# New Earth Solutions (Scottish Borders) Ltd

PPC Permit Variation Application

May 2013

# Notice

This document and its contents have been prepared and are intended solely for New Earth Solutions (Scottish Borders)' (NES) information and use in relation to the application for PPC permit variation application for the Easter Langlee MBT Facility.

Atkins Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 183 pages including the cover.

## Document history

| Job number: 5115659 | | | Document ref: PPC Permit Variation Application | | | |
|---|---|---|---|---|---|---|
| **Revision** | **Purpose description** | **Originated** | **Checked** | **Reviewed** | **Authorised** | **Date** |
| Rev 0 | Draft for client comment | PY, NB, AR | PY | AR, SW (NES) | JAS | 15/04/2013 |
| Rev 1 | FINAL | PY, NB, AR | PY | SW (NES) | JAS | 22/05/2013 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

# TABLE OF CONTENTS

## TABLES

## FIGURES

| **Form PPC1 Part A :** Application for a permit, variation, transfer or surrender | | | | | |
|---|---|---|---|---|---|
| FOR SEPA USE ONLY | Date Received | Fee Received<br>Yes ❐ No ❐ | Amount | Name Assigned to Installation | Application Reference |

Application for a permit, variation, transfer or surrender.
Pollution Prevention and Control Act, 1999
Pollution Prevention and Control (Scotland) Regulations 2000

SEPA Scottish Environment Protection Agency

## Introduction to Part A

### When to use this form

Use this form if you are sending an application to the Scottish Environment Protection Agency (SEPA) under the Pollution Prevention and Control (Scotland) Regulations 2000 ("the PPC Regulations").

This form is to be used for applications made in respect of both 'installations' and 'mobile plant' (and in the rest of the form, the term 'installation' also covers 'mobile plant' where appropriate).

### Why SEPA requires this information

The information provided in these forms will be used to determine your application. It will also be used to set appropriate limits on your operation, and it is in your interests to ensure that you answer each question as fully as possible.

### Before you start to fill in this form

Please read the notes we have produced to help you with your application, called *Part A Installations: Guide for Applicants.* You will also need to read the relevant Technical Guidance to which the Guide refers.

*The Guide contains a list of other documents you may need to refer to when you are preparing your application, and explains some of the technical terms we use.*

In particular, you should make sure that you refer to the explanation of 'installation' in the Guide. For example, there may be two or more operators in a single installation. Each operator will need a permit, each obtained by a separate application. Your applications will principally relate to the part of the installation under your control, but will also need to include some information on the rest of the installation. This will help us to assess the operation of the whole installation. The term 'installation', when used in this application form (and elsewhere) may refer to either the whole or part of the installation, depending on the nature of the information we are seeking to obtain.

### Which parts of the form to fill in?

The form is in six parts but we usually only send you the parts you need to fill in. **Everyone has to fill in Part A, and complete and sign Part F at the end of their application.**

The other parts you need to fill in depend on the type of application you are making:

- To apply for a **new permit** – *fill in* **Parts A** *and* **B** *then* **Part F**,
- To **vary and existing permit** – *fill in* **Parts A** *and* **C** *then* **Part F**,
- To **transfer all or part of an existing permit to someone else** – *fill in* **Parts A** *and* **D** *then* **Part F**. *This should be a joint application by the transferor and the transferee,*
- To **surrender all or part of an existing permit** – *fill in* **Parts A** *and* **E** *then* **Part F**.

### Operators of incineration and co-incineration plant that are submitting applications for plant that is subject to the Waste Incineration (Scotland) Regulations 2003 (SSSI 2003/170) should

- Ensure the information detailed in the Supplementary Guidance is included; and
- Note that for incineration plant and co-incineration plant that fall within Schedule 1, Part 1, Section 5.1, Part A, paragraph (d) and (e) there is no requirement to answer question B1.3 (site report) and B2.12 (satisfactory site condition).

### Other documents we need to see

There are a number of other documents you will need to send us with your application. Each time a request for documents is made in the application form you will need to record a document reference number for the document or documents that you are submitting in the box provided on the form for this purpose. Please also mark the document(s) clearly with this reference number and either the application reference number (if you have one, it is at the top right of this page) or your existing permit number. If you do not have either of these, please use the name of the installation.

### Using continuation sheets

In the case of questions required to be answered on the application form itself, please use a continuation sheet if you need extra space; but please indicate clearly on the form that you have done so by stating a document reference number for that continuation sheet. Please also mark the continuation sheet itself clearly with the information referred to above.

### Copies

For a **permit application** please send the original and **10** copies of the form and all other supporting material.

For a **variation application** please send the original and **2** copies of the form and all other supporting material. Further copies will be requested if the variation would qualify under paragraph 4 of Schedule 7 of the regulations.

**Copies** (cont)

For a **transfer or surrender applications** please send the original and **2** copies of the form and all other supporting material. Further copies will be requested if SEPA believes they are required by the regulations.

## If you need help and advice

We have made the application form as straightforward as possible, but please get in touch with us if you need any advice on how to set out the information we need.

*Please get in touch with your local SEPA office.*

## A1 About your Application

### A1.1 What type of application are you making

| | |
|---|---|
| **New permit:** | |
| **Variation of an existing permit:** | ✓ |
| **Transfer of an existing permit:** | |
| **Surrender of an existing permit:** | |

### A1.2 Name of the Installation

**Easter Langlee Integrated Waste Recovery and Renewable Energy Facility**

### A1.3 Please give the address of the site of the installation.

| | |
|---|---|
| **Address:** | **Langshaw Road** |
| | **Easter Langlee** |
| | **Galashiels** |
| | |
| **Postcode:** | **TD1 2NT** |

**Ordnance Survey national grid reference 8 characters,**
***For example SJ 123 456***

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | T | 5 | 2 | 1 | 0 | 3 | 6 | 1 | 3 | | |

### A1.4 Give details of any existing permit(s) for the installation

*Please give the current PPC permit number. If you do not have one, give details of any applicable IPC authorisation, APC authorisations, Groundwater Regulations authorisations, waste management licences or water discharge consents.*

Permit number(s) and type(s):

**PPC/A/1094330 Easter Langlee MBT Facility PPC permit**

### A1.5 Do you consider that the installation meets the criteria for a "low impact installation" as defined by SEPA

*(Please note that this definition does not apply to installations containing activities that are defined in the PPC Regulations by reference to a numerical threshold).*

NO ✓ YES ❑

Have you included the written confirmation from SEPA that you are a low impact installation?

NO ❑ YES ❑

| | |
|---|---|
| **Letter Reference Number:** | |

## A2 Authorised Contact

*It will help us to have someone who we can contact directly with any questions about your application. The person you name should have the authority to act on your behalf.*

**A2.1 Who can we contact about your application?**
*This could be an agent rather than the operator.*

| | | | |
|---|---|---|---|
| **Name:** | **Ms Sara Whittle** | | |
| **Position:** | **Environmental Permits Manager** | | |
| **Address:** | **Key House, 35 Black Moor Road, Ebblake Industrial Estate, Verwood** | | |
| | **Dorset** | | |
| **Postcode:** | **BH31 6AT** | | |
| **Tel No:** | **01202 812350** | **Fax No:** | **01202 829283** |
| **E-Mail:** | sara.whittle@newearthgroup.co.uk | | |

## A3 About the Operator

Please provide the information requested below about the operator, which means:

- For applications for a new permit – the person who it is proposed will have control over the installation in accordance with the permit (if granted),
- For applications for a variation, transfer or surrender – the person who currently has control over the installation in accordance with the permit.

*If you are applying for a transfer, we will ask for more information relating to the proposed new operator (transferee) in Part D.*

### Legal Status of Operator

**A3.1 Is the operator an individual, a group of individuals, a partnership or a company/corporate body?**

| | |
|---|---|
| **Individual (sole trader) or group of individuals go to question A3.2** | |
| **Partnership go to question A3.3** | |
| **Company or corporate body go to question A3.5** | ✓ |

## Individual Applicants

### A3.2 Please give us the following details.

Where more than one person is applying (other than as a partnership) we need details of each person.
*Continue on separate sheets if necessary*.

| | |
|---|---|
| **Full Name:** | |
| **Date of birth:** | |
| **Trading/business name (if any):** | |
| **Business Address** | |
| | |
| | |
| **Postcode:** | |
| **Contact Details:** | |
| **Phone Number:** | |
| **E-Mail Address:** | |
| **Fax Number:** | |

*Now go to question A4, What to do next.*

## Applications from Partnerships

### A3.3 Who is applying?

*We can issue permits to named individuals, and to a partnership name. However, we need details of each person in the partnership. (Continue on separate sheet if necessary)*

Person

| | |
|---|---|
| **Full Name:** | |
| **Date of birth:** | |
| **Principal place of business:** | |
| **Business Address** | |
| | |
| | |
| **Postcode:** | |
| **Contact Details:** | |
| **Phone Number:** | |
| **E-Mail Address:** | |
| **Fax Number:** | |

Person

| | |
|---|---|
| **Full Name:** | |
| **Date of birth:** | |
| **Principal place of business:** | |
| **Business Address** | |
| | |
| | |
| **Postcode:** | |
| **Contact Details:** | |
| **Phone Number:** | |
| **E-Mail Address:** | |
| **Fax Number:** | |

Person

| | |
|---|---|
| **Full Name:** | |
| **Date of birth:** | |
| **Principal place of business:** | |
| **Business Address** | |
| | |
| | |
| **Postcode:** | |
| **Contact Details:** | |
| **Phone Number:** | |
| **E-Mail Address:** | |
| **Fax Number:** | |

### A3.4 Please give us the following details about the partnership.

Person

| | |
|---|---|
| **Name of partnership (if there is one)** | |
| **Principal place of business:** | |
| **Business Address** | |
| | |
| | |
| **Postcode:** | |
| **Contact Details:** | |
| **Phone Number:** | |

| | |
|---|---|
| **E-Mail Address:** | |
| **Fax Number:** | |

**Now go to question A4, What to do next.**

## Companies or Other Corporate Applicants

### A3.5 Please give us the following details.

| | | | |
|---|---|---|---|
| **Full name of company or corporate body:** | **New Earth Solutions (Scottish Borders) Limited** | | |
| **Trading / Business name (if different)** | | | |
| **Registered Office Address** | **Key House**<br>**35 Black Moor Road**<br>**Ebblake Industrial Estate** | | |
| | **Verwood** | | |
| | **Dorset** | | |
| **Postcode:** | **BH31 6AT** | **E-Mail:** | sara.whittle@newearthgroup.co.uk |
| **Fax No:** | **01202 829283** | **Telephone No:** | **01282 812350** |

| | | | |
|---|---|---|---|
| **Principal Office Address (if different)** | | | |
| | | | |
| | | | |
| **Postcode:** | | **E-Mail:** | |
| **Fax No:** | | **Telephone No:** | |
| **Company Registration Number:** | **07592385** | **Date of Formation of Company:** | **05/04/2011** |

Is this a new application or has there been a change in registered company details since the last application (associated with this installation) to SEPA?

NO ✓ YES ❑

*If YES please provide a copy of the certificate of incorporation and any certificates of subsequent name changes.*

| | |
|---|---|
| **Reference Number for the Documents** | |

For applications from other corporate bodies, *please provide evidence of status*.

| | |
|---|---|
| **Reference Number for the Documents** | |

### A3.6 Is the operator a subsidiary of a holding company within the meaning of Section 736 of the Companies Act 1985?

NO ✓ YES ❑

| | |
|---|---|
| **Name of Ultimate Holding Company** | |

| | | | |
|---|---|---|---|
| **Registered Office Address** | | | |
| | | | |
| | | | |
| **Postcode:** | | **E-Mail:** | |
| **Fax No:** | | **Telephone No:** | |

| | | | |
|---|---|---|---|
| **Principal Office Address (if different)** | | | |
| | | | |
| | | | |
| **Postcode:** | | **E-Mail:** | |
| **Fax No:** | | **Telephone No:** | |
| **Company Registration Number:** | | **Date of Formation of Company:** | |

## A4 What to do Next

Now you need to fill in the other Parts of this form we sent you.
If you are applying for

- A new permit – **fill in Part B then go to Part F**.
- A variation – **fill in Part C then go to Part F**.
- A transfer – **fill in Part D then go to Part F**.
- A surrender – **fill in Part E then go to Part F**.

## Waste Incineration and Co-Incineration Plants Supplementary Guidance

**As a result of the Waste Incineration (Scotland) Regulations 2003, the following additional information shall be supplied by the operator as part of the application**

| Category / Question | Additional Information Required |
|---|---|
| ***Design & Operation*** | |
| **B2.2** | Demonstration that the plant is designed equipped and operated to meet the requirements of Regulations taking account of the categories of waste to be incinerated. |
| **B2.2** | Plant capacity, categories of waste (according to the European Waste catalogue) to be treated in the plant including their quantities, systems for receiving, storing and handing of waste on site. |
| **B2.2, B2.3 & B3** | For co-incineration plants, provide the information on the process and their conventional fuels and emission predictions or measured emission values. |
| **B2.3** | Information on temperatures and residence time (including measurement and validation methods), waste feed interlock to stop waste feed when the temperatures are below the permitted levels, provision of auxiliary burners including the description of proposed auxiliary fuel. |
| **B2.3** | In the case of a request for derogation from the temperature or residence time requirements, justification for the proposal and its effect on the quality and quantity of residues produced and the emissions into air of TOC and CO. |
| **B2.3 & B3** | In the case of abnormal operating condition, how will the dust emissions be controlled to below 150 $mg/m^3$. |
| **B2.3 & B3** | Information on the predicted emissions to air and water and show how the Directive's emission limits will be complied with at all times (e.g. by showing that there are enough operating margins between the predicted emissions and the ELV's). |
| **B2.6, B2.7, B3 & B6.3** | Information on methods and handling of waste waters on the site shall be provided to particularly show that storage areas have been designed in a way that will prevent the unauthorised and accidental release of any polluting substances into air, soil, surface water and ground water. |
| **B3** | Where an applicant is looking for a time-limited derogation from NOx limits (as allowed by the regulations), a BAT justification for these higher limits must be provided. |
| **B4.1** | Details of stack height calculations, dispersion calculations and the environmental impact of the emissions from the plant to demonstrate that human health and the environment will be protected. |
| ***Heat Recovery*** | |
| **B2.6, B2.7 & B2.8.1** | Information of the use of heat generated from the process – for example through combined heat and power, generation of process steam or district heating including proposals for future improvements in heat utilisation. |
| ***Residues*** | |
| **B2.6 & B2.7** | The quality (total organic carbon content and/or loss on ignition) and quantity of residues produced, handling and storage of these residues, proposals for minimising/recycling and disposal, and information on the chemical constituents of the residues. |
| ***Monitoring*** | |
| **B2.11** | Details of the monitoring techniques that will be employed to meet the requirements of the regulations. In particular, confirmation that CEN standards will be applied where available and, when such standards are not available, that ISO or national or international standards will be used (subject to the agreement of SEPA). |
| **B2.11** | Details of the monitoring points and the monitoring equipment to be used, especially the continuous monitors (CEM's). In the case of a plant already in operation, confirm that all CEM's will have been fully commissioned and operational by the date on which the regulations apply (e.g. 28 December 2005 for existing plants). They will also need to show that the CEM's have been calibrated to CEN standards by the above date. |

**Form PPC1 Part C :** Application for a variation

| FOR SEPA USE ONLY | Name Assigned to Installation | Application Reference |
|---|---|---|
| | | |

Use this part of the form if you are applying to vary the conditions or any other provision contained in your permit.

SEPA Scottish Environment Protection Agency

## C1 About your proposed changes

**Please fill in the installation table below with details of all the current activities and operators at the whole installation (even if your existing permit is in respect of only part of the installation) and the proposed changes.**

In column 1 **Activities in the "stationary technical unit"** please identify all activities listed in Schedule 1 to the PPC Regulations that are proposed to be carried out in the "Stationary technical unit" of the installation.

For **Directly associated activities** please identify any directly associated activities proposed to be carried out on the same site which:

- Have a technical connection with the activities in the stationary technical unit,
- Could have an effect on pollution.

In **Column 2 Schedule 1 references**, please quote the Chapter number, Section number, Part A or B, then paragraph and sub-paragraph number as shown in Part 1 of Schedule 1 to the PPC Regulations for each activity listed in column 1.

In **Column 3 Operator**, write the name of the operator for each activity (if you are the operator yourself, write "Applicant"). In **Column 4 Variations**, indicate how the proposed changes would affect the activities.

### C1.1 Installation table for new permit application

| **Column 1**<br>Activities in the 'Stationary Technical Unit' | **Column 2**<br>Schedule 1 refs | **Column 3**<br>Operator | **Column 4**<br>Variations |
|---|---|---|---|
| **Disposal of non-hazardous waste in plant with a capacity exceeding 50 tonnes per day by physico-chemical treatment specified in paragraph D9 of Annex IIA to Council Directive 75/441** | **Section 5.3 Part A(c)(ii)** | **New Earth Solutions (Scottish Borders) Limited (NESSB)** | **This has changed from the previous activity 5.3 Part A(c)(i)**<br>**Biostabilisation process removed** |
| **The incineration of waste, including animal remains, in an incineration plant not covered by paragraph (a) above, on premises where there is plant used or designed to incinerate waste at a rate of 1 tonne or more per hour** | **Section 5.1 Part A (b)** | **New Earth Solutions (Scottish Borders) Limited (NESSB)** | **New activity introduced by this application, incorporating the 4 NEAT pyrolysis and gasifier lines; purification of syngas and treatment of combustor exhaust gas; treatment and storage of residues, surface water and waste water; systems for controlling and monitoring operations; and receipt, storage and handling of wastes and raw materials (including fuels)** |

Directly Associated Activities

| | | | |
|---|---|---|---|
| **Electricity and power generation** | **N/A** | **New Earth Solutions (Scottish Borders) Limited (NESSB)** | **Generation of nominally 1 MWe per line using CHP engines for use on site, export to the grid or export to heat customers** |

## The variations you are proposing

**C1.2 Please provide a summary of the variations which you are applying for.**

This should include:
- A description of the change in operation requiring the variation (if appropriate),
- An indication of the variations to the conditions of the permit that you wish us to make.

| | |
|---|---|
| *Reference number for the summary* | **Section 1.3** |

**C1.3 Are you proposing any change in operation that would result in additional land being included within the site of the installation?**

| | | |
|---|---|---|
| ✓ | **NO** | |
| ☐ | **YES** | *Please provide:-* |

- *a site report for the additional land and, in particular, identifying any substance in, on or under the land which may constitute a pollution risk. The condition of the site includes the surface soils, as well as sub-surface strata and any associated groundwaters. The condition should be presented as concentration ranges for areas or zones at the installation which are likely to be in the same condition. The areas, when combined, should cover the entire installation.*

*Reference number for the site report*

- *maps or plans which are necessary to update those you submitted with your application for the existing permit.*

*Reference number for the maps or plans*

**C1.4 In your view, will the variations for which you are applying entail a substantial change as defined in the Pollution Prevention and Control (Scotland) Regulations 2000?**

| | | |
|---|---|---|
| ☐ | **NO** | *Please provide an explanation:* |

Reference number for the explanation:

| | | |
|---|---|---|
| ✓ | **YES** | *Please provide and explanation :-* |

Reference number for the explanation:

**Section 1.3**

# C2 Your proposed techniques

Please provide written information about how your proposed changes will affect the aspects of your installation listed below.
In each case you should:

- Address all of the issues set out in the section of the relevant technical guidance identified in brackets;
- Justify your proposals against any indicative requirements contained in the guidance; and
- Provide any other information about the installation which you think is relevant to that issue.

Information required:

**C2.1 Provide details of any changes to management techniques resulting from your proposals (section 2.3 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| | |
|---|---|
| *Doc Reference* | **Section 2.3** |

**C.2.2 Identify the raw and auxiliary materials, other substances and water that you propose to use and provide details of their fate and behaviour in the environment, and effects on both human health and the environment (section 2.4 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| | |
|---|---|
| *Doc Reference* | **Section 2.4** |

**C2.3 Describe any changes to the installation activities and the proposed techniques and measures to prevent and reduce waste arisings and emissions of substances and heat (including during periods of start-up or shut-down, momentary stoppage, leak or malfunction) as a result of your proposals (section 2.1 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| | |
|---|---|
| *Doc Reference* | **Section 2.4** |

**C2.4 Identify if there may be any new or changes to the disposal into or onto land of any wastes containing List or List II substances, as defined in the EC Groundwater Directive (80/68/EEC). If any are identified, please explain how the requirements of this Directive have been addressed. Your local SEPA office can be consulted for further advice on this.**

| | |
|---|---|
| *Doc Reference* | **Section 2.4** |

**C2.5 Identify if there may be any new or changes to the discharges into controlled waters containing List I or List II substances, as defined in the EC Dangerous Substances Directive (76/464/EEC). If any are identified, please explain how the requirements of this Directive have been addressed. Your local SEPA office can be consulted for further advice on this.**

| *Doc Reference* | **Section 2.4** |
|---|---|

**C2.6 Characterise and quantify any changes to waste streams from the installation resulting from your proposals and describe the proposed measures for waste management, storage and handling (section 2.5 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT**.

| *Doc Reference* | **Section 2.5** |
|---|---|

**C2.7 Describe how each changed waste stream is proposed to be recovered or disposed of and, if you propose any disposal explain why recovery is technically and economically impossible and describe the measures planned to avoid or reduce any impact on the environment (sect 2.6 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| *Doc Reference* | **Section 2.6** |
|---|---|

**C2.8.1** Provide a breakdown of any changes proposed to energy consumption and generation by source and end use (section 2.7.1 of the relevant technical guidance).

| *Doc Reference* | **Section 2.7** |
|---|---|

**C2.8.2 Describe the proposed basic measures for improvement of energy efficiency relevant to your proposals (section 2.7.2 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| *Doc Reference* | **Section 2.7** |
|---|---|

**C2.8.3 Are you, or will you be, subject to a Climate Change Levy Agreement?**

| | | |
|---|---|---|
| ✓ | **NO** | *Describe the proposed sector specific measures from improvement of energy efficiency relevant to your proposals (section 2.7.3 of the relevant technical guidance)* |
| Document Reference: **Section 2.7** | | |
| ❐ | **YES** | *Please give:* |
| • *the (expected) date of entry into the agreement:* | | |
| | | |
| • *Written confirmation that the installation is covered by a Climate Change Agreement and the terms of that agreement in so far as they relate to the installation* | | |
| Document Reference: | | |

**C2.9 Describe any changes to the documented system used to identify, assess and minimise the environmental risks and hazards of accidents and their consequences as a result of your proposals (section 2.8 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| *Doc Reference* | **Section 2.8** |
|---|---|

**C2.10 Describe any changes to the main sources of noise and vibration (including infrequent sources); and the techniques and measures for control of noise as a result of your proposals (section 2.9 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT**.

| *Doc Reference* | **Section 2.9** |
|---|---|

**C2.11 Describe any changes to the measures for monitoring emissions including any environmental monitoring, and the frequency, measurement methodology and evaluation procedure as a result of your proposals (section 2.10 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| *Doc Reference* | **Section 2.10** |
|---|---|

**C2.12 Describe any changes to the proposed measures upon definitive cessation of operations to avoid any pollution risk and return the site of the installation to a satisfactory state (including relevant measures for the design and construction of the installation), as a result of your proposals (section 2.11 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| *Doc Reference* | **Section 2.11** |
|---|---|

**C2.13 Where you are not the only operator of the installation, describe any change to the techniques and measures (including those to be undertaken jointly by yourself and other operators) for ensuring satisfactory operation of the whole installation resulting fro your proposals (section 2.12 of the relevant technical guidance). Please demonstrate how these proposals constitute BAT.**

| *Doc Reference* | **N/A** |
|---|---|

## C3 Your proposed emissions

Please provide written information about how your proposed changes will affect the emissions from the installation.

You should:

- Address all of the issues set out in the section of the relevant technical guidance identified in brackets;
- Justify your proposals against any benchmark emission levels contained in the guidance; and
- Provide any other information about the installation which you think is relevant to that issue.

Information required:

**C3.1 Describe the nature, quantities and sources of foreseeable emissions to land, air and water relevant to your proposals (section 3.1 of the relevant technical guidance).**

| | |
|---|---|
| *Doc Reference* | **Section 2.2 and 3** |

## C4 Impact on the environment and human health

Please provide written information about how your proposed changes will affect the impact your emissions may have on the environment and on human health as listed below:

In each case you should:

- Address all of the issues set out in the section of the relevant technical guidance identified in brackets;
- Justify your proposals against any indicative requirements contained in the guidance; and
- Provide any other information about the installation which you think is relevant to that issue.

Information required:

**C4.1 Provide an assessment of any change to the potential significant human health and environmental effects (including transboundary effects) of the foreseeable emissions resulting from your proposals (section 4.1 of the relevant technical guidance).**

| | |
|---|---|
| *Doc Reference* | **Section 4** |

**C4.2 Explain how the information provided in other parts of the application also demonstrates that the relevant objectives set out in the Waste Management Licensing Regulations 1994 have been addressed (in applicable cases), or provide additional information (section 4.2 of the relevant technical guidance).**

| | |
|---|---|
| *Doc Reference* | **Section 6** |

**C4.3 Provide an assessment of whether the proposed change in the operation of the installation is likely to have a significant effect on a European Conservation Site in Great Britain and, if it is, provide an assessment of the implications of the installation for that site, for the purposes of the Conservation (Natural Habitats etc.) Regulations 1994 (section 4.3 of the relevant technical guidance.**

| | |
|---|---|
| *Doc Reference* | **Section 4** |

## C5 Environmental statement

**C5.1 Has the development of the installation (or any subsequent change or extension of the development) required an environmental statement under Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment?**

| | | |
|---|---|---|
| ☐ | **NO** | |
| ✓ | **YES** | *Please supply a copy of the environmental statement submitted and details of any decision made (unless you have submitted this information in a previous application.* |

Document Reference:

**Section 5 and CD provided**

## C6 Statutory consultees

*We will use the information in this section to identify who we must consult about your proposals.*

**C6.1 In which local authority area is the installation located?**

*If premises are on a boundary, please give names of all relevant authorities.*

*Please give details:*

**Scottish Borders Council**

**C6.2 In which health board area is the installation located?**

*If premises are on a boundary please give names of all relevant boards.*

*Please give details:*

**Borders Health Board**

**C6.3 Could the installation involve the release of any substance into a sewer**

| | | | |
|---|---|---|---|
| ☐ | **YES** | ✓ | **NO** |

**C6.4 Are there any sites of special scientific interest (SSSIs) which are within 2 kilometres of the installation?**

| | | | |
|---|---|---|---|
| ✓ | YES | ❐ | NO |

*If YES, please give names of the sites:*

**Avenel Hill and Gorge SSSI**

**River Tweed SSSI**

**C6.5 Are there any other SSSIs which may be affected by emissions from the installation?**

| | | | |
|---|---|---|---|
| ✓ | YES | ❐ | NO |

*If YES, please give names of the sites:*

**Gattonside Moss SSSI**

**C6.6 Are there any European Conservation sites, as defined by regulation 10 of the Conservation (Natural Habitats) Regulations, which may be affected by emissions from the installation?**

| | | | |
|---|---|---|---|
| ✓ | YES | ❐ | NO |

*If YES, please give names of the sites:*

**River Tweed SAC**

**Borders Woods SAC**

**Threepwood Moss SAC**

**Whitlaw and Branxholme SAC**

**C6.7 Could the installation involve the release of any substance into a harbour managed by a harbour authority?**

| | | | |
|---|---|---|---|
| ❐ | YES | ✓ | NO |

*If YES, please give name of the harbour authority:*

**C6.8 Is the installation on a site for which:**

- A nuclear site licence is required under section 1 of the Nuclear Installations Act 1965.
- A major accident prevention policy document is required under regulation 5 of the Control of Major Accident Hazards Regulations 1999.

| | |
|---|---|
| *Doc Reference* | **N/A** |

**C6.9 Is the installation an upper tier establishment under the Control of Major Accident Hazard Regulations 1999?**

| | |
|---|---|
| ✓ | NO |
| ❐ | **YES** *please provide details of when your safety report under Regulation 7 of the Regulations was submitted.* |

*Please give details:*

## C7 Specified Waste Management Activities

**C7.1 Are you applying to change the operation of any 'specified waste management' activities?**

| | | |
|---|---|---|
| ❐ | NO | *Go to 'C8 What to do next'* |
| ✓ | YES | *Please describe:* |

*(a) Any proposed changes in the type or quantities of waste to be deposited:*

**The biostabilisation process is being removed so that pre-treatment is mechanical fuel preparation only. An advanced thermal treatment process has been added. No change in waste types or quantities to be accepted at the installation.**

*(b) Any proposed changes to the capacity of the disposal site:*

**No proposed changes**

*(c) Descriptions of any new areas of land to be part of the site including hydrogeological and geological characteristics:*

**No new areas of land included**

## Planning Status

**C7.2 Which of the following applies to the changes proposed to the specified waste management activities identified in C7.1?**

*We cannot vary the permit unless one of the following applies. We will need to see a copy of the relevant documents.*

| | |
|---|---|
| ✓ | You have planning permission. |
| *Reference Number:* **Planning consent in place for the MBT facility, reference 06/02477/SBC & 10/00165/AMC Application has been made for the ATT facility, reference 13/00445/FUL which is pending determination** | |

| | |
|---|---|
| ❐ | You have a certificate of lawful existing use or development. |
| *Reference Number:* | |

| | |
|---|---|
| ❐ | The Town & Country Planning (General Permitted Development) (Scotland) Order 1992 or other relevant orders applies. |
| *Please give details:* | |

| | |
|---|---|
| ❐ | Planning permission is not required. |
| *Please say why and enclose written confirmation from the planning authority:* | |
| *Reference Number:* | |

## Fit and proper person

We need to make sure that whoever holds the permit is a 'fit and proper person' in relation to any specified waste management activities. This includes consideration of relevant offences, technical competence and financial provision.

*Please read 'Waste Management Paper No.4'' before completing this section.*

## Relevant offences

C7.3 Has the operator, or any other 'relevant person', been convicted of any 'relevant offence'?

*A 'relevant person' includes each partner, director, manager, company secretary or any similar officer or can be an employee.*

| | | |
|---|---|---|
| ✓ | **NO** | *Go to question C**7.4*** |
| ❐ | **YES** | *Please give full information:* |
| *Reference number for this information:* | | |

*The details we need are listed below*
.
- *Full name of company or individual convicted.*
- *If an individual has been convicted, please state their position at time of offence.*
- *Name of court.*
- *Date of conviction.*
- *Offence and penalty imposed.*
- *Date of any outstanding appeal lodged against conviction.*
- *Any additional information which the operator would like us to take into account in determining whether they are a 'fit and proper person'. For example, why the offence happened, and what has been done to prevent a similar event occurring.*

## Technical Competence

**C 7.4 Are the specified waste management activities covered by the WAMITAB (Waste Management Industry Training Advisory Board) award scheme?**

| | | |
|---|---|---|
| ❐ | **NO** | *Go to question C**7.6*** |
| ✓ | **YES** | *Go to question C**7.5*** |

## WAMITAB sites

**C7.5 Who will provide the technically competent management of the specified waste management activities?**

*Please give details for each person and provide a copy of the WAMITAB certificate.*

If this is unchanged under the proposed variation then enter 'unchanged' in the first box and go to question C7.7.

*Responsible Person*

| | |
|---|---|
| Full name: | **Unchanged** |
| Position: | |
| Level of WAMITAB Certificate: | |
| Date: | |
| Reference number for copy of certificate: | |

*Responsible Person*

| | |
|---|---|
| Full name: | |
| Position: | |
| Level of WAMITAB Certificate: | |
| Date: | |
| Reference number for copy of certificate: | |

*Responsible Person*

| | |
|---|---|
| Full name: | |
| Position: | |
| Level of WAMITAB Certificate: | |
| Date: | |
| Reference number for copy of certificate: | |

*Responsible Person*

| | |
|---|---|
| Full name: | |
| Position: | |
| Level of WAMITAB Certificate: | |
| Date: | |
| Reference number for copy of certificate: | |

***Now go to question C7.7***

## Non WAMITAB sites

**C7.6 Who will be responsible for managing the specified waste management activities?**
*Please give details for each person.*

*For each person named below, we:*

- *Need to see a statement of qualifying experience,*
- *May want to carry out our own assessment.*

If this is unchanged under the proposed variation then enter 'unchanged' in the first box and go to question C7.7

*Responsible Person*

| | |
|---|---|
| Full name: | |
| Position: | |
| Doc reference for statement: | |

*Responsible Person*

| | |
|---|---|
| Full name: | |
| Position: | |
| Doc reference for statement: | |

## Management and other installations

**C7.7** Area any of these 'Responsible people' already providing the technically competent management at other PPC installations or at sites licensed under Part II of the Environmental Protection Act 1990?

| | | |
|---|---|---|
| ✓ | **NO** | *Go to question C**7.8*** |
| ❐ | **YES** | *See below:* |

*Please use a separate sheet to give details of these people. For each person we need to know the:*

- *Site / installation name and address; and*
- *Licence / permit reference number.*

| |
|---|
| *Reference Number:* |

## Financial provision

**C7.8 If known, how does the operator intend to make financial provision for the specified waste management activities?**

| | |
|---|---|
| ❒ | *Renewable bonds* |
| ❒ | *Bonds* |
| ❒ | *Bank guarantee* |
| ❒ | *Parent company guarantee (See below)* |

*Parent company guarantee – please include one copy of the parent company's audited trading accounts for the last three years (or for the period of trading if less than three years). These should be no more than 18 months out of date.*

*Document reference number for accounts:*

**Waste inventory will be reduced due to the removal of biostabilisation, so existing financial provision will be sufficient**

| | |
|---|---|
| ❒ | *Escrow account* |
| ❒ | *Trust fund* |
| ❒ | *Insurance captive* |
| ❒ | *Lump sum* |
| ❒ | *Other – please specify** |

** Other – please specify*

**Unchanged by this variation**

## Expenditure plan

**C7.9 Please provide a plan of the estimated expenditure for each phase of the specified waste management activities.**

*The plan should include the likely costs of:*

- *Monitoring*
- *Restoration – landfill only,*
- *Aftercare – landfill only,*
- *Clearing the installation (including drainage systems) of all wastes – non landfill,*
- *Remedial action in the event of the failure of pollution control systems.*

*We recognise that this plan may need to be revised before the issue of a revised permit.*

If you believe that the plan will be unchanged as a result of your proposals please insert 'unchanged' in the box below.

*Reference number for expenditure plan:*

**Unchanged by this variation**

## C8 What to do next

Now please fill in Part F and sign and date the application.

# Form PPC1 Part F: Application for a permit, variation, transfer or surrender

| For SEPA Use Only | Name Assigned | Application Reference |
|---|---|---|
| | | |

The fee charged for your application depends on a number of factors including the type of application and the size, type and potential environmental impact of your proposal. The fees are revised annually and are set out in this years ***"Pollution Prevention and Control (Parts A and B) Fees and Charges (Scotland) Scheme"*** which is available from SEPA office or our website www.sepa.org.uk

## F1 Type of Application made

Indicate by inserting a tick in the appropriate box, and then follow the instructions for that part.

| | | |
|---|---|---|
| Application for a new permit | | Go to F2 |
| Application to vary the conditions of your permit where that proposed change would constitute a "substantial change" (please consult with SEPA) | | ✓ |
| Application to vary the conditions of your permit | | Go to F4 |
| Application for a transfer of part / all of a permit | | Go to F5 |
| Application for surrender of part / all of a permit | | Go to F6 |

## F2 Application for a new permit

Complete this section if you are applying for a new permit

**What type of permit are you applying for?**

Indicate by inserting a tick in the appropriate box, and then follow the instructions for that part.

| | | |
|---|---|---|
| to operate a "general" Part A Installation or mobile plant | | Go to F7.2 |
| to operate a Low Impact Installation | | Go to F7.1 |
| to operate an Inert Waste Landfill | | |
| to operate a Landfill serving an isolated settlement and/or islands | | |

## F3 Application for a substantial change variation to the conditions of a permit

Complete this section if you are applying to vary the conditions of your permit and the proposed change would constitute a "substantial change" (please consult with SEPA)

**What type of permit do you wish to vary?**

Indicate by inserting a tick in the appropriate box, and follow the instructions for that part.

| | | |
|---|---|---|
| A "general" Part A Installation or mobile plant permit | | ✓ |
| A Low Impact Installation Permit | | Go to F7.1 |
| Inert Waste Landfill Permit | | |
| Landfill serving an isolated settlement and/or islands Permit | | |

## F4 Application to vary the conditions of a permit

Complete this section if you are applying to vary the conditions of your permit, unless the change would involve a "substantial change" in which case go to section F3 above.

### F4.1 What type of permit do you wish to vary?

Indicate by inserting a tick in the appropriate box, and follow the instructions for that part.

| | | |
|---|---|---|
| A general Part A Installation or mobile plant permit | | Go to F4.2 |
| A Low Impact Installation Permit | | Go to F7.1 |
| Inert Waste Landfill Permit | | |
| Landfill serving an isolated settlement and/or islands Permit | | |

### F4.2 What is the nature of the proposed variation?

Indicate by inserting a tick in the appropriate box, and following the instructions for that part.

| | | |
|---|---|---|
| A variation of the conditions of a permit which will not result in any change to the emissions OR is made solely for the purpose of implementing a change required as a result of compliance with a condition of the permit | | Go to F7.1 |
| All other variations | | Go to 7.2 |

## F5 Application for a transfer of part / all of a permit

Complete this section if you are applying to transfer all or part of your permit.

### F5.1 Are you applying to transfer the whole Permit or just part of it?

Indicate by inserting a tick in the appropriate box.

| | |
|---|---|
| Transfer the whole Permit | |
| Transfer part of the permit | |

### F5.2 What type of Permit do you wish to transfer (in whole or in part)?

Indicate by inserting a tick in the appropriate box, and following the instructions for that part.

| | | |
|---|---|---|
| a general Part A Installation or mobile plant permit | | Go to F7.1 |
| a Part A Specified Waste Management installation or mobile plant | | |
| a Low Impact Installation Permit | | |
| an Inert Waste Landfill Permit | | |
| a Landfill serving an isolated settlement and/or islands Permit | | |

## F6 Application for surrender of part of a permit or all of a permit

Please complete this section if you are applying to surrender all or part of your permit.

**What type of permit are you applying to surrender (in whole or in part)?**

Indicate by inserting a tick in the appropriate box, and follow the instructions for that part.

| | | |
|---|---|---|
| Landfill serving an isolated settlement and/or islands Permit | | Go to F7.1 |
| Inert waste landfill Permit | | |
| Any other landfill | | |
| A Low Impact Installation Permit | | |
| A general Part A Installation or mobile plant permit | | |

## F7 Determination of application fee

### F7.1 Applications with set application fees

There is a set fee for your application see Table 1 of the charging scheme. Please record the fee payable in the box and ensure you include this payment with your application.

Fee to be presented with your application £

*If applying for a new permit or a permit transfer (in whole or in part) go to F8 for all other applications go to F9.*

### F7.2 Applications for which the fee must be calculated

The fee for your application needs to be calculated using the formula given in table 1 of the charging scheme. Populate the boxes below to show your working and ensure that you include this payment with your application.

| | | Application Charge Units | | Total Fee |
|---|---|---|---|---|
| £2,900 | X | ( 5 + 2) | = | £20,300 |

*If applying for a new permit or a permit transfer (in whole or in part) go to F8 for all other applications go to F9.*

**Please note that payment of application fees may be made by cheque, BACS, credit card, debit card or by cash. Please see the charging scheme for details.**

## F8 Invoice Details

**Provide an invoice address for subsistence fees** - If we grant you a permit, or you have a permit transferred into your name you will be charged an annual subsistence fee. Please provide details of the address to which you wish invoices to be sent and details of someone we may contact about fees and charges.

**It is not possible to pay for your application fees by invoice**

| | | | |
|---|---|---|---|
| Name: | Lynn Matthews | | |
| Position: | Purchase Ledger Supervisor | | |
| Address: | NEAT Contracting Limited<br>Key House<br>35 Black Moor Road<br>Ebblake Industrial Estate<br>Verwood<br>Dorset | | |
| Postcode: | BH31 6AT | E-Mail | Lynn.matthews@newearthsolutions.co.uk |
| Telephone No: | 01202 812312 | Fax No: | 01202 829283 |

## F9 Commercial Confidentiality and National Security

**F9.1 Is there any information in your application that you believe should be kept from the public register on the grounds of commercial confidentiality?**

| | |
|---|---|
| No | ✓ |
| Yes | |

If yes please provide full details and justification

| | |
|---|---|
| *Where have you provided the information requested?* | |

**F9.2 Is there is any information in the application that you believe should be kept from the public register on the grounds of national security?**

If yes please give:

- Full information on separate sheets;
- Notify the Scottish Ministers to advise them of your concern.

Do not write anything about national security on this form, nor give reference numbers to the relevant information/documents submitted.

## F10 Data Protection Notice

The information you give will be used by the Scottish Environment Protection Agency to process your application. It will be placed on the relevant public register(s), and used to monitor compliance with licence/permit conditions, or to process renewal applications. We may also use and/or disclose any of the information you give us in order to:

- Offer/provide you with our literature/services relating to environmental matters;
- Consult with the public, public bodies and other organisations (for example Health and Safety Executive, local authorities, emergency services, Food Standards Agency);
- Carry out statistical analysis, research and development on environmental issues;
- Provide public register information to enquirers;
- Investigate possible breaches of environmental law and take any resulting action;
- Prevent breaches of environmental law;
- Access customer service satisfaction and improve our service.

We may pass on the information to agents/representatives who we ask to do any of these things on our behalf.

***Individuals have a right to see the information we hold about them. We will correct if it is inaccurate.***

**Individuals, groups of individuals or Partnerships** - All individuals mentioned in this application need to sign below, please use a separate sheet if you need to.

I have read the data protection notice and understand the implications of the Data Protection Act 1998.

| | |
|---|---|
| **Individual or partners signature** | |
| **Name (Block Capitals)** | SARA WHITTLE |
| **Date dd/mm/yyyy** | 01/05/2013 |

| | |
|---|---|
| **Individual or partners signature** | GMatthews |
| **Name (Block Capitals)** | LYNN MATTHEWS |
| **Date dd/mm/yyyy** | 1/5/2013 |

| | |
|---|---|
| **Individual or partners signature** | |
| **Name (Block Capitals)** | |
| **Date dd/mm/yyyy** | |

| | |
|---|---|
| **Individual or partners signature** | |
| **Name (Block Capitals)** | |
| **Date dd/mm/yyyy** | |

## F11 Non-technical summary

Please provide a non-technical summary of your application.

| | |
|---|---|
| *Where have you provided the information requested?* | **Section 1.4** |

## F12 Any Other Information

Is there any other information you wish to submit in support of your application?

| | |
|---|---|
| **No** | ✓ |
| **Yes** | |

If yes please provide full details

| | |
|---|---|
| *Where have you provided the information requested?* | |

## F13 Signatures and Declaration

It is an offence under Regulation 30 of the PPC (Scotland) Regulations to:

- Make a statement which you know to be false or misleading in a material particular,
- Recklessly make a statement which is false or misleading in a material particular,

for the purposes of obtaining a permit (for yourself or anyone else), seeking a variation, transfer or surrender of a permit.

If you make a false statement:

- We may prepare a report to the Procurator Fiscal who may prosecute you, and
- If you are convicted, you are liable to a fine or imprisonment, or both.

Declaration * (Delete as appropriate)

* I/we certify that the information in this application is correct.
* I/we apply: *for a permit/ *for a transfer of an existing permit (current operator(s) and proposed transferee(s) must sign below)/ *to vary an existing permit in respect of the particulars described in this application (including supporting documentation *I/we have supplied)/ to surrender the existing permit to the extent specified in this application.

