is already the subject of an enforcement notice, if you want to appeal against your local planning authority's decision on your application, then you must do so within 28 days of the date of this notice.

• Alternatively, if an enforcement notice is served relating to the same or substantially the same land and development as in your application and if you want to appeal against your local planning authority's decision on your application, then you must do so within 28 days of the date of service of the enforcement notice, or within 6 months of the date of this notice, whichever period expires earlier.

• Appeals must be made using a form which you can get from the Secretary of State at Temple Quay House, 2 The Square, Temple Quay, Bristol BS1 6PN (Tel: 0303 444 5000) or online at www.planningportal.gov.uk/pcs

• The Secretary of State can allow a longer period for giving notice of an appeal but will not normally be prepared to use this power unless there are special circumstances which excuse the delay in giving notice of appeal.

• The Secretary of State need not consider an appeal if it seems to the Secretary of State that the local planning authority could not have granted planning permission for the proposed development or could not have granted it without the conditions they imposed, having regard to the statutory requirements, to the provisions of any development order and to any directions given under a development order.

MEMORANDUM

To:	Abraham	**Organisation:**	Environment Agency
cc:		**Organisation:**	
From:	James Sturman	**Our Ref:**	S1552-0720-0010JRS
Date:	13 November 2015	**No. of Pages:**	6
Subject:	Additional Information For Duly Making		

Dear Abraham,

Further to your recent request, please find below a response to each of the points requested.

1. **Section 5b, Part B2 of the application form – Site condition report**
   The Site Condition Report was submitted within the application, in both paper and electronic format. An electronic copy of the files have been submitted via the post to your offices in West Bridgford, Nottingham.

2. **Section 3a, Part B3 of the application form – Technical standards**
   The Technical Standards which have been used to demonstrate that the paper pulp plant and the mechanical biological treatment facility represent BAT are as follows:
   - S5.06 - Guidance for the recovery and disposal of hazardous and non-hazardous waste.
   - EPR 6.01 – Paper and Pulp Sector Guidance.
   - Best Available Techniques (BAT) Reference Document for the Production of Pulp, Paper and Board
   - BREF – Waste Treatment.

3. **Section 5a, part B3 of the application form**
   A copy of the Environmental Statement has been submitted via the post to your offices in West Bridgford, Nottingham.

4. **Sections 1 to 3, Part F1 of the application form – Working out charges**
   An updated Form Part F1 is presented in Annex 1.

5. **Part B1 of the application form – standard rules**
   Form Part B1 is presented in Annex 2.

6. **Gas engines – AD facility**
   The thermal input of the gas engines is approximately 1.25MWth, which equates to an efficiency of approximately 40%.

7. **Air quality impact assessment – ecological receptors**
   An updated air quality assessment has been undertaken. This is presented in Annex 3. The updated assessment includes the additional Local Wildlife Sites requested.

8. Air quality assessment – gas engines

The updated air quality assessment includes the impact of sulphur dioxide from the CHP engines as requested.

9. Opra

A revised OPRA assessment is presented in Annex 4.

10. Charges

As can be seen from the revised OPRA Assessment, the OPRA complexity score for the facility has not changed, therefore no additional fees are payable for the application to be Duly Made.

We trust that the information contained above and enclosed is suitable to enable the application to be Duly Made. If you have any questions, please feel free to contact James Sturman.

Yours sincerely
FICHTNER Consulting Engineers Limited

James Sturman
Consultant

Stephen Othen
Technical Director

Annex 1 Updated Form Part F1

Application for an environmental permit
Part F1 – Opra, charges and declarations

Environment Agency

Fill in this part for all applications for installations, waste operations, mining waste operations and groundwater discharges onto land. Please check that this is the latest version of the form available from our website.

For applications for water discharge and point source groundwater discharge activities you need to fill in part F2 instead.

Please read through this form and the guidance notes that came with it. Please write clearly in the answer spaces.

It will take less than two hours to fill in this part of the application form.

Contents

1 Working out charges (you must fill in this section)

You have to submit an application fee with your application. You can find out the charge by either looking at the relevant standard rules permit page, the 'Making an application' webpage at http://www.environment-agency.gov.uk/business/topics/permitting/32318.aspx, or the current environmental permitting charging scheme on our website at www.environment-agency.gov.uk which sets out our charges under the Environmental Permitting Regulations. Please remember that the charges are revised on 1 April each year and that there is an annual subsistence charge to cover the costs we incur in the ongoing regulation of the permit.