---

**Signature(s) of current operators**

Please note that each individual operator must sign the declaration themselves, even if an agent is acting on their behalf. For applications from:

- More than one person – all persons should sign below,
- A company or other corporate body – an authorised person should sign below and provide evidence of authority from the Board of the company or body corporate.

| | |
|---|---|
| **Name** | Darren Stockley |
| **Signature** | |
| **Position** | Managing Director |
| **Date** | 7/5/13 |

| | |
|---|---|
| **Name** | |
| **Signature** | |
| **Position** | |
| **Date** | |

| | |
|---|---|
| **Name** | |
| **Signature** | |
| **Position** | |
| **Date** | |

**Signature(s) of proposed transferee (if applicable)**

| | |
|---|---|
| **Name** | |
| **Signature** | |
| **Position** | |
| **Date** | |

| | |
|---|---|
| **Name** | |
| **Signature** | |
| **Position** | |
| **Date** | |

**Now please return this form, and the appropriate number of copies, together with all supporting information and correct payment to the address of your local SEPA registry (see front page of your application).**

## GLOSSARY OF TERMS

| | |
|---|---|
| ABC | Air Blast Chiller |
| AMP | Accident Management Plan |
| AQS | Air Quality Standard |
| ATT | Advanced Thermal Treatment |
| BAT | Best Available Techniques |
| BRef | BAT Reference Document (EU) |
| CCA | Climate Change Agreement |
| CCTV | Closed Circuit Television |
| CEMS | Continuous Emissions Monitoring System |
| CFD | Computational fluid dynamic (modelling) |
| CHP | Combined Heat and Power |
| CL | Critical Load |
| COT | UK Committee on Toxicity of Chemicals in Food, Consumer Products |
| DPA | Direct Participation Agreement (in the ETS) |
| EAL | Environmental Assessment Level |
| ECU | Engine Control Unit |
| EfW | Energy from Waste |
| ELV | Emission Limit Value |
| EWC | European Waste Code (or Catalogue) |
| FGR | Flue Gas Recirculation |
| FGT | Flue Gas Treatment |
| FIBC | Fabric Intermediate Bulk Container |
| FPF | Fuel Preparation Facility |
| GWP | Global Warming Potential |
| HAZID | Hazard Identification |
| HAZOP | Hazard Operability |
| IBC | Intermediate Bulk Container |
| IED | Industrial Emissions Directive [Directive 2010/75/EU] |
| IMS | Integrated Management System |
| LOI | Loss on Ignition |
| MBT | Mechanical Biological Treatment |
| MCR | Maximum Continuous Rating |
| MCR | Maximum Continuous Rating |

| | |
|---|---|
| MSW | Municipal Solid Waste |
| NEAT | New Earth Advanced Thermal |
| NESSB | New Earth Solutions (Scottish Borders) Limited |
| ORC | Organic Rankine Cycle |
| P&ID | Pipework and Instrumentation Diagram |
| PAC | Powdered Activated Carbon |
| PAH | Polycyclic Aromatic Hydrocarbons |
| PC | Process Contribution |
| PEC | Process Environmental Contribution |
| PPA | Power Purchase Agreement |
| PPC | Pollution Prevention and Control (Scotland) Regulations 2000 |
| ppm | Parts per Million |
| SAC | Special Area of Conservation |
| SC | Stirling Cycle |
| SCADA | Supervisory Control and Data Acquisition |
| SCR | Selective Catalytic Conversion (of NOx) |
| SEC | Specific Energy Consumption |
| SEPA | Scottish Environment Protection Agency |
| SGN | Sector Guidance Note |
| SNCR | Selective Non-catalytic Conversion (of NOx) |
| SPA | Special Protection Area |
| SRF | Solid Recovered Fuel |
| SSSI | Site of Special Scientific Interest |
| SuDS | Sustainable Drainage System |
| SWMA | Specified Waste Management Activity |
| TDI | Tolerable Daily Intake |
| TOC | Total Organic Carbon |
| TPA/tpa | Tonnes per Annum |
| TTWG | Thermal Treatment of Waste Guidelines (SEPA) |
| WRATE | Waste and Resources Assessment Tool for the Environment |

| | |
|---|---|
| Pyrogas | Product gas generated in the pyrolysis process for combustion in the CHP engines after purification |
| Syngas | Synthesis gas from gasification of char and tar for combustion to generate heat for pyrolysis |

# 1. INTRODUCTION

## 1.1. INTRODUCTION TO THE APPLICATION

This application for substantial change to the current PPC permit reference PPC/A/1094330 has been prepared by the operator, New Earth Solutions (Scottish Borders) Limited. It provides all the additional information required by the Scottish Environment Protection Agency (SEPA) PPC application forms. Because the MBT facility permit was issued under the Pollution Prevention and Control (Scotland) Regulations 2000, the forms used are those relating to the 2000 Regulations, as instructed on the SEPA website.

A pre-application meeting was held with SEPA on 6th February 2013.

The purpose of the application is to remove the biological treatment process and add a renewable energy facility on the site of the permitted New Earth Solutions Scottish Borders mechanical biological treatment (MBT) facility. The proposed renewable energy facility will complement the existing facility as it will use a fuel to generate energy that has been prepared at the permitted waste facility. Fuel may also be prepared at other New Earth Solutions Group MBT facilities and may be brought in from other regional sources.

The chosen technology for the renewable energy facility is pyrolysis and gasification. This is discussed in more detail below. This is included within the definition of co-incineration activities under Directive 2010/75/EU (the Industrial Emissions Directive, IED). Installations which are subject to regulation by virtue of being named in the IED are required by that Directive to be operated in such a way that all the appropriate preventative measures are taken against pollution, in particular, through application of the best available techniques (BAT). They must also be operated in such a way that no significant pollution is caused.

Any application for a permit for such a process must contain a demonstration that BAT is being used. In order to facilitate the use of common standards across the member states, the European Commission established an organisation to prepare comprehensive documents describing BAT for a range of activities. These documents are known as BAT reference or BRef documents. Pyrolysis is named within the IED as being an activity subject to that Directive and so it is necessary to describe BAT for pyrolysis with reference to the Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration August 2006 (the BRef document for incineration). Other guidance is available in the form of the SEPA technical guidance note for the IPPC regime SGN S5.01. However, Article 42 of the IED allows for processes involving gasification or pyrolysis to be exempted from Chapter IV and Annex VI of the IED, as long as "*the gases resulting from this thermal treatment of waste are purified to such an extent that they are no longer a waste prior to their incineration and they can cause emissions no higher than those resulting from the burning of natural gas*."

Therefore, an "end of waste" application is also being made, demonstrating that this is the case for the pyrolysis pyrogas produced at the Easter Langlee facility. This is attached as Appendix F.

This application has therefore been prepared with reference to the BREF document for incineration and the relevant SEPA technical guidance. A BAT demonstration is provided in each section of the application.

## 1.2. THE APPLICANT

New Earth Solutions Group Ltd is the parent company of New Earth Solutions Ltd, New Earth Energy Ltd and New Earth Solutions (Scottish Borders) Limited. New Earth is a pioneering waste management and renewable energy business with its headquarters based in Verwood, Dorset. There are operational plants at Canford (Poole, Dorset), Blaise (Tonbridge and Malling, Kent), Sharpness (Stroud, Gloucestershire), Cotesbach (Leicestershire), and Avonmouth (Bristol). Easter Langlee will be the 6th operational waste treatment facility. New Earth provides sustainable waste management services to waste collection and waste disposal authorities and other public sector bodies and businesses in the UK. The applicant is New Earth Solutions (Scottish Borders) Limited. The organogram below shows how the applicant fits within the company structure.

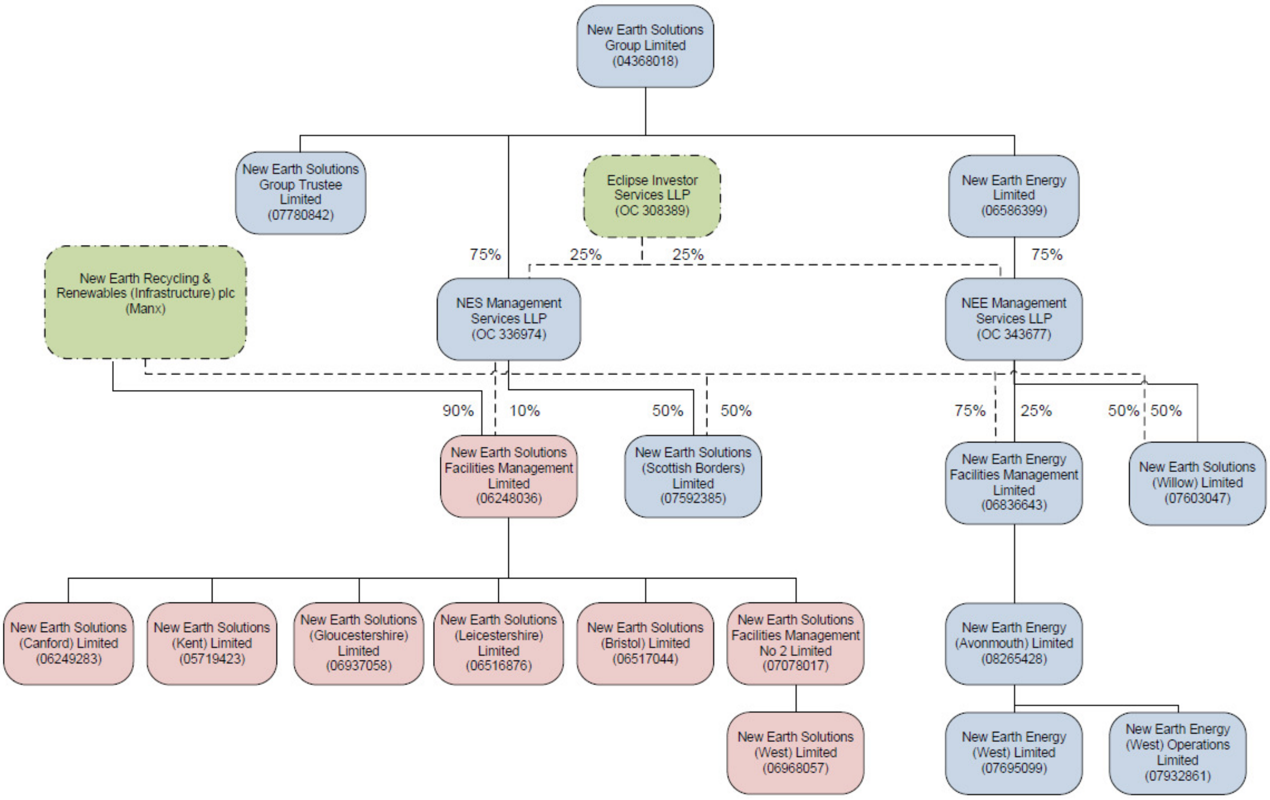



**Figure 1. New Earth Solutions Group Structure**

## 1.3. DESCRIPTION OF THE PROPOSED CHANGES TO THE INSTALLATION

This section of the variation application corresponds to Part C1 of the application for variation form, describing the proposed changes to the installation.

### 1.3.1. Changes to Current Installation

The facility currently subject to permit reference PPC/A/1094330 is for a mechanical and biological treatment (MBT) facility. This is currently described by Section 5.3 Part A(c)(i) of Schedule 1 to the Pollution Prevention and Control (Scotland) Regulations 2000 (as amended). These regulations have now been superseded by the Pollution Prevention and Control (Scotland) Regulations 2012.

The proposed changes to the existing facility are the removal of the biostabilisation process currently covered by this MBT permit and replacing it with a renewable energy facility using advanced thermal treatment (ATT) technology, namely staged pyrolysis and gasification using New Earth Advanced Thermal (NEAT) technology. The removal of the biostabilisation process and the addition of such a renewable energy activity comprise a substantial change to the MBT installation. The remaining mechanical treatment element of the installation will effectively become a process for the recovery of recyclate and the preparation of fuel for subsequent advanced thermal treatment (hereafter referred to as the fuel preparation facility), and as such is most appropriately described by Section 5.4 Part A(b)(ii) of Schedule 1 to the Pollution Prevention and Control (Scotland) Regulations 2012:

> *(b) Recovery or a mix of recovery and disposal of non-hazardous waste at an installation with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) by...*
>
> > *(ii) pre-treatment of waste for incineration or co-incineration.*

The permitted waste facility will remain dedicated to maximising recyclate removal from the mainly municipal waste input but with the residual output now being the fuel feed for the renewable energy facility. This PPC variation application therefore considers the environmental benefits achieved through this change, notably the reduced ammonia generation and reduced duty on the scrubber and biofilter (which are being retained) resulting from the removal of the biostabilisation process, and considers the potential impact of the amended installation from both the permitted waste facility and the ATT facility.

Table 1. Listed and Directly Associated Activities (as varied by this application)

| Existing Activity listed in Schedule 1 of the PPC (Scotland) Regulations 2000, as amended by this variation | Existing Activity listed in Schedule 1 of the PPC (Scotland) Regulations 2012, as amended by this variation | Description of specified activity |
|---|---|---|
| Section 5.3 Part A (c) (ii)<br>Disposal of non-hazardous waste in plant with a capacity exceeding 50 tonnes per day by physico-chemical treatment specified in paragraph D9 of Annex IIA to Council Directive 75/441 | Section 5.4 Part A (b) (ii) Recovery or a mix of recovery and disposal of non-hazardous waste at an installation with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) by pre-treatment of waste for incineration or co-incineration | From acceptance of waste to despatch of fuel to the thermal treatment facility |
| **New Activity listed in Schedule 1 of the PPC (Scotland) Regulations 2000** | **New Activity listed in Schedule 1 of the PPC (Scotland) Regulations 2012** | **Description of specified activity** |
| Section 5.1 Part A (b) The incineration of waste, including animal remains, in an incineration plant not covered by paragraph (a) above, on premises where there is plant used or designed to incinerate waste at a rate of 1 tonne or more per hour | Section 5.1 Part A (b) Incineration of non-hazardous waste with the exception of waste which is biomass or animal carcasses in an incineration or co-incineration plant | The thermal conversion of non-hazardous pre-prepared waste including the operation of pyrolysis and gasifier lines, CHP engines; facilities for the treatment of pyrogas and exhaust gas; on-site facilities for treatment and storage of residues, surface water and waste water; systems for controlling and monitoring operations; and receipt, storage and handling of wastes and raw materials (including fuels) |
| **Directly associated activities** | | |
| Electricity and power generation | Electricity and power generation | Generation of nominally 1 $MW_e$ using CHP engines for use on site, export to the grid or export to heat customers |
| Standby power | 750kVA back-up power generator (diesel fuel) | Emergency generation of electricity |
| Firewater supply | Diesel firewater pump | Pump to ensure firewater supply |

### 1.3.2. Advanced Thermal Treatment Process Description

The proposed advanced thermal treatment (ATT) facility will be co-located with the currently permitted (reference PPC/A/1094330) mechanical and biological treatment (MBT) process at Easter Langlee Landfill, Langshaw Road, Easter Langlee, Galashiels TD1 2NT. The same operator, New Earth Solutions (Scottish Borders) Limited (NESSB), will operate the varied installation including the ATT activity. The facility lies at National Grid Reference NT 52106 36130. The location is shown in Appendix A, which also provides the layout of the site as amended by this variation application. No land is added to the installation boundary as a result of this variation.

The ATT facility is planned to be commissioned early in 2015. It will have a throughput of 24,000 tonnes per annum (tpa) of fuel, depending on moisture content, almost entirely prepared by the co-located permitted waste facility. This will be the main activity for the purposes of the permit. This 24,000 tonnes is included within the already permitted by permit reference PPC/A/1094330. Activities associated with the main thermal treatment activity, which fall within the boundary of that activity include:

- Fuel reception and raw material handling
- Fuel handling and feed system
- Pyrogas cleanup including dosed quench and ceramic filter
- Energy recovery via combustion of pyrogas in CHP engines
- Combustor exhaust flue gas treatment
- Residue handling
- Controls and monitoring
- Storage and handling of wastes generated by the process
- 750kVA back-up power generator
- Standby diesel firewater pump

The combustion of pyrogas in the CHP engines will be directly associated to the main activity, by virtue of the end of waste application that removes them from the scope of Chapter IV of the IED (see Appendix F).

Process flow diagrams for the varied installation and the energy facility are shown in Appendix A.

The facility will accept the non-hazardous fuel feed prepared in the already permitted fuel preparation part of the facility at Easter Langlee and has the potential to accept directly delivered waste from other fuel preparation facilities, subject to the same feed specification requirements. The feedstock will be manufactured to a set specification that is under the control of NESSB and will still contain a high proportion of biomass material resulting from the contractually agreed targeted removal of fossil based plastics for recycling. Further details of the fuel specification and acceptance procedures are provided in section 2.1 below. Any third parties will be required to supply fuel to a specification and this will be controlled by contract. All deliveries will be subject to these acceptance and rejection procedures. The process will generate renewable energy using a proven advanced thermal treatment technology, specifically a staged pyrolysis and gasification process to generate product synthesis gas (pyrogas), followed by a power generation facility using combined heat and power (CHP) engines to generate power for export to local supply network, plus energy for third parties in the form of hot water.

The facility will consist of four (4) individual pyrolysis/gasification modules with CHP energy recovery using spark ignition engines. It is expected that three (3) units will be in operation at any one time, with the fourth unit either offline on planned maintenance or providing standby to ensure that the facility can operate at 100% of the capacity needed to satisfy the waste duty. The facility will meet the immediate opportunity to recover energy from residual waste already processed in the New Earth Solutions Group permitted facilities at Easter Langlee and elsewhere, and to utilise other solid recovered fuel from local and regional sources, resulting in an overall mass diversion from landfill. This installation is designed to meet the exacting criteria of the UK Government's Renewables Obligation Order (as amended) and other related renewable energy benefits and will attract a variety of renewable energy certificates for the electricity produced.

The feedstock is dried and transferred from the fuel preparation facility directly to the ATT activity, within the existing fully enclosed process building. The pre-treatment in the fuel preparation facility ensures removal of chlorinated plastics from the fuel, which ensures that potential for dioxin formation in the thermal treatment process is minimised (note that the starvation of oxygen in the pyrolysis units provides a further prevention mechanism against dioxin formation). Drying is undertaken on a conveyor drier with inbuilt heat recovery, which aims to achieve maximum 20% moisture content for the produced fuel.

Weighing conveyors at the exit from the fuel preparation facility and at the entry to the energy building will monitor and record the material transferred from the waste treatment building. Weighbridge tickets will be used for direct deliveries from third parties. Third party suppliers will be subject to a fuel specification and supply agreement with similar requirements to the feed from the permitted waste facility. Fuel is also inspected in the energy facility to ensure that it complies with the pre-treatment output and waste facility input specifications, and third party fuel will be subject to the same inspection regime. Hazardous waste will not be accepted.

A fuel buffer store is provided in the reception area of the building serving the renewable energy facility. Walking floor trailers can discharge fuel directly into the fuel buffer store, entering the building via a rapid operation roller shutter door in-line with the store. There is also a dedicated storage area for baled fuel, although storage of baled fuel will be minimised.

The feedstock is then shredded to a maximum particle size of 100mm in any one plane. The prepared feed will be continuously introduced into the individual pyrolyser buffer stores which contain approximately 60 minutes' of fuel (1 tonne for each line) to allow each thermal unit to be batch-filled and each feed compactor (2 per unit) to be continuously fed for 24/7 operation. The purpose of the compactors is to prevent the ingress of air into the pyrolysis process.

From the compactors the feedstock will be continuously fed into the pyrolyser. On entering the pyrolyser, the feedstock is delivered into the pyrolysis chamber which is heated to a temperature of 750-800°C. The retention time is variable but typically the feedstock remains in the chamber for 40 minutes. The ability to vary the temperature and residence time of the fuel within the pyrolysis chamber allows the process to be tuned for various feed materials, including un-shredded or un-dried fuel / variable moisture content.

The fuel passes through two distinct and separate processes in the pyrolysis plant:

- Material drying – where moisture is driven off creating steam
- Pyrolysis – where final thermal decomposition of the material and its by-products takes place to produce pyrogas (consisting of methane, hydrogen, carbon monoxide and water vapour), and residual material, in the form of solid carbon char

The pyrogas from the pyrolysis process is drawn, under negative pressure, through a ceramic filter to remove particulates. From there it passes through a wet quench, to rapidly reduce temperature to condense out the tars and oils and prevent de novo dioxin formation. This quench is dosed with sodium hydroxide and sodium hypochlorite, to remove acid gases such as HCl, HF and $H_2S$.

The pyrogas passes into a buffer store, where gas from each unit is blended to ensure homogeneity of the gas. From here it is fed into one of four CHP engines (one per line), for the generation of renewable-sourced electricity. Three will be in operation at any one time, as they are most efficient near to full output. The CHP engines are small scale and modular, so that the amount of heat required for process use can be adjusted, allowing the available power export to the grid or energy export to local heat customers to be maximised. The waste heat from the engine exhaust and cooling jacket is captured using heat exchangers for reuse in the fuel drying process and also for supply to a proposed local heat network.

The CHP exhaust gas then passes into the multi-flue main stack. The stack is 23m in height with each CHP engine flue having an internal diameter of 0.3m. Emission points A2-A5 are the 4 engine stacks, and all gasifier exhausts are routed through emission point A6, having an internal flue diameter of 0.664m. An emergency flare is also provided as emission point A7, to allow for safe flaring when pyrogas is out of specification or in the event of emergency shutdown. Emission point A1 is the currently permitted biofilter stack, which is not affected by this variation application. All emission points are shown in Appendix A.

The char and particulate collected in the ceramic filter, as well as the condensed tars and oils, have a residual energy value. These are gasified, leaving an inert ash and syngas. Each NEAT line has a gasifier. High temperature steam is injected into the gasification unit together with a limited amount of oxygen. This converts the char into syngas, with a remaining particulate ash. The ash residue from the gasification of the char will be removed and taken off-site for either disposal or re-use where possible.

The char and particulates collected in the ceramic filter will be screwed out. It will then be quenched and moved to a quench storage bunker. It is then conveyed from the bunker to the gasifier for gasification as required. This is so the rates of both processes don't have to be matched and also so the pyrolysis can continue should the gasification step need to be shut down. The combustor could continue on the auxiliary burner to heat the pyrolysis process if required. The gasification of the pyrolysis char is achieved by injecting a controlled ratio of steam and air through a bed of char in a gasification chamber; this chamber is continually filled by the char feed system from the pyrolysers. The resultant gasifier gas is then combusted to provide recovered indirect heat to the pyrolysis process, leading to a self sustaining process. The use of the renewable gasifier gas for the energy to power the pyrolysis process replaces the need for fossil fuels. Diesel is, however, used as a start-up fuel for the process.

The exhaust gas from each of the four combustors is combined before being passed through the flue gas treatment (FGT) plant. This consists of dry in-stack scrubbing using sodium bicarbonate to remove residual acid gases, followed by separately dosed powdered activated carbon (PAC) to remove volatile heavy metals, organic compounds and residual dioxins and furans by adsorption. There is a fabric filter to capture scrubbing chemicals containing the adsorbed pollutants prior to exhaust (ceramic material may be selected depending on temperature of the gas, to ensure material integrity and to prevent fire risk). This emission is subject to the requirements of Chapter IV of the IED. The fly ash from the gasifier that is collected in the bag filter will be disposed of at a suitably permitted facility.

The vast majority of the metals and dioxins and furans from the pyrolysis and gasification processes pass into the solid char reside and thence the ash residue. The halogens originating in the pyrolysis feed material are removed from the gas phase at the quench stage and are absorbed into the aqueous effluent. The char material is essentially free from halogens, and hence the potential for formation of dioxins from the subsequent combustion of the gas produced, and reformation post-filtration, is severely limited.

Appendix F provides the end of waste application for the pyrogas from pyrolysis. The pyrogas combustion process in the CHP engines therefore does not need to comply with the emission limit values of Annex VI of the Industrial Emissions Directive 2010/75/EU (IED), or temperature and residence time requirements of Article 50 of that Directive.

The facility will have an annual availability of close to 100% at maximum capacity of 3 tonnes per hour for 8,000 hours per year. Each unit will have an availability of around 71%, with the balance of operation designed to meet the 24,000 tpa capacity. Only 3 units will be operational at any one time. The facility will have an annual availability of close to 100% at maximum capacity of 3 tonnes per hour for 8,000 hours per year. Each unit will have an availability of around 71%, with the balance of operation designed to meet the 24,000 tpa capacity. Only 3 units will be operational at any one time. The electricity generated will be supplied to the local electricity network. The off-take and local use of renewable heat has been considered in light of the requirements of SEPA's Thermal Treatment of Waste Guidelines 2009, as amended. To that end, a heat and power plan has been undertaken, which is attached to the application as Appendix E. This seeks to achieve the optimum efficiency level for the energy plant, taking into account local heat requirements and opportunities. Owing to the nature of CHP engines, this is a flexible renewable energy facility that can supply base load electricity and heat demand as well as catering for peak demand, taking seasonality of demand into account. The heat and power plan will enable the on-site heat recovery and direct supply of heat to customers or proposed local networks to be maximised. Some of the electricity generated will also be used for the facility's own power needs and these needs will be covered prior to export of surplus electricity. This will be via an 11kV connection for the export of power. There will also be a Power Purchase Agreement (PPA) for wholesale of electricity.

Bottom ash is generated by the char gasification process. The ash is removed from the gasifiers by a sealed, water cooled auger system designed to prevent ingress of air into the system. Once removed from the gasifiers, the ash is transferred to a conveyor system via an ash wet bath system; this provides ancillary air ingress protection and cools the ash down to below $50^{0}$C, to prevent dust generation. The cool and damp ash will be discharged into an ash buffer store. It will be transferred by enclosed or covered vehicles and it is expected that it will be sent to the co-located Scottish Borders Council landfill site. If possible, markets will be sourced, such as in secondary aggregate production, and we would anticipate an improvement condition to investigate this potential use of bottom ash, subject to market demand. Approximately 3,500 tonnes per annum of bottom ash are expected to be generated by the facility.

Any aqueous effluent from the drier and quench will be routed to one of the two bulk storage tanks, prior to removal from site by tanker to a suitable permitted facility. There are tanks for condensate and quench effluent, along with a third for firewater, total capacity 400m$^3$.There is no effluent from the treatment of exhaust gas from the process. Ventilation air from the process buildings, which is moisture-laden and contains organic compounds, will be captured and exhausted via the scrubber and biofilter, to remove ammonia and organic compounds respectively, prior to release via the currently permitted emission point A1.

Mains water and harvested rainwater will generally be used for amenities, cleaning and for fire fighting. Rainwater run-off from the roofs will drain into a clean water storage tank with an approximate capacity of 600m$^3$.

Surface water run-off from the site roads will be discharged to the existing surface water system via hydrocarbon interceptors. Surplus rainwater run-off from the buildings will also be discharged to the surface water system. There is no change to the drainage system proposed as a result of this variation.

The plant will be operated from the control room which will overlook the pyrolyser/gasifier units. A CCTV system will allow operators to view other areas of the plant, such as the waste reception and storage areas, driers and the ash storage areas.

A continuous emission monitoring system (CEMS) will be installed on the combustor exhaust via emission point A6, which will take continuous samples from this flue, which is subject to IED Annex VI, and analyse them for the priority determinands to be covered by the PPC permit. The CEMS will be linked to the control system to ensure that char and quench effluent is stopped and the gasifiers cannot be operated during abnormal operation such as CEMS malfunction, start-up or shutdown. The monitoring and operational control of the gasifier combustion exhaust for pyrolyser heat supply will be subject to IED Chapter IV and Annex VI.

Section 2.1 of the application below outlines the selected technology and how it is controlled (Best Available Techniques), and section 2.2 how prevention of emissions using process control and technology selection is achieved before consideration is given to abatement techniques. In particular, the process prevents emissions through:

- Use of a homogenous pre-prepared fuel manufactured to a specification under control of the operator, prior to transfer to the energy facility from the pre-treatment facility within the same installation
- Receipt of the fuel within a completely enclosed system
- Management of the fuel storage to minimise residence times
- Operation in accordance with the company wide Integrated Management System (IMS) to ensure compliance with the permit conditions and prevention of emissions
- Use of proven pyrolysis and gasification technology to ensure the most efficient conversion to a high quality gas
- Compliance with Chapter IV of the IED (the requirements of Directive 2000/76/EC, or WID, as superseded by IED) for the gasifier combustor emissions

A simplified process flow diagram is shown below. The measures used at the ATT facility and described as BAT throughout the application are summarised in the non-technical summary below.

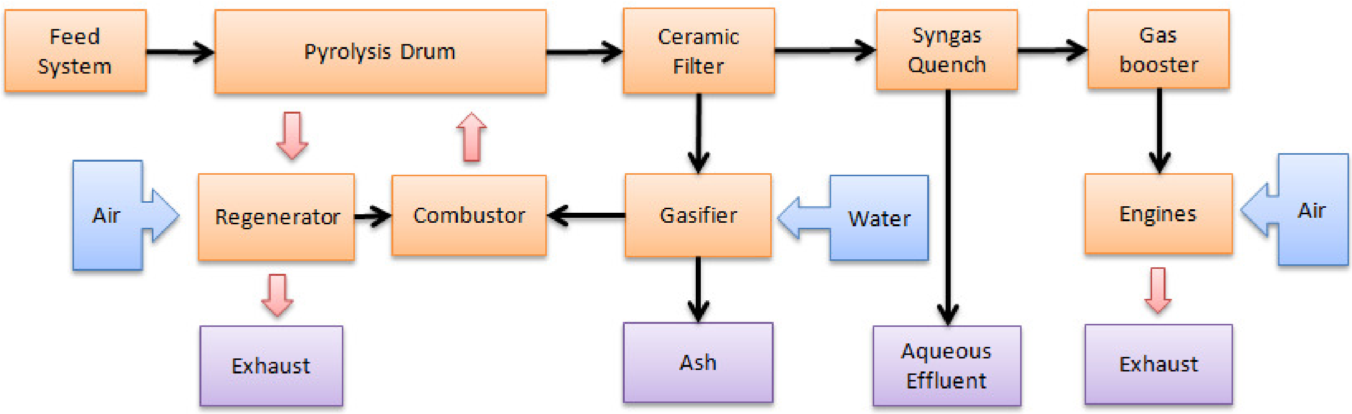



**Figure 2. Simplified Process Flow Diagram**

## 1.4. NON-TECHNICAL SUMMARY

### 1.4.1. In-process Controls

#### 1.4.1.1. Fuel Preparation

There is a permit in place for the waste facility (currently an MBT facility). This application removes the biostabilisation process, but Best Available Techniques (BAT) remains in place for the prevention or minimisation of emissions from the mechanical pre-treatment at the permitted facility. The EWC waste codes for wastes which may be received into the installation are not amended by this variation application. The waste pre-treatment output specification will determine the gross waste characteristics, and the ATT input specification, following drying and shredding, will be adhered to ensure consistent feed to the pyrolysis process. This will include:

- Biomass percentage by weight
- Moisture percent by weight
- Calorific value
- Density

The nature of the feedstock is well understood and materials which might compromise the operation of the NEAT process, such as batteries or chlorinated plastics will be removed. Any third party waste or waste from other New Earth permitted facilities will be subject to the same quality assurance requirements.

#### 1.4.1.2. Waste Acceptance, Storage and Handling

The ATT activity and associated waste transfer will be within the enclosed process building, under negative pressure. The biofilter and scrubber will remain in place to treat the exhausted air to prevent fugitive odour (and dust and litter) emissions. The site preventative maintenance programme will include all waste handling equipment and ventilation systems. This will be incorporated into the site IMS.

All feedstock will pass through a drier to ensure that they are suitable for feed to the NEAT process. This also allows for maximisation of the thermal efficiency of the process, and allows for reuse of waste heat in the pre-drying of waste or air.

These techniques represent BAT for waste types, and securing homogeneity of waste feed to the pyrolysis process, and for waste acceptance, reception and storage.

#### 1.4.1.3. Pyrolysis/Gasification

The fuel feed system ensures uniform input of fuel into the pyrolyser chamber whilst preventing the ingress of air. This is achieved through the compaction of the fuel feedstock to remove any intrinsic air and exclude oxygen, thereby preventing combustion of the fuel and the potential for the formation of dioxins.

Owing to its proven operational track record and simplicity of operation, the indirectly heated drum pyrolysis chamber has been identified as BAT and selected for this process. This equipment is well proven in a variety of applications, including our test facility at Canford, and represents BAT for product pyrogas generation.

In the NEAT process, the high grade heat for pyrolysis is provided by the exhaust gas from the gasifier syngas combustor. The char produced by the pyrolysis process consists predominantly of carbon and ash, which is collected in the ceramic filter. Once removed from the ceramic filter it is quenched to reduce the temperature and transferred to the separate gasification chamber whilst maintaining gas seals and process conditions. Pyrolysis pyrogas is rapidly quenched, allowing the tars and oils to condense out for transfer to the gasifier, contributing to energy recovery in the gasifier and combustor. The gasifier syngas is combusted in a dedicated combustor. The flue gas from the combustor is used as the means of indirectly heating the pyrolysis chamber, leading to a self sustaining process. Very close control over the fuel processing rate coupled with control of drum temperature via the external jacket heating system, provides very close control of the cracking process and hence the quality of the pyrogas produced. The design, operation and control of the pyrolysis system facilitates the production of a consistent and high quality pyrogas which is suitable for clean and efficient combustion in a wide range of engines with scope for CHP operation at high overall efficiencies.

The exhaust from the gasification process passes through a flue gas treatment plant consisting of dry in-stack scrubbing with sodium bicarbonate to remove acid gases, along with separately controlled dosing with powdered activated carbon (PAC) to remove VOCs, dioxins and furans and volatile metals. The particulate matter is then removed using a fabric (or ceramic) filter prior to exhaust. This exhaust gas is subject to the requirements of Chapter IV of the IED. BAT is therefore in place for the gasification of char and tars and oils from pyrolysis, the subsequent combustion of the syngas so produced, and the supply of high grade heat from this combustion to support the pyrolysis process. A continuous emission monitoring system (CEMS) will be installed on the gasifier combustor exhaust for IED compliance. This will be linked to the char, tar and oil feed system to ensure that the gasifiers cannot be operated during abnormal operation. The monitoring and operational control of the gasifier combustion exhaust for pyrolyser heat supply will be subject to IED Annex VI.

#### 1.4.1.4. Pyrogas Cleanup

Pyrogas will be subject to purification prior to being combusted in the CHP engines, as follows:

- Ceramic filter: filtration at high temperature via ceramic candle filters to remove particulates
- Wet scrubber/quench: provides rapid cooling to prevent dioxin reformation (note that metals and dioxins are routed to the solid char rather than being carried forward into the pyrogas). The scrubber also removes oils and tars, which are routed to the gasifier, and acid gases such as HCl and HF

Sulphur is removed from the waste stream and is not carried forward to the pyrolysis process, preventing formation of $H_2S$ and subsequent generation of $SO_2$ in the pyrogas combustion process. Residual $H_2S$ is also removed in the quench scrubber.

These measures for pyrogas purification are considered to represent BAT. In conjunction with the other measures outlined in the end of waste application, they ensure that the product pyrogas is no longer a waste when it is routed to the pyrogas buffer store ready for combustion. The pyrogas replaces the need for fossil fuels that would be used for generating the equivalent heat and power, and therefore Article 42 of IED is satisfied and the product pyrogas combustion falls outwith Chapter IV and Annex VI of IED.

#### 1.4.1.5. Power Generation

CHP engines are a well understood technique, considered BAT for generation of heat and power from landfill gas and biogas from sewage sludge digestion. These are the most similar fuel streams to the product pyrogas from pyrolysis of fuel manufactured from municipal waste sources.

CHP engines provide excellent efficiencies at the 3tph scale. Other techniques such as gas turbines or boilers are not efficient or economically viable for the amount of pyrogas generated by this 3tph scale activity (see section 2.7 below). CHP engines provide excellent flexibility to meet seasonality of demand, and diurnal peaks and troughs. Supply can be balanced between heat and power. The addition of a buffer heat store acts to smooth out the difference between duty and demand, increasing overall thermal efficiency by minimising heat dump from the system and minimising the need for topping up duty with fossil fuel combustion elsewhere.

CHP engines are considered to represent BAT for the combustion of the product pyrogas to provide the maximum heat and power output combined with the greatest flexibility.

Flaring is in place in the event that it is required for safety release, or if the pyrogas deviates from the specification as set out in the end of waste application, or in the event of process trips when pyrogas needs to be combusted. However, the built in redundancy achieved through using 3 of the 4 NEAT lines at any one time will minimise the need for flaring as far as practicable.

#### 1.4.1.6. Ancillary Services

Mains water and harvested rainwater will generally be used for amenities, cleaning and for fire fighting. Rainwater run-off from the roofs will drain into a clean water storage tank with an approximate capacity of 400m$^3$. Dirty water includes wash down water from the floors (though this is likely to be minimal), aqueous effluent from the quench and drier condensate. This will be stored in one of two 400m$^3$ capacity dirty water tanks prior to removal by tanker to an appropriate treatment facility elsewhere.

Surface water run-off from the site roads will be discharged to the existing surface water system via hydrocarbon interceptors. Surplus rainwater run-off from the buildings will also be discharged to the surface water system.

The plant will be operated from the control room which will overlook the pyrolyser/gasifier units. A CCTV system will allow operators to view other areas of the plant, such as the waste reception and storage areas, driers and the ash storage areas.

BAT has been demonstrated to be in place for in-process controls at the installation, as varied by this application.

### 1.4.2. Emissions Controls

The waste feed will exclude hazardous waste and will not contain significantly chlorinated or halogenated components or components with volatile metal content. This will be ensured by the fact that the waste feed comes from pre-treatment in the permitted facility at Easter Langlee. In conjunction with the starved oxygen environment in the pyrolysers, this minimises the potential formation of acid gases and dioxins and furans. The quick quench of product pyrogas and the absence of precursor substances minimises potential for dioxin reformation.

The purification of product pyrogas is described above. The emissions from the CHP engines are in line with the SEPA landfill gas guidance. The combustion control systems on the engines and the combustors control the air supply to continuously optimise combustion conditions, minimising $NO_x$ and CO as far as possible.

Treatment of exhaust gases from gasifier syngas combustion is discussed above. Emissions from the combustors will comply with IED Annex VI. The use of dry in-stack scrubbing means that an aqueous effluent that would require treatment either on site or offsite, is not generated. Diesel is the auxiliary fuel.

Fugitive emissions to air, water and sewer are prevented through design of the facility, good operational control, training and the implementation of an accident management plan.

The odour prevention arrangements, biofilter and scrubber provision for the treatment of potentially odorous ventilation air and the negative pressure of the process buildings are covered by the extant permit and are not affected by this variation application. All additional waste handling and storage will be within the process building.

BAT has been demonstrated to be in place for emissions control at the installation, as varied by this application.

### 1.4.3. Management Techniques

The installation will be managed by a suitably qualified and experienced team. The site will have an integrated management system (IMS) that will be certified to ISO14001:2004 as soon as possible after commencement of operation. BAT will be in place for management at the facility at the start of operations. The operational control measures described above for the prevention of point source and fugitive emissions, and the implementation of the accident management plan, will be under the close control of the IMS, with relevant policies and procedures and staff training in place.

BAT has been demonstrated to be in place for management at the installation, as varied by this application.

### 1.4.4. Raw and Auxiliary Materials

The main fuel is sourced from the permitted waste facility, and is subject to a stringent specification. Any fuel from other facilities will be subject to the same specification.

Other raw materials for use in the product pyrogas purification train or the combustor flue gas treatment plant, are industry standard for this type of application and have been assessed as BAT for Easter Langlee. The waste generated from usage of raw materials will be minimised through optimisation of the separate dosing processes. Water use will be minimised through rainwater harvesting and reuse. Diesel is a suitably low polluting start-up fuel.

Storage and handling of raw, materials will be within the process building, and liquids will be provided with secondary containment with capacity >110% of container capacity, or >25% of the total where multiple containers are stored within the same secondary containment area.

BAT has been demonstrated to be in place for raw and auxiliary materials and waste and water use minimisation at the installation, as varied by this application.

### 1.4.5. Waste Management, Storage and Handling

Rejected feedstock will be virtually nil, due to the upstream treatment. Wastes generated at the installation will be stored, handled and removed form site in accordance with the Duty of Care system, implemented through the IMS. Wastes will be segregated, and handled within the process building, and removed from site in covered or enclosed vehicles.

BAT has been demonstrated to be in place for waste management, storage and handling at the installation, as varied by this application.

### 1.4.6. Waste Recovery and Disposal

The char and the majority of the condensed organics from the quench are recycled into the gasification process, allowing recovery of their energy content. The main wastes generated at the installation, as varied by this application, will be:

- Ash – 4,320 tpa worst case (based on 16.8% dry matter)
- Bag filter residue – up to 300 tpa
- Condensate from the drier – 9,400 tpa
- Aqueous effluent from the pyrogas quench – 4,320 pa of which 1,520 tpa routed to the gasifier, 2,800 tpa sent for treatment/disposal
- Waste oil – up to 12,000 litres per annum

Ash generation of around 16.8% waste input compares favourably with traditional energy from waste facilities at around 24%. Ash and bag filter residue will be kept separate, and a market for re-use will be sourced to avoid disposal where possible. Composition will be monitored quarterly for LOI or TOC.

Waste will be dealt with as high up the waste hierarchy as possible, which is as follows, in priority order:

- Prevention
- Preparation for re-use
- Recycling/reclamation
- Other recovery (e.g. energy recovery)
- Disposal (e.g. landfill)

BAT has been demonstrated to be in place for waste recovery and disposal at the installation, as varied by this application.

### 1.4.7. Energy

The purpose of the ATT facility is to recover the energy from the pre-treated waste, to deliver renewable heat and power for local supply. This also avoids the emissions of $CO_2$ that would occur from the landfilling of the biogenic component of this waste.

The use of engines allows genuine CHP. A heat and power plan has been undertaken and is provided in Appendix E. This shows that the facility can achieve on overall thermal efficiency of around 46.7%, based on the currently identified demand for heat.

BAT has been demonstrated to be in place for energy at the installation, as varied by this application.

### 1.4.8. Accidents

The sources of hazards at the installation, as varied by this application, have been identified, along with the risks posed to the environment. The prevention of accidents through the generation and implementation of an accident management plan (AMP), which has been developed based on experience of operating other similar facilities. The AMP will be revised during operation as required and supplied to SEPA. It will be incorporated into the IMS through relevant procedures. Staff training will be provided in the prevention of accidents and the mitigation of their consequences. Communication with SEPA and other stakeholders, particularly in the event of an emergency or incident that may lead to environmental consequences, will be managed through the procedures within the IMS.

BAT has been demonstrated to be in place for in-process controls at the installation, as varied by this application.

### 1.4.9. Noise and Vibration

The sources of noise and vibration at the installation, as varied by this application, have been identified. Their impact has been assessed, and suitable prevention measures have been proposed to prevent emissions at source as far as practicable. The assessment demonstrates that receptors are unlikely to experience significant cause for annoyance due to noise from the installation. The full noise assessment is provided electronically as part of the environmental statement submitted for planning.

BAT has been demonstrated to be in place for noise and vibration at the installation, as varied by this application.

### 1.4.10. Monitoring

Non-continuous monitoring will be in place for emissions to air from the CHP engines A2 – A5, to demonstrate compliance with SEPA's landfill gas technical guidance LFTGN08, Table B of which requires annual testing.

Continuous emissions monitoring will be in place on the combustor exhaust A6, to demonstrate compliance with IED Article 48 and Annex VI.

Residues will be monitored quarterly for LOI or TOC in line with IED Article 50(1). Waste aqueous effluent and drier condensate will be monitored as required by the permitted facility that will accept this waste.

Continuous and non-continuous monitoring of process parameters, from waste reception through pyrolysis to pyrogas purification, combined with final combustion optimisation, is in place to ensure that the quality of purified pyrogas meets the requirements of the end of waste application. Temperature monitoring of the combustor exhaust gas is in line with IED Article 50(2).

BAT has been demonstrated to be in place for monitoring at the installation, as varied by this application.

### 1.4.11. Closure

An outline site closure plan has been developed for the installation, as varied by this application. Measures have been built in to the design to make decommissioning and closure easier, such as not having underground storage (apart from site drainage and interceptors) and not using asbestos containing materials. This will be updated on a regular basis during operation.

BAT has been demonstrated to be in place for closure of the installation, as varied by this application. A revised site report including reference data has not been undertaken, by agreement with SEPA, as this variation application is submitted under the Pollution Prevention and Control (Scotland) Regulations 2000.

### 1.4.12. Installation Issues

The current permit holder, New Earth Solutions (Scottish Borders) Limited, will also be the operator of the ATT facility.

### 1.4.13. Emissions Benchmarks

Emissions to air from the installation, as varied by this application, have been characterised and compared with the available and appropriate guidance, namely:

- Emissions to air from the CHP engines: SEPA LFTGN08
- Emissions to air from combustors: IED Annex VI

There will be no process emissions to water, sewer or land at the installation, as varied by this application.

### 1.4.14. Impact

Air quality modelling has been undertaken for the installation, as varied by this application. This demonstrates that emissions to air are no likely to have significant impact on human (air quality) receptors or ecological receptors. The full air quality report is provided in Appendix C to this application.

A human health risk assessment has also been undertaken, and this is provided in Appendix D. This shows that there is no significant risk to human health arising from emissions from the installation, as varied by this application.

No significant environmental impact is anticipated from the installation.

# 2. TECHNIQUES FOR POLLUTION CONTROL

## 2.1. IN-PROCESS CONTROLS

This section of the variation application corresponds to Part C2 of the application for variation form, describing the proposed techniques, specifically addressing the relevant technical guidance and the indicative requirements contained therein.

In particular, this section describes the proposed variation to the installation and activities and identifies the foreseeable emissions to air, water and land from each stage of the process. This section also describes the main techniques that will be used to prevent, or where not practicable, minimise emissions to air, water, sewer and land. In conjunction with section 2.2 below, it describes the main operating techniques that will be in place at the varied installation.

A process flow diagram for the varied installation, the NEAT process and an indicative site layout are provided in Appendix A.

### 2.1.1. Materials Handling and Storage

#### 2.1.1.1. Pre-acceptance Procedures to Assess Waste

The ATT facility accepts fuel arising from the processing of municipal solid wastes (MSW) and MSW-like commercial and industrial waste at the fuel preparation facility. The fuel will comprise only residual non-hazardous segregated material, which will be mainly sourced from the fuel preparation facility, but may also be sourced from other New Earth Group facilities and other similar local third party facilities.

The pre-acceptance procedures for waste arriving at the installation are discussed in detail in section 2.1.1 of the application for the waste treatment facility, dated May 2011. This section covers the measures taken before waste is accepted at the currently permitted fuel preparation facility.  This variation application does not amend this previous assessment of BAT for pre-acceptance procedures at the already permitted facility or the types or quantities of waste to be accepted.

#### 2.1.1.2. Acceptance Procedures when Waste and Raw Materials Arrive at the Installation

The acceptance procedures for waste arriving at the installation are discussed in detail in section 2.1.2 of the application for the waste treatment facility, dated May 2011. This section covers the measures taken during:

- Waste reception
- Quality control
- Acceptance standards
- Dealing with non-compliant loads
- Waste tracking

This variation application does not amend this previous assessment of BAT for acceptance procedures at the already consented facility. However, there will be additional measures to ensure that the fuel prepared at the waste treatment facility meets the required specification for the advanced thermal treatment (ATT) process, as discussed below.

### 2.1.1.3. Waste Storage

The waste storage measures and procedures are discussed in detail in section 2.1.3 of the application for the waste treatment facility, dated May 2011. This variation application does not amend this previous assessment of BAT for waste storage at the already consented facility. However, there will be additional waste storage within the process building, as discussed in section 2.1.1.7 below.

### 2.1.1.4. Removal of the Biostabilisation Process

As a result of this variation application, the biostabilisation process, described in section 2.1.4.2 of the previous application dated May 2011, will no longer take place at the already permitted waste treatment facility. The waste will continue to be mechanically treated to ensure the removal of recyclates as per the requirements of the waste treatment contract currently in place, as described in section 2.1.4.1 of the previous application dated May 2011.

The principal effect of the removal of the biostabilisation process is to significantly reduce the potential for odour generation as discussed below.

### 2.1.1.5. Odour Abatement

The BAT justification for the prevention of odour emissions from the mechanical treatment and storage of MSW, as set out in the previous application sections 2.2.1.4 and 2.2.6 remains unchanged by this variation application. The process building will still be designed to achieve negative pressure and hence minimise the potential for fugitive odour emissions. However, the main odorous process, the biological treatment process (biostabilisation), is now no longer taking place. Therefore, the potential for odour is significantly reduced as a result of this variation, since the generation of ammonia is eliminated. The biofilter and scrubber will remain to treat the ventilation air from the process building and from the drier.

A revised odour and air quality assessment is provided as Appendix C to this variation application. This demonstrates no potential for significant pollution arising from emissions to air or odour releases from the varied installation.

### 2.1.1.6. Other Raw Materials

Additional raw materials will be imported to site as a result of this variation. These are summarised in section 2.3 below and include treatment chemicals for the FGT plant serving the combustors and quench scrubber dosing chemicals.

### 2.1.1.7. Fuel Transfer and Drying

Waste that has been treated in the fuel preparation facility will be routed to the ATT area within the fully enclosed process building. The pre-treatment covered in the extant permit includes the following processes listed below, and ensures the removal of chlorinated plastics that could lead to dioxin formation, as a primary prevention mechanism for dioxins. Note that the small quantities of fuel that may come from any third party or other New Earth Group sites will be subject to the same specification requirements. The mechanical treatment processes have already been permitted and therefore represent BAT for the waste treatment facility. This variation application does not amend the previous assessment of BAT for these mechanical waste treatment processes. Segregated recyclates will continue to be transferred off-site for recovery elsewhere through existing contractual arrangements with plastics and metal reprocessors.

Fuel preparation processes include:

- Primary shredding (bag splitter)
- Primary screening to separate fine fractions
- Overband magnets for ferrous fraction removal
- Wind separator to separate light (paper and film) and heavy fractions
- Eddy current separator for the non-ferrous metal fraction
- Optical sorting for mixed plastics
- Secondary shredding
- Additional recyclate recovery equipment (ferrous metals, aggregates and battery removal)

A baling facility will also be included in the pre-treatment process. This is to allow RDF to be baled and sent off site if required in case of ATT facility unavailability.

Owing to the requirement to prepare fuel for the thermal treatment facility to a defined specification, an additional waste drying stage with two waste storage bunkers (one pre-drier and one post-drier) will be added prior to the ATT process to secure moisture content reduction to around 20%. This is to ensure maximum possible efficiency of the energy recovery process. Fines and the residual component from the mechanical pre-treatment process will be routed to the waste drier prior to introduction into the pyrolysers.

The drier has not yet been selected but the type of equipment is provisionally described here. It is likely to be an air drier, supported by diesel burners. Hot air is likely to be generated via hot water / air heat exchangers which will receive hot water at about 95$^0$C from the CHP heat recovery system and deliver hot air to the drier at a temperature of about 70$^0$C, assuming an ambient temperature of 15$^0$C. There is usually the potential to recover heat from the condenser air to pre-heat the input air, and the extent to which this is possible will depend on the final choice of drier. This has not yet been procured. The drier would take the shredded (<100mm), pre-treated fuel with a capacity of approximately 3 tonnes/hour output and a moisture content expected to be in the region of 40-50% incoming and 20% outgoing. The exhaust from the drier will be routed through the scrubber and biofilter for removal of organic compounds prior to release through emission point A1. This is currently estimated at around 31 $Nm^3/s$.

The drier would usually be equipped with multiple drying zones to ensure optimum efficiency of the drying process, allowing different temperatures and airflows to be used in different drying zones. The drying bed typically consists of:

- In the upper section, rapid initial moisture reduction occurs with the fully saturated air exhausted via doors above the bed and passed through condensers which remove the extracted water and recover heat for recycling to the drier; the condensate is collected for subsequent treatment and disposal
- In the lower section, the shredded waste gains further heat and becomes drier; the exhaust from this section is not fully saturated and is recycled directly to the drier's upper section via the input air heat exchangers in order to optimise overall drying efficiency

- In the cooling section, the moisture content has been reduced to the required level and the temperature of the dried product is therefore reduced prior to discharge from the drier; the hot exhaust air from this section is dry and can be recycled to the drying sections, via the input air heat exchangers if required

Positive conveyor action within the drier chambers ensures that all the waste passes through the drier at a uniform rate, avoiding the risk of “streaming” that can occur with gravity flow or rotary systems. Dried fuel is transferred from the drier outlet to an intermediate storage bunker prior to further transfer to the ATT fuel buffer store.

Air flow is accurately controlled, via motor inverter control on the hot air fans, to match the properties of the incoming waste. However, variation of waste properties is expected to be low since the waste feed is prepared to a tightly controlled specification range. The drier plenum chambers are fully insulated to maximise energy efficiency. The thermal energy requirement for a throughput of 3 tonnes/hour at the required moisture differential would be approximately 0.065kW/kg, or around 195kW. The electrical energy use of the drier is approximately 105kW, dominated by the centrifugal, backward curved blade hot air fans (90kW). Other power requirements are typically the bed drive, levelling device, agitators, slat cleaning brush and water pumps.

Control is via a full PLC system panel with 15” touch screen in a remote metal enclosure, with hot air and waste temperature display and motor speed control. The risk of fire in the dried waste stream is addressed by a fire control system which consists of three waste temperature monitoring probes with a scanning monitor in the panel, coupled to a fire extinguishing system provided by a galvanized feed pipe along the length of the drier bed with water spray nozzles and a flow control valve.

The additional drying stage in the mechanical treatment process is considered to be an element of BAT for the preparation of fuel for the thermal treatment process. It is one of the control techniques in the production of pyrogas to specification for subsequent combustion during the generation of energy and heat, and forms part of the BAT justification for the overall thermal efficiency of the ATT process.

We would propose to provide full details of the drier once it has been selected and would envisage that this would be via a prior operating condition.

### 2.1.2. Waste charging

At the drier outlet, further additional recyclate removal will be provided before the fuel is routed to a dried fuel buffer store, which feeds the individual pyrolyser day stores. The prepared fuel feedstock will be continuously transferred from the ATT fuel buffer store into the individual pyrolyser buffer stores, each of which contain approximately 60 minutes’ worth of fuel (1 tonne for each line) to allow each feed compactor and each thermal unit to be continuously fed for 24 hour per day / 7 day per week operation. The purpose of the compactors is to prevent the ingress of air into the pyrolysis process during continuous feed.

The NEAT hoppers are operated fully flooded so no high level alarm is required. Low level alarms fitted to the compactor hoppers inform the operator when fuel feed is insufficient. This can be caused by incorrect plant settings for a specific fuel or fuel handling equipment failure. A manual slide valve can be closed to isolate each NEAT unit hopper from the common feed conveyor. Surplus fuel can then be returned to the buffer store automatically if required.

The above feeding system provides a continuous feed of fuel into the pyrolyser. The whole of the fuel feed system will be enclosed and constructed from plate steel and feed will be automatically controlled. Once the fuel has entered the feed system, there will be no opportunity for it to escape.

### 2.1.3. Furnace Types

The drum pyrolysis process is an endothermic process requiring a continuous energy injection to maintain the conversion process of waste to pyrogas. This energy is provided to the pyrolyser via indirect heating from the exhaust gases from the gasifier syngas combustor and raises the temperature sufficiently to allow the thermal decomposition of the material in the absence of any free oxygen.

On entering the pyrolyser the fuel is heated to a temperature of around 750 - 800°C. The feed material is mechanically transported through the pyrolysis chamber at a controlled rate, with a typical residence time of 40 minutes (although much longer residence times can be achieved). The ability to vary the temperature and residence times within the pyrolysis chamber allows the process to be tuned for various feed materials, although it is expected that there will be little variability in fuel feed owing to the strictly controlled preparation of fuel in the fuel preparation facility. Nevertheless, to ensure the maximum efficiency of the process, the precise control of temperature within the pyrolysis unit and the residence time of the feed material will be optimised.

Three distinct processes occur within the pyrolyser chamber:

- Material drying – where moisture is driven off as steam
- Hydrolysis – where initial decomposition of the material and reaction with steam occurs
- Pyrolysis – where final thermal decomposition of the material and its by-products takes place to produce pyrogas and residual materials, in the form of char

The raw pyrogas is composed of a mixture of gases (CO, $CO_2$, $CH_4$, $H_2$, and N2), condensable vapours (oils, tars, waxes) and particulates (char). The pyrogas is cooled and enters a ceramic filter, designed to separate the pyrogas from the char and condensable vapours. The pyrogas is directed to the gas clean-up train whereas the char, oils, tars and waxes (at around 600$^0$C) proceed to the gasifier for further energy recovery.

The solid carbon char, together with the oils, tars and waxes, is fed into a gasification chamber where steam and a limited amount of oxygen are injected. The carbon char breaks down into a pyrogas and a solid ash residue, expected to be non-hazardous. The syngas is used as the fuel for the combustor whilst the ash residue is removed and collected for disposal or reuse, as appropriate. The char and tar feed system to each gasifier is interlocked with the combustor temperature and continuous emissions monitoring system (CEMS) in order to deliver the requirements of IED Chapter 4, Article 50, Operating Conditions, paragraph 4.

The combustor has been designed to fully combust the gaseous fuel from the gasification phase in a controlled manner. Computational fluid dynamic (CFD) modelling has been undertaken to optimise the combustor design to reduce $NO_x$ by staged combustion and minimisation of peak flame temperatures. This shows that the exhaust gas from the syngas combustion is held at >850$^0$C for >2s in compliance with IED Article 50(2).

The selection of the thermal treatment technology has undergone a full BAT assessment, to ensure that it is the most suitable technology for the treated contract waste, once the recyclates have been removed. A summary of the advantages and disadvantages of the available combustion (or conversion) technologies for a feedstock prepared from municipal waste compared with the NEAT system is included below. It has been assumed for this variation application that any thermal conversion technique including energy recovery is preferable to landfilling of waste, and as such, a BAT comparison against landfill has not been undertaken. However, it is important to understand the energy efficiency and $CO_2$ emissions associated with the NEAT process compared against landfill, as well as other thermal techniques, and more discussion on this is included in section 2.7 below.

The analysis shows that the NEAT process has key advantages over the other thermal treatment options and therefore represents BAT for energy and heat generation for full CHP operation using fuel from the fuel preparation facility at Easter Langlee, because:

- The NEAT process is available for efficient and effective operation at the required scale, whilst offering the flexibility to adapt to variable tonnage throughputs via modular operation
- The modular design of the NEAT process allows the flexibility to maximise genuinely efficient CHP heat and power operation whilst delivering baseload and / or peak power demand
- The modular design and multiple engine configuration of the NEAT process allows the flexibility to maintain the CHP engines at maximum operational efficiency (typically > 80% MCR) at lower waste throughputs and lower pyrogas production rates through providing inbuilt redundancy
- Modularity and flexibility of pyrolysis / gasification / engine system allows for balancing of power and heat output against load whilst maintaining optimum thermal efficiency and minimum $CO_2$ emission per tonne of waste processed
- The removal of plastics for recycling during fuel preparation will reduce potential for formation of dioxins and furans during thermal treatment
- The potential for generation of dioxins and furans during thermal treatment is further controlled and minimised during pyrolysis and gasification (the primary techniques) through oxygen starvation (pyrolysis) and oxygen level control (gasification), rather than abated post incineration stage using secondary techniques
- The pyrogas is manufactured to a product specification such that it will achieve “end of waste” status, resulting in cleaner combustion for energy and heat generation with no requirement for secondary post combustion abatement
- CHP emissions will meet landfill gas engine guidance emission benchmarks for combustion in spark ignition engines
- Emissions of metals in flue gases will be lower than conventional incineration as these are retained in solid residues (char and ash) at the pyrolysis and gasification stages. Metals are removed from the waste stream by the mechanical sorting process – pre and post drying.
- Char generated by pyrolysis is gasified on site, maximising energy recovery to the process for reduced parasitic load and minimum residue generation
- Raw material use is minimised since the principal usage comprises only chemicals for the pyrogas and syngas treatment trains plus supplementary fuels

Table 2. BAT Comparison of NEAT versus Available Alternatives at the 3 Tonne/hour Scale

| BAT Criteria | Incineration (Moving Grate, Fluidised Bed, Oscillating Kiln) | Plasma Gasification | Gasification | Pyrolysis | NEAT (Staged Pyrolysis/Gasification) |
|---|---|---|---|---|---|
| Availability of technique at the required scale | This would have low efficiency at the 3 tonne/hour scale and is likely to be uneconomic.<br>Limited flexibility of operation at peak efficiencies, even with multiple incineration lines. | Plasma gasification schemes tend to be large, single chamber techniques that may not be available at the required 3 tonne/hour scale.<br>Limited flexibility of operation at peak efficiencies. | Available at the required scale although limited number of proven plants in operation.<br>Limited flexibility of operation at peak efficiencies. | Available at the required scale although limited number of proven plants in operation.<br>Limited flexibility of operation at peak efficiencies. | Available at the required scale and currently operational at Avonmouth by New Earth Energy.<br>Modular process design allows the flexibility to maximise genuine CHP heat and power supply for baseload and / or peak demand whilst maintaining optimum efficiencies. |
| Feed pre-treatment | Pre-treatment of MSW not essential except for removal of bulky items only for hearth / grate and rotary kiln type units, although front end sorting to remove recyclables is typically incorporated for new schemes.<br>Particle size reduction for more homogenous feed essential for fluidised bed units. | Pre-treatment and size reduction of MSW is required for consistent feed composition.<br>Front end sorting to remove recyclables may be incorporated.<br>A wide range of feed wastes may be accommodated, e.g., biomass, shredded tyres. | Pre treatment and size reduction of MSW is required for consistent feed composition.<br>Front end sorting to remove recyclables may be incorporated.<br>No data is available on treatment of other wastes. | Pre treatment and size reduction of MSW is required for consistent feed composition.<br>Front end sorting to remove recyclables may be incorporated.<br>No data is available on treatment of other wastes. | Pre-treatment and size reduction of MSW is required for consistent feed composition.<br>Front end sorting to remove recyclables will be incorporated in the consented facility to maximise recycling of the contract waste.<br>Removal of plastics for recycling will reduce potential for formation of dioxins and furans during thermal treatment. |
| Waste Storage and Handling | Waste receipts subject to pre-acceptance and acceptance procedures and systems. | Waste receipts subject to pre-acceptance and acceptance procedures and systems. | Waste receipts subject to pre-acceptance and acceptance procedures and systems. | Waste receipts subject to pre-acceptance and acceptance procedures and systems. | Waste receipts subject to pre-acceptance and acceptance procedures and systems at the |

| BAT Criteria | Incineration (Moving Grate, Fluidised Bed, Oscillating Kiln) | Plasma Gasification | Gasification | Pyrolysis | NEAT (Staged Pyrolysis/Gasification) |
|---|---|---|---|---|---|
| | Enclosed storage and handling (including waste unloading) with measures for control of fugitive releases of odour, dust, litter, etc.<br>Bunker management techniques should prevent development of anaerobic conditions. | Enclosed storage and handling (including waste unloading) with measures for control of fugitive releases of odour, dust, litter, etc.<br>Bunker management techniques should prevent development of anaerobic conditions. | Enclosed storage and handling (including waste unloading) with measures for control of fugitive releases of odour, dust, litter, etc.<br>Bunker management techniques should prevent development of anaerobic conditions. | Enclosed storage and handling (including waste unloading) with measures for control of fugitive releases of odour, dust, litter, etc.<br>Bunker management techniques should prevent development of anaerobic conditions. | consented facility.<br>Enclosed storage and handling (including waste unloading) with measures for control of fugitive releases of odour, dust, litter, etc.<br>Location of waste treatment, storage and handling in same enclosed process building as existing consented facility reduces requirement for extended waste transfers via conveyor systems and associated potential for fugitive releases. |
| Emissions | Primary combustion technique alone cannot meet necessary emission standards for combustion gases, although fluidised beds generate lower $NO_x$ than other techniques.<br>Application of in-combination secondary abatement techniques required to reduce emissions to meet IED.<br>Emissions lower than IED are reported by many plants. | Emissions of metals in flue gas are likely to be lower than conventional incineration as these are either retained in solid residues (slag) at the gasification stage or separately tapped off as molten metal for recycling.<br>The potential for generation of dioxins and furans is controlled and minimised to very low levels at the gasification stage (the primary technique) through oxygen control rather than | Limited operational data available. Typically meet IED.<br>The potential for generation of dioxins and furans is controlled and minimised to very low levels at the gasification stage (the primary technique) through oxygen control rather than abated post incineration stage. But the presence of some oxygen does introduce a slight increase in dioxin formation compared with pyrolysis or | Some operational data available. Typically meet IED.<br>The potential for generation of dioxins and furans is controlled and minimised to very low levels at the pyrolysis stage (the primary technique) through oxygen starvation rather than abated post incineration stage.<br>Emissions of metals in flue gas are likely to be lower than conventional incineration as these are retained in solid | Currently operational plant at Avonmouth. Operational data from Canford.<br>Gas cleaning is sufficient to achieve "end of waste" status such that IED Chapter IV does not apply to CHP engine exhaust gas.<br>The potential for generation of dioxins and furans is controlled and minimised to very low levels at the pyrolysis and gasification stage (the primary technique) |

| BAT Criteria | Incineration (Moving Grate, Fluidised Bed, Oscillating Kiln) | Plasma Gasification | Gasification | Pyrolysis | NEAT (Staged Pyrolysis/Gasification) |
|---|---|---|---|---|---|
| | | abated post incineration stage. But the presence of some oxygen does introduce slight increase in dioxin formation compared with pyrolysis or staged pyrolysis/gasification.<br>Potentially polluting contaminants are removed from the syngas in the clean-up train prior to the power generation combustion stage, eliminating the need for pollutant removal by secondary abatement post syngas combustion. Emissions are lower than conventional incineration with secondary abatement techniques (e.g., SCR) only required for large scale plants in combination with primary techniques at the power train combustion stage for the reduction of $NO_x$. | staged pyrolysis/gasification.<br>Emissions of metals in flue gas are likely to be lower than conventional incineration as these are retained in solid residues at the gasification stage.<br>Potentially polluting contaminants are removed from the syngas in the clean-up train prior to the power generation combustion stage, eliminating the need for pollutant removal by secondary abatement post syngas combustion.<br>SCR not typically required to meet IED for $NO_x$. | residues at the pyrolysis stage.<br>Potentially polluting contaminants are removed from the pyrogas in the clean-up train prior to the power generation combustion stage, eliminating the need for pollutant removal by secondary abatement post pyrogas combustion.<br>Emissions performance data is limited, although it is reported that lower releases than conventional incineration are achievable with secondary abatement techniques (e.g., SCR) at the power train combustion stage for the reduction of $NO_x$ for larger applications.<br>Pyrolysis produces a liquid oil by-product that must be further processed to produce useful products. Also, due to the lower treatment temperatures vs. gasification, tars are more likely to be formed. Without linked gasification, this would have to be processed prior to reuse on site. | through oxygen starvation (pyrolysis) or close oxygen control (gasification) rather than abated post incineration stage using secondary techniques.<br>Potentially polluting contaminants are removed from the pyrogas in the clean-up train prior to the power generation combustion stage, eliminating the need for pollutant removal by abatement using secondary techniques post pyrogas combustion.<br>CHP emissions will meet landfill gas engine guidance emission benchmarks for combustion of biogas in spark ignition engines.<br>Emissions of metals in flue gas are likely to be lower than conventional incineration as these are retained in solid residues at the pyrolysis and gasification stages (char and/or ash).<br>Linked pyrolysis and gasification enables a self-sustaining process, using energy recovery form char and tars to provide |

| BAT Criteria | Incineration (Moving Grate, Fluidised Bed, Oscillating Kiln) | Plasma Gasification | Gasification | Pyrolysis | NEAT (Staged Pyrolysis/Gasification) |
|---|---|---|---|---|---|
| | | | | Pyrolysis likely to require fossil fuel combustion to support the process or to use renewable energy that could otherwise be exported, reducing thermal efficiency. No gasification stage linked to pyrolysis to generate process heat from pyrogas. | heat required for pyrolysis, minimising fossil fuel support fuel use and removing this waste stream.<br>Residues limited to ash from char gasification. |
| Design and Construction | Complex process engineering design and operation.<br>Gas tight plant required but less critical than for gasification / pyrolysis. System operates under induced draught and main concern is prevention of tramp air ingress leading to combustion trim imbalance.<br>Selection of plant materials of construction is less critical than for gasification / pyrolysis owing to the less aggressive nature of the combustion gases. | Complex process engineering design and operation.<br>Gas tight plant required but complete exclusion of air is difficult and some oxidation will occur.<br>Selection of plant materials of construction is critical owing to corrosive nature of syngas. | Complex process engineering design and operation.<br>Gas tight plant required but complete exclusion of air is difficult and some oxidation will occur.<br>Selection of plant materials of construction is critical owing to corrosive nature of syngas. | Complex process engineering design and operation.<br>Gas tight plant required but complete exclusion of air is difficult and some oxidation will occur.<br>Selection of plant materials of construction is critical owing to corrosive nature of pyrogas. | Complex process engineering design and operation.<br>Gas tight plant required but modular construction and smaller process units will make it easier to achieve gas tight status. Complete exclusion of air is difficult and some oxidation may occur.<br>Selection of plant materials of construction is critical owing to corrosive nature of pyrogas. Materials selection has been determined using the reference plant at Canford, Dorset. |
| Energy Recovery / $CO_2$ Generation | Parasitic load is lower than gasification / pyrolysis but energy recovery efficiencies are lower owing to inability to operate combined cycle mode. | Higher parasitic load than conventional incineration but scale allows for gas turbine syngas combustion in combined cycle mode, which allows higher | Limited operational data available.<br>Higher parasitic load than conventional incineration. Scale does not normally allow for gas | Limited operational data available.<br>Higher parasitic load than conventional incineration. Scale does not normally allow for gas | Operational data from Canford.<br>Modularity and integrated design for optimum energy recovery leads to lower parasitic load and greater degree of self- |

| BAT Criteria | Incineration (Moving Grate, Fluidised Bed, Oscillating Kiln) | Plasma Gasification | Gasification | Pyrolysis | NEAT (Staged Pyrolysis/Gasification) |
|---|---|---|---|---|---|
| | $CO_2$ emissions per unit energy generated are much higher than those for gasification or pyrolysis.<br>Scope for CHP mode operation but limited flexibility for maintaining efficiency at varying loads and outputs, even with multiple incineration lines. Difficult to match duty and demand. Only really suitable for baseload. | energy recovery efficiencies.<br>Scope for CHP mode operation but limited flexibility for maintaining efficiency at varying loads and outputs. Difficult to match duty and demand. Only really suitable for baseload. | turbine operation.<br>Overall energy efficiency is dependent on efficiency of syngas combustion.<br>Use of steam cycle only is likely to reduce thermal efficiency and increase $CO_2$ emissions unless genuine CHP can be achieved.<br>Scope for CHP mode operation but limited flexibility for maintaining efficiency at varying loads and outputs. | turbine operation.<br>Overall energy efficiency is dependent on efficiency of pyrogas combustion.<br>Use of steam cycle only is likely to reduce thermal efficiency and increase $CO_2$ emissions unless genuine CHP can be achieved.<br>Scope for CHP mode operation but limited flexibility for maintaining efficiency at varying loads and outputs. | sustaining operation than pure gasification or pyrolysis on their own.<br>Modularity and flexibility of pyrolysis / gasification / engine system allows optimisation for matching of power generation capacity to pyrogas output, maximum energy supply at peak periods and baseload power generation at optimum efficiencies. Also allows for balancing of power and heat output against load whilst maintaining optimum thermal efficiency and $CO_2$ emission per tonne waste processed.<br>Genuine, efficient CHP mode operation at a wide range of loads and outputs. |
| Residue Generation and Waste | Furnace bottom ash, which may be recycled to use as an aggregate.<br>Fly ash / FGT residues may be re-used in the chemicals sector as a neutralising agent, although care must be exercised to avoid re-mobilising pollutants. Market not proven. | Raw material consumption for treatment of residues typically lower than incineration so waste generation lower.<br>Solid residue is an inert by-product, comprising a vitrified granulated slag, which can be reused. | Raw material consumption for treatment of residues typically lower than incineration so waste generation lower.<br>Solid residues can vary from a low leaching ash to a low leaching slag, depending on the specific process technique. | Raw material consumption for treatment of residues typically lower than incineration so waste generation lower.<br>Ash or slag arises from inert solid material present in the waste feed.<br>Carbon char produced by the | Raw material consumption for treatment of residues typically lower than incineration so waste generation lower.<br>Char generated by pyrolysis is gasified on site, maximising energy recovery to the process for optimum parasitic load and |

| BAT Criteria | Incineration (Moving Grate, Fluidised Bed, Oscillating Kiln) | Plasma Gasification | Gasification | Pyrolysis | NEAT (Staged Pyrolysis/Gasification) |
|---|---|---|---|---|---|
| | Probably hazardous waste.<br>Fluidised bed generates larger waste volumes.<br>Control measures for the prevention of fugitive releases will be required. | | | pyrolysis process may be used as a product (e.g., carbon black), burned as fuel or disposed of as a waste residue. | minimising residue generation.<br>Only residue is ash from gasification which will be stable and have minimal pollution potential. |
| Odour | Odour management techniques typically prevent nuisance.<br>Waste pre-treatment required to avoid odour from untreated waste storage and handling. This can generate additional odour potential, requiring further control measures. | Odour management techniques typically prevent nuisance.<br>Waste pre-treatment required to avoid odour from untreated waste storage and handling. This can generate additional odour potential, requiring further control measures.<br>Syngas introduces odour potential, requiring control measures for storage and handling. | Odour management techniques typically prevent nuisance. Waste would typically be pre-treated so odour potential from fuel is low.<br>Waste pre-treatment can generate additional odour potential, requiring further control measures.<br>Syngas introduces odour potential, requiring control measures for storage and handling. | Odour management techniques typically prevent nuisance. Waste would typically be pre-treated so odour potential from fuel is low.<br>Waste pre-treatment can generate additional odour potential, requiring further control measures.<br>Syngas introduces odour potential, requiring control measures for storage and handling. | Odour management techniques typically prevent nuisance. Waste would typically be pre-treated so odour potential from fuel is low.<br>Waste pre-treatment can generate additional odour potential, requiring further control measures. |
| Noise | Noise management techniques, including equipment specification, plant maintenance and noise attenuation / abatement, typically prevent nuisance.<br>High pressure steam venting requires particular attention, | Noise management techniques, including equipment specification, plant maintenance and noise attenuation / abatement, typically prevent nuisance.<br>High pressure steam venting requires particular attention, | Noise management techniques, including equipment specification, plant maintenance and noise attenuation / abatement, typically prevent nuisance.<br>High pressure steam venting requires particular attention, | Noise management techniques, including equipment specification, plant maintenance and noise attenuation / abatement, typically prevent nuisance.<br>High pressure steam venting requires particular attention, | Noise management techniques, including equipment specification, plant maintenance and noise attenuation / abatement, typically prevent nuisance. |

| BAT Criteria | Incineration (Moving Grate, Fluidised Bed, Oscillating Kiln) | Plasma Gasification | Gasification | Pyrolysis | NEAT (Staged Pyrolysis/Gasification) |
|---|---|---|---|---|---|
| | although this generally only occurs in emergency / plant upset conditions. | although this generally only occurs in emergency / plant upset conditions. | although this generally only occurs in emergency / plant upset conditions. | although this generally only occurs in emergency / plant upset conditions. | |
| Accidents | Substantial operational experience in UK and overseas. Potential for accidents similar between differing EfW technologies and mainly related to loss of storage of FGT reagents, supplementary fuels and combustion / FGT residues. | Limited operational data available. Likely to have similar accident potential to EfW combustion options but with additional risks associated with plasma technology and potential for loss of containment of syngas, leading to risk of odour and fire/explosion. | Limited operational data available. Likely to have lower accident potential due to typically smaller scale of operation.<br>Additional risks associated with oxygen storage/generation and pressurised oxygen delivery systems, where used.<br>Potential for loss of containment of syngas, leading to risk of odour and fire/explosion. | Limited operational data available. Likely to have lower accident potential due to typically smaller scale of operation.<br>Potential for loss of containment of pyrogas, leading to risk of odour and fire/explosion. | Limited operational data available. Likely to have lower accident potential due to typically smaller and modular scale of operation.<br>Potential for loss of containment of pyrogas, leading to risk of odour and fire/explosion. |
| Raw Materials | Dependent on selected abatement technique, principal raw materials consumption comprises FGT chemicals and catalysts, boiler feed water treatment chemicals and supplementary fuels.<br>Fluidised bed units have greater raw materials usage owing to bed sand inventory. | Dependent on selected abatement technique, principal raw materials consumption comprises FGT chemicals and catalysts, boiler feed water treatment chemicals and supplementary fuels.<br>In addition, the plasma arc process uses metallurgical coke and limestone. | Dependent on selected abatement technique, principal raw materials consumption comprises FGT chemicals and catalysts, boiler feed water treatment chemicals and supplementary fuels. | Dependent on selected abatement technique, principal raw materials consumption comprises FG) chemicals and catalysts, boiler feed water treatment chemicals and supplementary fuels. | Principal raw materials consumption comprises treatment chemicals used in the pyrogas treatment train and supplementary fuels. |

### 2.1.4. Furnace Requirements

This section outlines the selected technology and how it is operated and controlled (using Best Available Techniques) and how prevention of emissions using process control, technology selection and management systems is achieved before consideration is given to abatement techniques. In particular, the process prevents or minimises emissions through:

- Use of a homogenous prepared pyrogas fuel manufactured to a product specification for “end of waste” status under the direct control of the operator
- Fuel transfer to the energy facility from the fuel preparation facility within the same building for full enclosure
- Receipt and storage of the fuel within a completely enclosed system
- Management of the fuel storage cycling to minimise residence times
- Use of proven modular pyrolysis and gasification technology to ensure the most efficient conversion to a high quality pyrogas
- Use of proven spark ignition engines for efficient combustion of pyrogas
- Use of multiple spark ignition engines configured for efficient CHP operation over a wide range of loads and outputs
- Balancing of power and heat output against load in CHP mode whilst maintaining minimum $CO_2$ emission per tonne waste processed
- Operation in accordance with the company wide Integrated Management System (IMS) to ensure compliance with the permit conditions and prevention of emissions
- Compliance with Chapter IV and Annex VI of the IED for the combustor emissions

The sole purpose of the NEAT pyrolysis process is to generate a synthesis product gas (pyrogas) which can be used to fuel industrial gas engines and generation sets for the purpose of generating clean renewable energy. All pyrogas produced by the NEAT process can be used directly as part of a close-coupled CHP scheme or be exported to another party for similar use.

Under normal circumstances, it is expected that three (3) modules will be in operation at any one time, with the fourth module either providing a standby facility for operation at 100% capacity or being offline for planned maintenance. The facility will have an annual availability of close to 100% at maximum capacity of 3 tonnes per hour for 8,000 hours per year. Each unit will have an availability of around 71%, with the balance of operation designed to meet the 24,000 tpa capacity. Planned maintenance can be scheduled to ensure only one line (or NEAT unit/engine) is offline at any one time; this will ensure no reduction in ability to treat the contract waste during planned maintenance. Planned maintenance will comprise of quarterly shutdowns on each line (or NEAT unit/engine) for statutory inspections. These will mainly be scheduled for warmer months, when the duty will be lower and so there is less impact on the supply side.

In summary, the thermal treatment facility operates as follows (more detailed analysis is provided in the subsequent sections below). From the pyrolyser fuel buffer store, the feedstock will be continuously fed via the compactors into the pyrolyser where pyrogas (consisting of methane, hydrogen, carbon monoxide and water vapour) and char (residual solid material) are generated. The pyrogas first moves forward to the pyrogas clean-up train before being combusted in the spark ignition CHP engines in order to generate electricity and heat. Meanwhile, the char proceeds to the gasifier, where it is gasified via the water gas reaction, leaving an inert ash and further gasifier syngas. This syngas is used as the fuel for the gasifier syngas combustor, which provides the indirect heat source for the pyrolysers and can contribute further recovered heat to the CHP heat recovery circuit. Combustion gases from the gasifier syngas combustor are subjected to flue gas treatment prior to being exhausted to atmosphere. The NEAT process schematic is shown in Appendix A.

#### 2.1.4.1. Fuel Specification

The receipt of all wastes at the installation is covered by existing pre-acceptance and acceptance procedures and systems which are not being amended by this application. Received wastes will comply with the listing of EWC waste codes already permitted and specified in the previous application dated May 2011; this listing is also not being amended by this application. Previously, the fines output from the mechanical pre-treatment at the MBT facility was transferred to the biostabilisation process. Following this variation, the principal output from the fuel preparation facility will be a fuel manufactured in accordance with a technical specification for use within the ATT facility for the production of pyrogas. All supplies of fuel delivered to the thermal treatment facility from the fuel preparation facility will be produced against this technical specification and assessed for suitability prior to acceptance at the facility. This also applies to fuel received directly from external providers.

**Table 3. Fuel Specification**

| Constituents | Value, wt/wt % |
|---|---|
| Paper | 35 - 45 |
| Plastics | 10 – 20 |
| Food | 4 – 8 |
| Wood | 4 – 8 |
| Textile | 25 – 35 |
| Metals | 0 – 3 |
| Inert (glass, grit & stones) | 0 - 3 |

**Table 4. Fuel Composition**

| Parameter [1] | Value |
|---|---|
| Calorific Value | 10 – 16 MJ/kg |
| Moisture content | 15 - 20% |
| Ash content | 8 - 14% |
| Biomass % by CV | 44 - 56% |
| Mercury mg/Kg | <1 |
| Cadmium mg/Kg | <1 |
| Antimony (Sb) mg/kg | 10 – 50 |
| Arsenic (As) mg/kg | <1 |
| Lead (Pb) mg/kg | 15 – 55 |
| Chromium (Cr) mg/kg | 10 – 40 |
| Cobalt (Co) mg/kg | 5 – 25 |
| Copper (Cu) mg/kg | 50 – 300 |
| Manganese (Mn) mg/kg | 0 – 60 |
| Nickel (Ni) mg/kg | 0 – 20 |
| Vanadium (V) mg/kg | <1 |
| Chlorine wt/wt% | 0.2 – 0.6% |

[1] Ash, Chlorine, Heavy Metals usually expressed on a dry weight basis.

### 2.1.4.2. Pyrolysis

The fuel feed system is an integral part of the pyrolyser design which ensures uniform input of fuel into the pyrolyser chamber whilst preventing the ingress of air. This is achieved through the compaction of the fuel feedstock to remove any intrinsic air and exclude oxygen, thereby preventing combustion of the fuel and the potential for the formation of dioxins.

There are a number of different techniques that can be used for sealing the pyrolyser inlet and preventing the ingress of air into the pyrolysis chamber. The objective is to provide a facility which has process flexibility to cope with the possibility of variable and changing nature of waste streams with little modification to process equipment (although, in this case the nature of the fuel feed is expected to be very consistent owing to its manufacture as a product to a specification). To meet this objective we must eliminate sealing equipment that requires the waste feed to be homogenous and small (in terms of particle size distribution). Therefore, rotary valves or roller sealing devices have not been selected. Other suitable techniques are as follows:

- Lock hopper system
- Continuous feed compactor

The continuous feed compactor has a large diameter live bottom hopper which prevents waste bridging and provides a continuous flow of materials to the pyrolysers. This equipment is well proven in a variety of applications and has therefore been selected as an established technique which represents BAT. The New Earth Canford R&D facility has a feed compactor unit installed to provide the negative pressure seal; this design has proven to be very effective and reliable in operation and is therefore "Available" for the Easter Langlee facility.

There are a range of techniques available which may be used for pyrolysis, although, as for the feed mechanism, the design basis is to eliminate pyrolysis techniques which require the waste feed to be homogenous and small (in terms of particle size and distribution). Therefore, ablative processes and fluidised beds were ruled out at an early stage and recognising the need to maintain high energy efficiencies rules out the technique of partial combustion pyrolysis. This leaves the following suitable techniques:

- Fixed beds relying on conduction
- Fixed beds relying on circulating heated pyrogas (which have potential heat exchanger fouling problems)
- Externally heated rotary kiln / retort
- Externally heated auger or drum

Fixed beds which operate on the conduction principle are known to be relatively slow, large and inefficient whilst those fixed beds which utilise circulating heated pyrogas are prone to fouling of heat exchangers, leading to heat transfer inefficiency and plant downtime for cleaning. An externally heated rotary kiln, of necessity, is likely to be a relatively large unit which restricts operational flexibility whereas externally heated augurs or drums, deployed as multiple units, offer simplicity, robustness, low risk of blockage and ease of sealing. Owing to its proven operational track record and simplicity of operation, the indirectly heated drum unit has been identified as BAT and selected for this process.

Pyrolysis typically occurs at temperatures in the range of 350°C and 900$^0$C and therefore requires the provision of high-grade heat. In the NEAT process, the high grade heat is provided by the exhaust gas from the gasifier syngas combustor. Hot gases at 850$^{0}$C pass over the outside of the pyrolysis drum in a counter current flow, i.e., from the discharge (gasifier) end to the inlet (feed compactor) end. This counter current flow of gas over the drum is important for the following reasons:

- The highest grade of heat (850°C) is available at the discharge end of the drum, in order to ensure complete pyrolysis
- Exhaust gases pass over the drum and transfer heat to the fuel leaving a slightly lower temperature exhaust gas (800°C) at the inlet end
- The lower temperature at the inlet end provides allows for the initial drying stage as the fuel enters the drum

The combined NEAT process system has been designed so that heat cascades through the process and is deployed against matching temperature requirements. High-grade heat is therefore not used for low-grade heat applications. For example, the hot exhaust gases from the gasifier syngas combustor are used for heating the pyrolyser and subsequently raising super heated steam for the gasification process. We therefore consider that the use of high grade heat for the pyrolysis process is justified as BAT and is thoroughly integrated with the overall combined process.

During operational pyrolysis, the fuel moves from the hopper to the compactor before being screw augured into the pyrolysis drum. The compacted fuel feed creates a permanent ‘plug-flow’ barrier to prevent air ingress into the pyrolysis chamber. Fuel feed hoppers will be kept full when the plant is operational to provide a fuel buffer of approximately 60 minutes’ operation, in order to ensure that there will always be fuel available to feed and maintain the air seal.

The drum chamber is essentially oxygen free. Oxygen level control within the drum is achieved via an initial nitrogen purge followed by a specific control philosophy and system design to eliminate air (and oxygen) ingress, especially via the feed system.

The drum chamber is maintained at a temperature of 750$^{0}$C ± 50$^{0}$C. The fuel retention time can be variable but typically the feedstock remains in the chamber for 40 minutes. The ability to vary the temperature and residence time of the fuel within the pyrolysis chamber allows the process to be tuned for various feed materials, although variability of delivered fuel is not expected owing to the tightly specified and controlled manufacturing process.

As it passes through the drum, moisture is driven off the fuel in the first portion of the chamber, following which pyrolysis takes place where thermal decomposition (“cracking”) of the fuel and its by-products produces pyrogas (consisting of methane, hydrogen, carbon monoxide and carbon dioxide). This is the principal product of the pyrolyser. The remaining residual material is in the form of solid carbon char. Very close control over the fuel processing rate, coupled with control of drum temperature via the external jacket heating system, provides very close control of the cracking process and hence the quality of the pyrogas produced. The absence of oxygen prevents combustion and therefore prevents the formation of dioxins and furans, whilst the product raw pyrogas has very low oxygen levels (typically < 0.5%).

The fuel processing temperature in the pyrolysis chamber means that gaseous contaminant compounds containing chlorine or sulphur, for example, which have a volatilisation temperature < 750$^{0}$C, exit the chamber in the gas phase with the raw pyrogas. These contaminants are then removed from the raw pyrogas by the gas clean-up train to produce purified pyrogas product.

The design, operation and control of the pyrolysis system facilitates the production of a consistent and high quality pyrogas which is suitable for clean and efficient combustion in a wide range of engines with scope for CHP operation at high overall efficiencies. The composition and properties of the syngas are shown in the end of waste application in Appendix F, along with a comparison against natural gas. The end of waste application also contains an assessment of pollution potential by evaluation of carbon intensity across the gas life cycle, expressed as kg $CO_2$ per kW electricity generated, and a WRATE (Waste and Resources Assessment Tool for the Environment) assessment comparing the environmental effects, costs and benefits of the proposed ATT process with other waste management processes. The outputs from the end of waste assessments show that the proposed ATT facility has carbon intensity of 0.34 compared with a carbon floor of 0.4., and that combustion of syngas has a lower overall environmental impact than using natural gas for power generation.

The end of waste application demonstrates that using natural gas in an internal combustion engine produces 0.48kg$CO_2$/kWh compared to 0.28kg$CO_2$/kWh for the base case syngas. Therefore the use of synthesis gas as a substitute of natural gas yields a $CO_2$ emissions reduction saving of 42%

It should be noted that the assessments contained in the end of waste application are based on a data set that is being expanded as more development work is undertaken. We are continuing our research efforts pending determination of this variation application, and pending determination of the end of waste application, by SEPA. We will provide as much further data as the research effort allows, to SEPA at the earliest possible opportunity to support this variation application. We would envisage that this might be required by SEPA under a prior operating condition on the varied PPC permit.

We would also seek to validate the anticipated pyrogas properties and emissions from the combustion of pyrogas during commissioning of the ATT installation against the PPC variation application and the end of waste application. This would demonstrate the pyrogas specification and the monitoring to be in place to ensure consistent compliance with this specification, as set out in the end of waste application, to ensure that the pyrogas continues to meet the definition of a clean marketable product. We would anticipate this being required by SEPA under an improvement condition on the varied PPC permit.

#### 2.1.4.3. Gasification

There are a large number of techniques available for gasification processes:

- Up-draft
- Down-draft
- Cross-draft
- Fluidised bed
- Circulating fluidised bed

The gasifier technology has not yet been finalised, but it is expected to be either an up –draft or down-draft type. There is a balance between the slightly improved efficiency of down-draft with the slightly improved handling of tars and oils for the up-draft type. The choice will depend on the lowest overall environmental impact for our project, taking cross media impacts into account, following our R&D trials later in 2013. Once the exact technology type has been selected, we will inform SEPA in writing, along with justification for the selection. This will be prior to commencement of operation and we would envisage this being required in response to a prior operating condition.

The char produced by the pyrolysis process consists predominantly of carbon and ash, although inert material which may be embedded in the fuel will also remain with the char. Char is driven out from the pyrolysis drum to the gasifier chamber, whilst the gas seals and process conditions are maintained.

The syngas produced from gasification passes through a cyclone to remove particulates that may contain residual catalysts for dioxin and furan generation such as copper and zinc, prior to combustion in the combustor chambers. The flue gas from the combustor is used as the means of indirectly heating the pyrolysis chambers, leading to a self sustaining process. The use of recovered energy from the gasifier syngas combustion to power the pyrolysis process replaces fossil fuels such as natural gas and prevents the need to draw heat from the CHP stage. Diesel is, however, used as the start-up fuel for the process until self-sustaining steady state operation has been established.

An inert particulate ash remains from char and tar gasification, which is collected for disposal or re-use according to technically feasible and commercially available options.

The exhaust from the combustors pass through a flue gas treatment plant consisting of dry in-stack scrubbing with sodium bicarbonate to remove acid gases, along with separately controlled dosing with powdered activated carbon (PAC) to remove VOCs and volatile metals. The particulate matter is then removed using a fabric filter prior to exhaust (ceramic material may be selected depending on temperature of the gas, to ensure material integrity and to prevent fire risk). This exhaust gas is subject to the requirements of Chapter IV and Annex VI of the IED.

The gasifier has key design and safety features:

- Minimum exhaust temperature is set at 900$^0$C on the basis that the char contains < 1% halogenated organics
- Temperature measurement at the outlet of the combustor, to ensure compliance with IED Chapter IV temperature requirements
- Computational fluid dynamic (CFD) modelling and design calculations confirm a minimum 2 seconds' residence time for the combustor exhaust gas in accordance with IED Chapter IV, Article 50(2)
- Airflow to the gasification system is continuously monitored by thermal dispersion mass flow meters for accurate control
- Pressure is continuously monitored in the gasification chamber and the exhaust ducts

#### 2.1.4.4. Residue

The purpose of the gasification of pyrolysis residue is to maximise the energy recovery. The final residue, the ash from gasification, is therefore minimised as far as possible. Ash from the gasification of char and oils will be collected, handled in an enclosed and controlled manner to prevent fugitive emissions to air and spillage to ground. The final residue, the ash from char and oil gasification, will comply with either 5% LOI or 3% TOC, depending on the analysis methodology selected. The aim is to sell the ash residue for reuse, subject to the market being available and economically viable.

The fly ash from the gasifier that is collected in the fabric (or ceramic) filters will be disposed of at a suitably permitted facility.

### 2.1.4.5. Pyrogas Quench and Purification System

The raw pyrogas product from the pyrolysis process contains contaminants such as particulate, tars and waxes and acid gases which must be removed via pyrogas purification and conditioning to achieve the required product specification. The gas needs the following processes to be applied before it is ready for use in a combustion device:

- Particulate removal
- Oil and tar removal
- Acid gas removal

#### 2.1.4.5.1. Particulate Removal

There are a number of options for particulate removal, some of which are described below along with the BAT decision for particulate removal from the pyrogas.