Note: for Opra charged Tier 3 Facilities you also need to complete an Opra profile (see section 2).

Table 1 – Working out charges

Type of application	Rivenhall IWMF			
	Summary of charges			
Tier 2 facilities (including Part A(2) and Part B; see guidance notes on part F1)	Charge identifier	Number of facilities	Charge for each facility (£)	Charges due (£)
AD facility	SR2012 No12	1	1,630.00	1,630.00
Tier 3 facilities				
Total Opra charging score for installations	293.00	× charge multiplier	206.00	= 60,358.00
Total Opra charging score for waste operations		× charge multiplier		=
Total Opra charging score for mining waste facilities		× charge multiplier		=
Other charges		1	500.00	500.00
Total charges due				62,488.00

2 Opra (does not apply to standard facilities, any other tier 2 permit applications (e.g. groundwater land spreading activities), or water-discharge or groundwater point source discharge activities)

If you are submitting a bespoke application, you must include a completed electronic copy in Excel of the current Opra spreadsheet.

For most variations, full and partial surrenders you will need to submit a copy of your current Opra profile based on your existing profile, not any new profile following the variation or surrender. Check the latest charges guidance for further advice.

For transfers you will need to submit a revised Opra profile to include your own operator performance. Note: this will not change the set transfer fee.

Tick this box to confirm that you have included the OPRA spreadsheet ☐

3 Payment

Tick below to show how you have paid.

Cheque ☑

Postal order ☐

Cash ☐ Tick below to confirm you are enclosing cash with the application

Credit or debit card ☐

Electronic transfer (for example, BACS) ☐

Remittance number

Date paid (DD/MM/YYYY)

How to pay

Paying by cheque, postal order or cash

Cheque details

Cheque made payable to

Cheque number

Amount £ 62,488.00

You should make cheques or postal orders payable to 'Environment Agency' and make sure they have 'A/c Payee' written across them if it is not already printed on.

Please write the name of your company and application reference number on the back of your cheque or postal order.
We will not accept cheques with a future date on them.

We do not recommend sending cash through the post. If you cannot avoid this, please use a recorded delivery postal service and enclose your application reference details. Please tick the box below to confirm you are enclosing cash.

I have enclosed cash with my application ☐

Paying by credit or debit card

If you are paying by credit or debit card, either we can call you or you can fill in the separate form CC1 and enclose it with the application. We will destroy your card details once we have processed your payment. We can accept payments by Visa, MasterCard or Maestro card only.

Please call me to arrange payment by debit or debit card ☐

I have enclosed form CC1 with my application ☐

Paying by electronic transfer BACS reference

If you choose to pay by electronic transfer you will need to use the following information to make your payment.

Company name:	Environment Agency
Company address:	Income Dept 311, PO Box 263, Peterborough, PE2 8YD
Bank:	Citigroup Centre
Address:	Canada Square, London, E14 5LB
Sort code:	08-33-00
Account number:	12800543
Payment reference number:	PSCAPPXXXXXYYY

You need to create your own reference number. It should begin with PSCAPP (to reflect that the application is for a permitted activity) and it should include the first five letters of the company name (replacing the X's in the above reference number) and a unique numerical identifier (replacing the Y's in the above reference number). The reference number that you supply will appear on our bank statements.

3 Payment, continued

You should also email your payment details and reference number to FSC-Income@environment-agency.gov.uk or fax it to 01733 464 892.

If you are making your payment from outside the United Kingdom, it must be in sterling. Our IBAN number is GB23 CITI0833 0012 8005 78 and our SWIFTBIC number is CITI GB2LXXX.

If you do not quote your reference number, there may be a delay in processing your payment and application.

Now read section 4 below.

4 The Data Protection Act 1998

We, the Environment Agency, will process the information you provide so that we can:

- deal with your application;
- make sure you keep to the conditions of the licence, permit or registration;
- process renewals; and
- keep the public registers up to date.

We may also process or release the information to:

- offer you documents or services relating to environmental matters;
- consult the public, public organisations and other organisations (for example, the Health and Safety Executive, local authorities, the emergency services, the Department for Environment, Food and Rural Affairs) on environmental issues;
- carry out research and development work on environmental issues;
- provide information from the public register to anyone who asks;
- prevent anyone from breaking environmental law, investigate cases where environmental law may have been broken, and take any action that is needed;
- assess whether customers are satisfied with our service, and to improve our service; and
- respond to requests for information under the Freedom of Information Act 2000 and the Environmental Information Regulations 2004 (if the Data Protection Act allows). We may pass the information on to our agents or representatives to do these things for us.