In some cases, high temperature particulate removal is required prior to removal of the oils and tars, which can only be achieved at small scale through the use of ceramic candle filters. Reverse jet cleaning using compressed pyrogas is essential, owing to the risk of fire arising from ignition of combustibles if compressed air were used.

Alternatively, electrostatic precipitators can be used efficiently to remove aerosols and is an established and effective technology. However, it is expensive at small scale and there is a significant operational risk owing to the combination of combustible gases with high voltages, leading to the potential for explosion.

Other conventional techniques, such as wet scrubbing to remove the particulates, would also remove oils, tars and acid gases, and may offer well established and reliable means of gas clean up. However, scrubbing generates a problematic waste water effluent which may be hazardous and is difficult and expensive to treat. Alternatively, oil scrubbing techniques may be used to remove oils and tars above the water dew point, in order to generate purer liquors and eliminate the waste water treatment issue.

In this instance, filtration at high temperature via ceramic candle filters followed by an aqueous quench scrubbing tower to both cool the gas and provide further filtration is selected as BAT. Particulates from the ceramic filter will then be fed back to the gasifier, with the syngas combusted to generate the heat required for the pyrolysis process.

#### 2.1.4.5.2. Cooling and Acid Gas Removal

To purify the pyrogas for an internal combustion appliance, one of the primary requirements is to cool the pyrogas; otherwise the higher temperature gas will significantly impair the efficiency of the gas turbine or gas engine. Cooling the pyrogas in the quench will condense the oils, tars and water vapour which are inherently present in the pyrogas and not removed in the ceramic filter.

From the ceramic filter, the pyrogas passes through an aqueous quench scrubbing tower in order to rapidly reduce the temperature to condense out the tars and oils and prevent de novo dioxin formation. This quench is dosed with sodium hydroxide and sodium hypochlorite, to remove acid gases such as HCl, HF and $H_2S$. This is considered to represent BAT for cooling and acid gas removal from the pyrogas, whilst at the same time being sufficiently rapid to prevent de novo dioxin reformation. The pyrogas exiting the scrubber is now a product pyrogas, purified and suitable for use in the power generation facility. The gas from each identical NEAT line is fed to a gas buffer store for homogenisation prior to routing to each of the four power generation facilities.

The product pyrogas after purification is no longer a waste, as demonstrated by the end of waste application attached as Appendix F. The monitoring required throughout the ATT process, from receipt of pre-treated waste to delivery of purified product pyrogas to the gas buffer store, to demonstrate that the product pyrogas retains this specification, is described in section 2.10 below.

The output from the quench is split. The maximum amount of quench possible is routed to the gasifier to ensure maximum energy recovery and minimisation of effluent that has to be removed from site. This is expected to be approximately 1,520 tonnes. This leaves approximately 2,800 tonnes per annum for disposal.

### 2.1.4.6. BAT Assessment for Heat and Power Generation

There are a number of options for power generation in conjunction with the NEAT process. The benefits and drawbacks of the main potential techniques are discussed below, along with the main BAT arguments and the BAT conclusion for the Easter Langlee ATT facility.

#### 2.1.4.6.1. Steam Cycles

Large scale coal fired power stations achieve typical overall thermal efficiencies of around 35% in power generation mode. EfW facilities tend to operate at much smaller scales than power stations (10MW steam turbines rather than > 600MW steam turbines) and lower steam conditions (400$^0$C and 40 bar g, rather than >550$^0$C and >150 bar g) owing to the acid gases in the exhaust and the requirement to avoid high temperature acid gas corrosion of the super heater tubes. Typical overall EfW efficiencies of < 20% in power generation mode are therefore more usual.

There are other external combustion techniques based on the steam cycle known as the Stirling Cycle and the Organic Rankine Cycle (ORC).

The Organic Rankine Cycle uses the same thermodynamic cycle as the Rankine Cycle but uses oil rather than water as the working fluid. Oil has a higher molecular weight than water but offers a lower operating temperature. The cycle therefore has a higher efficiency than a steam cycle when recovering low grade heat at around 200$^0$C - 300$^0$C. However, since high grade heat is available from an energy from waste process, with steam temperatures of 400$^0$C available, the ORC proves to be less efficient and more expensive than the conventional steam cycle for applications above about 3 $MWt_h$.

The Stirling Cycle also has potential applications in relation to waste treatment processes where energy recovery is a component. The Stirling Cycle efficiency claimed for this type of application is typically around 35% with a head temperature of > 600$^0$C. However, care needs to be taken in ascertaining the working temperature of the hot heat exchanger since the efficiency of this machine is highly dependent upon this working temperature. This device, although an external combustion engine, is also sensitive to fouling, corrosion and damage to the high temperature heat exchanger. We are not aware of any Stirling Cycle engines currently operating on waste derived pyrogas in excess of 5 $MWt_h$ that are proven as commercially available.

Steam cycle techniques are unlikely to offer sufficient flexibility of operation to deliver adequate efficiencies in conjunction with the NEAT process and are therefore unlikely to represent BAT.

###### 2.1.4.6.2. Gas Engines

Gas engines are available in two types: spark ignition and compression ignition.

Most modern applications for power generation from landfill gas / biogas / pyrogas deploy spark ignition engines which have been specifically adapted for combusting this particular fuel. Many manufacturers have found that engine combustion chamber design affects combustion efficiency and exhaust emission levels and have developed a range of combustion chamber configurations for specific applications, thereby providing inherent control of exhaust emissions and energy efficiency.

Over recent years, the water sector, in particular, has extended its utilisation of spark ignition engines in biogas combustion scenarios, achieving high efficiency values in CHP mode. Electrical efficiencies and heat recovery efficiencies of around 40% are not unusual and overall CHP efficiencies of 80% or more (at full load) are becoming more common. Comparison to other available options shows that spark ignition engine CHP units are often the most efficient option whilst offering considerable flexibility of operation in multi-engine, multi-size configurations.

The second type of gas engine, compression ignition, is very similar to a spark ignition engine but often operates with a low volume (~ 5%) fuel oil pilot to achieve stable ignition, owing to the lower calorific value of the biogas or pyrogas. Many older installations in the water sector utilise compression ignition engines for CHP operations, but they have a lower heat recovery potential and higher capital cost than spark ignition units, and, overall, are not as effective in this type of deployment.

###### 2.1.4.6.3. Gas Turbines

Waste to energy solutions using gas turbines are still at the developmental stage and there are very few full scale facilities in operation. Theoretically, if a gas turbine is used with an effective recuperator, the overall efficiency would be broadly in line with that of a gas engine. However, attention must be given to the low calorific value of the pyrogas and the associated compressor losses required to achieve sufficient gas compression for effective turbine operation. Typically, a gas turbine will produce an electrical efficiency of approximately 23% at 75% load, whereas a typical spark ignition engine will produce almost 40%.

In general, gas turbine efficiency decreases as the load decreases; therefore, a gas turbine is unlikely to offer sufficient flexibility of operation whilst delivering peak efficiencies in conjunction with the NEAT process. Gas turbines are therefore unlikely to be BAT for this scenario.

### 2.1.4.6.4. BAT for Energy Generation

The above assessment demonstrates that the most appropriate technique for power and energy generation from the pyrogas product resulting from the NEAT process is spark ignition engines, because they offer the flexibility of operation in multi-engine configuration to operate with high CHP efficiencies in conjunction with the NEAT process. This is the chosen basis of the ATT facility at Easter Langlee.

The next stage of BAT assessment for power generation is to consider the engine sizing and specifications, and how they are used to generate the required heat and power demand, to ensure that they represent BAT as installed. The type and amount of onsite heat recovery is also important to enable a BAT demonstration of the overall energy efficiency of the facility to be made.

It should be noted that engine equipment suppliers have not yet been procured, and therefore this information is indicative of the specifications likely to be obtained. We would envisage providing full details of the engine technology once it has been procured, and would anticipate this being covered by a prior operating condition.

### 2.1.4.6.5. Heat Recovery

The primary purpose of the CHP engines is to deliver operationally flexible and energy efficient combustion of the product pyrogas fuel supply provided by the NEAT process. To this end, the facility has been designed from the outset as a true combined heat and power plant for optimum energy recovery. Selection of a reciprocating spark ignition combustion unit as BAT for this application took into account the nature of the available fuel and the likely characteristics of the primary customer heat demands. The key design parameters for the CHP plant were therefore:

- The capacity to utilise the volume and composition of the pyrogas generated by the NEAT process, with continuous operation of engines at maximum efficiency, typically achieved at > 80% nominal maximum continuous rating (MCR) thermal input
- The capability to deliver true CHP operation whilst delivering the primary customer heat demands with appropriate heat transfer characteristics

In practice, the balance dictated by these parameters (utilising the full volume of pyrogas available and delivering the primary heat demand) is necessarily determined by demand. This is discussed in section 2.7 below and the heat and power plan in Appendix E. It is usually not possible to select engine sizes which precisely match the pyrogas availability. The balance between pyrogas supply and utilisation is typically achieved by slightly under-sizing the engine and flaring the surplus pyrogas (or utilising it on standby boilers which provide supplementary heat during periods of peak demand, if such equipment exists). This approach is typically considered to be BAT at, for example, wastewater treatment works where engines are fuelled by digester biogas, provided that flaring occurs for less than 10% of the time. Under these circumstances, experience tells us that operation of the flare may then be ignored for the purposes of assessing impact.

Secondly, it is generally not possible to select an engine which precisely matches the primary heat demand, especially if this leads to the installation of an engine which is over-sized in relation to the pyrogas supply, resulting in intermittent operation as a result of pyrogas supply exhaustion. Such an operational mode is not only inefficient in energy recovery terms; it also leads to increased emissions to air owing to frequent engine shutdowns and start-ups (which are the periods of peak emissions). Discontinuous operation is therefore not considered to represent BAT, and we have tried to prevent this through the process design.

There will also be a seasonal variation in the primary heat demand offered by the proposed heat customers, in particular the planned district heating system. In winter, when ambient temperatures are lower, the demand from the district heating system will typically constitute the maximum heat load. The key design parameter for the delivery of the primary heat demand suggests that engines should be sized on the basis of the winter heat demand, subject to the availability of sufficient pyrogas for efficient operation. Such an approach maximises the overall contribution of the CHP plant to the energy efficiency of the installation and is likely to comprise BAT in terms of overall energy efficiency.

However, whilst this approach constitutes BAT for energy efficiency in winter, it leads to a situation in summer where there may be surplus heat available from the CHP because the primary heat demand is lower than the design heat supply capability of the engines. This is due to reduced district heating load when ambient temperatures are higher. This seasonal heat load variation presents one of the main challenges to the delivery of consistent energy efficiency BAT. It requires the consideration of alternative (summer) heat loads in order to assess whether winter energy efficiency levels may be maintained in summer by directing surplus heat to alternative loads. The alternative is to accept a seasonal variation in energy efficiency as BAT because the alternative heat demands either may not be met or simply do not exist, due to the seasonality of demand.

The measures to be taken to ensure that the waste of heat is minimised, through buffering at the proposed energy centre and matching demand and supply, is discussed in detail in section 2.7 below and the appended heat and power plan.

#### 2.1.4.7. CHP Engines

The pyrogas passes into a buffer store, where gas from each unit is blended to ensure homogeneity of the gas feed to the engines. From here it is fed into one of four CHP engines (one per line), for the generation of electricity and heat. The engines will be small scale and modular, so that the amount of heat generated can be adjusted, meaning that the available power or heat export may be maximised. Diesel will be used for start-up of the engines.

The CHP engine supplier has not yet been selected. However, the comparator specification used for this variation application is the Caterpillar G3516LE, which is the engine being used at Canford.  This engine specification has been developed having regard to the combustion of landfill gas (60% methane), which is the closest gas specification to the product pyrogas generated at Easter Langlee. They are lean burn engines with thermal input 3,154kW$_{th}$, recovered heat rating of 1,279kW$_{th}$ and electrical output rating of 1,195kW$_{e}$.

Three will be in operation at any one time, as they are most efficient when operating at > 80% MCR thermal input. $NO_x$ control and prevention will be delivered by primary engine controls. Manual and automatic tuning provide the means for maintaining peak engine performance to control exhaust emissions at the required levels, whilst also providing good combustion and energy efficiency. To control combustion conditions within the engines an electronic engine management system (or engine control unit, ECU) is used. The key parameters recorded by the ECU that are used to manage the operation of the CHP (and hence may be considered to be surrogate environmental monitors) are summarised below:

- Pyrogas flow
- Methane content of pyrogas
- Oxygen content of pyrogas
- Pyrogas pressures
- Cylinder temperatures and pressures
- Oil temperature and pressures

These measurements are used by the ECU to adjust the engine ignition timing, air flow from the turbocharger and temperatures in the system. The engine is designed to operate in lean burn mode, thereby reducing emissions of $NO_x$ further. If any of the measured process parameters exceeds levels specified in the process control manuals, an alarm is raised and the operators informed. In a serious fault condition (low pyrogas pressure, electrical distribution failure), the plant would shut down to prevent uncontrolled emissions and the pyrogas would automatically divert to the flare. For less serious fault conditions, once the fault is cleared, the engine would automatically restart.

If the pyrogas flow is sufficient, the plant will operate normally. If there are problems with fuel supply or maintenance of the engine, the flare would be used. If there is an excess of pyrogas, this will be flared to control supply system pressure within safe operating limits until there is sufficient pyrogas to start a further engine.

During start up and shut down, engine emissions may change, but the time taken for the plant condition to stabilise is relatively short, and any peak emissions would therefore also be short term. Typically an engine takes 15 minutes to reach stable operating conditions from a cold start. Start-ups will be relatively infrequent events owing to continuous running under normal circumstances.

Preventative maintenance will be a key component of operational control and BAT at the facility for ensuring that air emissions and energy efficiency are maintained at the required levels. Chemical analysis of the engine oil will be carried out on a regular basis and will form part of the preventative maintenance regime. This indicates when oils need changing and can show possible wear or defects to engine components. All regular maintenance will be completed on the time scale specified by the equipment manufacturer, with an oil change and service every 1,000 hours. A high level of preventative maintenance is designed to avoid unscheduled down time, maximising engine availability and the ability to control emissions and maintain an efficient level of operation between overhauls.

The record sheets completed would highlight any issues that may require operator intervention outside the routine maintenance programme. Minor services will last approximately half a day. Major services can last a number of days but a service schedule will be developed by the engine manufacturer to minimise the impacts of these periods. The manufacturer or his agent will carry out all maintenance on the engine and generator. As part of this contract the maintenance contractor will remove any waste generated by the maintenance activity for appropriately licensed recycling and/or disposal. Unplanned maintenance will generally cover breakdown and other emergency situations and will be initiated by a divergence from normal operating parameters, as specified by the manufacturers.

The process has been designed with in-built redundancy of one engine, so that planned maintenance on any one engine will not impede normal operation of the ATT facility.

The CHP exhaust gas then passes into the multi-flue main stack. The stack is 23m in height with an internal diameter of 0.3m. These are emission points A2-A5, one for each engine, shown on the revised installation plan in Appendix A. Note that all four gasifier exhausts are combined and exhausted through emission point A6. Emission point A7 is the emergency flare. Emission point A1 is the currently permitted biofilter stack.

The engine performance is discussed in detail in section 2.7 below. The proposed emissions from the engines are discussed in section 3 below. They will comply with SEPA guidance on landfill gas combustion, and performance guarantees to secure this compliance will be sought from the equipment provider, once selected. These will be provided to SEPA upon request. On landfill gas, Caterpillar and other engine suppliers will guarantee $NO_x$ emissions of 500mg/Nm$^3$. Guarantees for lower emissions than this when firing on synthesis gases produced from waste gasification or pyrolysis are not available on the market at the time of writing this application. This specification of performance and emissions is contended to represent BAT for the installation.

#### 2.1.4.8. Flare

An emergency flare is also provided as emission point A7, to allow for safe flaring when pyrogas is out of specification or in the event of emergency shutdown. Flaring is also possible in order to maintain the pyrogas delivery system within safe operating pressures.

#### 2.1.4.9. Instrumentation and Control

The plant will be operated from the control room which will overlook the pyrolyser/gasifier units. A CCTV system will allow operators to view other areas of the plant, such as the waste reception and storage areas, driers and the ash storage areas. A continuous emission monitoring system (CEMS) will be installed which will take continuous samples from the stack and analyse them for the priority determinands to be covered by the PPC permit. The monitoring and operational control of the gasifier combustion exhaust for pyrolyser heat supply will be subject to IED Annex VI.

#### 2.1.4.10. Fire fighting and Firewater Retention

The replacement of the biostabilisation process with the ATT process does not require amendment of the fire fighting regime in place at the installation. The process building is constructed with kerb up stands with sufficient capacity to retain contaminated firewater within the building.

#### 2.1.4.11. Other Utilities

Mains water and harvested rainwater will generally be used for amenities, cleaning and for fire fighting. Rainwater run-off from the roofs will drain into a clean water storage tank with an approximate capacity of 400m$^3$. Dirty water includes wash down water from the floors (though this is likely to be minimal), a proportion of the quench effluent and drier condensate. This will be stored in two 400m$^3$ capacity dirty water tanks prior to removal by tanker to an appropriate treatment facility elsewhere. Surface water run-off from the site roads will be discharged to the existing surface water system via hydrocarbon interceptors. Surplus rainwater run-off from the buildings will also be discharged to the surface water system. There is no change to the drainage system as a result of this variation.

### 2.1.5. Summary of Gasifier Exhaust IED Compliance

The application for end of waste for the beneficial use of pyrogas in the CHP engines, generated by Sol Environment, is attached as Appendix F. This demonstrates that the synthesis gas produced by the pyrolysis plant meets the published definition of ‘end of waste’. This application is currently pending separate determination by SEPA. Therefore, pending this determination, and according to IED Article 42, the requirements of Chapter IV and Annex VI of the IED only apply to the exhaust gas from the combustion of syngas generated by the gasification of the char produced during pyrolysis, and not to the emissions from the CHP engines. A summary of how this exhaust complies with Chapter VI is shown below.

**Table 5. Combustor Exhaust IED Compliance**

| IED Chapter IV Requirement | Justification |
|---|---|
| Article 46 (1)<br>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. | Waste gases from each combustor are combined and exhausted through emission point A6. |
| Article 46 (2)<br>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.<br>If in a waste co-incineration plant more than 40 % of the resulting heat release comes from hazardous waste, or the plant co-incinerates untreated mixed municipal waste, the emission limit values set out in Part 3 of Annex VI shall apply. | Emissions to air from the gasifier combustors will comply with the limits set out in Annex VI though automated combustion control combined with flue gas treatment comprising dry in-stack scrubbing with sodium bicarbonate, separate PAC dosing and bag filtration.<br>Hazardous waste is not accepted at the ATT facility. |
| Article 46 (3)<br>Discharges to the aquatic environment of waste water resulting from the cleaning of waste gases shall be limited as far as practicable and the concentrations of polluting substances shall not exceed the emission limit values set out in Part 5 of Annex VI.<br>Article 46(4)<br>The emission limit values shall apply at the point where waste waters from the cleaning of waste gases are discharged from the waste incineration plant or waste co-incineration plant.<br>When waste waters from the cleaning of waste gases are treated outside the waste incineration plant or waste co-incineration plant at a treatment plant intended only for the treatment of this sort of waste water, the emission limit values set out in Part 5 of Annex VI shall be applied at the point where the waste waters leave the treatment plant. Where the waste water from the cleaning of waste gases is treated collectively with other sources of waste water, either on site or off site, the operator shall make the appropriate mass balance calculations, using the results of the measurements set out in point 2 of Part 6 of Annex VI in order to determine the emission levels in the final waste water discharge that can be | There is no discharge to the aquatic environment from the cleaning of waste gases at the ATT facility. Pyrogas is a product gas, not a waste gas, and is subject to an end of waste application submitted concurrently with this variation application. A proportion of the quench effluent is routed back to the gasifiers.<br>The effluent from the product pyrogas purification process will be tankered off site to a suitably permitted treatment facility. As described in Article 46(4), even if this was classified as wastewater from the cleaning of waste gas, the emission limit values would in any case apply at the point where the final wastewater discharge leaves the offsite wastewater treatment plant. |

| IED Chapter IV Requirement | Justification |
|---|---|
| attributed to the waste water arising from the cleaning of waste gases.<br><br>Under no circumstances shall dilution of waste water take place for the purpose of complying with the emission limit values set out in Part 5 of Annex VI. | |
| Article 46(5)<br><br>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.<br><br>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. | This variation application does not amend the storage and handling of waste activities already covered by the extant permit. Waste handling and storage associated with the ATT facility will be within the process building, as described above. This will prevent accidental release to soil, surface water and groundwater.<br><br>There is sufficient capacity in the process building to contain firewater and allow for capture and treatment off site as required. This is unchanged from the extant permitted arrangements. |
| Article 46(6)<br><br>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 period of more than 4 hours uninterrupted where emission limit values are exceeded.<br><br>The cumulative duration of operation in such conditions over 1 year shall not exceed 60 hours.<br><br>The time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device. | There will be a single gas cleaning system for the combined combustor exhausts, and a dedicated CEMS for the combustor emissions from A6. Char and tar/oils will cease to be fed to the gasifier in the event that emissions are in breach of the limits proposed in section 3 below and in Annex VI of the IED. |
| Article 47<br><br>In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored. | There will be a plant maintenance regime linked to a store of spares and consumables and contracts in place with equipment suppliers and other engineers as required to ensure speedy fault rectification and return to full functionality. The EMS is described in section 2.3 below. |
| Article 48(1)<br><br>Member States shall ensure that the monitoring of emissions is carried out in accordance with | |

| IED Chapter IV Requirement | Justification |
|---|---|
| Parts 6 and 7 of Annex VI. | Advisory. Monitoring arrangements are described in section 2.10 below. |
| Article 48(2)<br>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. | Monitoring arrangements are described in section 2.10 below. These include continuous monitoring on emission point A6 and non-continuous monitoring on emission points A2-A5. |
| Article 48(3)<br>The competent authority shall determine the location of the sampling or measurement points to be used for monitoring of emissions. | Advisory. Monitoring points will meet SEPA's requirements as set out in relevant technical guidance. |
| Article 48(4)<br>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. | Results of monitoring will have regard to IED Annex VI Part 6 and will be presented to enable direct comparison to be made. |
| Article 48(5)<br>As soon as appropriate measurement techniques are available within the Union, the Commission shall, by means of delegated acts in accordance with Article 76 and subject to the conditions laid down in Articles 77 and 78, set the date from which continuous measurements of emissions into the air of heavy metals and dioxins and furans are to be carried out. | Advisory. In the meantime, periodic monitoring is proposed in section 2.10 below. |
| Article 49<br>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. | Advisory. Monitoring summary reports and data validity assessments will have regard to Part 8 of Annex VI. |
| Article 50(1)<br>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. | The final residue, the ash from char and oil gasification, will comply with either 5% LOI or 3% TOC, depending on the analysis methodology selected. |
| Article 50(2) | |

| IED Chapter IV Requirement | Justification |
| --- | --- |
| 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. | The gasifiers are co-incinerator plant as they are for the purpose of energy generation. |
| Waste co-incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the co-incineration of waste is raised 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. | The combustion of syngas from char gasification is co-incineration, as the main purpose is to raise energy for the pyrolysis process. CFD modelling for the combustor chambers for the syngas generated from char and oil gasification demonstrates that the exhaust gases are held above 850$^0$C for more than 2 seconds. |
| If hazardous waste with a content of more than 1 % of halogenated organic substances, expressed as chlorine, is incinerated or co-incinerated, the temperature required to comply with the first and second subparagraphs shall be at least 1 100 °C. | Hazardous waste is not accepted at the ATT facility. |
| In waste incineration plants, the temperatures set out in the first and third subparagraphs shall be measured near the inner wall of the combustion chamber. The competent authority may authorise the measurements at another representative point of the combustion chamber. | Temperature measurement in the combustor will be at the outlet, ahead of the regenerator. |
| Article 50(3)<br>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 tonsure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber.<br>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. | Each combustor will be fitted with an auxiliary burner using diesel as a fuel. This will operate automatically to ensure that combustion gases are kept over 850$^0$C. |
| Article 50(4)<br>Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations:<br>(a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature | Feed of char and oils to the gasifiers will be prevented in the event that emissions exceed the limits set out in IED Annex VI. |

| IED Chapter IV Requirement | Justification |
|---|---|
| specified in accordance with Article 51(1) has been reached;<br>(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;<br>(c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices. | |
| Article 50(5)<br>Any heat generated by waste incineration plants or waste co-incineration plants shall be recovered as far as practicable. | This is discussed in detail in section 2.7 below and the heat and power plan in Appendix E. Overall energy recovery from the char and oil gasification is estimated at 62.2%. Every effort has been made to re-use heat as far as possible at the installation and in external supply, with maximum flexibility built in. The selection of CHP engines allows for this flexibility to maximise renewable heat generation which, when combined with a buffer heat store, maximises heat recovery by matching demand to duty as far as practicable. |
| Article 50(6)<br>Infectious clinical waste shall be placed straight in the furnace, without first being mixed with other categories of waste and without direct handling. | Infectious clinical waste is not accepted at the ATT facility. |
| Article 50(7)<br>Member States shall ensure that the waste incineration plant or waste co-incineration plant is operated and controlled by a natural person who is competent to manage the plant. | Suitably qualified and technically competent management will be in place as described in the previous permit application for the MBT facility. They will also be suitably qualified and experienced to operate the ATT facility. |
| Article 51<br>Authorisation to change operating conditions | We do not request changes to operating conditions for the combustors. |
| Article 52(1)<br>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. | The waste handling and storage arrangements for wastes coming into the installation have already been assessed as BAT through the issue of the extant permit. This variation application does not amend the waste storage and handling arrangements covered by the extant permit. All storage and handling of waste associated with the ATT facility will be within the process building, as described above. This will prevent accidental release to soil, surface |

| IED Chapter IV Requirement | Justification |
|---|---|
| | water and groundwater. |
| Article 52(2)<br>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. | The waste feed to the plant subject to IED Chapter IV is the char and oils from the pyrolysis process. The properties of this are well known, as they arise from the pyrolysis of waste that has been pre-treated at the same installation by the same operator, and is subject to stringent specification and control. The list of incoming wastes to the installation, as set out in the extant permit, is not affected by this variation application. |
| Article 52(3)<br>Prior to accepting hazardous waste at the waste incineration plant or waste co-incineration plant, the operator shall collect available information about the waste for the purpose of verifying compliance with the permit requirements specified in Article 45(2).<br>That information shall cover the following:<br>(a) all the administrative information on the generating process contained in the documents mentioned in paragraph 4(a);<br>(b) the physical, and as far as practicable, chemical composition of the waste and all other information necessary to evaluate its suitability for the intended incineration process;<br>(c) the hazardous characteristics of the waste, the substances with which it cannot be mixed, and the precautions to be taken in handling the waste. | The waste feed to the plant subject to IED Chapter IV is the char and oils form the pyrolysis process. The properties of this are well known, as they arise from the pyrolysis of waste that has been pre-treated at the same installation by the same operator, and is subject to stringent specification and control. The list of incoming wastes to the installation, as set out in the extant permit, is not affected by this variation application. |
| Article 52(4)<br>Prior to accepting hazardous waste at the waste incineration plant or waste co-incineration plant, at least the following procedures shall be carried out by the operator:<br>(a) the checking of the documents required by Directive2008/98/EC and, where applicable, those required by Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste and by legislation on transport of dangerous goods;<br>(b) the taking of representative samples, unless inappropriate afar as possible before unloading, to verify conformity with the information provided for in paragraph 3 by carrying out | Hazardous waste is not accepted at the ATT facility. |

| IED Chapter IV Requirement | Justification |
|---|---|
| controls and to enable the competent authorities to identify the nature of the wastes treated.<br><br>The samples referred to in point (b) shall be kept for at least 1month after the incineration or co-incineration of the waste concerned. | |
| Article 52(5)<br><br>The competent authority may grant exemptions from paragraphs 2, 3 and 4 to waste incineration plants or waste co-incineration plants which are a part of an installation covered by Chapter II and only incinerate or co-incinerate waste generated within that installation. | The waste co-incineration requirements of IED only apply to wastes generated in the pyrolysis activities that are covered by Chapter IV of the Directive. CHP engines are covered by Chapter II but not Chapter IV by virtue of the end of waste application for the product pyrogas. Therefore, additional information on the char and oils as set out in Article 52(2), (3) and (4) is not required. |
| Article 53(1)<br><br>Residues shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside. | The purpose of the gasification of pyrolysis residue is to maximise the energy recovery and minimise fossil fuel use. The final residue, the ash from gasification, is therefore minimised as far as possible. The aim is to sell the ash residue for reuse, subject to the market being available and economically viable. |
| Article 53(2)<br><br>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. | Ash will be handled and stored on site in enclosed vessels or containers, and transported off site in covered or enclosed vehicles to prevent fugitive emissions to air and spillage to the ground. |
| Article 53(3)<br><br>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. | These tests will be undertaken in the process of sourcing the potential market for the material. |

**Table 6. BAT Justification for In-process Controls**

| Indicative requirement | BAT justification |
|---|---|
| **Environmental management system** | |
| EMS | New Earth Group is currently certified to ISO14001 (as well as ISO 9001 and OHSAS 18001) as part of its integrated management system (IMS), at all IVC and MBT sites and head office. It is the intention to achieve certification at the Easter Langlee facility as soon as possible, including the ATT facility. The site will be managed by a dedicated on-site team. They will have the required skills and experience to operate the facility in an efficient and proper manner. They will ensure compliance with the conditions of the permit and that effective operational and preventative maintenance procedures are in place to prevent impact on the environment. There will be a facility manager who will have overall responsibility for compliance with the permit.<br>The EMS will include relevant procedures for all site operations which have the potential for impact on the environment, including:<br>• Waste reception and storage<br>• Waste treatment and processing<br>• General housekeeping and site cleanliness<br>• Preventative inspection and maintenance<br>• Staff training and competence, including CoTC where appropriate<br>• An accident management plan which identifies the likelihood and consequence of accidents, with actions to prevent and mitigate any consequences (see section 2.8 below)<br>• Procedures for the investigation and communication / reporting of accidents, incidents and other non-conformances<br>• Management of process and engineering change, including design and construction of new facilities<br>• Incorporation of environmental considerations into procurement systems<br>An environmental policy and programme will be implemented which will include provision for regular audits against defined objectives and KPIs and annual reporting of performance.<br>Further detail will be confirmed prior to commencement of operation under a proposed prior operating condition. |
| **Incoming waste and raw materials management** | |
| European Waste Catalogue (EWC) waste codes | The EWC waste codes for wastes which may be received into the installation are not amended by this variation. |
| Pre-treatment and pre-acceptance | The already permitted waste treatment facility accepts and pre-treats contract and similar wastes, removing recyclates as per the contract specification and routing only the residual waste to the ATT facility, after drying. This variation removes the biological process from the currently permitted facility. It also adds an ATT facility. |

| Indicative requirement | BAT justification |
|---|---|
| | The mechanical pre-treatment processes remain unaffected.<br><br>The ATT activity and associated waste transfer will be within the enclosed process building, under negative pressure. The biofilter will remain in place to treat the exhausted air to prevent fugitive odour emissions. The site preventative maintenance programme will include all waste handling equipment and ventilation systems. This will be incorporated into the site IMS.<br><br>The waste pre-treatment output specification will determine the gross waste characteristics, and the ATT input specification, following drying and shredding, will be adhered to ensure consistent feed to the pyrolysis process. This will include:<br><br>• Biomass percentage by CV<br>• Moisture percent by weight<br>• Calorific value<br><br>The nature of the feedstock is therefore well understood and materials which might compromise the operation of the NEAT process, such as chlorinated plastics, will be removed. All feedstock will pass through a drier to ensure that they are suitable for feed to the NEAT process. This also allows for maximisation of the thermal efficiency of the process, and allows for reuse of waste heat in the pre-drying of waste or drier air.<br><br>These techniques represent BAT for waste types, and securing homogeneity of waste feed to the pyrolysis process. |
| Waste acceptance, reception and storage | The waste acceptance, reception and storage arrangements covered by the extant permit are not affected by this variation application. All additional waste handling and storage will be within the process building.<br><br>In the event that third party waste is accepted from other New Earth Group or local facilities, each shipment of waste will be accompanied by a waste transfer note (WTN), providing a detailed description / analysis of the waste feedstock and reporting the 6 digit EWC Code. This will be under contract and subject to the same specification requirements as the waste from the already consented Easter Langlee facility.<br><br>These measures represent BAT for waste acceptance, reception and storage. |
| Odour management | The odour prevention arrangements, biofilter and scrubber provision for the treatment of potentially odorous ventilation air and the negative pressure of the process buildings are covered by the extant permit and are not affected by this variation application. All additional waste handling and storage will be within the process building.<br><br>These measures represent BAT for the control of fugitive odours. |
| Raw materials reception, storage and handling | The raw material acceptance, reception and storage arrangements covered by the extant permit are not affected by this variation application. All additional raw materials required for the ATT facility are described in section 2.4 below. Storage of liquids and drums will be within the process building, apart from the dirty water tanks, and will be provided with appropriate containment measures, including hardstanding and secondary containment (bunding) designed to contain 110% of the largest container or 25% of the total storage capacity, whichever is the greater. |

| Indicative requirement | BAT justification |
|---|---|
| | These measures represent BAT for raw material acceptance, reception and storage. |
| **Waste charging to pyrolysers** | |
| Pyrolyser charging | The fuel feed system will be an integral part of the pyrolyser design, which ensures uniform input of fuel into the pyrolyser chamber whilst preventing the ingress of air. This is achieved through the compaction of the fuel feedstock to remove any intrinsic air and exclude oxygen, thereby preventing combustion of the fuel and the potential for the formation of dioxins. The continuous feed compactor has a large diameter live bottom hopper which prevents waste bridging and provides a continuous flow of materials to the pyrolysers.<br>During operational pyrolysis, the fuel moves from the compactor into the feed hopper before being fed into the drum pyrolysis chamber. The compacted fuel feed creates a permanent 'plug-flow' barrier to prevent air ingress into the pyrolysis chamber. Fuel feed hoppers will be kept full when the plant is operational to provide a fuel buffer of approximately 60 minutes, in order to ensure that there will always be fuel available to feed and maintain the air seal.<br>This equipment is well proven in a variety of applications, including our test facility at Canford, and has therefore been selected as an established technique which represents BAT. |
| **NEAT operation (pyrolysis and gasification)** | |
| Pyrogas production via pyrolysis | Owing to its proven operational track record and simplicity of operation, the indirectly heated drum pyrolysis chamber has been identified as BAT and selected for this process.<br>In the NEAT process, the high grade heat is provided by the exhaust gas from the gasifier syngas combustor. Hot gases at 850$^0$C pass over the outside of the pyrolysis chambers in a counter current flow, i.e., from the discharge (gasifier) end to the inlet (feed compactor) end. This counter current flow of gas over the tubes is important for the following reasons:<br>• The highest grade of heat (850°C) is available at the discharge end of the drum, in order to ensure complete pyrolysis<br>• Exhaust gases pass over the drum and transfer heat to the fuel leaving a slightly lower temperature exhaust gas (800°C) at the inlet end<br>• The lower temperature at the inlet end provides allows for the initial drying stage as the fuel enters the chamber<br>The combined NEAT process system has been designed so that heat cascades through the process and is deployed against matching temperature requirements. High-grade heat is therefore not used for low-grade heat applications. This technique represents BAT.<br>The chamber is essentially oxygen free. The absence of oxygen prevents combustion and therefore prevents the formation of dioxins and furans. Very close control over the fuel processing rate coupled with control of drum temperature via the external jacket heating system, provides very close control of the cracking process and hence the quality of the pyrogas produced.<br>The fuel processing temperature in the pyrolysis chamber means that gaseous contaminant compounds containing chlorine or sulphur, for example, which have a volatilisation temperature < 750$^0$C exit the pyrolyser in the gas phase with the raw pyrogas. These contaminants are then removed from the raw pyrogas by the gas |

| Indicative requirement | BAT justification |
|---|---|
| | purification train to produce refined pyrogas product.<br>The design, operation and control of the pyrolysis system facilitates the production of a consistent and high quality pyrogas which is suitable for clean and efficient combustion on a wide range of engines with scope for CHP operation at high overall efficiencies. The technology therefore represents BAT for product pyrogas generation. |
| Gasification of char and oils and syngas combustion | The gasifier selection will be confirmed prior to operation and will represent BAT taking cross-media impacts into account.<br>The char produced by the pyrolysis process consists predominantly of carbon and ash, although inert material which may be embedded in the fuel will also remain with the char. The char is driven out of the pyrolysis chamber and transferred to the separate gasification chamber whilst maintaining gas seals and process conditions. Pyrolysis pyrogas is rapidly quenched, allowing the tars and oils to condense out for transfer to the gasifier, contributing to energy recovery in the gasifier and combustor.<br>The gasifier syngas is combusted in a dedicated combustor. The flue gas from the combustor is used as the means of indirectly heating the pyrolysis chamber, leading to a self sustaining process. The use of recovered energy from the gasifier syngas to power the pyrolysis process replaces fossil fuels such as natural gas. Diesel is, however, used as the start-up fuel for the process until self-sustaining steady state operation has been established.<br>The exhaust from the gasification process passes through a flue gas treatment plant consisting of dry in-stack scrubbing with sodium bicarbonate) to remove acid gases, along with separately controlled dosing with powdered activated carbon (PAC) to remove VOCs, dioxins and furans and volatile metals . The particulate matter is then removed using a fabric (or ceramic) filter prior to exhaust. This exhaust gas is subject to the requirements of Chapter IV of the IED.<br>The gasifier has key design and safety features:<br>• Minimum exhaust temperature is set at $900^{0}$C<br>• Temperature measurement at the combustor outlet to ensure compliance with IED Chapter IV temperature requirements<br>• Computational fluid dynamics (CFD) modelling and design calculations confirm a minimum 2 seconds' residence time for the combustor exhaust gas in accordance with IED Chapter IV, Article 50(2)<br>• Airflow to the gasification system is continuously monitored by thermal dispersion mass flow meters for accurate control<br>• Pressure is continuously monitored in the gasification chamber and the exhaust ducts<br>BAT is therefore in place for the gasification of char and tars and oils from pyrolysis, the subsequent combustion of the syngas so produced, and the supply of high grade heat from this combustion to support the pyrolysis process. In addition, emissions from syngas combustion will have flue gas treatment to ensure they comply with IED Annex VI. |
| Cooling | Pyrogas is rapidly quenched upon leaving the pyrolysers. Heat recovery will be from two sources within the process:<br>• Heat is recovered from engine jacket cooling $3.0MW_{th}$<br>• Heat is recovered from the CHP engine exhaust gases $2.0MW_{th}$ |

| Indicative requirement | BAT justification |
|---|---|
| | These measures are considered to represent BAT for cooling and heat recovery. |
| Ash handling | Ash from the gasification of char and oils is the only process residue generated. It will be collected, handled in an enclosed and controlled manner to prevent fugitive emissions to air and spillage to ground. A market for its reuse will be sought. The fly ash from the gasifier that is collected in the bag filter will be disposed of at a suitably permitted facility.<br>These measures are considered to represent BAT for ash discharge and handling. |
| Ancillary and utilities systems | Mains water and harvested rainwater will generally be used for amenities, cleaning and for fire fighting. Rainwater run-off from the roofs will drain into a clean water storage tank with an approximate capacity of 400m$^3$. Dirty water includes wash down water from the floors (though this is likely to be minimal), a proportion of the aqueous quench effluent and drier condensate. This will be stored in two 400m$^3$ capacity dirty water tanks prior to removal by tanker to an appropriate treatment facility elsewhere.<br>Surface water run-off from the site roads will be discharged to the existing surface water system via hydrocarbon interceptors. Surplus rainwater run-off from the buildings will also be discharged to the surface water system.<br>The plant will be operated from the control room which will overlook the pyrolyser/gasifier units. A CCTV system will allow operators to view other areas of the plant, such as the waste reception and storage areas, driers and the ash storage areas.<br>A continuous emission monitoring system (CEMS) will be installed on the gasifier combustor exhaust for IED compliance. This will be linked to the char, tar and oil feed system to ensure that the gasifiers cannot be operated during abnormal operation. The monitoring and operational control of the gasifier combustion exhaust for pyrolyser heat supply will be subject to IED Annex VI. |
| **Pyrogas purification** | |
| Pyrogas purification(pre-combustion) | Pyrogas will be subject to purification prior to being combusted in the CHP engines, as follows:<br>• Ceramic filter: filtration at high temperature via ceramic candle filters to remove particulates<br>• Wet scrubber/quench: provides rapid cooling to prevent dioxin reformation (note that metals and dioxins are routed to the solid char rather than being carried forward into the pyrogas). The scrubber also removes oils and tars, which are routed to the gasifier, and acid gases such as HCl and HF<br>Sulphur is removed from the waste stream and very low amounts are expected to be forward to the pyrolysis process, preventing formation of $H_2S$ and subsequent generation of $SO_2$ in the pyrogas combustion process. Residual $H_2S$ is also removed in the quench scrubber.<br>These measures for pyrogas purification are considered to represent BAT. In conjunction with the other measures outlined in the end of waste application, they ensure that the product pyrogas is no longer a waste when it is routed to the pyrogas buffer store ready for combustion. The pyrogas replaces the need for fossil fuels that would be used for generating the equivalent heat and power, and therefore Article 42 of IED is satisfied and the product pyrogas combustion falls outwith |

| Indicative requirement | BAT justification |
|---|---|
| | Chapter IV and Annex VI of IED. |
| **Pyrogas Combustion** | |
| Flare | Flaring is in place in the event that it is required for safety release, or if the pyrogas deviates from the specification as set out in the end of waste application, or in the event of process trips when pyrogas needs to be combusted. However, the build in redundancy achieved through using 3 of the 4 NEAT lines at any one time will minimise the need for flaring as far as practicable. Periods of flaring pyrogas will be recorded and provided to SEPA as required.<br>Flare design will be generated in accordance with relevant guidance.<br>These measures for flaring are considered to represent BAT. |
| CHP engines | CHP engines have been selected as BAT for the generation of power and heat for local supply. The justification of BAT is shown above, but in summary:<br>• CHP engines are a well understood technique, considered BAT for generation of heat and power from landfill gas and biogas from sewage sludge digestion and anaerobic digestion. These are the most similar fuel streams to the product pyrogas from pyrolysis of fuel manufactured from municipal waste sources<br>• CHP engines provide excellent efficiencies at the 3tph scale. Other techniques such as gas turbines or boilers are not efficient or economically viable for the amount of pyrogas generated by this 3tph scale activity (see section 2.7 below)<br>• CHP engines provide excellent flexibility to meet seasonality of demand, and diurnal peaks and troughs. Supply can be balanced between heat and power<br>• The addition of a buffer heat store acts to smooth out the difference between duty and demand, increasing overall thermal efficiency by minimising heat dump from the system and minimising the need for topping up duty with fossil fuel combustion elsewhere<br>CHP engines are considered to represent BAT for the combustion of the product pyrogas to provide the maximum heat and power output combined with the greatest flexibility. |
| **Environmental performance indicators** | |
| EPIs | Key process performance indicators will be devised in discussion with SEPA prior to commencement of operation of the facility. Process monitoring proposed to be carried out is discussed in section 2.10 below. |

## 2.2. EMISSIONS CONTROLS

This section of the variation application corresponds to Part C3 of the application for variation form, describing the proposed emissions from the installation.

This section considers the prevention of new emissions to air, water and land, illustrating BAT by demonstrating prevention of new emissions from the advanced thermal treatment (ATT) facility as a priority, and subsequently where emissions are minimised or treated prior to release. The main sources and types of emissions from the new ATT part of the installation are summarised in this chapter to aid understanding. Note that references to volatile organic compounds (VOC) can be taken to also mean total organic compounds (TOC).

Section 3 discusses the relevant benchmark values of emissions to air for the ATT facility, along with the monitoring and reporting requirements.

The impacts of installation activities on the environment, as varied by this application, are assessed in section 4. This section includes a summary of the air quality assessment findings (see also Appendix C), insofar as they relate to the stack characteristics and the dispersion of emitted pollutants. The assessment covers effects on sensitive receptors, such as human health, soil and terrestrial ecosystems and includes both the currently permitted fuel preparation facility and the new ATT facility.

In combination with section 2.1, this section describes the operational techniques that will be in place at the proposed installation, as varied by this application.

### 2.2.1. Abatement of Point Source Emissions to Air

#### 2.2.1.1. Nature of Point Source Emissions to Air

The emission point to air A1, as identified in section 1.2 of permit reference PPC/A/1094330, the biofilter stack, is not amended by this variation application.

The emission points to air, as amended by this variation application, and the pollutants potentially discharged, are shown below. New emission points will be added by the addition of the ATT process. These are the four (4) engine flues and the common combustor flue, which will all exhaust through the same stack but in separate flues. These are named A2 – A5 for the engine flues and A6 for the common gasifier flue. In addition, there will be a flare stack, A7, separate from the main stack.

Appendix F to this application for variation contains the application for end of waste relating to the product pyrogas generated by the NEAT process. This application demonstrates that the measures for pyrogas purification, which are considered to represent BAT, in conjunction with the other measures outlined in the end of waste application, ensure that the purified product pyrogas is no longer a waste when it is routed to the pyrogas buffer store ready for combustion. The pyrogas replaces the need for fossil fuels that would be used for generating the equivalent heat and power, and therefore Article 42 of IED is satisfied and the product pyrogas combustion falls outwith Chapter IV and Annex VI of IED. Therefore, for emissions from A2 – A5, reference is made to SEPA's Landfill Technical Guidance LFTGN08, 2004[1], which is identified as the most relevant guidance available for benchmarking emissions from purified pyrogas combustion. The remainder of this section should therefore be read in light of the end of waste application, which SEPA is determining concurrently with this variation application. SEPA combustion guidance S1.01[2] only contains emission standards for engines using natural gas, which are not applicable to the combustion of pyrogas, which is closest in its properties to landfill gas.