Now read section 5 below.

5 Confidentiality and national security

We will normally put all the information in your application on a public register of environmental information. However, we may not include certain information in the public register if this is in the interests of national security, or because the information is confidential.

You can ask for information to be made confidential by enclosing a letter with your application giving your reasons. If we agree with your request, we will tell you and not include the information in the public register. If we do not agree with your request, we will let you know how to appeal against our decision, or you can withdraw your application.

Only tick the box below if you wish to claim confidentiality for your application

Please treat the information in my application as confidential ☐

National security

You can tell the Secretary of State that you believe including information on a public register would not be in the interests of national security. You must enclose a letter with your application telling us that you have told the Secretary of State and you must still include the information in your application. We will not include the information in the public register unless the Secretary of State decides that it should be included.

You can find guidance on national security in 'Core Environmental Permitting Guidance' published by Defra and available via our website at www.environment-agency.gov.uk.

You cannot apply for national security via this application.

Now go to section 6.

6 Declaration

If you knowingly or carelessly make a statement that is false or misleading to help you get an environmental permit (for yourself or anyone else), you may be committing an offence under the Environmental Permitting (England and Wales) Regulations 2010.

A relevant person should make the declaration (see guidance notes on part F1). An agent acting on behalf of an applicant is NOT a relevant person.

Each individual (or individual trustee) who is applying for their name to appear on the permit must complete this declaration. You will have to print a separate copy of this page for each additional individual to complete.

If you are transferring all or part of your permit, both you and the person receiving the permit must make the declaration. You must fill in the declaration directly below; the person receiving the permit must fill in the declaration under the heading 'For transfers only'.

6 Declaration, continued

Note: If you are unable to trace one or more of the current permit holders please see below under the transfers declaration.

I declare that the information in this application is true to the best of my knowledge and belief. I understand that this application may be refused or approval withdrawn if I give false or incomplete information.

If you deliberately make a statement that is false or misleading in order to get approval you may be prosecuted.

I confirm that my standard facility will fully meet the rules that I have applied for (this only applies if the application includes standard facilities) ☑

Tick this box to confirm that you understand and agree with the declaration above, then fill in the details below ☑

Tick this box if you do not want us to use information from any ecological survey that you have supplied with your application (for further information please see the guidance notes on part F1) ☐

Name

Title (Mr, Mrs, Miss and so on): Mr

First name: Ralph

Last name: Keeble

on behalf of (if relevant; for example, a company or organisation and so on): Gent Fairhead and Co. Limited

Position (if relevant; for example, in a company or organisation and so on): Director

Today's date (DD/MM/YYYY): 23/09/2015

For transfers only – declaration for person receiving the permit

A relevant person should make the declaration (see guidance notes on part F1).

I declare that the information in this application to transfer an environmental permit to me is true to the best of my knowledge and belief. I understand that this application may be refused or approval withdrawn if I give false or incomplete information.

Note: If you cannot trace a person or persons holding the permit you may be able to transfer the permit without their declaration as above. Please contact us to discuss this and supply evidence in your application to confirm you are unable to trace one or all of the permit holders.

If you deliberately make a statement that is false or misleading in order to get approval you may be prosecuted.

Tick this box to confirm that you understand and agree with the declaration above ☐

Name

Title (Mr, Mrs, Miss and so on):

First name:

Last name:

on behalf of (if relevant; for example, a company or organisation and so on):

Position (if relevant; for example, in a company or organisation and so on):

Today's date (DD/MM/YYYY):

Now go to section 7

7 Application checklist (you must fill in this section)

If your application is not complete we will return it to you. If you aren't sure about what you need to send, speak to us before you submit your application.

You must do the following:

Complete legibly all parts of this form that are relevant to you and your activities ☐

Identify relevant supporting information in the form and send it with the application ☐

7 Application checklist (you must fill in this section), continued

List all the documents you are sending in the table below.
If necessary, continue on a separate sheet. This separate sheet also needs to have a reference number and you should include it in the table below ☐

For new permits or any changes to the site plan, provide a plan that meets the standards given in the guidance note on part F1 ☐

Provide a supporting letter for any claim that information is confidential ☐

Get the declaration completed by a relevant person (not an agent) ☐

Send the correct fee ☐

Question reference	Document title	Document reference

8 How to contact us

If you need help filling in this form, please contact the person who sent it to you or contact us as shown below.