There is no bypass around either the combustion of cleaned pyrogas in the CHP engines or the combustion of syngas produced from char gasification.

The table below describes the potential pollutants in the exhaust emissions to air. In the case of the engine exhausts A2 – A5, this is after the removal of the components of the pyrogas product and syngas as described below.

**Table 7. Summary of Releases to Air**

| Release point | | | | List of pollutants |
|---|---|---|---|---|
| Reference number | Description | Height, m | Location | |
| A1 | Biofilter exhaust, already permitted | 11.5 | NT 5220 3608 | VOC, $NH_3$, particulate matter |
| A2 | Engine 1 exhaust | 23 | NT 5217 3611 | $NO_x$, VOC, CO, $CO_2$ |
| A3 | Engine 2 exhaust | 23 | | |
| A4 | Engine 3 exhaust | 23 | | |
| A5 | Engine 4 exhaust | 23 | | |
| A6 | Common gasifier exhaust | 23 | | $NO_x$, $SO_2$, CO, $CO_2$, VOC, HCl, HF, particulate matter, heavy metals, dioxins and furans |
| A7 | Flare | 9 | NT 5222 3608 | $NO_x$, CO, $CO_2$, VOC |

An assessment of stack height has been undertaken, and is provided as an addendum to the dispersion modelling report in Appendix C. The stack height was found to be 17m but for conservative reasons we applied a 100% conversion of $NO_x$ to $NO_2$ which gives 21m. However, following initial model runs which included sensitive receptors near the site, we increased this to 23m.

### 2.2.1.2. Control of Point Source Emissions to Air from CHP Engines

The primary mechanism for BAT for the prevention of emissions from pyrogas combustion is the purification that the pyrogas undergoes prior to combustion. The table below describes the mechanisms for removal of substances from the pyrogas product prior to its combustion that could otherwise lead to polluting emissions from the engine exhausts A2 – A5.

[1] Guidance for monitoring landfill gas engine emissions LFTGN08, SEPA, 2004
[2] IPPC Sector Guidance Note Combustion Activities, SEPA eta l, v2.03.27.07.05 at http://www.sepa.org.uk/air/process_industry_regulation/pollution_prevention__control/uk_technical_guidance/s1_energy.aspx

**Table 8. Summary of Pyrogas Clean-up Measures**

| Pyrogas Component | Clean-up Technique |
|---|---|
| Particulates | Ceramic filters to remove particulates from pyrogas prior to combustion in the CHP engines. |
| Acid gases (HCl, HF, $H_2S$) | These follow through into the gas, rather than the solid char. Wet quench dosed with sodium hypochlorite and sodium hydroxide to scrub out acid gases from pyrogas prior to combustion in the CHP engines. |
| $SO_2$ | Wet quench dosed with sodium hypochlorite and sodium hydroxide to scrub out $H_2S$ to prevent $SO_2$ formation in the CHP engines through oxidation of $H_2S$. |
| VOC | Wet quench to condense out tars and organic compounds from pyrogas prior to combustion in the CHP engines. |
| Heavy metals | Ceramic filters to remove particulates including metals from pyrogas prior to combustion in the CHP engines. |
| Dioxins and furans | Catalysts for dioxin and furan formation, such as copper and zinc, are removed from the waste stream. The cyclone between the gasifier and combustor will further remove residual catalysts.<br>Quick quench also provided to prevent de novo formation.<br>Ceramic filters to remove particulates including dioxins and furans from pyrogas prior to combustion in the CHP engines. |

#### 2.2.1.2.1. BAT Assessment for Engine $NO_x$

Fuel control is an important primary measure for the prevention of $NO_x$. The fuel incoming to the ATT facility is under the applicant's control through the extant PPC permit. Its properties will therefore be under our control. This leads to the generation of a pyrogas of well known and consistent composition and quality through the process monitoring as set out in the end of waste application and in section 2.10 below. The prevention of $NO_x$ emissions through the close, automated control of combustion is recognised as BAT for a wide range of installations. This will be in place at the Easter Langlee ATT facility, and will achieve the emission level of 500mg/Nm$^3$ as set out in the relevant SEPA guidance. An emissions guarantee (provided by the engine manufacturer) to this effect will be supplied to SEPA prior to operation of the facility, and we would envisage that this would be required in a prior operating condition in the varied permit.

It should be noted that we recognise that CHP engines running on pyrogas or landfill gas may have the potential to operate at levels of $NO_x$ lower than 500 mg/Nm$^3$, although emission guarantees to this effect are not currently available from any of the equipment providers we have identified. The engine supplier has not yet been selected, and therefore we cannot, at this stage in the development of the ATT facility, provide such a guarantee to SEPA. We do, however, propose to undertake commissioning emissions monitoring, and emissions monitoring during the operation of the facility, and we would anticipate that this would be a requirement of the permit. We would also like to voluntarily propose that we use the monitoring results from the first year of operation, to investigate the engine performance in more detail, based on actual data. We will forward this data to SEPA, along with a report investigating the possibility of future reductions to the emission limit for $NO_x$. We would anticipate that this investigation would be included in the permit as an improvement condition.

Additional secondary measures to abate $NO_x$ emissions from the CHP exhausts have been considered as to whether they are “available” (as defined under the IED) for the ATT facility, as follows.

**Table 9. Secondary $NO_x$ Control Measures Considered**

| Measure | Advantages and Disadvantages[3] | Available? |
|---|---|---|
| Flue gas recirculation | FGR recirculates 10-20% of secondary combustion air, lowering oxygen concentration and therefore reducing temperature and $NO_x$ generation. This makes FGR a useful technique for large scale waste disposal facilities. However, FGR can lead to increased CO emissions.<br>FGR can reduce the volume of flue gas generated in the pyrogas combustion process. However, at a small scale, modular ATT facility designed for renewable energy generation, FGR would act to quench the CHP engines, adversely impacting on overall thermal efficiency. | N |
| Selective non-catalytic reduction (SNCR) | Applicable to combustion plant with longer residence time, such as boiler plant. Lower capital cost than SCR. Operating costs for SNCR are generally 25-40% cheaper than SCR.<br>Ammonia slip possible when trying to achieve $NO_x$ reduction >60-80%, particularly when ammonia is injected. $N_2O$ emissions likely when urea is injected (GWP = 310, compared with $CO_2$ GWP = 1).<br>Requires on site storage of ammonia or urea.<br>SNCR is effective at combustion gas temperatures of 850–1,000$^0$C. Low temperature residence time of CHP engines means SNCR likely to be ineffective as there is insufficient time and temperature to allow $NO_x$ reduction reactions to occur. | N |
| Selective catalytic reduction (SCR) | This is potentially applicable, although not required to meet the landfill gas $NO_x$ standard of 500mg/Nm$^3$. We are unaware of any landfill gas or biogas combustion installation of similar size where this has been regarded as economically viable. The capital cost is very high and this is usually considered more suitable for larger installations with single combustion lines.<br>Operating cost per tonne $NO_x$ saving is estimated at up to €4,500/tonne.<br>SCR at incinerators functions at 230-300$^0$C, so would require exhaust gas re-heat, significantly impairing energy efficiency of the installation.<br>Additional emissions from ammonia slip can occur, generally around 10mg/Nm$^3$.<br>Requires regular changing of catalyst due to build-up on ammonium salts, which adds to the waste generated at the installation and requires offsite disposal or reclamation, increasing energy and resource use by the technology provider. | N |

The primary prevention of $NO_x$ emissions through upstream waste supply quality assurance, quality assurance of pyrogas production and purification, and ongoing automated control of pyrogas combustion in the engines to meet 500mg/Nm$^3$ is therefore contended to represent BAT for the prevention of $NO_x$ emissions from purified pyrogas combustion at the installation.

##### 2.2.1.2.2. BAT Assessment for Engine CO and VOC

The emission standards contained in LFTGN08 for CO and VOC are a function of the combustion process in CHP engines. As discussed in more detail in section 2.1 and 2.7 of this document, CHP engines have been selected because of their increased overall thermal efficiency compared with other combustion techniques, and their ability to provide both baseload and peak power and heat supply. Their use has been justified as

[3] Data sourced from IPPC Waste Incineration BRef Document, EC, August 2006

BAT, and there is no technical capability to prevent VOC and CO emissions from engines further. However, the VOC emissions are almost entirely methane-based. The proportion of NMVOC is minimal, as shown by our process modelling and data from many such engines situated at wastewater treatment works and running on biogas from sewage sludge digestion. We would demonstrate this through the commissioning and ongoing emissions monitoring described above.

Secondary removal is not required to meet the landfill gas VOC standard of 1,000mg/Nm$^3$ or the CO standard of 1,400mg/Nm$^3$. There is no justification for the secondary removal of CO or VOCs based on the results of the air dispersion modelling study discussed in section 4 below, because there is no risk of environmental assessment levels or quality standards being breached by the installation, as varied by this application. We are unaware of any landfill gas or biogas combustion installation of similar size where this has been regarded as economically viable. The capital cost is very high and this is usually considered more suitable for larger installations with single combustion lines. However, we have investigated the possibility of secondary removal of CO and VOC from the engine exhausts. Potential techniques would constitute catalytic conversion for CO, and post-combustion, scrubbing or cryogenic removal of VOC.

The provision of catalytic conversion for CO would introduce a new waste stream to the installation. Regular changing of the catalyst would be required, which adds to the waste generated at the installation and requires offsite disposal or reclamation, increasing energy and resource use by the technology provider. We are not aware of operational, proven applications of catalytic removal of CO from engine exhausts running on biogas or pyrogas. This would therefore not be considered available, and would not represent BAT for Easter Langlee.

Post-combustion of VOC would require a significant capital cost, and the concentration would be unlikely to be sufficient for genuine autothermality. Therefore, combustion of significant amounts of additional fossil fuels would be required to successfully combust VOC. This would lead to high operational cost, generate high emissions of $CO_2$ from fossil fuel combustion and drastically decrease the overall thermal efficiency of the ATT facility. This technique has therefore been discounted as not representing BAT for Easter Langlee.

Alternatives such as cryogenic removal or scrubbing also introduce significant operational and capital expenditure, and would be unlikely to be effective as the VOC composition is likely to be mixed. These techniques have also been discounted as not representing BAT for Easter Langlee.

The primary prevention of CO and VOC emissions through upstream waste supply quality assurance, quality assurance of pyrogas production and purification, and ongoing automated control of pyrogas combustion in the engines to meet 1,400mg/Nm$^3$ for CO and 1,000mg/Nm$^3$ for VOC is therefore contended to represent BAT for the prevention of CO and VOC from purified pyrogas combustion at the installation.

#### 2.2.1.2.3. BAT Assessment for Engine $CO_2$

Emissions of $CO_2$ are subject to the requirement to prevent emissions using BAT. The prevention of $CO_2$ emissions is intimately linked to the maximisation of energy efficiency at the facility. This is discussed in detail in section 2.7 below, but regard should be had to the effects on energy efficiency from the BAT assessment for other emissions above. We contend that the use of CHP engines to maximise the efficiency and flexibility of heat and power energy export represents BAT for energy efficiency at the facility. The prevention of greenhouse gas emissions from landfill that the overall installation gives by providing high levels of recycling of Scottish Borders waste, combined with an efficient renewable energy source using the residual waste fraction after recycling, represents BAT for the prevention of $CO_2$ from the facility and from the waste stream more generally.

#### 2.2.1.3. Control of Point Source Emissions to Air from Combustors

Prevention of emissions in the exhaust gas from the combustors prior to treatment consists of:

- Acid gases pass into the product pyrogas for aqueous dosed quench, rather than into the solid char phase, meaning that potential for generation of acid gases from combustors is significantly reduced.
- The cyclone between the gasifiers and combustors removes particulates, including any residual dioxin and furan catalysts that may be present.
- Lack of chlorinated compounds in the char minimises risk of dioxin and furan generation. Removal of dioxin and furan catalysts such as copper and zinc further prevent dioxin and furan formation in the combustors.

The exhaust gas from the combustion of syngas produced in the gasifiers and emitted via A6 is subject to the controls contained in Chapter IV of the IED, and emission limits are proposed in line with IED Annex VI accordingly. The exhaust from the combustion of gasifier syngas passes through a flue gas treatment plant consisting of:

- Built-in flue gas recirculation (FGR) in the combustors
- Dry in-stack scrubbing with sodium bicarbonate to remove acid gases
- Separately controlled dosing with powdered activated carbon (PAC) upstream of the filter to remove VOCs, dioxins and furans and volatile metals
- Fabric (or ceramic) filter to remove particulate matter, which also contains the residual adsorbed metals, VOCs and dioxins and furans

These secondary removal techniques are in common use throughout the industry and have been assessed as BAT in many cases. In particular, dry in-stack scrubbing using sodium bicarbonate and PAC, with a subsequent bag filter, with independent dosing control of the sodium bicarbonate and PAC, allows for dose rates to be controlled having regard to continuous emissions monitoring. Dosing rate will be continuously adjusted to account for the CEMS reading and compliance with the emission limit value as set out in IED Annex VI.

Alternatives, such as wet or semi-dry scrubbing, were considered. However, these generate additional aqueous waste streams that are sufficiently polluted that may require onsite treatment, and would fall within the scope of IED Annex VI Part 5. Therefore, avoiding these effluents through the use of dry in-stack scrubbing represents BAT for flue gas cleaning of the exhaust gas from the combustors at the installation.

These measures represent BAT for prevention of emissions to air from the CHP and combustor exhausts at the installation, as varied by this application.

### 2.2.2. Proposed Emission Limit Values to Air

Proposed emission limits from the ATT facility and the monitoring proposed to demonstrate compliance are shown in the table below. It should be noted that these are the emission limits used in the detailed air dispersion modelling exercise described in section 4 of this document. The chimney height has been assessed for dispersion capability and an assessment made of the fate of the substances emitted to the environment.

Note that the gas exhaust temperatures are anticipated to be 250$^0$C for the engines and 298$^0$C for the combined combustor exhaust. This is sufficient to ensure no risk of visible plumes.

The risk of de novo dioxin formation is removed because the chlorinated compounds that can be precursors for dioxin formation are contained in the pyrogas, and are subsequently removed in the dosed quench, ending up in the final effluent. The char material is essentially free from halogens, and therefore there is negligible risk of de novo dioxin reformation after filtration on emission point A6.

**Table 10. Summary of Prevention of Releases to Air**

| Reference number | Description | Potential Pollutants | Prevention Technique | Removal Technique |
|---|---|---|---|---|
| A1 | Biofilter exhaust, already permitted | VOC, $NH_3$, particulate matter | No change from extant permit PPC/A/1094330 | |
| A2 – A5 | Engine 1 - 4 exhausts | $NO_x$, VOC, CO, $CO_2$ | $NO_x$: Optimisation of pyrogas combustion in the CHP engines.<br>CO and $CO_2$: Optimisation of pyrogas combustion in the CHP engines, optimisation of combustion control and maximisation of energy recovery for onsite requirement.<br>VOC: Wet quench to condense out tars and organic compounds from pyrogas prior to combustion in the CHP engines. | No further control measures. |
| A6 | Common gasifier exhaust | $NO_x$, $SO_2$, CO, $CO_2$, VOC, HCl, HF, particulate matter, heavy metals, dioxins and furans. | $NO_x$: Optimisation of syngas combustion in the combustion chamber.<br>CO and $CO_2$: Optimisation of syngas combustion in the combustion chamber, optimisation of combustion control and maximisation of energy recovery for onsite requirement.<br>Acid gases ($SO_2$, HCl, HF): Removal of halogenated compounds in fuel preparation facility.<br>Heavy metals: Removal of unsuitable wastes (e.g. batteries) in fuel preparation facility.<br>Dioxins and furans: Removal of precursors such as halogenated compounds in the fuel preparation facility, control of oxygen in the gasification process to prevent dioxin and furan formation, holding combustion gases at >8500C for >2 seconds in compliance with IED Article 50(2). | Acid gases ($SO_2$, HCl, HF): Dry in-stack scrubbing with sodium bicarbonate.<br>Heavy metals: Dry in-stack dosing of PAC to adsorb volatile heavy metals prior to bag filter for particulate removal.<br>Dioxins and furans: Dry in-stack dosing of PAC to adsorb volatile compounds prior to bag filter for particulate removal.[4]<br>Particulate matter: bag filter. |
| A7 | Flare | $NO_x$, CO, $CO_2$, VOC | Avoidance of flaring through having spare pyrogas combustion capability (3 out of 4 engines operating at any one time).<br>This inbuilt redundancy and maintenance programme allows for preventing unforeseen downtime without compromising output and availability. | No further control measures. |

[4] The activated carbon injection rate is controlled independently and injected with a separate injection point.

**Table 11. Proposed Emission Limits to Air**

| Reference number | Description | Substance | Emission Limit, mg/Nm³ (unless otherwise stated) | Reference Oxygen Concentration, % | Averaging Period (where applicable) |
|---|---|---|---|---|---|
| A1 | Biofilter exhaust, already permitted | VOC, $NH_3$, particulate matter | No change from extant permit PPC/A/1094330 | | |
| A2 – A5 | Engine 1 - 4 exhausts | $NO_x$ (as $NO_2$) | 500 | 5 | Spot |
| | | VOC | 1000 | | Spot |
| | | CO | 1400 | | Spot |
| A6 | Common gasifier exhaust | $NO_x$ (as $NO_2$) | 200 | 11 | Daily |
| | | | 400 | | Half-hourly |
| | | $SO_2$ | 50 | | Daily |
| | | | 200 | | Half-hourly |
| | | CO | 50 | | Daily |
| | | | 100 | | Half-hourly |
| | | | 150 | | 10 minute |
| | | VOC | 10 | | Daily |
| | | | 20 | | Half-hourly |
| | | HCl | 10 | | Daily |
| | | | 60 | | Half-hourly |
| | | HF | 1 | | Daily |
| | | | 4 | | Half-hourly |
| | | Total dust | 10 | | Daily |
| | | | 30 | | Half-hourly |
| | | Heavy metals (∑Hg+Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V) | 0.5 | | Spot |
| | | ∑Cd + Tl | 0.05 | | Spot |
| | | Dioxins and furans | 0.1 ng/Nm³ | | Spot |
| A7 | Flare | $NO_x$, CO, $CO_2$, VOC | None proposed | n/a | n/a |

These measures represent BAT for emissions to air at the installation, as varied by this application. The BAT justification for emissions to air is provided in the table below.

**Table 12. BAT Justification for Point Source Emissions to Air**

| Indicative BAT | Justification |
|---|---|
| Emissions identification and benchmark comparison | The emissions from the CHP engines are in line with the SEPA landfill gas guidance<br>Emissions from the combustors will comply with IED Annex VI<br>Benchmark comparisons have been provided above and in section 3 below |
| Vent & chimney height dispersion capacity and assessment of emitted substances fate in the environment. | An impact assessment and human health risk assessment have been carried out and are appended to this document |
| Visible particulate plumes | No visual particulate plumes are anticipated |
| Visible condensed water plumes | No visual condensed water plumes are anticipated due to the temperature of the discharge |
| Particulate matter | Particulates from purified pyrogas combustion are controlled by particulate removal systems including ceramic filter and wet scrubber quench, with captured particulate and char from pyrolysis being fed to the gasification process tor energy recovery<br>Particulates from gasifier syngas combustion are removed using fabric (or ceramic)filters |
| **$NO_x$ - Primary Measures** | |
| Fuel selection | Primary fuel for CHP is the purified pyrogas, prepared from pre-treated waste at the installation. Diesel is the auxiliary fuel |
| Combustion chamber design | CHP engines used to maximise modularity and flexibility, delivering high energy efficiency and duty/demand matching selected as BAT<br>Combustors have built-in FGR to prevent $NO_x$ |
| Air control – primary and secondary | Acid gases pass into the product pyrogas phase where they are quenched out<br>The combustion control systems on the engines and the combustors control the air supply to continuously optimise combustion conditions |
| Temperature control | Temperature monitoring and use of the combustion control systems will ensure continuous combustion control |
| Flue gas recirculation | Built-in FGR in place for the combustors<br>This will not be used on the CHP engines as it not considered to be BAT |
| **$NO_x$ – Secondary measures** | |
| SNCR | This will not be used as it not considered to be BAT |
| SCR | This will not be used as it is not considered to be BAT |
| $NO_x$ control - cost/benefit study | A detailed BAT assessment has been provided. Careful consideration has been made during the design stage of this project to ensure that releases of $NO_x$ are well managed by appropriate primary measures and close automated control of combustion |
| **Acid gases and halogens** | |
| Primary acid gas measures | The waste feed will exclude hazardous waste and will not contain significantly chlorinated or halogenated components |

| Indicative BAT | Justification |
|---|---|
| | This will be ensured by the fact that the waste feed comes from pre-treatment in the permitted facility at Easter Langlee |
| Secondary acid gas measures | Wet quench dosed with sodium hypochlorite and sodium hydroxide to scrub out acid gases from pyrogas prior to combustion in the CHP engines<br>Dry in-stack scrubbing upstream of the filter to remove acid gases from the combustor exhaust |
| Alkaline reagent selection | Wet quench dosed with sodium hypochlorite and sodium hydroxide to scrub out acid gases from pyrogas prior to combustion in the CHP engines<br>Sodium bicarbonate selected as the dry scrubbing reagent for combustor exhaust gas treatment |
| Acid gas control: cost/benefit study | A detailed BAT assessment has been provided. Careful consideration has been made to ensure that releases of acid gases and halogens are well managed by appropriate primary and secondary measures |
| **Carbon dioxide** | Energy efficiency measures are in place at the installation, as described above and in section 2.7 below. Diesel remains the preferred option, as the support fuel |
| **Carbon monoxide and VOCs** | A detailed BAT assessment has been provided. Careful consideration has been made during the design stage of this project to ensure that releases of CO and VOCs are well managed by appropriate primary measures and close automated control of combustion |
| **Dioxins and furans** | Dioxin emissions from the CHP engines are prevented through removal of precursor materials such as halogenated plastics, careful control of the pyrolysis conditions in the absence of oxygen, followed by quick quench to prevent de novo reformation<br>Dioxin emissions from combustors are prevented through removal of precursor materials such as halogenated plastics, copper and zinc from the waste feed<br>The cyclone between the gasifier and combustor further removes particulates that may contain residual catalysts<br>Careful control of the combustion conditions, and secondary removal through dry in-stack dosing of PAC to adsorb dioxins and furans and other organic substances prior to bag filter for particulate removal |
| **Metals** | Metal emissions from the CHP engines are prevented through removal of precursor materials such as batteries, careful control of the pyrolysis conditions to ensure metals are routed to the solid phase, followed by quick quench to condense out residual volatile metals such as mercury<br>Metal emissions from combustors are prevented through removal of precursor materials such as batteries, careful control of the combustion conditions, and secondary removal through dry in-stack dosing of PAC to adsorb volatile and semi-volatile metals prior to bag filter for particulate removal |
| **Iodine and bromine** | Significant concentrations of halogens in the waste feed are not expected, owing to upstream control measures in place. The quick quench scrubber will remove halogenated acid gases that may remain in the pyrogas. Dry in-stack scrubbing will remove iodine and bromine from the combustor exhaust |

### 2.2.3. Abatement of Point Source Emissions to Surface Water and Sewer

#### 2.2.3.1. Minimising Emissions to Water

Emissions to water are minimised by:

- Using dry gas treatment techniques rather than semi-dry or wet
- Harvesting rainwater
- Maximising water recycling at the site

Rainwater run-off from the roofs will drain into a clean water storage tank with an approximate capacity of 400m$^3$. This will be used, with mains water top-up, for amenities, cleaning and for fire fighting

Dirty water includes wash down water from the floors (though this is likely to be minimal), a proportion of the aqueous quench effluent and drier condensate. This will be stored in two 400m$^3$ capacity dirty water tanks prior to removal by tanker to an appropriate treatment facility elsewhere.

#### 2.2.3.2. Nature of Wastewater

There will be three wastewater streams, none of which will be discharged to water. They will be handled as follows.

Foul water (from the offices etc): this is not affected by this variation application. It will go to an on-site bio-disc treatment plant and then to soakaway, as already permitted. We have investigated the potential for disposal of this to sewer. However, the location of the nearest sewer connection is about a kilometre from the site, making it uneconomic to construct a new connection for the limited amount of domestic effluent likely to be generated at the facility. We understand that the Scottish Borders private pumped main from their site is at capacity.

Condensate from the dryers and wash down water: our preferred solution would be to discharge this to foul sewer, but for the same reasons as for domestic effluent, this is not practicable. The cost of a connection has been estimated as at least £500,000. In order to try to overcome this, we have been in discussions with Scottish Borders on the potential of partnering on the development of on-site treatment, potentially using reed bed technology. These discussions are ongoing. In the meantime, drier condensate will be stored and tankered off-site. We would reinforce that this is not effluent form the cleaning of exhaust gases, and therefore the requirements of Annex VI of the IED do not apply to this effluent.

The maximum amount possible of the aqueous waste stream from pyrogas quench is routed to the gasifier chamber along with the collected char from pyrolysis. This is estimated at 1,520 tpa. This allows us to gain the benefit of the calorific value from the tars and oils within this stream, further maximising energy efficiency of the ATT installation. The remainder, estimated at 2,800 tpa is routed to the bulk wastewater tank, for removal by a suitable contractor for offsite treatment. This wastewater is not discharged from the installation, and is subject to permit controls at the suitably permitted treatment facility.

In addition, surface water run-off from the site roads will be discharged to the existing surface water system to soakaway via hydrocarbon interceptors. Surplus rainwater run-off from the buildings will also be discharged to the surface water system. There is no change to the management of surface water as detailed in the original permit application.

There will be no emissions to sewer from the installation. These measures represent BAT for point source emissions to water at the installation, as varied by this application. The BAT justification for point source emissions to water is provided in the table below.

**Table 13. BAT Justification for Point Source Emissions to Surface Water and Sewer**

| Indicative BAT | Justification |
|---|---|
| Water use | Water use will be minimised and recycled where possible, as described above, using rainwater harvesting and reuse in amenities and fire fighting |
| Contamination identification and fate analysis | Sampling, monitoring and analysis will be carried out, once the installation is operational, in agreement with SEPA |
| Filtration | No further filtration necessary |
| Off-site treatment | Condensate, quench effluent and potentially contaminated surface water is routed via tanker to a suitably permitted treatment facility |
| Benchmark comparison - Control of emissions to meet EQS and IED requirements | IED Annex VI ELVs do not apply |

### 2.2.4. Point Source Emissions to Groundwater

There are no anticipated process point source emissions to groundwater at the ATT facility. Accidental releases are prevented through undertaking all activities within the process buildings, with the bunding and storage arrangements as described in this application.

**Table 14. BAT Justification for Point Source Emissions to Groundwater**

| Indicative BAT | Justification |
|---|---|
| Identification of hazardous or dangerous substances | None likely to be present |
| Prior Investigation | N/A |
| Surveillance | N/A |

### 2.2.5. Control of Fugitive Emissions to Air

There are no additional sources of dust, odour or VOCs resulting from this variation application. Control of dust and prevention of fugitive emissions at the ATT facility is delivered through design of the process, the process buildings (which remain unaffected by this variation application) and the waste feed to be used. All waste handling, treatment and the operation of the NEAT lines will be within the process building. Waste buffer storage is minimised by the redundancy of having 4 NEAT units available, but only 3 operating at 1tph throughput at any one time, thereby removing the need for additional buffer storage of waste prior to feed into the ATT facility.

The process building remains under negative pressure, with the ventilation air routed through the scrubber and biofilter prior to exhaust via emission pint A1. This is covered by the extant permit and is not affected by this variation application. This will prevent fugitive emissions of odour and dust. The containment of all waste handling and processing activities within the process building will prevent fugitive emissions of litter. The biostabilisation process is no longer part of the installation as a result of this variation application, means that the only potential source of bioaerosols from the installation has been removed.

These measures, and the measures already assessed as BAT for the permitted facility, represent BAT for fugitive emissions to air at the installation, as varied by this application. The BAT justification for fugitive emissions to air is provided in the table below.

**Table 15. BAT Justification for Fugitive Emissions to Air**

| Indicative BAT | Justification |
|---|---|
| Covering of skips and vessels | There will be no open skips or vessels at the facility which could give rise to fugitive emissions. |
| Avoidance of outdoor or uncovered stockpiles (where possible) | There will be no outdoor or uncovered stockpiles which could give rise to fugitive emissions.<br>Ash is handled in the enclosed building and removed form site in covered or enclosed vehicles. |
| Where dust creation is unavoidable, use of sprays, binders, stockpile management techniques, windbreaks and so on | Roads will be hard surfaced and will not give rise to dust emissions. |
| Regular wheel and road cleaning (avoiding transfer of pollution to water and wind blow) | N/A |
| Closed conveyors, pneumatic or screw conveying (noting the higher energy needs), minimising drops. Filters on the conveyors to clean the transport air prior to release | All waste handling and treatment activities will be within the process buildings |
| Regular housekeeping | The installation staff will be fully trained and regularly audited through the IMS to ensure that housekeeping measures are appropriate to the nature and scale of the activities and that there is minimum possibility of uncontrolled emissions. This is already required by the extant permit. |
| Enclosed silos (for storage of bulk powder materials) vented to fabric filters. | All bulk storage or powdered FGT chemicals will be within the process building, in IBCs or similar in designated storage areas. |
| The recycling of collected material should be considered under Section 2.6. | This is discussed in Section 2.6. |
| Enclosed containers or sealed bags used for smaller quantities of fine materials. | No fine materials will be stored outside. Small volumes of materials for maintenance, flue gas treatment chemicals etc. will be stored in appropriate containers, within the process building, sealed so as to prevent fugitive emissions. |
| Mobile and stationary vacuum cleaning. | Mobile and stationary vacuum cleaning will be used if necessary, particularly for spillages of dusty materials. |
| Ventilation and collection in suitable abatement equipment. | The process building is under negative pressure with ventilated air routed through the scrubber and biofilter before discharge via emission point A1, which is subject to the extant permit. |
| Closed storage with automatic handling system. | All storage will be closed and transferred using an automated handling system. |
| Sealed charging system. | The charging system will be fully enclosed. |
| VOC control measures | N/A |

### 2.2.6. Fugitive Emissions to Surface Water, Sewer and Groundwater

The measures to prevent fugitive emissions to surface water or groundwater are discussed below. There is no mains sewer connection at the facility. More information is provided in section 2.8 below, along with the accident management plan.

#### 2.2.6.1. Subsurface Structures

There are no subsurface structures at the ATT facility, other than on site drainage systems and the associated hydrocarbon interceptors. Process waters, potentially contaminated site drainage waters, emergency fire water, chemically-contaminated waters and spillages of chemicals will be contained and where necessary routed to the site drainage system and stored prior to transfer off site. Safe shutdown procedures will be in place.

#### 2.2.6.2. Surfacing

All waste will be processed in the enclosed building. The process will not involve the use of bulk hazardous liquids. All process areas and areas where spillages may occur will be covered with an impermeable surface. The main process area will be made of high quality concrete hardstanding with sealed construction joints where appropriate. Process and non-process areas are separate, with potentially contaminated surface water (i.e. from operational areas) kept separate from general site surface water.

All external roadways, turning areas and parking areas will be sealed concrete or tarmac with concrete kerbs. Such areas will be laid with falls towards the drainage system so that all runoff is directed towards the dedicated drains, which are fitted with oil interceptors, rather than escape onto surrounding soft ground.

#### 2.2.6.3. Above Ground Tanks

The only above ground bulk liquid storage tanks will be for the drier condensate, aqueous quench effluent and potentially contaminated surface water. This will be provided with bunding provided with 110% of tank capacity.

#### 2.2.6.4. Storage Areas

Powered materials used in the combustor exhaust gas treatment, liquids used in scrubber dosing, and other raw materials with the potential to cause pollution should they escape into the aquatic environment, will be stored inside the process building in designated areas. Storage arrangements for raw materials, products and wastes will be designed and operated to minimise risks to the environment. There will be appropriate secondary containment in the form of bunding, catchpots and kerbing within buildings.

Appropriate control techniques will be in place to limit the consequences of an accident, such as isolation of drains, provision of oil spillage equipment, alerting of relevant authorities and evacuation procedures.

The fire protection arrangements and firewater containment are discussed in section 2.1 above. In the event of a fire, the fire protection system is designed to direct the water to the main equipment areas, which means that contaminated firewater will mainly fall on the areas of hardstanding and be contained within the building. Potentially contaminated firewater can be contained and held in the main building before removal from site.

These measures represent BAT for prevention of fugitive emissions to water and groundwater at the installation, as varied by this application. The BAT justification for prevention of fugitive emissions to water and groundwater is provided in the table below.

**Table 16. BAT Justification for Fugitive Emissions to Water and Groundwater**

| Indicative BAT | Justification |
| --- | --- |
| Subsurface structures | N/A. |
| Surfacing design appropriate surfacing and containment or drainage facilities for all operational areas, taking into consideration collection capacities, surface thicknesses, strength/reinforcement; falls, materials of construction, permeability, resistance to chemical attack, and inspection and maintenance procedures:<br>have an inspection and maintenance programme for impervious surfaces and containment facilities;<br>unless the risk is negligible, have improvement plans in place where operational areas have not been equipped with:<br>– an impervious surface<br>– spill containment kerbs<br>– sealed construction joints<br>– connection to a sealed drainage system | Surfacing has been designed in accordance with typical design standards for similar installations. All joints are sealed.<br>The surfacing is designed to ensure that it is of the appropriate strength, reinforcement and thickness to withstand the heavy traffic which will pass over it during operations.<br>The installation will have in place an extensive maintenance programme within the IMS, which will include provision for the inspection of all appropriate plant and structures. The detailed inspection of the impervious surfaces and containment will be in line with the construction engineer's recommendations.<br>Since this is a new installation it will be BAT from commencement of operations. |
| Above-ground tanks | The wastewater tanks will be bunded to >110% capacity or >25% total aggregate capacity of multiple tanks. |
| Storage areas (IBCs, drums, bags etc)<br>Storage areas should be located away from watercourses and sensitive boundaries, (e.g. those with public access) and should be protected against vandalism.<br>Storage areas should have appropriate signs and notices and be clearly marked-out, and all containers and packages should be clearly labelled.<br>Where spillage of any stored substance could be harmful to the environment, the area should be appropriately kerbed or bunded.<br>The maximum storage capacity of storage areas should be stated and not exceeded, and the maximum storage period for containers should be specified and adhered to.<br>Appropriate storage facilities should be provided for substances with special requirements (e.g. flammable, sensitive to heat or light) and formal arrangements should be in hand to keep separate packages containing incompatible substances (both "pure" and waste).<br>Containers should be stored with lids, caps and valves secured and in place - and this also applies to emptied containers.<br>All stocks of containers, drums and small packages should be regularly inspected (at least weekly).<br>Procedures should be in place to deal with damaged or leaking containers. | All non-bulk storage (IBCs etc), where used, will be stored within the fully contained building. In the event of a release into the onsite foul water drainage system, the system will be closed off and the materials contained within will be tested prior to tankering off site. |

### 2.2.7. Odour

#### 2.2.7.1. Location of Sensitive Receptors

A full dispersion modelling study has been undertaken, and is provided in Appendix C. This shows the locations of the receptors for emissions to air, which includes odour. This is discussed in full detail in section 4 below. Note that the biofilter was included in the dispersion model for the cumulative effects of oxides of nitrogen emissions. However, there will be a reduction in the overall odour potential from the varied installation due to the removal of the biostabilisation process.

The emissions from the biofilter will be reduced with the ATT plant in place because the biostabilisation process will be replaced with mechanical drying, resulting in a lower volume of air and reduced odour input requiring treatment in the biofilter. However, for the purposes of the current assessment, it is assumed that there would be no change, and the values as presented in the RPS report on emissions from the consented waste facility may be taken to represent a conservative assessment. Figure 5 of the RPS report shows that the very limited extent of the 1 $ou_E/m^3$ plume, which represents the limit of detection, extending less than 100 metres from the site boundary.

#### 2.2.7.2. Odour Sources

There are no additional odour sources resulting from this variation application. All waste handling, treatment and the operation of the NEAT lines will be within the process building. Pyrogas is always within enclosed systems and pipework. The ATT facility includes the following odour prevention techniques:

- Use of a pre-sorted and pre-sized feed material
- Use of totally enclosed waste feedstock storage, handling and conveyance systems within the process building
- Use of totally enclosed pyrogas handling system
- Minimisation of on-site waste storage at the ATT facility by matching output of the currently permitted pre-treatment facility with the availability of the NEAT processes
- Provision of additional redundancy through having 4 NEAT units available, but only 3 operating at 1tph capacity at any one time, thereby removing the need for additional buffer storage of waste prior to feed into the ATT facility
- Provision of negative pressure in the process building, with ventilation air routed to the scrubber and biofilter, as already covered by the extant permit

#### 2.2.7.3. Odour Prevention and Treatment

The current permit covers the provision of building ventilation, maintaining the building under negative pressure with the treatment of exhausted air using a scrubber and biofilter prior to exhaust via emission point A1. This is not affected by this variation application.

These measures represent BAT for prevention of odour at the installation, as varied by this application. The BAT justification for prevention of odour is provided in the table below.

**Table 17. BAT Justification for Odour Prevention**

| Indicative BAT | Justification |
|---|---|
| The Operator should maintain the containment and manage the operations to prevent its release at all times | All waste movements will take place within the process building. Doors will be closed during processing. The building will be kept at negative pressure and the air inside the building will be exhausted via the scrubber and biofilter as covered by the extant permit |
| For existing installations, the releases should be modelled to demonstrate the odour impact at sensitive receptors. The target should be to minimise the frequency of exposure to ground level concentrations that are likely to cause annoyance | Air dispersion modelling has been undertaken and is discussed in detail in section 4 below |
| For new installations, or for significant changes, the releases should be modelled and it is expected that the Operator will achieve the highest level of protection that is achievable with BAT from the outset | Dispersion modelling has been undertaken. Impact is anticipated to be insignificant. The design and operational controls are covered by the extant permit, and are not affected by this variation application<br>They remain BAT and will prevent significant annoyance from odour |
| Where there is no history of odour problems then modelling may not be required although it should be remembered that there can still be an underlying level of annoyance without complaints being made | Measures in place are BAT and will prevent significant annoyance from odour |
| Where, despite all reasonable steps in the design of the plant, extreme weather or other incidents are liable, in the view of the Regulator, to increase the odour impact at receptors, the Operator should take appropriate and timely action, as agreed with the Regulator, to prevent further annoyance (these agreed actions will be defined either in the Permit or in an odour management statement) | Advisory. |
| Where odour generating activities take place in the open, (or potentially odorous materials are stored outside) a high level of management control and use of best practice will be expected | No outdoor waste treatment activities or storage |
| Where an installation releases odours but has a low environmental impact by virtue of its remoteness from sensitive receptors, it is expected that the Operator will work towards achieving the standards described in this Note, but the timescales allowed to achieve this might be adjusted according to the perceived risk | Measures in place are BAT and will prevent significant annoyance from odour |
| Enclosing odorous areas | The building, including the ATT facility, will be enclosed |
| Enclosing odorous waste all the way to the furnace | The building, including the ATT facility, will be enclosed |
| Confining waste to designated areas | The building, including the ATT facility, will be enclosed |
| Ensuring that putrescible waste is incinerated within an appropriate timescale | There will be no long term standing putrescible waste |
| Refrigeration of such waste which is to be stored for longer than | N/A |

| Indicative BAT | Justification |
|---|---|
| an appropriate timescale | |
| Regular cleaning and (for putrescible wastes) disinfection of waste handling areas | There will be no long term standing putrescible waste |
| Design of areas to facilitate cleaning | Facility is new and designed to ease cleaning |
| Ensuring that the transport of waste and ash is in covered vehicles, where appropriate | All appropriate vehicles will be covered |
| Ensuring good dispersion at all times from any release points | Release points have been designed aided by modelling to ensure adequate dispersion - see section 4 |
| Preventing anaerobic conditions by aeration, turning of waste and short timescales | N/A waste feed to the ATT facility is from the co-located permitted facility |
| Chlorination of waters being returned to STW or in storage drawing air from odorous areas at a rate which will ensure that odour is captured (all), and treating such extracted air prior to release to destroy the odours - see below | Potentially odorous air is treated using scrubber and biofilter prior to exhaust |
| The use of these techniques should obviate the need for odour masking or counteractants | Masking agents or counteractants are not required during normal operation |
| The use of odorous air e.g. air from the waste handling area or air displaced from tanks, as furnace air is an ideal way of treating odours. The quantity of contaminated air that can be handled this way is obviously limited by the needs of the furnace. A disadvantage is the need to consider provision for odour control when the incinerator is not operating | Potentially odorous air is treated using scrubber and biofilter prior to exhaust<br>It is not suitable for feed into the oxygen starved conversion processes |
| Biofilters | The extant permit covers the biofilter<br>This is not amended by this variation application |
| Scrubbing for odour control | The extant permit covers the scrubber<br>This is not amended by this variation application |
| Carbon filters | Carbon beds are not used at the installation |
| For a new plant it would normally be the case that the imposition of conditions achieving BAT also secures that no significant pollution (including odour) is caused | The proposed measures will prevent significant odour pollution |

## 2.3. MANAGEMENT TECHNIQUES

This section of the variation application corresponds to Part C2.1 of the application for variation form, describing the proposed management systems at the installation.

In particular this section provides information on the procedures and policies for the environmental management techniques to be used at the installation. Operations will be carried out in accordance with the company integrated management system. New Earth is currently certified to ISO14001 (as well as ISO 9001 and OHSAS 18001) at all IVC and MBT sites and head office. It is the intention to achieve certification at the Easter Langlee MBT Facility as soon as possible.

The site will be managed by a dedicated on-site team. They will have the required skills and experience to operate the facility in an efficient and proper manner. They will ensure compliance with the conditions of the permit and that effective operational and preventative maintenance procedures are in place to prevent impact on the environment.

The risks that the activities pose to the environment have been indentified and all reasonable actions are taken to prevent or minimise those risks. The site has documented procedures for:

- Operations
- Maintenance
- Accidents, Incidents and non-conformances
- Competence and training
- Managing documentation and records

These procedures are part of the integrated management system (IMS) which is accessible by all NES staff. The IMS documents are held electronically and regularly updated. A copy of the Environmental Permit along with this application will be available at all times, for reference by all staff working at the facility.

### 2.3.1. Operations and Maintenance

#### 2.3.1.1. Control of Operations That May Have an Adverse Impact on the Environment

Procedures are in place to cover all aspects of operations that may have an adverse impact upon the environment; the procedures are held in the IMS as detailed above. Consideration is given on how to minimise the environmental risks and impacts of the normal running of the site operations. These procedures cover:

- Operation of equipment
- Maintenance of equipment
- Material handling operations
- Spill contingency procedures

The procedures are reviewed and amended periodically. For example they may be amended under the following scenarios:

- Periodic review identifies an improved method of operation - the revised procedure will have a reduced or unchanged risk of impact upon safety, health and environment
- A need to amend procedures is identified following a near miss investigation
- A need to amend procedures is identified following an incident investigation
- Legislative requirements change resulting in a need to alter procedures

#### 2.3.1.2. Prioritising Plant/Equipment for Preventative Maintenance

The programme of planned preventative maintenance seeks to minimise the risk to safety, health and the environment by ensuring that all appropriate plant and equipment whose failure may lead to environmental impacts within the site are serviced and inspected on a regular basis. The manufacturer's inspection and maintenance schedules are followed where available. In particular, CEMS equipment will be subject to preventative maintenance and routine servicing and calibration by the supplier or in accordance with the supplier's instructions, and key spares will be held on site.

Whilst the maintenance programme will be followed to make sure that equipment does not fail, there may be faults, breakdowns or repairs needed at other times. In the event that this does happen, details of faults, breakdowns and repairs will be documented within the IMS as and when they occur. Faults and breakdowns will be investigated and the service schedule revised if necessary. Operations will be restored to normal as quickly as possible.

#### 2.3.1.3. Monitoring Emissions/Impacts

Appropriate monitoring regimes will be established and implemented, to ensure compliance with the conditions of the permit (see section 2.10). All monitoring equipment will be calibrated and records of calibration kept.

#### 2.3.1.4. Housekeeping

Detailed operating procedures, including housekeeping measures, will be in place as already required by the extant permit. The housekeeping procedures will be extended to include items such as:

- External areas – regular inspection around boundary fence and litter picking as required, and daily cleaning around high usage areas such as the weighbridge
- Reception area – during the day, regular clearing back into the buffer store of any spilt fuel, wash down of reception area floor if necessary so the floor is completely clean for the following day
- Ash loading area – inspection following each truck loading, any spilt ash will be cleaned up (i.e. by use of vacuum cleaners) and returned to the storage area
- Thermal plant area floor – daily inspection and wash down as required
- Reagent storage area – regular inspection
- Fuel feed hoppers – inspection and cleaning of any litter around hoppers on a daily basis
- Pests, vermin and flies – prevention and control as necessary

#### 2.3.1.5. Performance Review of Maintenance System

The maintenance system is already covered by the extant permit, along with an internal auditing programme, with audit reports and recommendations reported to senior management on a regular basis. This will be extended to include regular checks and formal inspections of 'static' items such as tanks, pipework, retaining walls, bunds and ducts in the ATT facility.