General enquiries: 03708 506 506 (Monday to Friday, 8am to 6pm)

Textphone: 03702 422 549 (Monday to Friday, 8am to 6pm)

Email: enquiries@environment-agency.gov.uk

Website: www.environment-agency.gov.uk

If you are happy with our service, please tell us. It helps us to identify good practice and encourages our staff. If you're not happy with our service, please tell us how we can improve it.

Please tell us if you need information in a different language or format (for example, in large print) so we can keep in touch with you more easily.

9 Where to send your application (for how many copies to send see the guidance note on part F1)

Please send your filled in application form to:

Permitting Support Centre
Quadrant 2
99 Parkway Avenue
Parkway Business Park
Sheffield
S9 4WF

Do you want all information to be sent to you by email?

Please tick this box if you wish to have all communication about this application sent via email (we will use the details provided in Part A) ☐

Feedback

(You don't have to answer this part of the form, but it will help us improve our forms if you do.)

We want to make our forms easy to fill in and our guidance notes easy to understand. Please use the space below to give us any comments you may have about this form or the guidance notes that came with it.

How long did it take you to fill in this form? ______

We will use your feedback to improve our forms and guidance notes, and to tell the Government how regulations could be made simpler.

Would you like a reply to your feedback?

Yes please ☐

No thank you ☐

Crystal Mark 19132
Clarity approved by Plain English Campaign

For Environment Agency use only

Date received (DD/MM/YYYY) ______

Our reference number ______

Payment received?

No ☐

Yes ☐ Amount received £ ______

Annex 2 Form Part B1

Application for an environmental permit Part B1 – Standard facilities permit

Fill in this part of the form, together with parts A and F1 or F2, if you are applying for a new permit for standard facilities. Please check that this is the latest version of the form available from our website.

Please read through this form and the guidance notes that came with it. Please write clearly in the answer spaces.

(If you are making a bespoke application and are not applying for any standard facilities, do not use this form. Fill in part B2.)

It will take less than one hour to fill in this part of the application form.

Contents

1 About the permit

1a Discussions before your application

If you have had discussions with us before your application, give us the permit reference number or details on a separate sheet. Tell us below the reference you have given to this extra sheet.

Permit or document reference for the extra sheet

1b Is the permit for a site or for mobile plant?

Site ☑ Now go to section 2

Mobile plant ☐ Now go to section 3

Note: The term 'mobile plant' does not include mobile sheep dipping units.

2 About the site

What is the site name, address, postcode and national grid reference?

Site name: Rivenhall Integrated Waste Management Facility

Address: Rivenhall Airfield
Woodhouse Lane
Kelvedon
Essex

Postcode: CO5 9DF

National grid reference for the site (for example, ST 12345 67890): TL 824 204

National grid reference for the regulated facility:

3 About this application

3a Standard facilities

Tick the relevant boxes below to show which standard rules you are applying for.

Table 1 – Sets of standard rules that are available for your permit

Plain English Campaign's Crystal Mark does not apply to Table 1.

Standard rule description	Tonnes per annum (tpa)	Standard rule reference (office use only)
Household, commercial and industrial waste transfer station	Less than 75,000 tpa ☐	SR2008No1 75kte