### 2.3.2. Competence and Training

The facility will be supervised by staff members who are suitably trained and fully conversant with the requirements of the permit. Training throughout New Earth follows a company training policy. The training and competence required of each position on-site are identified and summarised in the training matrix. Training requirements for each position are tabulated in the matrix, which provides details on the mandatory training requirements and those which may be relevant during career progression. Starting employees are given induction training. This covers:

- The regulatory requirements associated with the permit
- Likely potential environmental impacts that might be caused by plant under their control (both normal and abnormal operations)
- Reporting procedures to inform managers of deviations from permit conditions
- Procedures to be used by managers for reporting of deviations to SEPA
- Prevention of accidental emissions and procedures to be taken if they do occur

Employees are only permitted to perform procedures that they have been trained for. All positions are trained in the requirements of the permit for the procedures they are permitted to undertake and in accordance with other relevant legislative requirements. The training and competence required for contractors is also identified as part of the company training policy. Contractor training records are evaluated and kept on site as part of the tender process. All contractors are given an induction prior to starting work on site. Competency records are kept for each member of staff. These record the date and type of training undertaken, the training provider and how the skills and training received met the training requirements. They also identify future training needs.

### 2.3.3. Accidents/Incidents/Non-conformance

Procedures for investigating incidents and non-conformances as well as the corrective action to take are provided in the IMS. Incidents that require investigation include any malfunction, breakdown or failure of plant, equipment and techniques and any near misses. Details of the accident management plan as extended to the ATT facility are provided in section 2.8. This will be subject to periodic review, and will also be reviewed as a result of any accidents, incidents, near misses etc. to ensure that it remains appropriate to the nature and scale of the facilities operations. A formal written procedure is in place for reporting, recording and investigating incidents and near-misses. Staff are trained in detecting abnormal operations (see competence and training above). In the short-term, procedures are followed to ensure normal operation is resumed. In the long-term, steps are taken to prevent the problem happening again. There is a formal written procedure to cover the reporting of non-conformances, assigning actions and tracking to completion of the actions. Details on reporting monitoring results are provided in Section 2.10 of this document. There are documented procedures for handling, investigating, communicating and reporting complaints, and tracking the completion of corrective actions.

### 2.3.4. Organisation

There will be a facility manager who will have overall responsibility for compliance with the permit. We do not yet have a staff structure diagram, but the intention is for the staff to cover a 4 on 4 off continental shift pattern. The staff structure will include appropriate managerial, technical and administrative staff. New Earth Solutions

Group has a published Quality and Environmental Policy Statement, relevant to all existing and future facilities, signed by the Managing Director. This:

- Contains a commitment to continual improvement and prevention of pollution
- Includes a commitment to comply with relevant legislation and other requirements to which the organisation subscribes

This policy is held in the company IMS and reviewed regularly as necessary. There is a formal management programme which identifies, sets, monitors and reviews environmental objectives and targets, independently of the permit. The procedures used to manage the environmental performance of the facility will be subject to an auditing programme, which will be completed at least annually. This programme will ensure that the following objectives are attained:

- Identification that the management system is being implemented in accordance with the defined written procedures
- The management system including written procedures is appropriate, effective and meets all relevant legislative and good practice standards
- A general assessment of environmental performance and identification of areas for improvement

The following documentation pertinent to effective environmental management of the installation will be stored and controlled appropriately:

- Policies
- Roles and responsibilities
- Targets
- Procedures
- Monitoring records
- Results of audits
- Results of reviews

These measures represent BAT for management at the installation, as varied by this application. The BAT justification for management is provided in the table below.

Table 18. BAT Justification for Management

| Indicative BAT | Justification |
|---|---|
| **Operations and Maintenance** | |
| Documented control procedures | Appropriate documented procedures are in place and will be maintained as described above |
| Documented preventative maintenance management procedure | Appropriate documented procedures are in place and will be maintained as described above |
| Documented emissions and impacts monitoring procedure | Appropriate documented procedures are in place and will be maintained as described above |
| Preventative maintenance programme | Appropriate documented procedures are in place and will be maintained as described above |
| Auditing system | Appropriate documented procedures are in place and will be maintained as described above |
| **Competence and Training** | |
| Awareness (permit requirements, potential environmental effects, non-conformance reporting, preventative and corrective action) | Awareness training is delivered to all staff |
| Skills and competencies for key posts and training needs and records | Training requirements for all posts identified |
| Contractor environmental risk assessment and environmental protection instructions | Procedures to carry out risk assessments of contractors' work are in place |
| Industry standards and codes of practice for training | Industry standards to be followed where applicable |
| **Accidents/Incidents/ Non-Conformance** | |
| Accident plan | Accident plan developed (see section 2.8) |
| Documented non-compliance management procedures | Appropriate documented procedures are in place and will be maintained as described above |
| Documented complaint management procedures | Appropriate documented procedures are in place and will be maintained as described above |
| Documented incident management procedures | Appropriate documented procedures are in place and will be maintained as described above |
| **Organisation** | |
| Environmental policy | Environmental policy is in place |
| Environmental improvement programme | Environmental improvement programme is part of the company integrated management system |
| Facility change management procedures | Appropriate documented procedures are in place and will be maintained as described above |
| Capital approval and purchasing policy | Appropriate documented procedures are in place and will be |

| Indicative BAT | Justification |
|---|---|
| | maintained as described above |
| Operational audits | Appropriate documented procedures are in place and will be maintained as described above |
| Annual reporting | Appropriate documented procedures are in place and will be maintained as described above |
| Formal management system | A formal integrated management system is in place as described above |
| Record keeping | Appropriate documented procedures are in place and will be maintained as described above |

## 2.4. RAW AND AUXILIARY MATERIALS

This section of the variation application corresponds to Part C2.2 – C2.5 of the application for variation form, describing the proposed changes to raw and auxiliary materials at the installation and to the measures to prevent waste arising.

In particular it identifies changes to raw and other materials, other substances and water associated with the ATT facility. This section does not amend the raw materials description covered by the extant permit.

A range of raw materials will be used at the facility, some of which will be large stock items used in the thermal conversion process itself and others will be small quantities used for general maintenance purposes. Information regarding the use of raw materials is provided below. As the facility is not yet operational and in the final stages of design, the proposed quantities of each material should be considered indicative and are based on comparable operations and the development and trialling process. Similarly, the volume of the bulk storage should also be considered indicative.

### 2.4.1. Raw Material Selection

An inventory of the raw materials used in the ATT facility is included below. Those materials which are maintenance consumables are not listed here, as they will be used in low volumes and are considered to have minimal environmental impact. The table also includes details on the use of the material, quantity likely to be used, storage arrangements, the fate of the material and any alternatives considered. Where alternatives are not considered, a justification of the choice of material is included.

In answer to question C2.4 of the application for variation form, no disposal to land of List I or List II substances is anticipated during normal operation. Measures to prevent fugitive emissions are discussed in section 2.2 above.

In answer to question C2.5 of the application for variation form, no disposal to controlled water of substances defined in Directive 76/464/EEC (the Dangerous Substances Directive) is anticipated during normal operation. Measures to prevent fugitive emissions are discussed in section 2.2 above.

#### 2.4.1.1. Flue Gas Treatment Reagents

The use of flue gas treatment reagents (powdered activated carbon and sodium bicarbonate) and dosing chemicals for the pyrogas quench (sodium hypochlorite and sodium hydroxide are discussed in section 2.1 above. The materials selected will be appropriately stored inside the process building, with secondary containment provided with capacity >110% of the container, or >25% of the total container capacity where multiple containers are stored on the same containment.

#### 2.4.1.2. Support Fuel

Diesel will be used to start up and support the energy plant, although in normal operation, the heat for pyrolysis is supplied by the gasifier syngas combustion exhaust gas on each NEAT line.

#### 2.4.1.3. Hydraulic and Lubricating Oils

Small quantities of hydraulic and lubricating oils are required for plant and machinery, and for oil changes in the CHP engines. Oil changes typically occur every 1,500 operating hours or 5 times per year, with each change of 600 litres per fill. Estimated quantity is therefore 3,000 litres per engine per annum.

Oils will be appropriately stored inside the process building, with secondary containment provided with capacity >110% of the container, or >25% of the total container capacity where multiple containers are stored on the same containment. Waste oils will be sent for recycling/recovery at a suitably permitted facility, which further reduces the environmental impact of its use.

#### 2.4.1.4. Raw Material Quality Assurance

Materials will be supplied through negotiated contracts, which will specify the required performance and quality criteria for the relevant material.

#### 2.4.1.5. Raw Materials Review

New developments in raw materials will be kept under regular review. Suitable materials with improved environmental profiles will be substituted over those specified in the inventory whenever possible. We are committed to improving the environmental performance of the installation, and will continue to explore new and improved technologies.

#### 2.4.1.6. Incoming Fuel Composition

The incoming fuel is a pre-prepared waste derived fuel material that comprises the residual fraction arising from the processing of municipal solid wastes (MSW) and commercial MSW-like wastes. This fuel will not be hazardous due to the pre-processing and fuel specification requirements, and will not contain significant chlorinated or halogenated components. It is possible that there may be a small degree of variation in the composition of incoming fuel from load to load; however, these will be very minor variations, and will not deviate from the ranges in the fuel specification. Further information on the incoming fuel specification is included in section 2.1.

Table 19. Raw Materials Inventory

| Material | Use | Annual Quantity (approx) | Storage Arrangements | Properties/ Active Ingredients | Fate of Material | Environmental Impact | Alternatives Considered/ Justification |
|---|---|---|---|---|---|---|---|
| Fuel | Fuel used to generate pyrogas which is combusted to produce energy | 24,000 tonnes | Stored in buffer stores in the ATT facility (post drying) | Combustible fraction of residual municipal, commercial and industrial waste | Thermally converted to ash | Reduction in landfill use<br>Generates emissions to air and residual ash | Material is an essential component to the process<br>Beneficial use of waste |
| Sodium bicarbonate | Flue gas treatment reagent | 134 tonnes | Stored in FIBC bulk bags. | Sodium bicarbonate | Reacts with acid gases to form sodium salts, which are discharged from bag filter<br>Disposal at hazardous landfill | Consumption of raw material<br>Landfilling of hazardous waste | Sodium bicarbonate is a more efficient sorbent than lime<br>Standard substance in this application |
| Powdered activated carbon | Flue gas treatment reagent | 4 tonnes | Stored in FIBC bulk bags | 80-90% carbon | Discharged from bag filter<br>Disposal at hazardous landfill | Consumption of non-renewable raw material<br>Landfilling of hazardous waste | Standard substance in this application |
| Sodium hypochlorite | Quench dosing chemical | Up to 200m$^3$ | Stored in containers IBCs | 45% sodium hypochlorite solution | Discharged from quench to gasifier<br>. | Emissions to air | Standard substance in this application |
| Sodium hydroxide | Quench dosing chemical | Up to 200m$^3$ | Stored in containers IBCs | 45% sodium hydroxide solution | | | Standard substance in this application |

| Material | Use | Annual Quantity (approx) | Storage Arrangements | Properties/ Active Ingredients | Fate of Material | Environmental Impact | Alternatives Considered/ Justification |
|---|---|---|---|---|---|---|---|
| Diesel | For thermal plant start up/shut down, operation of auxiliary burners and operation of standby generator | 20,000l | Stored in 3,000 litre tank | Diesel | Combusted | Consumption of a raw material.<br>Emission of combustion gases to atmosphere | Typically used for thermal plant start up |
| Hydraulic and lubricating oils | Use in plant and machinery | Engine lubrication oil – up to 12,000 litres<br>Hydraulic oil – 50 litres | Stored in drums within a bunded area. | Mineral oils | Disposal to thermal process or to waste oil re-processor | Consumption of a raw material | No alternatives identified |
| Span gases | For CEMS spanning | HCl - 50 litres<br>Tri Mix (NO, $SO_2$, CO) - 50 litres<br>$C_3H_8$ - 50 litres<br>$O_2$ - 50 litres<br>$N_2$ - 100 litres<br>$H_2$,He - 300 litres | Compressed gas bottles | Various gases | Emission to air | Consumption of a raw material | No alternative identified – requirement of equipment supplier |

These measures represent BAT for raw materials at the installation, as varied by this application. The BAT justification for raw material selection is provided in the table below.

**Table 20. BAT Justification for Raw Materials**

| Indicative BAT | Justification |
|---|---|
| Alkaline reagents | Sodium bicarbonate for FGT, sodium hypochlorite and sodium hydroxide for scrubber dosing selected as BAT |
| Powdered activated carbon | Selected, BAT for heavy metal and dioxin removal (see SGN and Section 2.2.1) |
| Ammonia and Urea | Not used – SCR and SNCR are not BAT for the installation |
| Sodium Bicarbonate | Sodium bicarbonate is a more efficient sorbent than lime, so is selected as BAT |
| Support fuels - fuel oil | Diesel will be the backup fuel |
| Lube oil | Manufacturer's recommendation for CHP engines |
| Dispersants/surfactants | None currently specified |
| Biocides | Not used as there is no boiler |
| Incoming waste stream composition identification | Only pre-prepared fuel is accepted from the consented waste facility, as described in section 2.1 |
| Plant design for incoming waste stream | The plant is specifically designed to accommodate the waste specification set out in section 2.1 from the permitted waste facility, and can deal with variations in fuel composition |

### 2.4.2. Waste Minimisation Audit

The purpose of conducting waste minimisation audits is to minimise the use of raw materials at the installation.

#### 2.4.2.1. Waste Audit

We will develop a programme of waste minimisation audits to ensure that an audit is carried out at least once every 4 years. The first audit will be undertaken within 2 years of permit issue and will include the following:

- Methodology used
- Analysis of raw materials used
- Assessment of opportunities for reduction
- An action plan for improvements

This will be submitted to SEPA within 2 months of completion.

The use and fate of all raw and other materials, including by-products, support fuels and abatement agents will be mapped onto the process flow diagram. This will be based upon the raw materials inventory, as well as other company data where appropriate.

Data will be incorporated for each principal stage of the operation, which will enable the calculation of the actual mass balance of the operation. This will then be used to assess opportunities to improve efficiency and reduce waste generation. Following this, an action plan will be prepared which will set out a timescale for the implementation of the improvements. We would anticipate that this would focus on the optimisation of the FGT and scrubber quench dosing regime.

#### 2.4.2.2. Feedstock Homogeneity

Only a pre-prepared fuel will be accepted from the permitted waste facility, which is part of the installation as varied by this application and under our control. We are therefore able to ensure that a homogenous material is supplied. Any direct deliveries of similar wastes to the installation will be subject to the same specification. The material pre-acceptance and acceptance procedures and fuel specification are discussed in section 2.1 above.

#### 2.4.2.3. Furnace Conditions

The proposed operation is a pyrolysis and gasification process, and therefore does not include a furnace. The pyrolysis and gasification processes have been designed to be as efficient as possible; temperature and residence times can be adjusted in accordance with the fuel being put through the process if necessary.

#### 2.4.2.4. Flue Gas Treatment Conditions

Flue gas treatment is discussed further in section 2.2.

#### 2.4.2.5. Waste Management

Waste management is discussed in detail in Section 2.5.

These measures represent BAT for waste minimisation at the installation, as varied by this application. The BAT justification for waste minimisation is provided in the table below:

**Table 21. BAT Justification for Waste Minimisation**

| Indicative BAT | Justification |
|---|---|
| Waste audit | Waste audits will be carried out every 4 years, with the first being undertaken in the first 2 years of operation |
| Feedstock homogeneity | A homogenous fuel is used in this process |
| Furnace conditions | There is no furnace in this process; the NEAT process has been designed to maximise efficiency and deliver genuine CHP, as discussed in section 2.7 below |
| Gas treatment conditions | See section 2.2 above |
| Waste management | See sections 2.5 & 2.6 below |

### 2.4.3. Water Use

Water use throughout the operations at the installation as varied by this application will be minimised, as discussed in section 2.2 above. As a natural resource, efforts will be made to use water prudently. The installation does not require high volumes of water, however it is required at various stages of the process and we will use harvested rainwater wherever possible.

#### 2.4.3.1. Mains Water Use

Mains water will generally be used to top up harvested rainwater for amenities, cleaning, fire-fighting. Water meters will be fitted for each of these uses. In addition, a water meter is fitted to the incoming main.

#### 2.4.3.2. Rainwater Use

In order to minimise the use of mains water, rainwater will be harvested at the installation, and stored in a clean water storage tank. The rainwater tank will have a capacity of 600m$^3$ and the water will be used for the following purposes:

- Wash-down water (with hosepipes fitted with trigger controls where practical)
- Firewater
- As a source of grey water for appropriate domestic uses

During dry weather conditions, it may become necessary to use the mains water supply to meet these demands.

#### 2.4.3.3. Water Audit

A water minimisation audit will be undertaken within 4 years of permit issue, and this will be submitted to SEPA within 2 months of completion. Following this, an audit will be carried out at least once every 4 years. The audit will identify opportunities to improve water efficiency by taking the following approach:

- Use of water flow diagrams and mass balances to map water usage
- Establish water efficiency objectives within identified constraints
- Identify opportunities for reduction
- Develop an action plan to implement the improvements

#### 2.4.3.4. Reduction at Source

Throughout the conceptual and design stages, opportunities to minimise water use have been reviewed and implemented in the plant design. Water usage has been minimised by the use of closed systems and rainwater harvesting to allow for recycling of water where practicable.

#### 2.4.3.5. Minimising contamination risk

Measures to minimise the contamination risk to surface water and groundwater are identified and discussed in section 2.2 above.

These measures represent BAT for water use at the installation, as varied by this application. The BAT justification for water use is provided in the table below.

**Table 22. BAT Justification for Water Use**

| Indicative BAT | Justification |
|---|---|
| Water minimisation audit | An audit will be undertaken at least once every 4 years, with the first taking place within 2 years of the permit being issued |
| Reduction at source | Water usage has been minimised by incorporating closed systems and rainwater harvesting into the installation design |
| Minimising contamination risk | Details in section 2.2 |
| Benchmarks for water consumption | No relevant benchmarks included in Sector Guidance Note SGN IPPC S5.01 |
| Other techniques for reducing gross water use | All possible measures we are aware of have been incorporated into the design, but this will be reviewed as a result of the water audits undertaken |
| Recycling of water | Cooling loops are closed systems that re-circulate water. Rainwater will be stored and used for wash-down activities, fire fighting and as grey water feed |

## 2.5. WASTE MANAGEMENT, STORAGE AND HANDLING

This section of the variation application corresponds to Part C2.6 of the application for variation form, describing the proposed changes to prevention of waste arising.

In particular, it characterises and quantifies the changes of each waste stream, or new waste streams expected from the installation as varied by this application, and describes the proposed measures for waste prevention and reduction.

### 2.5.1. Waste Handling

This type of process does not inherently produce a large volume of waste. However, it is recognised that it is important to identify measures for waste prevention and reduction whenever possible.

#### 2.5.1.1. Waste Streams

Waste streams unaffected by this variation application, and already covered by the extant permit, will include the neutralised scrubber solution, biofilter medium and front end waste rejects. The main waste stream that will no longer be produced by the installation is the process effluent from the biostabilisation process.

The main new waste streams arising from the operations are considered to be the following:

- Ash – 4,320 tpa worst case (based on 16.8% dry matter)
- Bag filter residue – up to 300 tpa
- Condensate from the drier – 9,400 tpa
- Aqueous effluent from the pyrogas quench – 4,320 pa of which 1,520 tpa routed to the gasifier, 2,800 tpa sent for disposal
- Waste oil – up to 12,000 litres per annum

#### 2.5.1.2. Waste Documentation and Records

A waste control system will be operated at the facility in order to demonstrate compliance with Duty of Care. This will form part of the company's integrated management system, which is described in detail in section 2.3. This will ensure that waste is handled, stored, and recovered/disposed of in a manner that minimises impact on the environment. The system includes procedures for waste storage, waste security, record keeping, contractor selection and auditing.

#### 2.5.1.3. Waste Segregation

The waste streams arising from the installation will be collected, stored and handled separately in order to prevent cross-contamination and enable effective and efficient waste handling. This will also assist with opportunities for re-use or recycling offsite.

#### 2.5.1.4. Ash Handling

Ash will be produced from the gasification process. The ash will be stored in the ash bunker within the building, and removed from site when required using covered or enclosed vehicles. Throughout the handling of ash, measures will be implemented in order to minimise dust becoming airborne. This can be achieved by the incorporation of containment facilities and/or dust suppression sprays. Ash will be passed through an ash bath after leaving the gasifier, using recovered water for this function when practicable. Adequate cleaning equipment, such as a vacuum cleaner, will be provided to enable the prompt and effective clean up of any spilled ash. The building is bunded in order to retain spillages.

##### 2.5.1.4.1. Bag Filter Residue Handling

The bag filter residues arising from the flue gas treatment process are likely to be classed as hazardous waste and as such are likely to be disposed of to hazardous waste landfill. The residue will be collected using a bagging system. The residue will fill fabric intermediate bulk containers (FIBCs) or similar, located in the plant building, and these will be loaded into a covered or enclosed lorry and removed from site. We will continue to investigate economically viable re-use or recovery options, although none have been identified to date.

The quantity of residue produced is dependent upon the amount of sodium bicarbonate and powdered activated carbon that is used to abate emissions from the facility. Typically, production of residue is around 5% of waste throughput although we will seek to optimise the dosing regime once the plant is operational to minimise the waste generated.

##### 2.5.1.4.2. Recovered Waste Fractions

Owing to the composition of the feedstock used in the facility, it is unlikely that there will be any recoverable waste fractions. Any such fractions will be sent for recycling as already covered by the extant permit.

### 2.5.2. Rejected Feedstock

The feedstock will mainly be supplied from the fuel preparation facility that is part of the same installation; therefore the feedstock is from a known source under our control, and will have been prepared in accordance with the fuel specification described in section 2.1 above. Consequently, all feedstock that is supplied to the installation will be fit for use and none should be rejected. However, inspection procedures will be in place as discussed in section 2.1 above. Any rejected fractions will be sent for recycling or disposal as already covered by the extant permit.

These measures represent BAT for waste management, storage and handling at the installation, as varied by this application. The BAT justification for waste management, storage and handling is detailed in the table below.

Table 23. BAT Justification for Waste Management, Storage and Handling

| Indicative BAT | Justification |
|---|---|
| **General** | |
| System | A control system will be in place to demonstrate Duty of Care |
| Records | All records will be held to demonstrate Duty of Care |
| Prevention of emissions | All residue handling will occur within the building, and transportation will be using covered or enclosed vehicles |
| Segregation | Wastes will be handled separately |
| **Ash Handling** | |
| Segregation | Ash will be handled separately from bag filter residue |
| Dust prevention | Ash will be handled wet, and dust suppression sprays will be used. Ash will be stored in suitable containment facilities (ash bunker inside the building) |
| **Bag Filter Residue Handling** | |
| Segregation | Residues will be handled separately from ash and other waste streams |
| Storage | Residue will be kept dry, except if there are spillages<br>The residue will be collected in bags (fabric intermediate bulk containers (FIBCs) or similar and loaded directly into suitable containers for storage<br>It will be removed from the site in these containers (Rollonoff or similar) |
| **Recovered Waste Fractions** | |
| Minimisation | The feedstock is prepared in the permitted waste facility<br>Recyclables have already been recovered during pre-processing of the residual waste through the mechanical sorting process<br>It is therefore not envisaged that there will be additional recoverable wastes |
| **Rejected Feedstock** | |
| Minimisation | Due to the processing of the waste into a suitable fuel prior to transfer to the facility, the feedstock will be homogenous and meet the required specification<br>Therefore there should not be rejected feedstock |
| Inspection | Incoming waste will be inspected, and audits of composition will be carried out as required. |

## 2.6. WASTE RECOVERY AND DISPOSAL

This section of the variation application corresponds to Part C2.7 of the application for variation form, describing the proposed changes to recovery or disposal of waste streams from the installation.

In particular, it describes how new waste streams expected from the installation as varied by this application are recovered and if it is technically and financially impossible to recover the waste, describes how the waste is disposed of avoiding or reducing any effect it has on the environment.

This variation application does not amend the waste recovery and disposal arrangements covered by the extant permit. The types and quantities of new waste generated at the installation with the addition of the ATT facility are detailed below. These are based on a fuel input of 24,000 tpa, with the availability of plant and waste CV as described in section 2.1 above.

- Ash – 4,320 tpa worst case (based on 16.8% dry matter)
- Bag filter residue – up to 300 tpa
- Condensate from the drier – 9,400 tpa
- Aqueous effluent from the pyrogas quench – 4,320 pa of which 1,520 tpa routed to the gasifier, 2,800 tpa sent for disposal
- Waste oil – up to 12,000 litres per annum

IED Article 53(1) requires that residues shall be minimised in amount and harmfulness. Typically, energy from waste (EfW) plants produce 0.242kg ash residue per kg of waste incinerated[5], which is equivalent to 24.2 % ash. This would equate to approximately 5,808 tonnes at the installation at Easter Langlee based on an annual throughput of 24,000 tonnes. The EU BRef document (Draft March 2004, Chapter 3.4) indicates bottom ash generation of 200-350 kg per tonne of waste incinerated (4,800 – 8,400 tonnes for Easter Langlee) and 7-45kg APC residue per tonne of waste incinerated for dry sorption techniques (168 – 1,080 tonnes bag filter residue for Easter Langlee). However, it is anticipated that approximately 4,320 tonnes of ash (16.8%) and up to 300 tonnes of bag filter residue will be produced per year at the Easter Langlee facility, indicating that this installation is likely to produce less waste than a typical EfW plant. Therefore, this requirement of IED is satisfied.

### 2.6.1. Re-use/Recycling of Ash

Ash will be transferred off-site with the intention of obtaining contracts for recovery or re-use. Such contracts have not yet been signed, but we are in the process of investigating the market. In the event that an economically viable recovery or re-use route is identified, this will be the preferred option rather than disposal. However, in the absence of such a route, disposal may still be required.

Residues from the gasifiers are subject to IED Article 50(1), which requires residue to have total organic carbon (TOC) content < 3% by dry weight, or to have <5% loss on ignition. All ash residues will be sampled quarterly for loss on ignition (LOI) or total organic carbon (TOC) prior to removal from site.

[5] Source: Energy from Waste: A Good Practice Guide, CIWM, November 2003

IED Article 53(2) requires residue transport and intermediate storage to be undertaken in a manner to prevent release of residue to the environment. The measures described above satisfy this requirement of IED.

### 2.6.2. Re-use/Recycling of Bag Filter Residues

To date, no opportunities for the recovery of bag filter residue have been identified. In the short term, the residue will be disposed of to a hazardous waste landfill site whilst options for recovery are explored further.

### 2.6.3. Re-use/Recycling of Condensate/Quench Effluent

The drier condensate is expected to have significant organic compound loading, and would not be suitable for re-use on site without significant treatment. This is not considered BAT, as the condensate is better treated at a suitably permitted facility with the correct techniques and sufficient throughput and capacity to make the treatment economically viable.

### 2.6.4. Recovery and Disposal Options

As discussed, ash will be sent for recovery where possible, with a likely market being the aggregates industry. In the absence of an economically viable market it will be sent for disposal. Quarterly testing for LOI or TOC will allow its composition to be monitored. We are not aware of any SEPA guidance or protocols for ash sampling, so we will use the Environment Agency ash sampling protocol[6] unless otherwise advised by SEPA. This monitoring will ensure the avoidance of environmental consequences arising from the subsequent use or disposal of ash.

Bag filter residues are likely to be classed as hazardous waste as they contain the contaminants removed from the flue gas. To date, no recovery options have been identified, and although we will continue to investigate potential re-use options, in the meantime it will be sent for disposal at a hazardous waste landfill site.

Drier condensate will be routed to one of the two bulk dirty water tanks and removed by tanker for treatment at a suitably permitted facility. We aim to achieve 20% moisture content for the waste feed to pyrolysis units, to maximise energy efficiency, as discussed in section 2.7 below. Therefore, the amount of condensate generated is a function of the moisture content of the waste incoming to the installation, and is outwith our control. Reducing the condensate by less effective drying would reduce the amount of renewable energy and thermal efficiency of the ATT facility and would therefore not represent BAT.

### 2.6.5. Environmental Impacts

The recovery and re-use options discussed allow for the minimisation of environmental impacts off site. The re-use of ash, potentially in the manufacture of aggregates, reduces the amount of raw materials needed for this use and the significant amounts of energy involved in the manufacture of these raw materials. The quarterly testing of this waste stream enables the prevention and mitigation of any environmental impacts of these ash wastes themselves.

The process control systems in place ensure that the generation of wastes which are destined for disposal to landfill is minimised.

[6] Guidelines for Ash Sampling and Analysis, Version 6, Environment Agency, March 2011

The Duty of Care system that will be implemented allows for waste carriers and the operators of waste disposal/recovery sites to be properly audited. This will help to prevent or minimise the environmental effects of these residues, both in their transportation and end use.

These measures represent BAT for waste recovery and disposal, in that all waste types will be dealt with as high up the waste hierarchy as possible. The BAT justification for waste recovery and disposal is detailed in the table below.

**Table 24. BAT Justification for Waste Recovery and Disposal**

| Indicative BAT | Justification |
|---|---|
| Re-use/recycling of ash | Segregation of waste streams allows the recovery of gasifier ash<br>Recovery of FGT ash is thought unlikely to be available but will be investigated<br>Composition of ash is monitored quarterly for TOC or LOI |
| Recovery of condensate | This is not economically viable, condensate will be tankered off site for treatment |
| BPEO (Best Practicable Environmental Option) for disposal | Waste will be dealt with as high up the waste hierarchy as possible, which is as follows, in priority order:<br>• Prevention<br>• Preparation for re-use<br>• Recycling/reclamation<br>• Other recovery (e.g. energy recovery)<br>• Disposal (e.g. landfill)<br>The environmental consequences of the recovery/disposal options chosen have been considered and monitoring will be undertaken accordingly<br>Duty of Care system monitors and audits hauliers and operators |
| Departures from H1 | All wastes that are generated are reused or recycled as far as practicable |
| Justification of no re-use | All waste streams will be dealt with as high up the hierarchy as possible<br>Reuse of condensate is not possible and onsite treatment is not economically viable<br>To date there have been no viable recovery options identified for bag filter residue although this will continue to be investigated |
| Waste disposal/recovery audit | Waste minimisation audits will be implemented to ensure that waste prevention is placed at the top of the agenda at the installation<br>Ongoing research to source economically viable markets for wastes that offer least environmental impact will be carried out |

## 2.7. ENERGY

This section of the variation application corresponds to Part C2.8.1 – C2.8.3 of the application for variation form, describing the proposed changes to energy efficiency at the installation.

This section looks at energy efficiency, illustrating BAT by demonstrating that the basic energy requirements and the sector specific energy requirements listed in the sector guidance are met. This section also makes reference to the heat and power plan, attached as Appendix E, which has been generated to demonstrate the genuine CHP nature of the facility, and SEPAs Thermal Treatment of Waste Guidelines 2009.

There is no Climate Change Agreement (CCA) or Direct Participation Agreement (DPA) within the Emissions Trading Scheme in place for the installation.

The primary purpose of this facility is the generation of energy from a pyrogas product gas produced through the pyrolysis of pre-treated waste. The pyrogas will be produced by the four New Earth Advanced Thermal (NEAT) staged pyrolysis and gasification units, each feeding an electrical power producing reciprocating CHP engine with heat recovery from both jacket cooling and flue gases. The ATT facility, incorporating the CHP plant, will improve the energy efficiency of the existing facility as a whole and provide a source of renewable electrical and thermal energy for export to local customers. To this end, the facility has been designed from the outset for optimum energy recovery from the renewable energy source available on site.

The facility can operate at two extremes; either generating maximum electricity output, or generating steam and hot water with little electricity generation (sufficient to cover the electrical parasitic load of the plant). The heat and power plan attached to this application has been generated to maximise the overall efficiency of the facility by maximising as far as possible both the onsite heat recovery and the direct steam and hot water off take.

### 2.7.1. Heat Recovery and Export

The calorific value of the fuel has been assessed as 13MJ/kg (3.1kW/kg) or 312,000,000MJ per annum (74,666 MWh per annum). Pyrolysis of this feedstock will produce a continuous gas output with a CV estimated at 18.7MJ/Nm$^3$ (gross CV) and 17MJ/Nm$^3$ (net CV). Three NEAT units and three gas engines will be in continuous operation. The planning assumption of engine efficiency is around 32%, producing a net output of 2.7MW$_e$ across the plant.

Heat recovery will be from two sources within the process, in particular the engine cooling jacket and hot exhaust gas.

Heat from jacket cooling, estimated output 3.0MW$_{th}$, will be recovered through a collection tank and heat exchangers for re-use in the waste treatment processes to improve recyclate production in the post-drying phase, and improve material handling and to operate the drier. The reduction in fuel moisture content in the drier to around 20% improves the energy efficiency of the ATT process. The benefits of the drier in terms of BAT for the overall energy efficiency of the ATT process are discussed in section 2.1 above. However, this heat can be diverted back into a district heating system in the event that waste drying is suspended, allowing the CHP engines to continue operation and ensuring continuity of heat recovery. In addition, conventional engine cooling by air blast coolers (ABCs) will ensure that engines can remain fully operational regardless of the operational status of the dryer.

Waste heat from engine flue gases will be recovered by plate heat exchangers and transferred by a large collection / buffer tank accumulator to feed a planned district heating system. This output is estimated at around $2.0MW_{th}$ at the stack, with an outflow temperature to collection of $120^0C$. For the purposes of helping with the planning of a district heating system, a continuous export potential of $1.2MW_{th}$ is assumed. This may eventually be increased to $2MW_{th}$.

It is not usually considered economically viable to recover the low grade heat from the intercooler and oil cooler for CHP engines.

It is anticipated that the district heating system will be managed from an energy centre located within the facility. The feed will go to a large (estimated 55,000 litre) heat buffer/ accumulator which will feed the main district heating circuits. It should be noted that a gas main runs close to the site, giving a capacity to replace in full the exported heat and provide resilience in case of heat export failure from the plant and also to address any unusual peak heat load. This will also ensure complete hydraulic separation between the waste heat feed and district heating circuits. High temperature hot water from the accumulator, at $>100^0C$, will then be fed, via large plate heat exchangers, to the separate district heating circuits.

Potential heat customers and their likely demand have been identified in the vicinity, as summarised in section 4 of the heat and power plan. It is currently anticipated that there will be initially four circuits, each with the potential for an extension loop:

1. Langlee housing (Hawthorn Road, Broom Drive, Primrose Bank, Marigold Drive) with the potential for an extension loop to housing at Beech Avenue, Laurel Grove and Larch Grove to the west).
2. Netherdale, via Langlee Drive and Woodstock Avenue to Dale Street and High Mill, Borders College(with the potential for an extension later to Heriot-Watt University Residences at Tweed Street)
3. Melrose Gait, immediately south of the facility, primarily supplying the affordable housing to be provided in phases by local Registered Social Landlords (RSLs).
4. A further route north to serve agricultural and biomass/ wood drying developments.

The heat and power plan in Appendix E provides the P&IDs for the heat recovery system, the anticipated demand curves and supply lines. These show that demand management and buffer storage will help to avoid heat being wasted by filling the troughs and lopping the peaks in the supply curve. If heat does have to be spilled, the engine exhaust heat exchangers can be turned down. Where winter demand is such that heat recovery needs to be supplemented, a CHP engine heat recovery circuit may be diverted from waste drying to the system in exceptional circumstances, with care being taken to minimise the introduction of fuel that has too high a moisture content.

The heat rejected to atmosphere (estimated at 7.0% of the total heat rejected from the engines) comprises the radiant losses from the engine itself plus certain ancillary equipment. There is also low grade heat potentially available from the intercooler and oil cooler. The recovery of these is not economically feasible and is not considered to represent BAT for Easter Langlee.

### 2.7.2. Electrical Power Export

Gross electrical output will be in the region of 2.9MW$_e$. Parasitic loads for fuel feed, pumps, controls, heat exchangers, etc. will be in the region of 180KW$_e$, giving an export potential of 2.72MW$_e$ net. On the basis of an industry standard Power Purchase Agreement (PPA) based on 8,000 hours per annum, this will provide an annual export of around 21.76GWh$_e$. Export will be by an 11KV underground cable (3 phase, 50 Hz) to connect to Scottish Power Energy Networks (SPEN) in the vicinity of the junction of Tweed Road and Winston Road, Galashiels at OS Grid Reference NT 350840/634664.

### 2.7.3. Power Generation Efficiency

A previous audit of the MSW collected from across Scottish Borders Council's area has been produced and is attached to the heat and power plan. In addition, survey data from the Zero Waste Scotland (ZWS) report[7] provides comparable data from a number of local authorities with similar economic and demographic profiles to Scottish Borders. The assessed calorific value of the fuel is 13MJ/kg (3.111kWh/kg) or some 312,000,000MJ per annum (74,666 MWh per annum).

Pyrolysis of this feedstock will produce a continuous gas output with a CV estimated at 18.7MJ/Nm$^3$ (gross CV) and 17MJ/Nm$^3$ (net CV). The energy produced from the fuel and the outputs for electricity and the two heat sources are shown below. These figures are the basis for the QI calculations shown in section 6 of the heat and power plan.

From these data the following performances are derived. For full details of the QI calculations, please refer to section 6 of the heat and power plan in Appendix E.

SEPA's guidance document IPPC S5.01 Issue 1 July 2004 (pg 94) expects "9 MW of electricity should be recoverable per 100,000 tonnes of annual waste throughput, depending on waste composition" for municipal waste incineration processes. The ability of the Easter Langlee ATT facility to generate 12.08MW per 100,000 tonnes fuel, compared with standard energy from waste incinerators that typically recover 9MW per 100,000 tonnes fuel, therefore demonstrates an excellent conversion rate, and represents BAT for the installation.

[7] "The Composition of Municipal Solid Waste in Scotland; Final report", April 2010, WasteWorks and AEA

**Table 25. Efficiency of CHP**

| Parameter | Value |
|---|---|
| Operating regime | 8,000 hrs per annum |
| Fuel processed | 24,000 tpa<br>3 tph |
| Gross CV of Fuel | 15.25 MJ/kg |
| Net CV of Fuel | 12.63 MJ/kg |
| Pyrogas produced | 1,874 $Nm^3$/hr |
| Pyrogas density | 1.049 kg/$Nm^3$ |
| Gross CV of pyrogas | 18.70 MJ/$Nm^3$ |
| Net CV of pyrogas | 17.00 MJ/$Nm^3$ |
| Gross pyrogas thermal energy content (GCV) | 9.73 MW |
| Net pyrogas thermal energy content (NCV) | 8.85 MW |
| Gross conversion efficiency | 76.6% |
| Net conversion efficiency | 84.08% |
| Engine electrical output | 2.90 $MW_e$ |
| Parasitic load | 0.20 $MW_e$ |
| Engine parasitic load | 0.04 $MW_e$ |
| Gross engine electrical efficiency | 29.79% |
| Net engine electrical efficiency | 32.77% |
| Heat in stack | 1.90 $MW_{th}$ |
| Heat in jacket water | 3.00 $MW_{th}$ |

**Table 26. Energy Outputs**

| Parameter | Value |
|---|---|
| Engine thermal input | 77,875 MWh |
| Engine electrical output<br>2.9MW x 8,000hours | 23,200 MWh |
| Engine heat output<br>1.2MW steam heat to district heating + 0.45MW parasitic load for waste drying<br>1.65MW x 8,000 hours | 13,200 MWh |
| Specific electrical energy generation | 2.90 $MW_e$ per 24,000 tonnes fuel<br>12.08 $MW_e$ per 100,000 tonnes fuel |

The overall efficiencies of the overall ATT process are therefore as follows:

**Table 27. Overall ATT Process Efficiencies**

| Parameter | Value |
|---|---|
| Power | 29.70% |
| Heat | 16.95% |
| Overall | 46.74% |

The char produced in the pyrolysis process is subsequently gasified, along with the tars generated in the pyrolysis process, with the syngas produced combusted to generate heat for the pyrolysis process. The emissions from this exhaust are subject to Annex VI of the IED. The efficiency of this heat-only generating process has been calculated separately as follows.

**Table 28. Thermal Efficiency of Gasification**

| Parameter | Value |
|---|---|
| Char produced | 0.22 tph |
| Gross char CV | 9.70 MJ/kg |
| Energy in char | 0.593 MW |
| Energy in pyrolysis tar | 0.195 MW |
| Energy absorbed by pyrolyser | 0.490 MW |
| Thermal efficiency | 62.20% |

### 2.7.4. Emissions Significance

The purpose of the facility is the avoidance of waste being sent to landfill, and therefore avoiding the methane generation that this would induce. Methane ($CH_4$) has a global warming potential (GWP) of up to 25, depending on the reference material, compared with $CO_2$ of 1. In addition, the facility combusts the product gas generated from the pyrolysis of the pre-treated waste to generate renewable heat and power. However, the ATT process does generate emissions of $CO_2$, through on site use of energy, and these are shown below for completeness.

**Table 29. Carbon Dioxide Emissions from Energy Used and Generated at the Installation**

| Energy Source | Primary Energy MWh | $CO_2$ Emission Factor kg/MWh | $CO_2$ Emissions (tonnes) |
|---|---|---|---|
| Electricity generated on-site including parasitic load and export | 23,200 | 911[1] | 21,135 |
| Electricity imported from the national grid | 50 | 166[2] | 8 |
| Diesel (gas oil)[3] | 196 | 250[2] | 49 |
| Total $CO_2$ emissions | | | 21,192 |

[1] Electrical energy generated on site = 23,200 MWh from 24,000 tonnes waste. There are no known associated SEC benchmarks for this sector. Associated environmental CO2 emissions for EfW have therefore been used. Assume 1kg MSW burned in an EfW incinerator generates 0.881 kg CO2, assuming 100% excess air (source: Table 6 - Energy from Waste: A Good Practice Guide, CIWM, November 2003). Total CO2 emissions from waste combustion are therefore 21,144 tCO2, therefore 0.911 t CO2 emitted per MWh electricity generated.
[2] Emissions factors taken from IPPC H2: Energy Efficiency, table 3. Value for ethane used (54.5kg/MWh).
[3] Annual diesel use estimated at 20$m^3$

Total $CO_2$ emissions from the ATT facility are therefore 21,192 tonnes $CO_2$ per year, or approximately 0.95 $tCO_2$/tonne waste, which includes an allowance for the start-up fuel and parasitic load. Against this, the generation of electricity from waste displaces the $CO_2$ emissions caused by the generation and distribution of electricity that would otherwise be supplied from the national grid. Diverting 24,000 tonnes of waste per annum from landfill also prevents the release of more potent greenhouse gases (specifically methane) through the biological decomposition of waste in landfill. Estimates of the avoided greenhouse gas emissions from displaced energy generation and waste diverted from landfill are shown below.

**Table 30. Avoided Carbon Dioxide Emissions**

| Energy Source | Supplied Energy, MWh | Primary Energy, MWh | $CO_2$ emission factor, t/MWh | $CO_2$ emissions, tonnes |
|---|---|---|---|---|
| Replacement of energy production from the public supply | 23,200 | 55,680 | 0.166 (1) | 9,242 |
| Prevention of emissions from landfill[1] | | | | 26,160 |
| Total avoided $CO_2$ | | | | 35,402 |

[1] Assuming a weighted gas generation rate of 1.09t of $CO_{2eq}$ per tonne of waste (Source: WME Environment Business Media http://www.wme.com.au/categories/waste_managemt/april4_07.php)

So it can be seen that even accounting for the $CO_2$ emissions form parasitic load and diesel use, there is a net saving of around 14,210 tonnes of $CO_2$ per annum by implementing the ATT at the installation.

### 2.7.5. Further Energy Efficiency Measures

Energy efficiency forms an integral part of the facility. This is driven by the need to maximise generation and hence the need to operate as efficiently as possible. To achieve this, various general measures will be implemented to ensure equipment on the plant is regularly maintained either to gain improvement of, or to sustain, the energy efficiency of the activity.

#### 2.7.5.1. Operating, Maintenance and Housekeeping Measures

All plant at the ATT facility is subject to the preventative maintenance programme which ensures that operational efficiency is maintained. Section 2.3 provides further information on the preventative maintenance programme.

#### 2.7.5.2. Basic Low-cost Physical Techniques

Electrical loads are controlled by variable speed drives which have high efficiency class motors installed. Optimisation of the control system will be achieved during the commissioning phase. Unnecessary discharge of heated water or air will be avoided.

Thermal heat efficiency has a significant impact on power generation; hence the thermal plant will be insulated with high grade refractory linings to minimise heat loss.

#### 2.7.5.3. Energy Efficient Building Services

The process and waste halls are not considered normally occupied and hence do not require compliance with relevant Building Regulations. The office facilities are, however, normally staffed, and are required to comply with the requirements of Building Regulations Part L. In order to achieve this it is intended that:

- Wall and window insulation will meet Part L requirements
- Zoned heating and lighting controls will be installed
- Natural ventilation will be used in place of air conditioning units for all rooms bar the control room

#### 2.7.5.4. Energy Management Techniques

Energy management and monitoring techniques are under development, but we envisage that all loads will be metered to comply with Ofgem requirements. The energy management techniques will be centred upon the electronic monitoring and management system.

#### 2.7.5.5. Energy Efficiency Plan

As this is a new plant, energy efficiency measures are incorporated into the design, and represent BAT.

### 2.7.6. Further Energy Efficiency Requirements

#### 2.7.6.1. Energy Supply Techniques

The purpose of the facility is to generate energy for both on and off-site uses. The facility uses a pre-prepared fuel, produced to a defined specification, rather than unprocessed waste. Procedures are in place to ensure that the fuel meets this specification and that unsuitable materials are not accepted at the facility. CHP is the most efficient form of electricity and heat generation from pyrogas; therefore alternative energy supply techniques do not require further consideration.

### 2.7.6.2. Specific Energy Consumption (SEC)

The energy performance of the facility is shown above.