3 About this application, continued

Table 1 – Sets of standard rules that are available for your permit, continued

Standard rule description	Tonnes per annum (tpa)		Standard rule reference (office use only)
Household, commercial and industrial waste transfer station (no building)	Less than 5,000 tpa	☐	SR2008No2 5kte
Household, commercial and industrial waste transfer station with treatment	Less than 75,000 tpa	☐	SR2008No3 75kte
Household, commercial and industrial waste transfer station with treatment (no building)	Less than 5,000 tpa	☐	SR2008No4 5kte
Household, commercial and industrial waste transfer station with asbestos storage	Less than 75,000 tpa	☐	SR2008No5 75kte
Household, commercial and industrial waste transfer station with asbestos storage (no building)	Less than 5,000 tpa	☐	SR2008No6 5kte
Household, commercial and industrial waste transfer station with treatment and asbestos storage	Less than 75,000 tpa	☐	SR2008No7 75kte
Household, commercial and industrial waste transfer station with treatment and asbestos storage (no building)	Less than 5,000 tpa	☐	SR2008No8 5kte
Asbestos waste transfer station	Less than 3,650 tpa	☐	SR2008No9 3650te
Inert and excavation waste transfer station	Less than 75,000 tpa	☐	SR2008No10 75kte
Inert and excavation waste transfer station with treatment	Less than 75,000 tpa	☐	SR2008No11 75kte
Non-hazardous household waste amenity site	Less than 75,000 tpa	☐	SR2008No12 75kte
Non-hazardous and hazardous household waste amenity site	Less than 75,000 tpa	☐	SR2008No13 75kte
Materials recycling facility	Less than 75,000 tpa	☐	SR2008No14 75kte
Materials recycling facility (no building)	Less than 5,000 tpa	☐	SR2008No15 5kte
Non-hazardous mechanical biological (aerobic) treatment (MBT) facility	Less than 75,000 tpa	☐	SR2008No18 75kte
Non-hazardous sludge biological, chemical and physical treatment site	Less than 250,000 tpa	☐	SR2008No19 250kte
Vehicle storage, depollution and dismantling (authorised treatment) facility	Less than 75,000 tpa	☐	SR2008No20 75kte
Metal recycling site	Less than 75,000 tpa	☐	SR2008No21 75kte
Storage of furnace ready scrap metal for recovery	Less than 75,000 tpa	☐	SR2008No22 75kte
Waste Electrical and Electronic Equipment authorised treatment facility (ATF) excluding ozone depleting substances	Less than 75,000 tpa	☐	SR2008No23 75kte
Clinical waste and healthcare waste transfer station	Less than 75,000 tpa	☐	SR2008No24 75kte
Clinical waste and healthcare waste treatment and transfer station	Less than 75,000 tpa	☐	SR2008No25 75kte
Mobile plant for the treatment of waste soils and contaminated material, substances or products	Tonnes per annum does not apply	☐	SR2008No27 Rem MP
Low impact Part A installation	Tonnes per annum does not apply	☐	SR2009No2
Low impact Part A installation for the production of biodiesel	No more than 2,000 tpa	☐	SR2009No3
Combustion of biogas in engines at a sewage treatment works	Tonnes per annum does not apply	☐	SR2009No4
Inert and excavation waste transfer station	Less than 250,000 tpa	☐	SR2009No5
Inert and excavation waste transfer station with treatment	Less than 250,000 tpa	☐	SR2009No6
Storage of furnace ready scrap metal for recovery	Less than 1,000,000 tpa	☐	SR2009No7
The management of inert extractive wastes at mines and quarries (and appendix 2; see below)	Tonnes per annum does not apply	☐	SR2009No8
Discharge to surface water: cooling water and heat exchangers	Max volume 1,000 cubic metres per day	☐	SR2010No2
Discharge to surface water: secondary treated domestic sewage	Max volume between 5 and 20 cubic metres per day	☐	SR2010No3

3 About this application, continued

Table 1 – Sets of standard rules that are available for your permit, continued

Standard rule description	Tonnes per annum (tpa)		Standard rule reference (office use only)
Mobile plant for land spreading	Spreading of waste for agricultural or ecological benefit. Up to 10 wastes types 50 hectares per deployment	☐	SR2010No4
Mobile plant for reclamation, restoration or improvement of land	Spreading of waste to create a soil profile. Up to 10 wastes types per hectare over 50 hectares	☐	SR2010No5
Mobile plant for land spreading of sewage sludge	Deployment max 250 tonnes per hectare over 50 hectares	☐	SR2010No6
Use of waste in construction	Less than 50,000 tonnes per site	☐	SR2010No7
Use of waste in construction	Less than 100,000 tonnes per site	☐	SR2010No8
Use of waste for reclamation, restoration or improvement of land	Less than 50,000 tonnes per site	☐	SR2010No9
Use of waste for reclamation, restoration or improvement of land	Less than 100,000 tonnes per site	☐	SR2010No10
Mobile plant for the treatment of waste to produce soil, soil substitutes and aggregate	Less than 75,000 tonnes per deployment	☐	SR2010No11
Treatment of waste to produce soil, soil substitutes and aggregate	Less than 75,000 tonnes per year	☐	SR2010No12
Use of waste to manufacture timber and construction products	Less than 75,000 tonnes per year	☐	SR2010No13
Composting biodegradable waste	Open and contained systems. Less than 500 tonnes on site at any one time	☐	SR2010No14
Storage of digestate from anaerobic digestion plant	Less than 75,000 tonnes storage at any one time	☐	SR2010No17
Storage and treatment of dredgings for recovery	Less than 125,000 cubic metres at any one time	☐	SR2010No18
Discharge to land: enzyme treated sheep dip	5 cubic metres per day	☐	SR2010No19
Composting biodegradable waste (in open and contained systems)	Open and contained systems. Less than 500 tonnes on site at any one time	☐	SR2011 No1_500t
Metal recycling site	Less than 25,000 tonnes per site	☐	SR2011 No2
Vehicle storage, depollution and dismantling (authorised treatment) facility	Less than 5,000 tonnes per site	☐	SR2011 No3
Treatment of waste wood for recovery	Less than 75,000 tonnes per site	☐	SR2011 No4
Composting in closed systems – waste operation	Limit of 75 tonnes per day	☐	SR2012 No3
Composting in closed systems – Part A installation	Less than 75,0000 tonnes	☐	SR2012 No4
Composting in open systems – waste operation	Limit of 75 tonnes per day	☐	SR2012 No7

3 About this application, continued

Table 1 – Sets of standard rules that are available for your permit, continued

Standard rule description	Tonnes per annum (tpa)		Standard rule reference (office use only)
Composting in open systems – part A installation	Less than 75,0000 tonnes	☐	SR2012 No8
Part A installation – on farm anaerobic digestion facility including the use of the resultant biogas	Over 100 tonnes per day and up to 100,000 tonnes per year and 5MW thermal input	☐	SR2012 No9
Waste recovery operation – on farm anaerobic digestion facility including the use of the resultant biogas	Less than 100 tonnes per day	☐	SR2012 No10
Part A installation – anaerobic digestion facility including the combustion of the resultant biogas	Over 100 tonnes per day and up to 100,000 tonnes per year and 5MW thermal input	☐	SR2012 No11
Waste recovery operation – anaerobic digestion facility including the combustion of the resultant biogas	Less than 100 tonnes per day	☑	SR2012 No12
Part A installation – treatment of incinerator bottom ash (IBA)	Over 75,000 tonnes per site	☐	SR2012 No13
Metal recycling, vehicle storage, depollution & dismantling (authorised treatment) facility	Less than 25,000 tonnes a year of waste metal and less than 5,000 tonnes a year of waste motor vehicles.	☐	SR2012 No14
Storage of electrical insulating oils	Less than 500 tonnes a year	☐	SR2012 No15
Small clinical waste treatment unit	Less than 100 tonnes a year	☐	SR2013 No1
The management of extractive waste, not including a waste facility, generated from onshore oil and gas prospecting activities of drill, core and decommissioning without well stimulation (using oil and/or water based drilling mud)		☐	SR2014 No2
		☐	
		☐	
		☐	
		☐	
		☐	

3b SR 2009No8 Management of inert extractive wastes at mines and quarries

Tick the box to confirm that you have filled in the waste management plan checklist in appendix 2 ☐

SR 2014 No2 The management of extractive waste, not including a waste facility, generated from onshore oil and gas prospecting activities of drill, core and decommissioning without well stimulation (using oil and/or water based drilling mud)

Please tick the relevant box to indicate which mining waste plan you are using.

Mining waste plan for water-based drilling mud ☐

Mining waste plan for oil- and water-based drilling mud ☐

Please provide an estimate of the total quantity of extractive waste to be generated ______ tonnes

3 About this application, continued

3c SR 2009No4 Combustion of biogas in engines at a sewage treatment works

Please tick if answer is yes.

3c1 Is the effective stack height more than 3 metres or is the stack height more than 7 metres? ☐

3c2 Do the engine stack gas releases not exceed 500 mg/m^3 for oxides of nitrogen and 1400 mg/m^3 carbon monoxide? ☐

If both boxes are ticked, the distance limit to dwellings of 200 metres no longer applies, for further guidance see the relevant web page.

3d SR 2010Nos 7, 8, 9 and 10 Deposit for recovery purposes (see guidance notes on part B1)

3d1 Are you applying for a waste recovery activity involving the permanent deposit of waste on land for construction or land reclamation?

No ☐

Yes ☐

3d2 Have we told you during pre-application discussions that we believe the activity is waste recovery?

No ☐

Yes ☐

3d3 Have there been any changes to your proposal since the pre-application discussion?

No ☐

Yes ☐

3d4 Please send us a copy of your waste recovery plan that complies with Regulatory Guidance Note 13. You need to highlight any changes you have made since the pre-application discussions. Also, below, give us the reference you have given the document with your justification.