### 2.7.6.3. Energy Efficiency Techniques

As this is a new plant, energy efficiency measures are incorporated into the design, and represent BAT. The CHP engines that will be in use will be optimised to maximise energy efficiency, whilst minimising emissions, as discussed above.

The combined NEAT process system has been designed so that heat cascades through the process and is deployed against matching temperature requirements. High-grade heat is therefore not used for low-grade heat applications. For example, the hot exhaust gases from the gasifier syngas combustor are used for heating the pyrolyser and subsequently raising super heated steam for the gasifier.

Other optimisation techniques to be used will include turbo charging and air intercooling, plus heat recovery from the engine exhaust gas and water jacket cooling system.

### 2.7.6.4. BAT Justification Discussion

In selecting CHP engines as BAT for the combustion of product pyrogas to generate heat and power, consideration was given to alternative techniques. The CHP engine supplier has not been selected at the time of writing, although the reference specification discussed in section 2.1 is that of a Caterpillar engine. These will be guaranteed by the manufacturer to meet the tightest market available emission levels for pyrogas, which for $NO_x$ is 500mg/Nm$^3$.

These measures represent BAT for energy efficiency, in that:

- The pyrolysis and gasification process has been designed to match the contractually agreed waste delivery amount and specification
- Genuine CHP plant with maximised efficiencies will be in place
- A heat and power plan has been generated, and measures have been identified to match energy duty to the demand profile identified to date in the local area whilst minimising heat spill

The BAT justification for the energy efficiency measures is detailed in the table below.

**Table 31. BAT Justification for Energy**

| Indicative BAT | Justification |
|---|---|
| **Basic Energy Requirements (1)** | |
| Consumption | Projected consumption and efficiency data provided above<br>Overall ATT process thermal efficiency 46.74% |
| SEC | SEC information supplied, favourable comparison against benchmarks |
| Emission significance | Net reduction in $CO_{2,eq}$ emissions of 14,210 tonnes resulting from implementing the ATT process |
| **Basic Energy Requirements (2)** | |
| Operation, maintenance, housekeeping | Measures proposed to ensure on-going energy efficiency |
| Physical techniques | Measures proposed to ensure on-going energy efficiency |
| Building services | Measures proposed to ensure on-going energy efficiency |
| Energy management | Energy management techniques and monitoring proposed |
| Energy efficiency plan | Energy efficiency measures are incorporated into the design |
| **Further Energy Efficiency Requirements** | |
| Energy supply techniques | Electricity and heat will be produced for both external and internal energy use |
| Use of less polluting fuels | Gas is unavailable at this site, diesel to be used for start-up |
| SEC | SEC information will be supplied annually |
| Energy efficiency techniques | An energy efficiency plan is to be produced<br>The heat and power plan is appended to this variation application |

## 2.8. ACCIDENTS

This section of the variation application corresponds to Part C2.9 of the application for variation form, describing the proposed changes to the accident prevention system and accident management plan at the installation.

This section of the variation application covers accidents and their consequences. The current accident management systems for the permit are added to by consideration of the ATT facility. It is not limited to major accidents but includes spills and abnormal operation. The inventory of substances on site is not sufficient to trigger the requirements of the Seveso II Directive as implemented by the Control of Major Accident Hazards Regulations 1999 (COMAH).

This variation application does not amend the accident management plan already covered by the extant permit.

### 2.8.1. General

Our philosophy is that all accidents and incidents are preventable. Every employee has the responsibility of ensuring safe, environmentally sound, and reliable operations. As the employer, we have the responsibility, through example and employee involvement, to create a climate where employees make safety and environmental protection the highest priority.

We have developed an accident management plan (AMP) in line with the requirements identified in section 2.8 of Sector Guidance Note SGN IPPC S5.01, discussed below, which will be implemented through our IMS. The AMP will be reviewed in the operational phase on a regular basis and as a result of any incidents, and updated accordingly.

The AMP includes the following three key elements:

- Identification of hazards
- Assessment of the risks of accidents and their possible consequences
- Implementation of measures to reduce the risks of accidents, and contingency or mitigation plans for any accidents that may occur

### 2.8.2. Identification of Hazards and Risks

The development of the accident management plan has been guided by experience obtained at other sites, together with information gathered during plant design. The process of plant design involves regular HAZID and HAZOP processes; the hazards and risks identified through these procedures, together with identified avoidance or mitigation measures.

The objectives of the hazard identification phase include:

- Identifying deviations from the design intent of the system
- Determining the safety concerns associated with the identified deviations
- Suggesting considerations to manage the resulting risk identified, and presenting the results and considerations for review

A procedure specifies the process for assessing the risks associated with each identified hazard, and then identify techniques to remove, mitigate or control the risks.

### 2.8.3. Identification of the Techniques Necessary to Reduce the Risks

The AMP also identifies actions to be taken in the event of a particular accident occurring and identifies clear lines of control and responsibility. Emergency response procedures will be in place as part of the site IMS, and will address topics such as, *inter alia*:

- EH&S critical product integrity issues
- Off-site incidents affecting the facility
- Security Incidents (consider intruders, theft, terrorist acts)
- Fire
- Transport emergencies
- Power failure
- Loss of containment
- Process emergencies
- Gas and chemical releases
- Failure of utilities
- Pipeline emergencies
- Natural disasters
- Medical emergencies
- Unlawful acts, physical threats
- Bomb threats and harassing phone calls
- Emergencies involving lone workers
- Health related emergencies

Potential risks which are identified are managed through a hierarchy of control:

1. Utilising inherently safer design.
2. Incorporating engineering controls to prevent, detect and mitigate hazards.
3. Develop administrative controls to address risks.

These are discussed in the following sections.

#### 2.8.3.1. Plant Design

The plant is designed to prevent accidents and incidents through systematic identification of accident hazards using a qualitative methodology, including hazard and operability (HAZOP) studies.

Facility siting is considered by the hazard review team to identify any unusual hazards to personnel posed by the location of equipment or facilities. Significant concerns relating to toxics, flammables, explosions, electrical classifications, etc. which could lead to impacts from release are identified and considered, along with mitigation options where appropriate.

Storage arrangements for raw materials, products and wastes will be designed and operated to minimise risks to the environment. There will be appropriate secondary containment in the form of bunding, catchpots and kerbing within buildings. There are separate storage areas within the building for wastes and raw materials.

There will be automatic process controls backed-up by manual supervision, both to minimise the frequency of emergency situations and to maintain control during emergency situations. Instrumentation may include, where appropriate, microprocessor control, trips and process interlocks, coupled with independent level, temperature, flow and pressure metering and high or low alarms.

Appropriate control techniques will be in place to limit the consequences of an accident, such as isolation of drains, provision of oil spillage equipment, alerting of relevant authorities and evacuation procedures.

Process waters, potentially contaminated site drainage waters, emergency fire water, chemically contaminated waters and spillages of chemicals will be contained and where necessary routed to the dirty water tanks, and stored prior to transfer off site. They will be kept separate from the site surface water drainage system. Safe shutdown procedures will be in place.

Duplicate or standby plant will be provided where necessary, with maintenance and testing to the same standards as the main plant.

A procedure will be in place to require evaluation of significant change to the ATT facility, to make sure that the change does not introduce new hazards or compromise safeguards, or to ensure that risks posed by any new hazards are suitably managed.

#### 2.8.3.2. Site Security

Security vulnerabilities have been assessed for the facility. Security requirements are incorporated into the design and management arrangements, where appropriate. In order to prevent unauthorised access, the site itself will be gated and secured by fencing. The site is co-located with other waste management uses. The main entrance/ weighbridge will be manned for a significant proportion of the day and has CCTV coverage. Security incidents will be investigated and followed up in accordance with dedicated procedures. In the event that incidents occur, they will be reported via the accident and incident reporting and investigation process, so that root causes can be established, preventive action taken and any lessons learnt.

#### 2.8.3.3. Provision of Firefighting Materials and Site Fire Protection

The fire protection arrangements and firewater containment are discussed in section 2.1 above. In the event of a fire, the fire protection system is designed to direct the water to the main equipment areas, which means that contaminated firewater will be retained in the process building. Potentially contaminated firewater can be held up in the process building before removal from site.

#### 2.8.3.4. Preventative Maintenance

In addition to the hazard review programme, the facility will have preventative maintenance and mechanical integrity programmes for pressure equipment, which includes pressure vessels, heat exchangers, tanks, piping and pressure relief devices. The objective of the programmes is to proactively identify and mitigate potential equipment problems through monitoring by operators, risk-based assessment of certain process systems, and condition-based testing programmes by pressure equipment inspectors.

Equipment inspection is another important programme to ensure operating integrity is assured. The inspections require plant management to be proactive in identifying potential problems; for example, corrosion, and resolving the problem before an incident occurs. Periodic equipment inspections are dictated by the preventative maintenance programme. Special mechanical integrity proof testing is performed for equipment, instrumentation and controls that provide important environmental protection.

Procedures and training are in place in the IMS to ensure that all reported actual or near-miss safety, health or environmental incidents are reported to determine root causes, develop corrective actions and identify trends for learnings and systemic improvements.

#### 2.8.3.5. Management Arrangements and Training

There will be an up-to-date inventory of substances, present or likely to be present, which could have environmental consequences if they escape. SEPA will be notified of any significant changes to this inventory.

There will be a formal system for the logging and recording of all incidents, accidents and near-misses. The roles and responsibilities of personnel involved in incident management will be formally specified.

Clear guidance will be available on how each potential accident scenario might best be managed (e.g. containment or dispersion, to extinguish fires or to let them burn).

Procedures will be in place for checking and handling raw materials and waste to ensure compatibility with other substances which they may accidentally come into contact with.

To manage the plant hazards, the company trains personnel in safe and environmentally responsible plant operation (see section 2.3 above). Personnel at the facility follow maintenance, test and inspection procedures laid down by the company, national codes of practice and statutory regulations. A comprehensive work permit system is operated in accordance with the company management systems. All accidents and incidents that involved chemical release of a threshold quantity, injury, or potential for serious risk, including near misses are investigated and incident investigation undertaken so that root causes can be established, preventive action taken and lessons learnt. Where the investigation indicates training as being an issue, training is reviewed and implemented.

Signage will be used and areas will be appropriately labelled. Physical protection will be in place where necessary. For example, barriers will be constructed to prevent damage to equipment or tanks from the movement of vehicles.

Techniques and procedures will be in place to prevent overfilling of tanks and bunds, where appropriate. Level measurements will be displayed both locally and at the central control point, along with independent high-level alarms. There will also be a system in place to ensure bund levels are kept to a minimum at all times.

Spill contingency procedures will be in place to minimise accidental release of raw materials, products and waste materials to site drainage.

Procedures will be in place to avoid incidents occurring as a result of poor communications between staff at shift change or during maintenance or other engineering work. Communication channels with emergency services and other relevant authorities will be established, and available for use in the event of an incident. Procedures will include the assessment of harm following an incident and the steps needed to redress this.

### 2.8.3.6. Emergency Actions Controls

The accident management plan applies to the following foreseeable environmental emergencies.

**Table 32. Foreseeable Emergency Types**

| Type | Emergency | Receptors |
|---|---|---|
| A | Major leakage or spillage of polluting liquids or solids, including uncontrolled release to air | Escape through site drains/watercourse to cause water pollution<br>Uncontrolled emission to air<br>Site users and staff |
| B | Fire or explosion involving waste materials, failure of plant or plant fire | Neighbouring businesses and residential properties<br>Escape through site drains/watercourse to cause water pollution<br>Site users and staff |

### 2.8.3.7. Description of Emergency Type

As can be seen from the table above, emergencies are categorised in to 3 types. These are presented in the following sections.

#### *2.8.3.7.1. Type A Emergency*

1. Isolate the affected area to prevent unauthorised access, evacuate and close site gates.
2. If safe to do so, isolate source of leak, spillage or emission to air to prevent further losses.
3. Use appropriate personal protective equipment.
4. Protect site drains (see drainage plan) by positioning spill kits and drain covers as appropriate. Protect any interceptor outfall using suitable means.
5. Use absorbents or booms to contain spread of spillage.
6. Notify SEPA and senior manager.
7. Transfer any residual contents and contaminated absorbents to suitable temporary storage area.
8. Obtain specialist advice of decontamination of surfaces, drains and the interceptor.

#### *2.8.3.7.2. Type B Emergency*

1. Isolate the affected area and evacuate site to the assembly area.
2. Dial 999 and call for assistance from the Fire Brigade.
3. If safe to do so, tackle any fire using the appropriate fire fighting equipment.
4. Notify SEPA and senior manager.
5. If safe to do so, protect site drains, insert bung in outfall chamber.
6. Remove bung from outfall chamber only when authorised by SEPA.

#### *2.8.3.7.3. All Emergencies*

The most senior person present on site will take immediate control of the incident pending handover to the appropriate authority or site manager. An incident report form will be completed. As much information as possible will be gathered, including names and addresses of any witnesses, and photographs will be taken if possible.

### 2.8.4. Abnormal Operation

In the event of a breakdown, operations will be reduced or closed down as soon as practicable until normal operation can be restored. The feed system for the process is automated and in the event of significant departure from normal operating conditions, the process will automatically turn down or shut down in a controlled manner.

The gasifier syngas combustor will also be monitored by a continuous emissions monitoring system (CEMS) that will be linked to the central control point. In the event of a CEMS malfunction the gasification process will cease operating in compliance with IED Article 46(6).

### 2.8.5. Accident Management Plan (AMP)

The plant will be operated by a dedicated on-site team that have the required skills and experience to operate the installation in a safe manner. An outline AMP is in place based on experience of operating similar facilities. This covers the following aspects:

- Identification of hazards
- Assessment of the risks of accidents and their possible consequences
- Implementation of measures to reduce the risks of accidents, and contingency or mitigation plans for any accidents that may occur

The table below details the AMP, which will be reviewed and refined following commencement of operation.

Table 33. Hazard Identification and Risk Assessment

| Hazard | Incident Type | Receptor | Pathway | Consequence | Risk Management/Mitigation | Probability of Exposure | Overall Risk |
|---|---|---|---|---|---|---|---|
| Minor liquid leak/spillage | A | Land Groundwater | Infiltration<br>Percolation.<br>Contamination of ground or ground water, discharge to surface water (with potential fish kill) | Contaminated land and/or groundwater | All substances are stored in appropriate bunded storage<br>Bunded transportation<br>All staff members are trained in correct handling and storage procedures<br>Liquids are delivered and handled within areas that benefit from sealed surfaces and sealed drainage<br>Site inspections<br>Staff training<br>Spill kits<br>Management response procedure | Unlikely | Low |
| Major liquid/substance leak. | A | Land Groundwater | Infiltration<br>Percolation<br>Contamination of ground<br>or ground water, discharge to surface water (with potential fish kill) | Contaminated land and/or groundwater | All substances are stored in appropriate bunded storage<br>All staff members are trained in correct handling and storage procedures<br>Liquids are delivered and handled within areas that benefit from sealed surfaces and sealed drainage<br>Site inspections<br>Staff training<br>Spill kits<br>Management response procedure | Unlikely | Low |

| Hazard | Incident Type | Receptor | Pathway | Consequence | Risk Management/Mitigation | Probability of Exposure | Overall Risk |
|---|---|---|---|---|---|---|---|
| Failure of containment systems e.g. physical failure. | A | Land Groundwater | Infiltration<br>Percolation<br>Contamination of ground or ground water, discharge to surface water (with potential fish kill) | Contaminated land and/or groundwater | Bunds, tanks and surfaces will be inspected on a regular basis as part of the 'site checks' with any faults being reported immediately and corrective action taken as soon as possible<br>Bunds and tanks will be fitted with high-level alarms | Unlikely | Low |
| Liquid transfer pipe failure | A | Land Groundwater | Infiltration<br>Percolation<br>Contamination of ground<br>or ground water, discharge to surface water (with potential fish kill) | Contaminated land<br>and/or groundwater | Infrastructure will be inspected on a regular basis as part of the 'site checks' with any faults being reported immediately and corrective action taken as soon as possible<br>Pipework routed within bunded area and/or areas that benefit from impermeable surfaces etc.<br>Staff competence and training | Unlikely | Low |
| Powder spillage | A | Atmosphere Land Groundwater | Dust emission to atmosphere and ground, or water contamination through final deposition | Contaminated land and/or groundwater<br>Release to air | Small quantities within building<br>Use of materials handling procedures<br>Storage inspections<br>Staff training<br>Deliveries supervised | Unlikely | Low |
| Powder delivery spillage | A | Atmosphere Land Groundwater | Dust emission to atmosphere and ground, or water contamination through final | Contaminated land and/or groundwater | Small quantities within building<br>Use of materials handling procedures | Unlikely | Low |

| Hazard | Incident Type | Receptor | Pathway | Consequence | Risk Management/Mitigation | Probability of Exposure | Overall Risk |
|---|---|---|---|---|---|---|---|
| | | | deposition | Release to air | Storage inspections<br>Staff competence and training<br>Deliveries supervised | | |
| Process plant failure | A,B | Atmosphere | Loss of control, uncontrolled emission of process gases, initiation of other hazards | Release to air | Staff competence and training<br>Process control procedures<br>Preventative maintenance<br>Unauthorised releases procedures<br>Emergency plant shutdown procedures<br>Emergency management procedures | Unlikely | Low |
| Emergency plant shutdown | A, B | Atmosphere | Uncontrolled releases from process | Release to air | Staff competence and training<br>Process control procedures<br>Preventative maintenance<br>Unauthorised releases procedures<br>Emergency plant shutdown procedures<br>Emergency management procedures | Unlikely | Low |
| Small scale local fires | B | Emission to air<br>Land/water<br>contamination | Local emission of combustion fumes from uncontrolled fire, with possible health and safety implications<br>Potential expansion into large fire and associated environmental issues (see large scale plant fire) | Release to air, run off of fire water –see below | Appropriate storage of flammable materials<br>Control of flammable situations<br>PPM of plant and equipment<br>Staff competence and training<br>Provision of fire control apparatus -fire extinguishers, blankets etc.<br>Emergency Management procedures | Unlikely that fire will occur<br>Appropriate fire prevention measures in place | Low |

| Hazard | Incident Type | Receptor | Pathway | Consequence | Risk Management/Mitigation | Probability of Exposure | Overall Risk |
|---|---|---|---|---|---|---|---|
| Large scale plant fire | B | Emission to air<br>Land/water contamination | Large scale emission of combustion fumes from uncontrolled fire<br>Firewater run-off<br>Emergency plant shutdown | Release to air, run off of fire water – see below | Provision of fire control apparatus - fire extinguishers, blankets etc.<br>Firewater tank (600m$^3$ capacity)<br>Sprinkler system in /storage bunkers and over conveyors<br>Emergency management procedures | Unlikely due to fire management control and provision of fire fighting/response | Low |
| Firewater run-off | C | Land<br>Groundwater | Infiltration<br>Percolation | Contaminated land and/or groundwater | Bunding of building to contain firewater<br>Testing prior to removal from site | Possible in the event of fire | Medium |
| Security based incident | A, B | Security breach<br>Emission to air<br>Land/water contamination | Cause of occurrence of all types of spillage, discharge or explosion risks, as specified within this plan | Contaminated land and/or groundwater | CCTV<br>Security doors and barriers | Unlikely | Low |
| Failure of site services (electricity) | A | Emission to air<br>Land/water contamination | Creation of situation leading to hazards listed within this plan | Contaminated land and/or groundwater | Monitoring of site services<br>Emergency Management procedures<br>750kVA back-up power generator (diesel fuel) | Unlikely | Low |

### 2.8.6. BAT Justification for Accidents

These measures represent BAT for accidents. In conjunction with sections 2.1 and 2.2 above, they also demonstrate compliance with IED Article 46(5). The BAT justification for accidents is provided in the following table.

**Table 34. BAT Justification for Accidents**

| Indicative BAT | Justification |
|---|---|
| Accident management plan | An installation AMP has been developed based on experience of operating other similar facilities<br>AMP to be revised during operation as required and supplied to SEPA |
| Identification of the hazards | Outlined above and detailed in the AMP |
| Assessment of the risks | Outlined above and detailed in the AMP |
| Identification of mitigation measures | Outlined above and detailed in the AMP |
| Abnormal operating conditions | Procedures outlined above |
| Firewater containment | Fire water is included in the installation AMP |

## 2.9. NOISE AND VIBRATION

This section of the variation application corresponds to Part C2.10 of the application for variation form, describing the proposed changes to the sources of noise at the installation and their control.

This section of the environmental permit variation application provides details with respect to noise and vibration. The existing permit controls on noise and vibration contained in permit reference PPC/A/1094330 are maintained. However, the noise assessment to inform the planning application for the ATT facility has re-assessed the noise and vibration from the varied installation as a whole. Therefore, the overall impact of the varied installation is discussed here. The additional BAT measures for control of noise at source are discussed here for the additional ATT facility, as BAT for the waste reception and pre-treatment facility, that is part of the permitted waste facility, has already been assessed and agreed via the extant permit.

This chapter should be read in conjunction with the noise assessment submitted as part of the environmental statement to support the planning application. This has been provided electronically with this permit variation application.

Basic good practice measures for the control of noise, including adequate maintenance of any parts of plant or equipment whose deterioration may give rise to increases in noise (for example, bearings, air handling plant, the building fabric, and specific noise attenuation kit associated with plant or machinery) will be employed throughout the installation, as varied by this application.

### 2.9.1. Sources of Noise

The principal sources of noise at the facility will be:

- The waste reception hall
- Link corridor
- Mechanical treatment and drier
- ATT building
- Energy recovery building
- Biofilter
- 23m high stack
- 13.5m biofilter stack
- Transformer
- Air blast chillers (ABCs)

The source descriptions and operational regimes are shown below. Building source data are reverberant, and are shown without accounting for the building insulation properties. Noise data has been derived where possible from operational noise measurements obtained at our waste treatment facility at Avonmouth, which employs a number of similar processes. The remaining noise data has been derived using the manufacturer's information on plant/processes.

Table 35. Noise Sources Pre-Insulation

| Source | Daytime Operating Time % | Night-time Operating Time % | Sound Power Level dB(A) |
|---|---|---|---|
| Reception hall | 100% | 10% | 90 |
| Link corridor | 100% | 25% | 84 |
| Mechanical treatment/dryer | 100% | 50% | 83 |
| ATT building | 100% | 100% | 68 |
| Energy recovery building | 100% | 100% | 78 |
| Biofilter building | 100% | 50% | 74 |
| Exhaust (23m) | 100% | 100% | 58 |
| Biofilter chimney (13.5m) | 100% | 100% | 38 |
| 11kV 25000kVA transformer | 100% | 100% | 61 |
| Air blast chiller at 1m[1] | 100% | 100% | 75 |

[1]Noisiest side

### 2.9.2. Noise Sensitive Receptors

The noise sensitive receptors identified by the noise assessment comprise local residential properties and other receptors including adjacent industrial premises/offices. Baseline noise monitoring during the daytime and night-time has been undertaken for these receptors. Their locations are shown below, along with the baseline survey locations.

A. 30 Loan View (long term noise monitoring position) located to the south-west at ~430m.
B. Nearest house on Coopersknowe Crescent located to the southwest at ~ 330m.
C. Drymen No. 186 - future residential development (ref. Persimmon Homes drawing 02-01/E) located to the south at ~180m.
D. Easter Langlee Farmhouse located to the south at ~250m.
E. Lowood Lodge (at the other side of B6374) located to the south at ~680m.
F. Cottage near B6374 located to the southeast at ~810m
G. Wester Housebyre near Davie's Brae located to the northeast at ~790m.

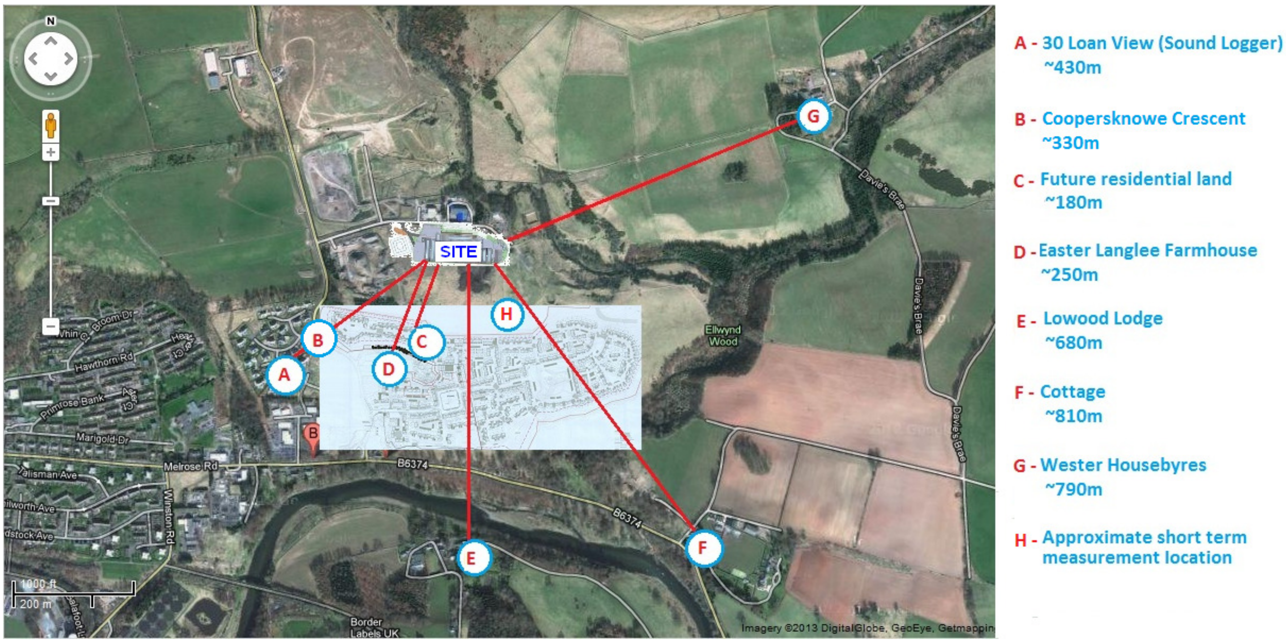



Figure 3. Site, Measurement and Receptor Locations

### 2.9.3. Noise Control at Source

Noise surveys, measurements, investigations and modelling have been carried out for this new installation. In addition, there are a number of techniques to be implemented at the installation that represent BAT. These are discussed below.

#### 2.9.3.1. Enclosure and Building Insulation

Noise control techniques will be employed to ensure that the noise from the installation does not give rise to reasonable cause for annoyance. Such techniques include:

- The insulation of the south elevation and roof of the building which gives noise attenuating properties
- The housing of the main noise producing equipment within individual acoustic enclosures (the engines)

The noise control cladding is concentrated on those areas along the south facade that will provide the greatest protection, given that this is the direction of the noise sensitive receptors. This is particularly the reception hall and link corridor. Airborne sound insulation performances for the materials forming the key areas of the building shell requiring additional treatment are given below. They would be representative of the airborne sound insulation performances of the candidate materials and the acoustic integrity of the building, which would not be compromised, for example, by having poor wall/roof panel perimeter joints.

Typically, the reception building, link corridor, mechanical treatment/dryer building, ATT building and energy recovery building would have insulation that may comprise composite wall panels of thickness 40mm of density 33 kg/m$^3$ lined internally using a 0.7mm thick profiled metal liner and 50mm thick continuous mineral wool insulation. Typical sound reduction indices achievable are shown in the table below.

The proposed 40mm thick composite roof panel would also typically be internally lined using 0.7m thick profiled metal liner and 120mm thick continuous mineral wool insulation of density 60kg/m$^3$.

Table 36. Building material sound insulation figures used in the noise emission prediction models

| Source | Description | Weighted Sound Reduction Index, $R_w$ dB(A) |
|---|---|---|
| Mechanical treatment (main) building | External walls and roofs | 22 |
| | External walls | 35 |
| | Roofs | 37 |
| | Roof lights | 18 |
| | Personal access doors | 34 |
| | Roller shutter doors | 17 |
| Biofilter building | External walls | 26 |
| | Roof | 20 |
| Both buildings | Ventilation (free opening) | 0 |

### 2.9.3.2. Engine Exhaust

Each engine will be fitted with a primary silencer after the heat recovery point, and be placed inside an acoustic enclosure. There will be a secondary silencer and a common plenum before the silenced engine exhausts are connected to their individual flues within the proposed 23m high common exhaust stack. The plenum will be lined internally using sound absorbent material except the inlet and outlet areas. Connections to the walls and ceiling to support the pipework/silencer will be of resilient type to ensure that high levels of vibration transmission do not occur that might otherwise result in structure borne sound.

### 2.9.3.3. External Air Blast Chillers

A number of potential locations were considered for the air blast chillers (ABCs). The final location on the ground level to the north of the building provides the most benefit from the acoustic screening of the main building, given that receptors are largely located to the south east, south, south west and west of the site. The location of these is shown in Appendix A. If required during the final, detailed design phase, a separate barrier may be considered to ensure that acoustic screening is maximised.

### 2.9.3.4. Designing Out Noise and Vibration

Engine exhaust pipes, exhaust silencers and other pipework that can transfer or generate strong vibrations will be supported off the heavy concrete floor whenever practicable, to prevent transfer of vibrations to the building structure. The extent of this will be assessed during the detailed design phase. This will also be considered, if required, for services such as fans and associated ductwork.

Noisy machinery and plant will be positioned away from external or internal walls wherever practicable to prevent coupling. This will be finalised during the detailed design phase.

### 2.9.4. Noise Assessment

The likely noise emission levels from the proposed ATT development were used to model their potential impact on the receptors identified above, including the sound reduction index for a typical building of this type shown above.

In the first instance a spreadsheet model was created (Model I) to estimate the noise emissions from the ATT building together with the 23m high exhaust, four ground level air blast chillers (up to three operating simultaneously) and two 11kV transformers. A second model was created to estimate the likely noise emissions from the biofilter and associated chimney (Model II).

The external surfaces of the buildings were divided into smaller elements and the noise emissions from each individual element were estimated. To calculate the noise emission from each building, noise emission levels for individual elements for that building were combined logarithmically. Then the estimated building noise emission levels for each building and noise emission levels due to the external noise sources were combined logarithmically to obtain a single figure noise level. This method of calculation is based on BS12354-4: 2000[8]. The estimated noise level is called Specific Noise Level in accordance with BS4142: 1997[9]. To obtain a single figure Rating Noise Level a +5dB(A) source characteristic feature correction was applied to noise sources based either on the tonality assessment of individual one-third octave spectrum carried out in line with Appendix D of ISO1996-2: 2007[10].

Directional, distance, soft ground and screening due to the proposed buildings were taken into account for each building element and external noise source with respect to each receiver position. No soft ground attenuation was applied to exhausts due to their height. However, soft ground attenuation based on the 50% of the propagation path within the point source radiation region was applied following the guidance given in BS5228-1: 2009[11]. This is considered to be a conservative approach.

The permitted operating hours for the consented waste facility are between 07:30 and 22:00 hours seven days a week, with waste deliveries between 07:30 and 19:00 hours, Monday to Saturday. The ATT facility will operate on a 24/7 basis. Therefore, the potential impact has been assessed during daytime and night-time, weekdays and weekends, assuming that all doors are kept closed, and also assuming one door remains open, to account for waste deliveries in the daytime Monday to Saturday (i.e. worst case scenario).

Procedures will be in place to prevent the main doors being left open accidentally at any time and particularly at night.

The full calculations are provided in the environmental statement attached electronically to this application.

[8] BS12354-4: 2000 "Building acoustics – Estimation of acoustic performance of buildings from the performance of elements" – Part 4: "Transmission of indoor sound to the outside".
[9] BS4142: 1997 "Method for rating industrial noise affecting mixed and residential and industrial areas".
[10] Annex D "Objective method for assessing the audibility of tones in noise-Simplified method" of ISO1996-2: 2007- "Description, measurement and assessment of environmental noise" - Part 2: "Determination of environmental noise levels"
[11] BS5228-1:2009 "Code of practice for noise and vibration control on construction and open site" – Part 1: "Noise".

Table 37. BS4142: 1997 Assessment - Week, Daytime, All Doors Closed

| Receptor | Distance and Direction to nearest building, m | Estimated Specific Noise Level dB(A) | [A] Estimated Rating Noise Level dB(A) | [B] Lowest Measured Background Noise Level dB (A) | Difference (A-B) dB(A) | Comments |
|---|---|---|---|---|---|---|
| A | 430m SW | 34 | 35 | 42 | -7 | 12dB(A) less than "marginal significance" |
| B | 330m SW | 37 | 37 | 42 | -5 | 10dB(A) less than "marginal significance" |
| C | 180m S | 41 | 42 | 44 | -2 | 7dB(A) less than "marginal significance" |
| D | 250m S | 38 | 39 | 44 | -5 | 10dB(A) less than "marginal significance" |
| E | 680m S | 30 | 32 | 42 | -10 | "Complaints are unlikely" |
| F | 810m SE | 28 | 30 | 44 | -14 | Less than "Complaints are unlikely" |
| G | 790m NE | 28 | 32 | 42 | -10 | "Complaints are unlikely" |

Table 38. BS4142: 1997 Assessment - Week, Night-time, All Doors Closed

| Receptor | Distance and Direction to nearest building, m | Estimated Specific Noise Level dB(A) | [A] Estimated Rating Noise Level dB(A) | [B] Lowest Measured Background Noise Level dB (A) | Difference (A-B) dB(A) | Comments |
|---|---|---|---|---|---|---|
| A | 430m SW | 29 | 31 | 34 | -3 | 8dB(A) less than "marginal significance" |
| B | 330m SW | 31 | 33 | 34 | -1 | 6dB(A) less than "marginal significance" |
| C | 180m S | 37 | 39 | 36 | 3 | 2dB(A) less than "marginal significance" |
| D | 250m S | 33 | 36 | 36 | 0 | 5dB(A) less than "marginal significance" |
| E | 680m S | 26 | 29 | 34 | -5 | 10dB(A) less than "marginal significance" |
| F | 810m SE | 25 | 28 | 36 | -8 | 13dB(A) less than "marginal significance" |
| G | 790m NE | 27 | 31 | 34 | -3 | 8dB(A) less than "marginal significance" |

Table 39. BS4142: 1997 Assessment - Week, Daytime, One Door Left Open

| Receptor | Distance and Direction to nearest building, m | Estimated Specific Noise Level dB(A) | [A] Estimated Rating Noise Level dB(A) | [B] Lowest Measured Background Noise Level dB (A) | Difference (A-B) dB(A) | Comments |
|---|---|---|---|---|---|---|
| A | 430m SW | 39 | 44 | 42 | 2 | 3dB(A) less than “marginal significance” |
| B | 330m SW | 41 | 47 | 42 | 5 | “marginal significance” |
| C | 180m S | 44 | 49 | 44 | 5 | “marginal significance” |
| D | 250m S | 41 | 46 | 44 | 2 | 3dB(A) less than “marginal significance” |
| E | 680m S | 32 | 37 | 42 | -5 | 10dB(A) less than “marginal significance” |
| F | 810m SE | 28 | 33 | 44 | -11 | Less than “Complaints are unlikely” |
| G | 790m NE | 29 | 34 | 42- | -8 | 13dB(A) less than “marginal significance” |

Table 40. BS4142: 1997 Assessment - Weekend, Daytime, All Doors Closed

| Receptor | Distance and Direction to nearest building, m | Estimated Specific Noise Level dB(A) | [A] Estimated Rating Noise Level dB(A) | [B] Lowest Measured Background Noise Level dB (A) | Difference (A-B) dB(A) | Comments |
|---|---|---|---|---|---|---|
| A | 430m SW | 34 | 35 | 37 | -2 | 7dB(A) less than “marginal significance” |
| B | 330m SW | 37 | 37 | 37 | 0 | 5dB(A) less than “marginal significance” |
| C | 180m S | 41 | 42 | 39 | 3 | 2dB(A) less than “marginal significance” |
| D | 250m S | 38 | 39 | 39 | 0 | 5dB(A) less than “marginal significance” |
| E | 680m S | 30 | 32 | 37 | -5 | 10dB(A) less than “marginal significance” |
| F | 810m SE | 28 | 30 | 39 | -9 | 14dB(A) less than “marginal significance” |
| G | 790m NE | 28 | 32 | 37 | -5 | 10dB(A) less than “marginal significance” |

Table 41. BS4142: 1997 Assessment - Weekend, Night-time, All Doors Closed

| Receptor | Distance and Direction to nearest building, m | Estimated Specific Noise Level dB(A) | [A] Estimated Rating Noise Level dB(A) | [B] Lowest Measured Background Noise Level dB (A) | Difference (A-B) dB(A) | Comments |
|---|---|---|---|---|---|---|
| A | 430m SW | 29 | 31 | 33 | -2 | 7dB(A) less than "marginal significance" |
| B | 330m SW | 31 | 33 | 33 | 0 | 5dB(A) less than "marginal significance" |
| C | 180m S | 37 | 39 | 35 | 4 | 1dB(A) less than "marginal significance" |
| D | 250m S | 33 | 36 | 35 | 1 | 4dB(A) less than "marginal significance" |
| E | 680m S | 26 | 29 | 33 | -4 | 9dB(A) less than "marginal significance" |
| F | 810m SE | 25 | 28 | 35-(2) | -7 | 12dB(A) less than "marginal significance" |
| G | 790m NE | 27 | 31 | 33-(1) | -2 | 7dB(A) less than "marginal significance" |

Table 42. BS4142: 1997 Assessment - Weekend, Daytime, One Door Left Open

| Receptor | Distance and Direction to nearest building, m | Estimated Specific Noise Level dB(A) | [A] Estimated Rating Noise Level dB(A) | [B] Lowest Measured Background Noise Level dB (A) | Difference (A-B) dB(A) | Comments |
|---|---|---|---|---|---|---|
| A | 430m SW | 39 | 44 | 39 | 5 | "marginal significance" |
| B | 330m SW | 41 | 47 | 39 | 8 | 3dB(A) above "marginal significance" |
| C | 180m S | 44 | 49 | 41 | 8 | 3dB(A) above "marginal significance" |
| D | 250m S | 41 | 46 | 41 | 5 | "marginal significance" |
| E | 680m S | 32 | 37 | 39 | -2 | 7dB(A) less than "marginal significance" |
| F | 810m SE | 28 | 33 | 41 | -8 | 13dB(A) less than "marginal significance" |
| G | 790m NE | 29 | 34 | 39 | -5 | 10dB(A) less than "marginal significance" |

### 2.9.5. Significance of Impact

A full assessment of significance, having regard to PAN1/2011 TANAN, is contained in the documents supporting the planning application. The assessment shows that including the proposed mitigation measures, the sensitivity of the noise sensitive receptors is “Medium” or “Low” with level of significance “Slight” or better.

These measures represent BAT for noise and vibration. The BAT justification for accidents is provided in the following table.

**Table 43. BAT Justification for Noise**

| Indicative BAT | Justification |
|---|---|
| Maintenance<br>• Plant<br>• Equipment<br>• Fans<br>• Bearings<br>• Vents<br>• Building Fabric<br>• Other | Appropriate preventative maintenance will be provided for the various elements of the installation. This will ensure no deterioration of plant or equipment that would give rise to increases in noise |
| Control techniques and comparison with BAT indicative thresholds | Control techniques will be in place:<br>• The building design will be finalised having regard to designing out noise and vibration, including insulation to prevent vibration, and positioning of equipment<br>• External air blast chillers will be placed to maximise screening, and barriers provided where required<br>• Engine exhaust primary and secondary silencers and common plenum chamber<br>• Building insulation to meet best practice |
| Reasonable cause for annoyance – sensitive receptors/complaints? | The impact assessment demonstrates that the installation, as varied by this application, will not give rise to reasonable cause for annoyance<br>In the unlikely event that complaints are received measures described in the integrated management system will be put in place |
| Noise survey | A noise assessment in accordance with statutory noise guidance has been carried out, including detailed modelling<br>Conclusions are that noise sensitive receptors will not be adversely affected by noise or vibration |

## 2.10. MONITORING

This section of the variation application corresponds to Part C2.11 of the application for variation form, describing the proposed changes to the measures and frequencies to be used for monitoring emissions from the ATT facility.

This variation application does not amend the monitoring already required by the extant permit.

### 2.10.1. Emissions to Air

The CHP engines from A2 – A5 are not covered by Chapter IV or Annex VI of the IED by virtue of the end of waste application made concurrently with this variation application. Therefore, monitoring is proposed that meets the requirements of SEPA's own guidance on the combustion of landfill gas in CHP engines. This is the most relevant guidance to follow when considering methodology and frequency of monitoring of emissions to air from engines running on purified pyrogas, which has properties closest to those of landfill gas.

The combustor emissions from A6 are subject to Chapter IV and Annex VI of the IED. Article 48 and Annex VI of the IED set mandatory minimum monitoring requirements which must be followed for this exhaust. These are also reflected in Sector Guidance Note S5.01 section 2.10. For these emissions, a continuous emissions monitoring system (CEMS) will be installed, that has been specified for this type of operation. The CEMS sampling points have not yet been confirmed but will be agreed with SEPA in line with their monitoring Quick Guides and other monitoring guidance.

$NO_x$, CO, particulates (total dust) and TOC will be monitored continuously on emissions from A6. Annual non-continuous monitoring will also be undertaken to satisfy IED Article 48(2). Because of the pyrogas purification system described in section 2.1 above, and in accordance with IED Annex VI Part 6 points 2.3 and 2.5, HCl, HF and $SO_2$ will be monitored non-continuously, along with heavy metals, dioxins and furans, dioxin-like PCBs and PAHs. Six monthly monitoring is proposed, although we would seek to reduce this by agreement with SEPA, in line with IED Annex VI Part 6 point 2.6.

The readouts from the CEMS will be processed using software that reports monitoring compliance information to enable direct comparisons with the ELVs specified in the permit. The calibration of continuous monitoring equipment and the periodic measurements of emissions to air will be carried out representatively, and in accordance with CEN standards. If these are not available, ISO standards or national/international standards which can provide data of equivalent scientific quality will be used.

Sampled gas will be dried prior to analysis. It may be appropriate to periodically undertake visual and olfactory assessments of final releases to air. This will ensure that all releases are colourless, free from persistent trailing mist or fume and free from droplets.

Monitoring is not proposed for the flare, A7. Periods of flaring, together with the reasons for flaring, will, however, be logged and reported to SEPA.

Table 44. Techniques for Monitoring Emissions to Air

| Emission Point | Source of Emissions | Substance | Monitoring Frequency | Monitoring Technique[12] |
|---|---|---|---|---|
| A1 | Biofilter stack | VOC, $NH_3$, particulate matter | No change from extant permit PPC/A/1094330 | |
| A2 – A5 | CHP engines | $NO_x$ (as $NO_2$) | 6 monthly non-continuous | BS EN 14181 |
| | | CO | 6 monthly non-continuous | BS EN 14181 |
| A6 | Combined combustor exhaust (subject to IED Chapter IC and Annex VI) | $NO_x$ (as $NO_2$) | Continuous | BS EN 14181 |
| | | | Annual non-continuous | BS EN 14181 |
| | | Total dust | Continuous | BS EN 14181 |
| | | | Annual non-continuous | BS EN 14181 |
| | | CO | Continuous | BS EN 14181 |
| | | | Annual non-continuous | BS EN 14181 |
| | | TOC | Continuous | BS EN 14181 |
| | | | Annual non-continuous | BS EN 14181 |
| | | $SO_2$ | 6 monthly | BS EN 14181 |
| | | HCl | 6 monthly | BS EN 1911 Parts 1, 2 and 3 |
| | | HF | 6 monthly | BS ISO 15713 |
| | | Heavy metals (∑Hg+Sb+As+Pb+Cr+Co +Cu+Mn+Ni+V) | 6 monthly | BS EN 14385 |
| | | ∑Cd + Tl | 6 monthly | BS EN 14385 |
| | | Hg | 6 monthly | BS EN 13211 |
| | | Dioxins and furans | 6 monthly | BS EN 1948 |
| | | PAH | 6 Monthly | BS ISO 11338-1 (2003) part 1 or BS ISO 11338-2 (2003) part 2 |
| A7 | Flare | $NO_x$, CO, $CO_2$, VOC | None proposed | |

### 2.10.2. Emissions to Water and Sewer

There are no new process discharges to water or sewer introduced to the installation through this variation application. This is discussed in section 2.2 above. Monitoring is therefore not proposed.

The collected condensate and aqueous effluent will be sampled prior to removal from site and tested, according to the requirements of the facility accepting it for treatment.

### 2.10.3. Residue Monitoring

Ash and FGT residue will be sampled and monitored quarterly for LOI or TOC, to demonstrate compliance with IED Article 50(1). Char is not as residue, but nonetheless, monitoring will be undertaken during commissioning and occasionally thereafter.

[12] Or equivalent standard as agreed with SEPA

### 2.10.4. Process Monitoring

Significant monitoring of the ATT facility, from waste input to pyrogas quality, will be undertaken to ensure that the purified product pyrogas continues to be classified as "end of waste" These are described in detail in the end of waste application in Appendix F of this variation application.

#### 2.10.4.1. Incoming Waste Quality Monitoring

The incoming waste will be subject to ongoing non-continuous monitoring to ensure compliance with the specification set out in section 2.1 above and CEN/TS 15359.

#### 2.10.4.2. Purified Product Pyrogas Quality Monitoring

Continuous monitoring of the gross calorific value of the product pyrogas will be undertaken in compliance with the Renewables Obligation Order 2009, as amended. The analysers used by the plant will comprise high speed process gas analyser for monitoring and control of calorific value, Wobbe Index, specific gravity and the air/fuel ratio of the gas. This analyser will feed back directly into the SCADA control system and is used to control a number of the key input parameters of the plant (e.g. fuel feed rate).

In addition the synthesis gas produced by the plant will be subject to periodic compliance sampling to double check and verify the online analysers and to confirm other gas quality aspects (e.g. gas chemical analysis).