Document reference

3e SR 2010Nos 2 or 3 Discharges to surface water (see guidance notes on part B1)

What date do you want the permit for this effluent to start? (DD/MM/YYYY)

Please note that charges will start on this date, even if you have not started to discharge.

Please give name of watercourse

We recommend that you contact us during pre-application discussions to find out if your proposed activity meets the nature conservation risk criteria (see guidance notes on part B1). Please tick this box if we have confirmed that you can meet the nature conservation risk criteria ☐

3f Low-impact installations

Are any of the regulated facilities low-impact installations?

No ☑

Yes ☐ Please give us a description of your proposed activity telling us how you meet the conditions for a low-impact installation and send it to us with your application form. Tell us below the reference number you have given this (see appendix 1 in the guidance notes on part B1).

Document reference

Tick the box to confirm you have filled in the low-impact installation checklist in appendix 1 for each regulated facility. ☐

4 General information (not mobile plant)

4a Provide a plan or plans for the site (See the guidance notes on part B1 for what needs to be marked on the plan)

Document plan reference or references: Refer to Annex 1.

4b Provide the relevant sections of a site condition/baseline report report (this only applies to installations – see guidance notes on part B1)

Document report reference: Refer to Annex 2.

If you are applying for a standard permit for an IED installation (SR2012 Nos 4, 8, 9, 11 and 13), tick the box to confirm that you have sent in a baseline report ☐

5 Your ability as an operator

5a Relevant offences (this applies to all except standalone surface water discharges and groundwater discharges – see guidance notes on part B1)

Have you, or any other relevant person, been convicted of any relevant offence?

No ☑

Yes ☐ Please give details below

Name of the relevant person

Title (Mr, Mrs, Miss and so on)

First name

Last name

Date of birth (DD/MM/YYYY)

Position held at the time of the offence

Name of the court where the case was dealt with

Date of the conviction (DD/MM/YYYY)

Offence and penalty set

Date any appeal against the conviction will be heard (DD/MM/YYYY)

If necessary, use a separate sheet to give us details of other relevant offences and tell us below the reference number you have given the extra sheet.

Document reference of the extra sheet

Now go to question 5b

5b Technical ability (relevant waste operations only – see the guidance notes on part B1)

Please tick the scheme you are using to show you have the suitable technical skills and knowledge to manage your facility.

CIWM/WAMITAB ☐

ESA/EU ☐

Please send in a registration letter from your scheme as above ☐

Now go to question 5c

5c Finances (installations, waste operations and mining waste operations only)

Please note that if you knowingly or carelessly make a statement that is false or misleading to help you get an environmental permit (for yourself or anyone else), you may be committing an offence under the Environmental Permitting (England and Wales) Regulations 2010.

Do you or any relevant person have current or past bankruptcy or insolvency proceedings against you?

No ☑

Yes ☐ Please give details below, including the required set-up costs (including infrastructure), maintenance and clean up costs for the proposed facility against which a credit check may be assessed.

We may want to contact a credit reference agency for a report about your business's finances.

5d Management systems (all)

You can find guidance on management systems in 'How to Comply'. We have also developed environmental management toolkits for some business sectors which you can use to produce your own management system. You can get these by calling 03708 506 506 or by downloading them from our website at www.environment-agency.gov.uk.

Does your management system meet the conditions set out in our guidance?

No ☐

Yes ☑

5 Your ability as an operator, continued

What management system will you provide for your regulated facility?

EC Eco-Management and Audit Scheme (EMAS) ☐
ISO 14001 ☑
BS 8555 (Phases 1–5) ☐
Green Dragon ☐
Own management system ☐

6 How to contact us

If you need help filling in this form, please contact the person who sent it to you or contact us as shown below.

General enquiries: 03708 506 506 (Monday to Friday, 8am to 6pm)

Textphone: 03702 422 549 (Monday to Friday, 8am to 6pm)

Email: enquiries@environment-agency.gov.uk

Website: www.environment-agency.gov.uk

If you are happy with our service, please tell us. It helps us to identify good practice and encourages our staff. If you're not happy with our service, please tell us how we can improve it.

Please tell us if you need information in a different language or format (for example, in large print) so we can keep in touch with you more easily.

Feedback

(You don't have to answer this part of the form, but it will help us improve our forms if you do.)

We want to make our forms easy to fill in and our guidance notes easy to understand. Please use the space below to give us any comments you may have about this form or the guidance notes that came with it.

How long did it take you to fill in this form?

We will use your feedback to improve our forms and guidance notes, and to tell the Government how regulations could be made simpler.

Would you like a reply to your feedback?

Yes please ☐
No thank you ☑

Crystal Mark 19102
Clarity approved by Plain English Campaign

For Environment Agency use only

Date received (DD/MM/YYYY)

Our reference number

Payment received?

No ☐

Yes ☐ Amount received

£

Plain English Campaign's Crystal Mark does not apply to appendices 1 and 2.

Appendix 1 – Low impact installation checklist (see the guidance notes on part B1)

Installation reference				
Condition	Response			Do you meet this?
A – Management techniques	Provide references to show how your application meets A.			Yes ☐ No ☐
	References			
B – Aqueous waste	Effluent created		m^3/day	Yes ☐ No ☐
C – Abatement systems	Provide references to show how your application meets C.			Yes ☐ No ☐
	References			
D – Groundwater	Do you plan to release any hazardous substances or non-hazardous pollutants into the ground?		Yes ☐ No ☐	Yes ☐ No ☐
E – Producing waste	Hazardous waste		Tonnes per year	Yes ☐ No ☐
	Non-hazardous waste		Tonnes per year	
F – Using energy	Peak energy consumption		MW	Yes ☐ No ☐
G – Preventing accidents	Do you have appropriate measures to prevent spills and major releases of liquids? (See 'How to comply'.)		Yes ☐ No ☐	Yes ☐ No ☐
	Provide references to show how your application meets G.			
	References			
H – Noise	Provide references to show how your application meets H.			Yes ☐ No ☐
	References			
I – Emissions of polluting substances	Provide references to show how your application meets I.			Yes ☐ No ☐
	References			
J – Odours	Provide references to show how your application meets J.			Yes ☐ No ☐
	References			
K – History of keeping to the regulations	Say here whether you have been involved in any enforcement action as described in Compliance History Appendix 1 explanatory notes.		Yes ☐ No ☐	

Appendix 2 – Waste management plan checklist for standard permit applications for mining waste operations

Waste management plan checklist for standard rules SR2009No8 – the management of inert wastes and unpolluted soil resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries, at mines and quarries

Name of operator ______

Name of site ______

Please confirm whether the standard answers apply to you in the YES/NO/NA column.

Questions	Answers
Do you have a waste management plan that you will operate to for the minimisation, treatment, recovery and safe disposal of extractive waste?	Yes ☐ No ☐
Is it available for inspection by the Environment Agency on request?	Yes ☐ No ☐
If the waste will be deposited, or will accumulate in a waste facility, does your waste management plan provide justification that it is not a Category A facility?	Yes ☐ No ☐ NA ☐
Does your waste management plan characterise the waste in accordance with Annex II of the Directive?	Yes ☐ No ☐
Does your waste management plan confirm that the waste is inert?	Yes ☐ No ☐
Does your waste management plan provide an estimate of the total quantity of extractive waste to be generated during the operational phase?	Yes ☐ No ☐
Does your waste management plan describe the operation generating the waste and any subsequent treatment of the waste?	Yes ☐ No ☐
Does your waste management plan contain a description of how the environment and human health could be adversely affected by the deposit of extractive waste and the preventive measures that you will take in order to minimise the environmental impact during operation and after closure, including any control and monitoring procedures? Note: the plan should include, but not be limited to, selection of the location of the facility, preventive measures to minimise dust, noise, vibration and the run-off of waste from the activities.	Yes ☐ No ☐
Does your waste management plan contain a proposed plan for the closure of the site?	Yes ☐ No ☐
If you operate a mining waste facility, does your waste management plan contain a survey of the condition of the land to be affected by the waste facility?	Yes ☐ No ☐ NA ☐

Does the mining waste operation include one or more inert mining waste facilities?

No ☐

Yes ☐ Provide the number of inert mining waste facilities ______

Sector category

Tick the correct category below:

Construction minerals ☐

Metallic minerals ☐

Industrial minerals ☐

Energy minerals ☐

Other sectors ☐ Please provide details below

Explanatory notes to checklist

- This checklist applies only to standard permit applications.
- The Environment Agency will not need to see the waste management plan as part of the application for a standard permit.
- The waste management plan itself may include material prepared for other purposes, such as planning applications and health and safety legislation.
- You must review your waste management plan at least every five years and, where necessary, amend the plan.
- We will monitor the implementation of the waste management plan as part of our compliance work.

Annex 3 Updated Air Quality Assessment

AQ model files not accessible to public

Annex 4 Updated OPRA Assessment

see separate file