#### 2.10.4.3. Pyrogas Combustion Monitoring

The CHP engines that will be used for downstream electrical generation will all be fitted as standard with engine management systems that will modulate in accordance to any variations in gas parameters. The gas engines will typically be controlled by continuously monitoring gas CO levels, gas pressure, flow rate and temperature.

#### 2.10.4.4. Combustor Monitoring

The combustors for the gasifier exhaust gases are subject to IED Chapter IV. Temperature monitoring of the combustor exhaust gas will be undertaken at the combustor outlet to demonstrate compliance with Article 50(2).

#### 2.10.4.5. Environmental Monitoring

Environmental monitoring due to the addition of the ATT facility is not considered necessary or proportionate.

These measures represent BAT for monitoring. They also demonstrate compliance with IED Article 48 and Annex VI. The process monitoring also demonstrates that it will secure ongoing pyrogas quality in line with the end of waste application. The BAT justification for monitoring is provided in the following table.

**Table 45. BAT Justification for Monitoring Proposals**

| Indicative BAT | Justification |
|---|---|
| Emissions monitoring to air | Monitoring of emissions to air from CHP engines via A2 – A5 are in line with SEPA guidance and represent BAT<br>Monitoring of emissions to air from the combustors via A6 is in line with IED Article 48 and Annex VI and represent BAT |
| Emissions monitoring to water and sewer | There are no process emissions to water or sewer, monitoring not proposed |
| Residue monitoring | Monitoring of residues is in line with IED Article 50(1) and represents BAT |
| Monitoring of process variables | Monitoring of process parameters is in line with that required to demonstrate end of waste for the purified product pyrogas, and represents BAT<br>Temperature monitoring of the combustor exhaust gas is in line with IED Article 50(2) |
| Environmental monitoring | Not required |

## 2.11. CLOSURE

This section of the variation application corresponds to Part C2.12 of the application for variation form, describing the proposed changes to site closure.

In particular, this section describes the proposed measures to be taken to avoid any pollution risk to land and return the site of the installation to a satisfactory state upon definitive cessation of activities. The changes to the installation operations mean that there will be an increased volume of hazardous substances stored at the site. However, the volumes and potential risks associated with them are not considered to be significant, in particular since there will be appropriate management measures in place.

### 2.11.1. Operations During the Permit

The sector guidance states that "operations during the life of the permit should not lead to any deterioration of the site…" if the requirements of the relevant statutory guidance are followed. The site report applicable to this application for a variation is the original site report for the existing facility. Therefore, the facility will be returned to the condition outlined in the original site report.

Any incidents that arise, during the operation of the facility, which could impact on the site condition will be documented, along with the measures taken to ameliorate their impact on the site condition.

All of this information, as well as procedures and measures undertaken to prevent any further contamination of the land during the operation of the facility will be documented throughout the life of the site. It will be brought together in a surrender site report. This will be submitted at the stage of surrendering the permit to support any surrender application.

### 2.11.2. Steps Taken at Design and Build Stage

The facility will be built in accordance with the Construction (Design and Management) (CDM) Regulations 2007 to ensure ease of decommissioning. There will be no underground storage vessels or pipework, with the exception of drainage and interceptors. No asbestos will be contained in the building structures or plant. Therefore, asbestos will not be a hazard during decommissioning. Where ever possible, the design has used materials that cannot become wind entrained during decommissioning.

### 2.11.3. Site Closure Plan

An indicative site closure plan is shown in the table below.

These measures represent BAT for closure. A revised site report including reference data has not been undertaken, by agreement with SEPA, as this variation application is submitted under the Pollution Prevention and Control (Scotland) Regulations 2000.

**Table 46. Indicative Site Closure Plan**

| Structure | Hazard | Action for Safe Decommissioning |
|---|---|---|
| Underground drainage | Residual materials may be contained in underground drainage | Before decommissioning, underground drainage is to be flushed with water and emptied<br>Any potentially harmful substances will be moved and disposed of by suitably authorised waste contractors |
| Underground interceptor | Residual hazardous substances may be contained in interceptors | Interceptors will be flushed with water and emptied to ensure all residual substances are removed before decommissioning<br>Any potentially harmful contents will be removed and disposed of by suitably authorised waste contractors |
| General building structures | Insulation materials on site, such as pipe lagging and roofing insulation may contain man made mineral fibres | Before decommissioning a hazardous materials survey will be conducted<br>Removal will be undertaken through approved methods and by specialist contractors<br>During decommissioning there may be problems of dust generation concerning non-asbestos materials. All materials will be removed by an authorised waste contractor |
| Main process structures and associated properties | All dry material stores to be emptied and removed off site. Any areas contaminated with hazardous materials e.g. chemicals will be cleaned prior to decommissioning. The main problem during decommissioning of this phase will be through dust generation<br>Insulation materials on site, such as pipe lagging and roofing insulation may contain man made mineral fibres | Before decommissioning a hazardous materials survey will be conducted<br>Removal will be undertaken through approved methods and by specialist contractors |
| Plant equipment | Residual substances (primarily oil) may be present in plant equipment and pipework | All equipment and associated pipework will be dismantled and removed by approved contractors with care to ensure that there are no releases of oils |
| Pipework and vessels containing consumables | Residual hazardous substances may be contained in tanks and associated pipes | Pipe work will be flushed with water and emptied to ensure all residual substances are removed before decommissioning<br>Any potentially harmful contents will be removed and disposed of by licensed waste contractors |

## 2.12. INSTALLATION ISSUES

This section of the variation application corresponds to Part C2.13 of the application for variation form, relating to multi-operator installations.

The entire installation, including the new plant will be owned and operated by New Earth Solutions (Scottish Borders) limited. There will be no installation-wide issues associated with the variation to the existing permit.

# 3. PROPOSED EMISSIONS

## 3.1. EMISSIONS INVENTORY

This section of the variation application corresponds to Part C3 of the application for variation form, describing the proposed emissions from the installation.

The table below summarises the emissions from the varied installation following the addition of the ATT facility.

**Table 47. Emissions from the Installation**

| Reference | Description | Medium | Potential Pollutants |
|---|---|---|---|
| A1 | Biofilter exhaust, already permitted | Air | VOC, $NH_3$, particulate matter |
| A2 – A5 | Engine 1 - 4 exhausts | Air | $NO_x$, VOC, CO, $CO_2$ |
| A6 | Common gasifier exhaust | Air | $NO_x$, $SO_2$, CO, $CO_2$, VOC, HCl, HF, particulate matter, heavy metals, dioxins and furans |
| A7 | Flare | Air | $NO_x$, CO, $CO_2$, VOC |

## 3.2. EMISSIONS BENCHMARKS

### 3.2.1. Emissions to Air

The exhaust emissions from the CHP engines that are combusting the product pyrogas generated in the pyrolysis process are not subject to the emission limit standards contained in Annex VI of the IED, by virtue of Article 42 of that Directive. The end of waste application to demonstrate this is provided in Appendix F. The proposed emission limits to air for A2 – A5 are shown in the table below. The most relevant published guidance for emissions from the CHP engines is the SEPA document LFTGN 08 Guidance for monitoring landfill gas engine emissions. SEPA combustion guidance S1.01 only contains emission standards for engines using natural gas, which are not applicable to the combustion of pyrogas or landfill gas.

The exhaust gas from the combustion of syngas produced in the char gasifiers and emitted via A6, is subject to the controls contained in Chapter IV and Annex VI of the IED, and emission limits are proposed accordingly.

Table 48. Proposed Limit Values for Emissions to Air

| Reference | Description | Substance | Proposed Emission Limit, $mg/Nm^3$ (unless otherwise stated) | Reference $O_2$ Concentration, % | Averaging Period (where applicable) |
|---|---|---|---|---|---|
| A1 | Biofilter exhaust, already permitted | VOC, $NH_3$, particulate matter | No change from extant permit PPC/A/1094330 | | |
| A2 – A5 | Engine 1 - 4 exhausts | $NO_x$ (as $NO_2$) | 500 | 5 | Spot |
| | | VOC | 1000 | | Spot |
| | | CO | 1400 | | Spot |
| A6 | Common gasifier exhaust | $NO_x$ (as $NO_2$) | 200 | 11 | Daily |
| | | | 400 | | Half-hourly |
| | | $SO_2$ | 50 | | Daily |
| | | | 200 | | Half-hourly |
| | | CO | 50 | | Daily |
| | | | 100 | | Half-hourly |
| | | | 150 | | 10 minute |
| | | VOC | 10 | | Daily |
| | | | 20 | | Half-hourly |
| | | HCl | 10 | | Daily |
| | | | 60 | | Half-hourly |
| | | HF | 1 | | Daily |
| | | | 4 | | Half-hourly |
| | | Total dust | 10 | | Daily |
| | | | 30 | | Half-hourly |
| | | Heavy metals ($\sum$Hg+Sb+As+Pb+ Cr+Co+Cu+Mn+Ni+ V) | 0.5 | | Spot |
| | | $\sum$Cd + Tl | 0.05 | | Spot |
| | | Dioxins and furans | 0.1 $ng/Nm^3$ | | Spot |
| A7 | Flare | $NO_x$, CO, $CO_2$, VOC | None proposed | n/a | n/a |

### 3.2.2. Water and Sewer

There are no anticipated process emissions to water or sewer from the varied installation. There is no available connection to sewer in proximity to the facility. Discussions are underway with Scottish Borders Council on the potential of partnering on the development of on-site treatment, potentially using reed bed technology. These discussions are ongoing. In the meantime, condensate will be collected in the condensate tank and tankered off site.

### 3.2.3. Emissions to Land and Groundwater

There are no anticipated process emissions to land or groundwater at the installation during normal operation. Preventative measures described in the respective sections above are contended to represent BAT for preventing such emissions from the varied installation.

These measures represent BAT for emissions. They also demonstrate compliance with IED Article 46 and Annex VI. The BAT justification for emissions is provided in the following table.

**Table 49. BAT Justification for Emissions**

| Indicative BAT | Justification |
|---|---|
| Comparison against benchmarks | Comparison has been made against the following benchmarks:<br>Emissions to air from the CHP engines: SEPA LFTGN08<br>Emissions to air from combustors: IED Annex VI |
| Compliance with the IED | Compliance is secured for the relevant plant, the combustors, as demonstrated throughout this application for variation |

# 4. IMPACT ON THE ENVIRONMENT

This section of the variation application corresponds to Part C4 of the application for variation form, describing the potential impact on human health and the environment arising from the proposed emissions from the installation.

## 4.1. SITE LOCATION

### 4.1.1. Important and Sensitive Receptors

#### 4.1.1.1. Human Health Receptors

A selection of sensitive properties representative of those closest to the facility has been included in the model as discrete receptors; these receptors are shown below. The table below also shows to the nearest 10 metres the distance of each location from the ATT plant exhaust (shown as a small red dot on the figure, near the eastern site boundary).

The nearest existing residential property is at Easter Langlee Farmhouse to the south west of the ATT exhaust. There are a number of houses on Loan View 450 metres to the west south west of the exhaust and at Wester Housebyres, approximately 850 metres to the east north east of the exhaust. To the west, north and east of the site the land is predominantly agricultural. Permission has been granted permission for a new residential development to the south of the application site and development has commenced. The nearest property within this development will be around 200 metres from the exhaust.

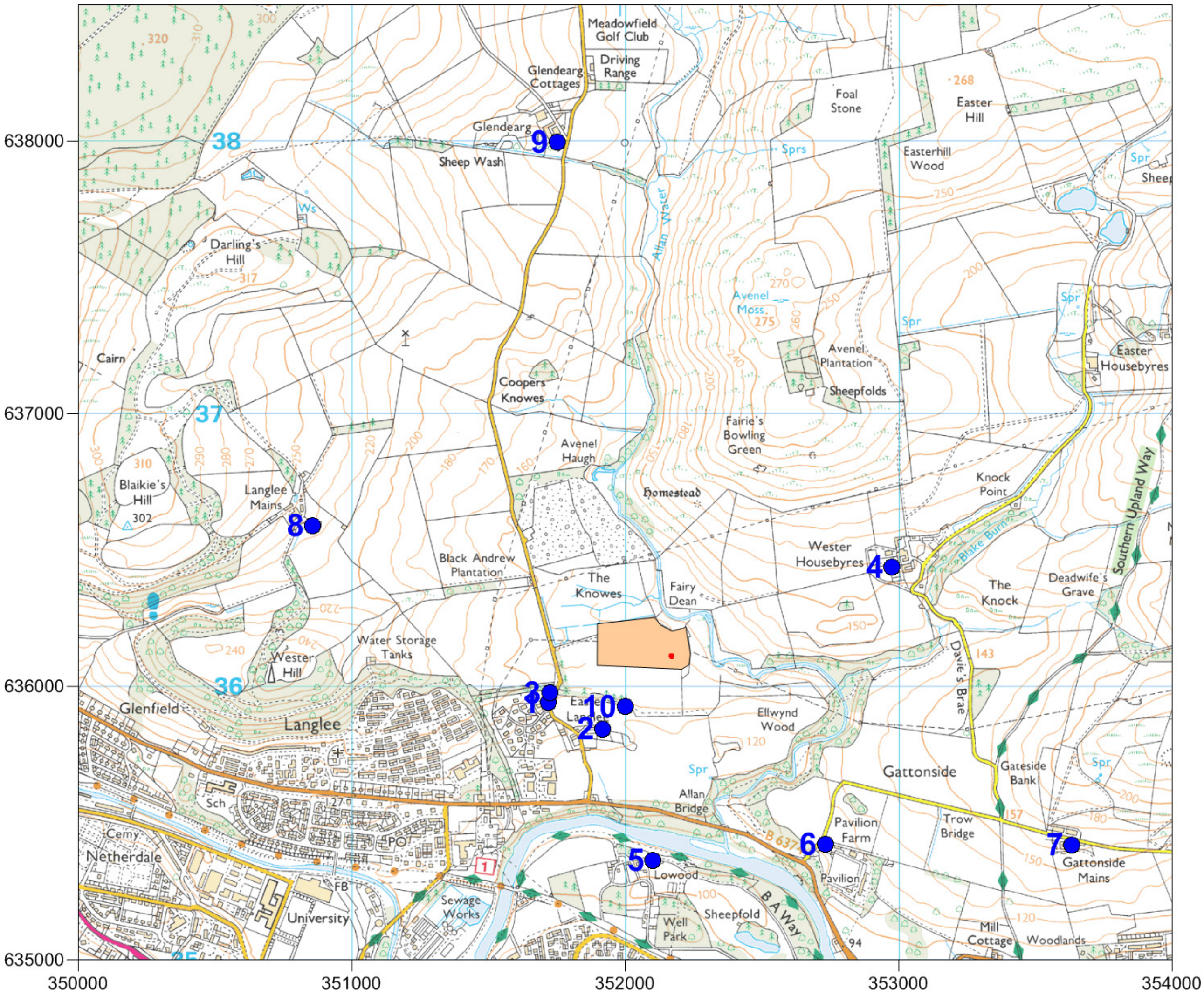



**Figure 4. Residential Receptors Included in Model**

**Table 50. Key to Residential Receptors**

| Receptor | Address | Location | | |
|---|---|---|---|---|
| | | Eastings, m | Northings, m | Distance from stack, m |
| 1 | 10 Loan View | 351718 | 635940 | 480 |
| 2 | 1 Easter Langlee | 351918 | 635844 | 370 |
| 3 | 9 Loan View | 351724 | 635976 | 470 |
| 4 | Wester Housebyres | 352975 | 636435 | 870 |
| 5 | Lowood | 352101 | 635364 | 750 |
| 6 | Pavilion Farm | 352731 | 635421 | 890 |
| 7 | Gattonside Mains | 353634 | 635420 | 1620 |
| 8 | Langlee Mains Farmhouse | 350857 | 636588 | 1400 |
| 9 | Glendearg | 351750 | 637995 | 1930 |
| 10 | Proposed development | 352000 | 635925 | 200 |

### 4.1.1.2. Ecological Receptors

The SEPA H1 guidance requires an air quality assessment to address designated ecological sites. This entails evaluation against critical levels specified for oxides of nitrogen and against critical loads for nitrogen deposition. The H1 guidance recommends that designated sites including Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites and SSSIs be considered where they fall within ten kilometres of the installation. For smaller facilities such as the one proposed at Easter Langlee, a search radius of just a few kilometres is normally adequate to demonstrate the effects on air quality.

The DEFRA "Magic" website[13] was used to find information regarding nationally designated ecological sites in the vicinity of the proposed development. Further information on specific designated sites is published by Scottish Natural Heritage (SNH)[14].

There are no SPAs or Ramsar sites within ten kilometres of the proposed facility, but there are four SACs. In addition there are three SSSIs within two kilometres. These designated ecological sites are shown below, together with their qualifying interest features for designation.

**Table 51. Designated Ecological Sites**

| Name | Designation | Qualifying Interest |
|---|---|---|
| River Tweed | SAC, SSSI | River lamprey, Brook lamprey, Otter, Sea lamprey, Atlantic salmon. Rivers with floating vegetation often dominated by water-crowfoot. |
| Avenel Hill and Gorge | SSSI | Broadleaved, mixed and yew woodland (upland oak woodland), butterflies |
| Gattonside Moss | SSSI | Basin fen (medium to rich), beetle assemblages |
| Borders Woods | SAC | Mixed woodland on base-rich soils |
| Threepwood Moss | SAC | Active raised bog, degraded raised bog |
| Whitlaw and Branxholme | SAC | Base-rich fens, feather-moss, transition mires with unstable, quaking surface |

Locations representing the nearest boundary of the designated sites were selected as discrete receptors in the dispersion model; in some cases two points were chosen where the designated feature covers an extensive area. The ecological receptors included in the model are shown and in tabular form below.

[13] http://magic.defra.gov.uk/
[14] http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/local-designations/local-nature-conservation/

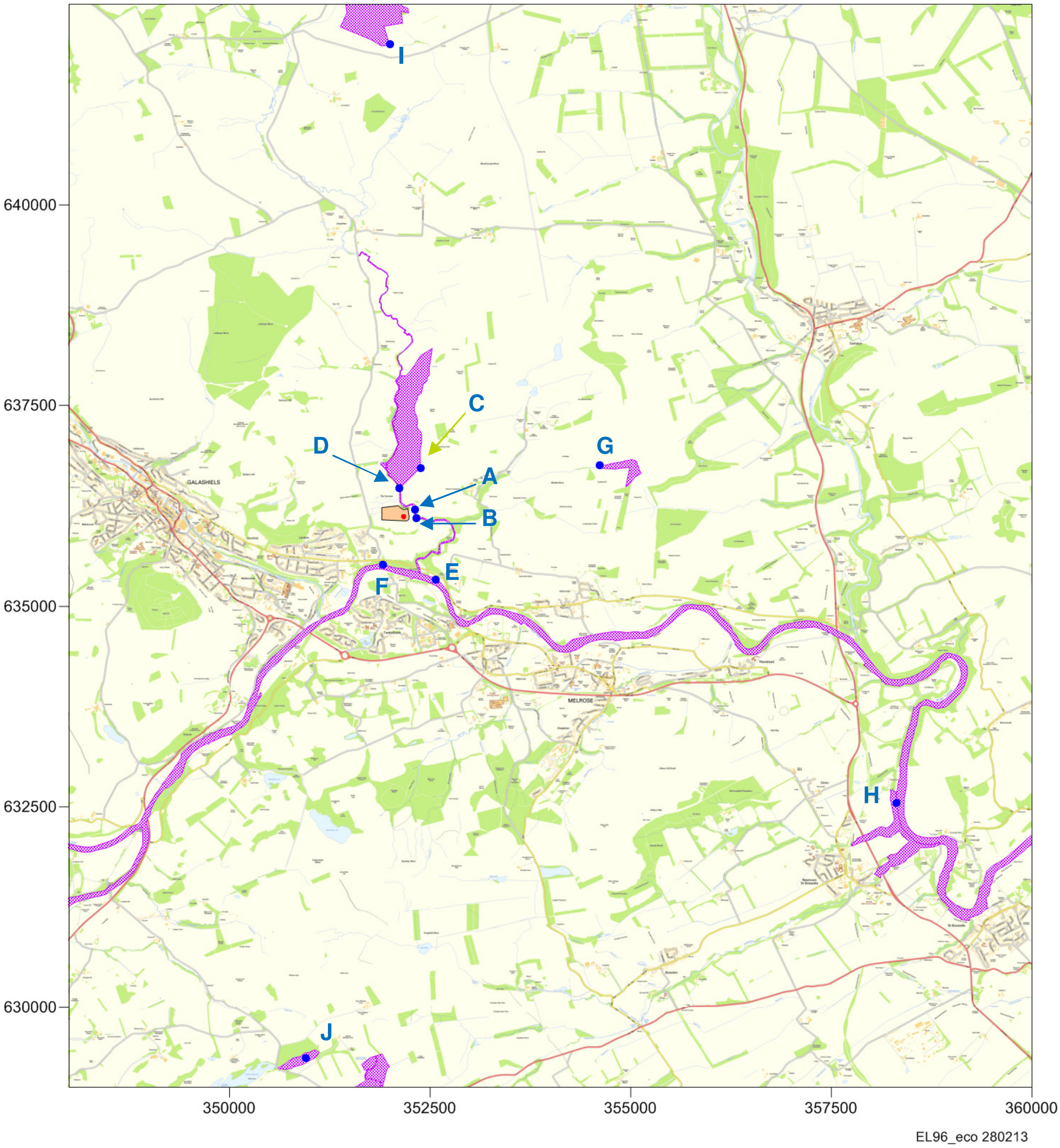



*Figure Contains Ordnance Survey data © Crown copyright and database right 2013*

**Figure 5. Ecological Receptors Included in Model**

Table 52. Key to Discrete Ecological Receptors

| Receptor | Address | Location | | |
|---|---|---|---|---|
| | | Eastings, m | Northings, m | Distance from stack, m |
| A | River Tweed SAC (1 of 2) | 352310 | 636204 | 170 |
| B | River Tweed SAC (2 of 2) | 352326 | 636097 | 160 |
| C | Avenel Hill and Gorge SSSI (1 of 2) | 352380 | 636720 | 650 |
| D | Avenel Hill and Gorge SSSI (2 of 2) | 352120 | 636470 | 370 |
| E | River Tweed SSSI (1 of 2) | 351912 | 635522 | 640 |
| F | River Tweed SSSI (2 of 2) | 352573 | 635330 | 880 |
| G | Gattonside Moss SSSI | 354618 | 636757 | 2520 |
| H | Borders Woods SAC | 358310 | 632550 | 7100 |
| I | Threepwood Moss SAC | 352000 | 642000 | 5890 |
| J | Whitlaw and Branxholme SAC | 350950 | 629360 | 6860 |

## 4.2. POINT SOURCE EMISSIONS TO AIR

### 4.2.1. Model Selection

Emissions data used for the impact assessment of emissions to air were those shown in the relevant guidance as reproduced in Section 3 above. In addition, an assessment of the potential short-term emissions during abnormal emissions episodes was undertaken using the half-hourly average emission limits specified in the IED for the gasifier combustor exhaust. These results represent highly exceptional occurrences. The dispersion modelling of exhaust emissions was carried out using the United States Environmental Protection Agency (US EPA) model AERMOD PRIME version 1206015. This model is the result of many years development by the US EPA and the American Meteorological Society. It has been developed as a regulatory model that incorporates the current understanding of atmospheric physical processes. AERMOD is used by regulatory agencies, consultants and industry worldwide to assess the impact of air emissions from point, area, line, flare and volume sources. It is commonly used in the UK for planning and regulatory applications. AERMOD simulates essential atmospheric physical processes and provides refined concentration estimates over a wide range of meteorological conditions and modelling scenarios. The modelling system includes:

- An advanced meteorological pre-processor to compute site-specific planetary boundary layer (PBL) parameters
- Highly developed dispersion formulations that incorporate current PBL understanding and variables for both convective and stable boundary inversions
- Enhanced treatment of plume rise and plume penetration for elevated inversions allowing for effects of strong updrafts and downdrafts that occur in unstable conditions
- Improved computation of vertical profiles of wind, turbulence and temperature
- A “dividing streamline” approach for computations in complex terrain

AERMOD includes two data pre-processors for streamlining data input: AERMET, a meteorological pre-processor, and AERMAP, a terrain pre-processor. The model can address both local topography and building downwash effects concurrently, where relevant to the study. The model provides reasonable estimates over a

[15] AERMOD software provided by Trinity Consultants Inc, http://www.breeze-software.com/

wide range of meteorological conditions and modelling scenarios. The building downwash algorithms in AERMOD PRIME, using parameters calculated by the Building Parameter Input Program (BPIP), distinguish this model from earlier versions of AERMOD, which used simpler procedures to address downwash.

### 4.2.2. Meteorological Data

The most appropriate meteorological station for the dispersion modelling study is the Charterhall RAF Met Office site. An hourly sequential meteorological data file from Charterhall for the five year period 2006 to 2010 was used in the modelling. The meteorological station is located at grid reference NT 7592 4618 (10 m precision) approximately 27.8 kilometres to the east north east of Easter Langlee, and hence the data is considered to be representative of the application site. The five year meteorological data file from Charterhall contains over 43,000 hourly records, and is quite adequate to characterise local meteorology in terms of both extreme events and long-term average conditions for the purposes of dispersion modelling. The data incorporates numerous limited mixing height measurements within the extensive hourly records, thus adequately representing temperature inversion conditions. Terrain elevations for all model objects (i.e. exhausts and buildings) and receptors were used in the dispersion model, as derived from Ordnance Survey digital terrain data files. The inclusion of elevation data for the receptor grids ensures that complex terrain (i.e. terrain above the height of the stack) in the surrounding area is taken into account by the model when calculating ground level concentrations. The application site was assumed to be levelled at 133 m above ordnance datum (AOD).

The modelled annual average concentrations are period averages derived using five years of meteorological data and are considered to be robust. We have on this occasion not considered individual annual average results as this site is not at risk of exceeding any AQS objectives or EALs. Undertaking such modelling would have no material consequence on the findings of the report, which is that the facility increment is a small percentage of the background concentration, and total concentrations are well below objectives. The assessment was based on a number of conservative assumptions, which are discussed in the report. The full dispersion modelling report is attached to this variation application as Appendix C.

### 4.2.3. Summary of Results

The maximum field-wide short-term and long-term ground level concentrations (PCs) resulting from the air dispersion modelling exercise, together with the relevant air quality criteria (AQS or EAL), are presented below. The table also shows in the final column the maximum percentage contribution that the plant is expected to make to the air quality criteria. Note that PAHs, PCBs, $N_2O$ and other non-WID pollutants from emission point A6 are not covered as these pollutants do not have an emission limit value and therefore there is no basis for modelling at this stage. Should SEPA require such an assessment, we propose that this is undertaken following commissioning once monitoring data for non-WID pollutants are available to form the basis of the modelling exercise. For example, we will monitor for PAH during operation using techniques compliant with BS ISO 11338-1 (2003) part 1 or BS ISO 11338-2 (2003) part 2. We have on this occasion not considered individual annual average results as this site is not at risk of exceeding any AQS objectives or EALs. Undertaking such modelling would have no material consequence on the findings of the report, which is that the facility increment is a small percentage of the background concentration, and total concentrations are well below objectives.

**Table 53. Summary of Atmospheric Dispersion Results for Field-Wide Maximum**

| Pollutant | Averaging Period | PC, µg/m³ | Criterion, µg/m³ | Source | PC / EAL, % |
|---|---|---|---|---|---|
| Nitrogen oxides | Hourly | 197 | - | - | - |
| | Annual | 4.9 | 30 | AQS (veg) | 16.4 |
| Nitrogen dioxide | Hourly | 68.8 | 200 | AQS | 34.4 |
| | Annual | 3.4 | 40 | AQS | 8.6 |
| Particulates[16] | Daily | 0.34 | 50 | AQS | 0.7 |
| | Annual | 0.03 | 18 | AQS | 0.2 |
| Sulphur dioxide | 15-minute | 8.5 | 266 | AQS | 3.2 |
| | Hourly | 6.3 | 350 | AQS | 1.8 |
| | Daily | 1.6 | 125 | AQS | 1.3 |
| | Annual | 0.16 | 20 | AQS (veg) | 0.8 |
| Carbon monoxide | Hourly | 485 | 30,000 | EAL | 1.6 |
| | 8-hourly | 164 | 10,000 | AQS | 1.6 |
| | Annual | 12.0 | 350 | EAL | 3.4 |
| Hydrogen chloride | Hourly | 4.6 | 800 | EAL | 0.6 |
| | Annual | 0.12 | 20 | EAL | 0.6 |
| Hydrogen fluoride | Hourly | 3.2 | 250 | EAL | 1.3 |
| Hydrogen sulphide | Hourly | 5.6 | 150 | EAL | 3.7 |
| | Annual | 0.14 | 140 | EAL | 0.1 |
| VOC (non methane) | Hourly | 35.6 | 208 | EAL Benzene | 17.1 |
| | Annual | 0.88 | 3.25 | AQS Benzene | 27.1 |
| Group 1 metals (total) | Hourly | $6.3\times10^{-3}$ | 1.5 | EAL Cd | 0.4 |
| | Annual | $1.6\times10^{-4}$ | 0.005 | EAL Cd | 3.1 |
| Group 2 metals (total) | Hourly | $6.3\times10^{-3}$ | 7.5 | EAL Hg | 0.1 |
| | Annual | $1.6\times10^{-4}$ | 0.25 | EAL Hg | 0.1 |
| Group 3 metals (total) | Hourly | 0.06 | See below | | - |
| | Annual | $1.6\times10^{-3}$ | | | - |
| Dioxins and furans | Annual | $3.2\times10^{-10}$ | | | - |

The maximum results tabulated above do not necessarily represent a relevant location for exposure of a sensitive human health or ecological receptor. The geographical locations of the long-term and short-term maximum modelled process contributions presented in the above table are discussed over the following pages in the context of the graphical results for specific pollutants, alongside tables with the maximum concentrations at the discrete modelled sensitive receptors.

The SEPA Guidance Note H1 describes a screening procedure in which process contributions of less than 1% of the long-term environmental benchmark, or less than 10 % of the short-term benchmark, are considered not to warrant further assessment.

[16] The maximum annual average increment for particulates of 0.03 µg/m³ is also less than one percent of the annual mean objective for $PM_{2.5}$ of 12 µg/m³.

In the table above, a comparison is made with the AQS or EALs for human health. The maximum percentage that the PC makes to the criterion is at most 17 %. The results for particulates, sulphur dioxide, hydrogen chloride, hydrogen fluoride, hydrogen sulphide, and Group 2 metals are all deemed to be insignificant on the basis that the PC contributes less than 1% to the long term EAL and/or 10% to the short term EAL for human health.

The next section of this chapter describes the results in more detail with respect to the EALs for human health and where appropriate, i.e. where the PC alone cannot be considered insignificant as it exceeds the H1 screening criteria, the calculated PECs are provided (these have been estimated using the simple H1 method of combining with a background concentration).

The potential effects on vegetation are discussed in the section entitled "ecological assessment" below.

### 4.2.4. Human Health Assessment

#### 4.2.4.1. Oxides of Nitrogen

##### 4.2.4.1.1. Annual Average

The modelled annual average ground level oxides of nitrogen concentrations resulting from the proposed ATT plant emissions are shown graphically below. The contour plot demonstrates the dispersion pattern of off-site ground level concentrations.

The pattern of dispersion reflects the long-term frequencies of winds depicted in the wind rose shown in the full report. The effects of the proposed ATT plant emissions are relatively localised, the highest annual average oxides of nitrogen concentration of 4.9 $\mu g/m^3$ occurring 150 metres to the north-east of the ATT plant exhaust, beyond the site boundary over land that encompasses a car park. There is a secondary maximum to the south west, where concentrations are 1.6 $\mu g/m^3$ or less. Concentrations reduce rapidly with increasing distance from these maxima, such that in the majority of the surrounding area, increments in the annual average are less than 1 $\mu g/m^3$.

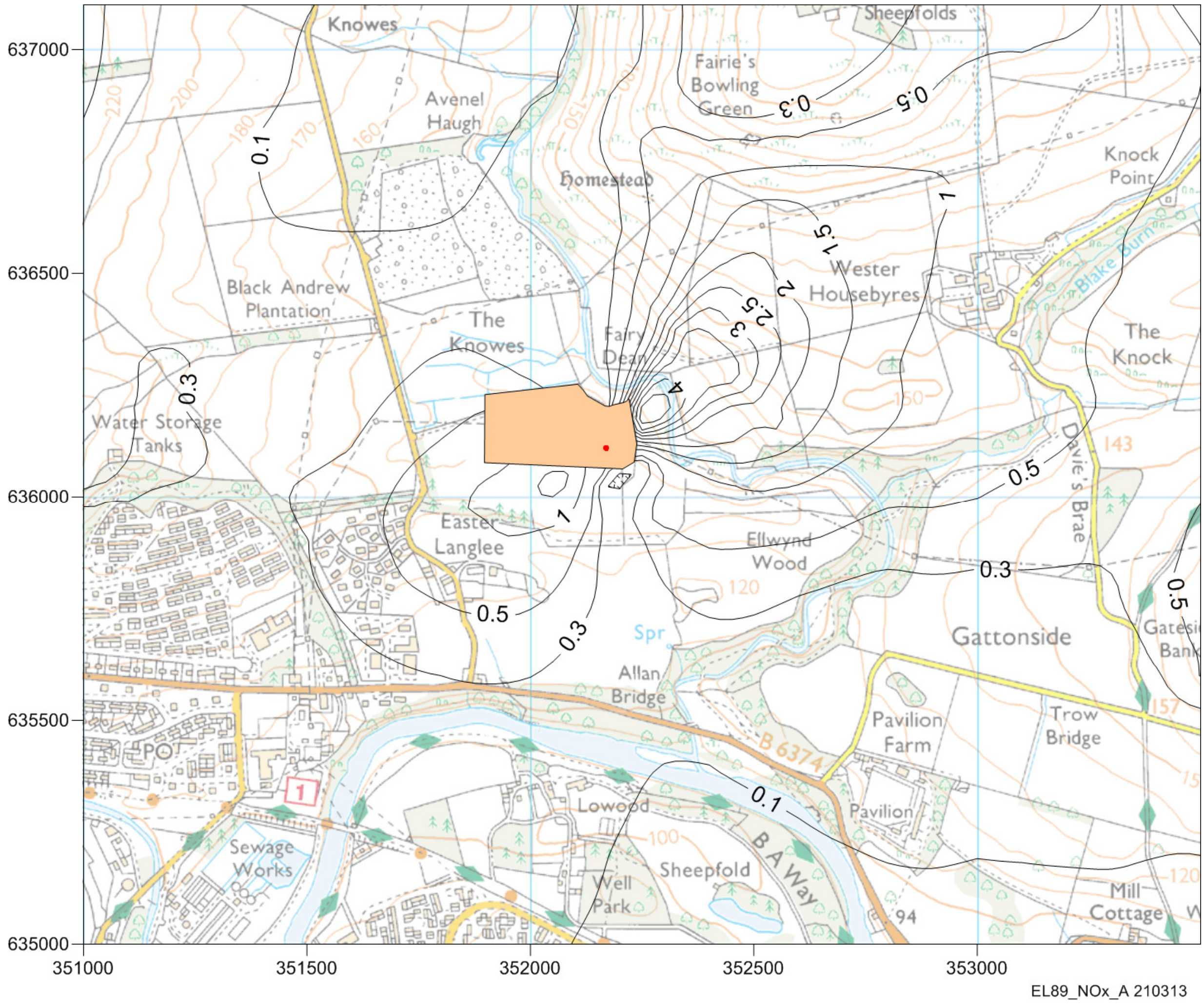



**Figure 6. Maximum Annual Average Oxides of Nitrogen Concentrations, µg/m$^3$**

The annual average nitrogen dioxide PCs at nearby residential receptors are shown below, which have been calculated assuming a conservative 70% conversion rate from oxides of nitrogen. The highest concentration at any residential receptor is found at receptor 10, located on the northern edge of the planned new residential development to the south of the facility. Here the maximum increment to annual average oxides of nitrogen concentrations is 1 µg/m$^3$. The modelled increment is equivalent to 0.7 µg/m$^3$ as nitrogen dioxide, less than 2% of the AQS objective of 40 µg/m$^3$.

**Table 54. Annual Average Oxides of Nitrogen Results at Discrete Receptors**

| ID | Receptor | Annual $NO_x$, µg/m³ | Annual $NO_2$, µg/m³ | PC / EAL, % | PEC $NO_2$, µg/m³ | PEC / EAL, % |
|---|---|---|---|---|---|---|
| 1 | 10 Loan View | 0.6 | 0.4 | 1.1 | 10.4 | 26.1 |
| 2 | 1 Easter Langlee | 0.8 | 0.6 | 1.4 | 10.6 | 26.4 |
| 3 | 9 Loan View | 0.6 | 0.4 | 1.1 | 10.4 | 26.1 |
| 4 | Wester Housebyres | 0.8 | 0.6 | 1.4 | 10.6 | 26.4 |
| 5 | Lowood | 0.1 | 0.1 | 0.2 | 10.1 | 25.2 |
| 6 | Pavilion Farm | 0.1 | 0.1 | 0.2 | 10.1 | 25.2 |
| 7 | Gattonside Mains | 0.2 | 0.1 | 0.3 | 10.1 | 25.3 |
| 8 | Langlee Mains Farmhouse | 0.1 | 0.1 | 0.2 | 10.1 | 25.2 |
| 9 | Glendearg | 0.1 | 0.1 | 0.1 | 10.1 | 25.1 |
| 10 | Proposed development | 1.0 | 0.7 | 1.8 | 10.7 | 26.8 |

As the PC exceeds 1% of the EAL at some of these properties, the total PEC was calculated, as shown in the sixth column. This calculation was undertaken by adding the 2011 nitrogen dioxide concentration measured in Galashiels, 10 µg/m³, to each modelled PC. The total concentration at a property within the new development was thus estimated to be 10.7 µg/m³.

The final column of the table shows the PEC as a percentage of the EAL, the annual mean AQS objective of 40 µg/m3. The estimated total nitrogen dioxide concentrations using this conservative procedure demonstrates that at all receptors - where there may be a relevant exposure over a long-term time period - ambient concentrations will remain well below – around a quarter of - the objective. These results demonstrate that the effects of the facility emissions are not significant.

Given the highly conservative assumption of 70% conversion to nitrogen dioxide used in the assessment, the actual increments in annual average nitrogen dioxide concentrations are likely to be even lower than those presented.

#### 4.2.4.1.2. Hourly Average

The contour plot for maximum hourly average oxides of nitrogen concentrations is shown below. The maximum ground level concentration of 197 µg/m³ occurs over 600 metres north of the facility, on an area of elevated terrain at Fairies Bowling Green. There is a secondary maximum approximately 1.2 km to the west north west of the site, on high ground near Langlee Mains, with concentrations around 150 µg/m³.

For comparison with the short-term EAL for nitrogen dioxide of 200 µg/m³, a 35% conversion ratio was applied to the maximum modelled hourly concentrations of oxides of nitrogen. The results for the nearest residential properties are summarised in below.

**Table 55. Hourly Average Oxides of Nitrogen Results at Discrete Receptors**

| ID | Receptor | Hourly $NO_x$, µg/m$^3$ | Hourly $NO_2$, µg/m$^3$ | PC / AQS, % | PEC $NO_2$, µg/m$^3$ | PEC / AQS, % |
|---|---|---|---|---|---|---|
| 1 | 10 Loan View | 36.0 | 12.6 | 6.3 | 32.6 | 16.3 |
| 2 | 1 Easter Langlee | 33.0 | 11.6 | 5.8 | 31.6 | 15.8 |
| 3 | 9 Loan View | 39.4 | 13.8 | 6.9 | 33.8 | 16.9 |
| 4 | Wester Housebyres | 10.1 | 3.5 | 1.8 | 23.5 | 11.8 |
| 5 | Lowood | 9.2 | 3.2 | 1.6 | 23.2 | 11.6 |
| 6 | Pavilion Farm | 8.9 | 3.1 | 1.6 | 23.1 | 11.6 |
| 7 | Gattonside Mains | 16.6 | 5.8 | 2.9 | 25.8 | 12.9 |
| 8 | Langlee Mains Farmhouse | 61.6 | 21.6 | 10.8 | 41.6 | 20.8 |
| 9 | Glendearg | 43.5 | 15.2 | 7.6 | 35.2 | 17.6 |
| 10 | Proposed development | 46.8 | 16.4 | 8.2% | 36.4 | 18.2 |

The maximum short-term concentration at any residential receptor is found at receptor 8, Langlee Mains Farmhouse, where the maximum hourly average increment as nitrogen dioxide is 21.6 µg/m$^3$, the equivalent of just under 11% of the AQS objective. Adding twice the annual background concentration to the PC gives an estimate of the short-term PEC. It is evident from the table that maximum hourly $NO_x$ concentrations are a fifth of the short-term AQS objective of 200 µg/m$^3$, exceedances of which are permitted up to 18 times a year

It can be seen that total concentrations are well below the AQS short-term criterion at all residential receptors. At the location of the maximum ground level concentration shown above, which can conservatively be used to represent all public open space, the PEC would be 89 µg/m$^3$, or less than half the criterion. These results demonstrate that the effects of the facility emissions on short-term concentrations are not significant.

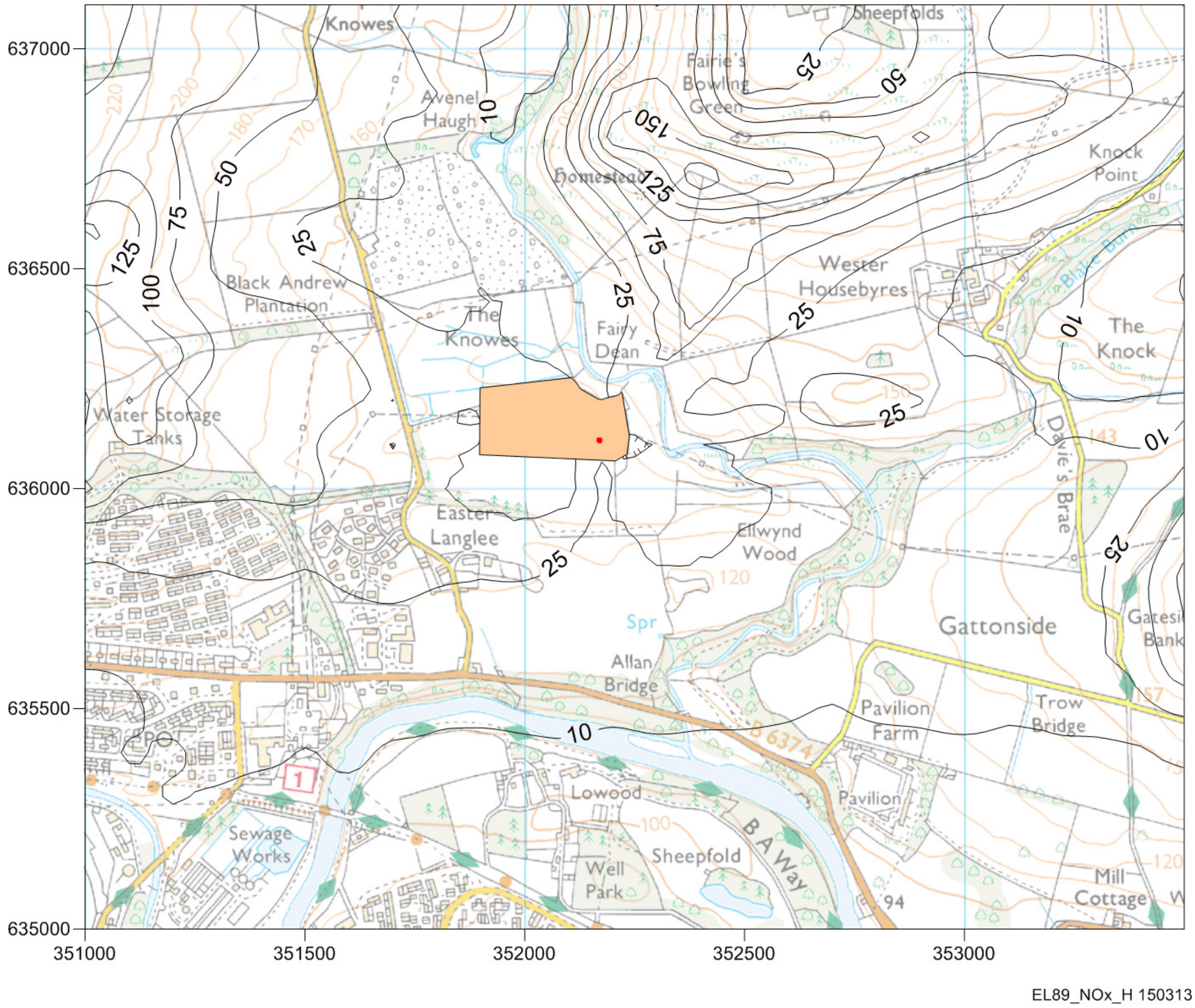



**Figure 7. Maximum Hourly Average Oxides of Nitrogen Concentrations, µg/m$^3$**

### 4.2.4.2. Carbon Monoxide

The maximum annual average carbon monoxide PCs are shown graphically below. The effects of the proposed ATT plant emissions are relatively localised, the highest annual average carbon monoxide concentration of 12.0 µg/m$^3$ occurring 110 metres to the north-east of the ATT plant exhaust. The modelled increment is equivalent to 3.4% of the EAL of 350 µg/m$^3$.

The maximum annual mean concentration at any residential receptor is found at receptor 10, within the proposed housing development, where the annual mean increment is 2.5 µg/m$^3$. This result is negligible in the context of the EAL of 350 µg/m$^3$, as it represents less than 1% of the criterion.

The hourly mean PCs were shown to be insignificant in the summary table above, in the context of the hourly EAL and eight hourly AQS objective, and hence are not considered further.

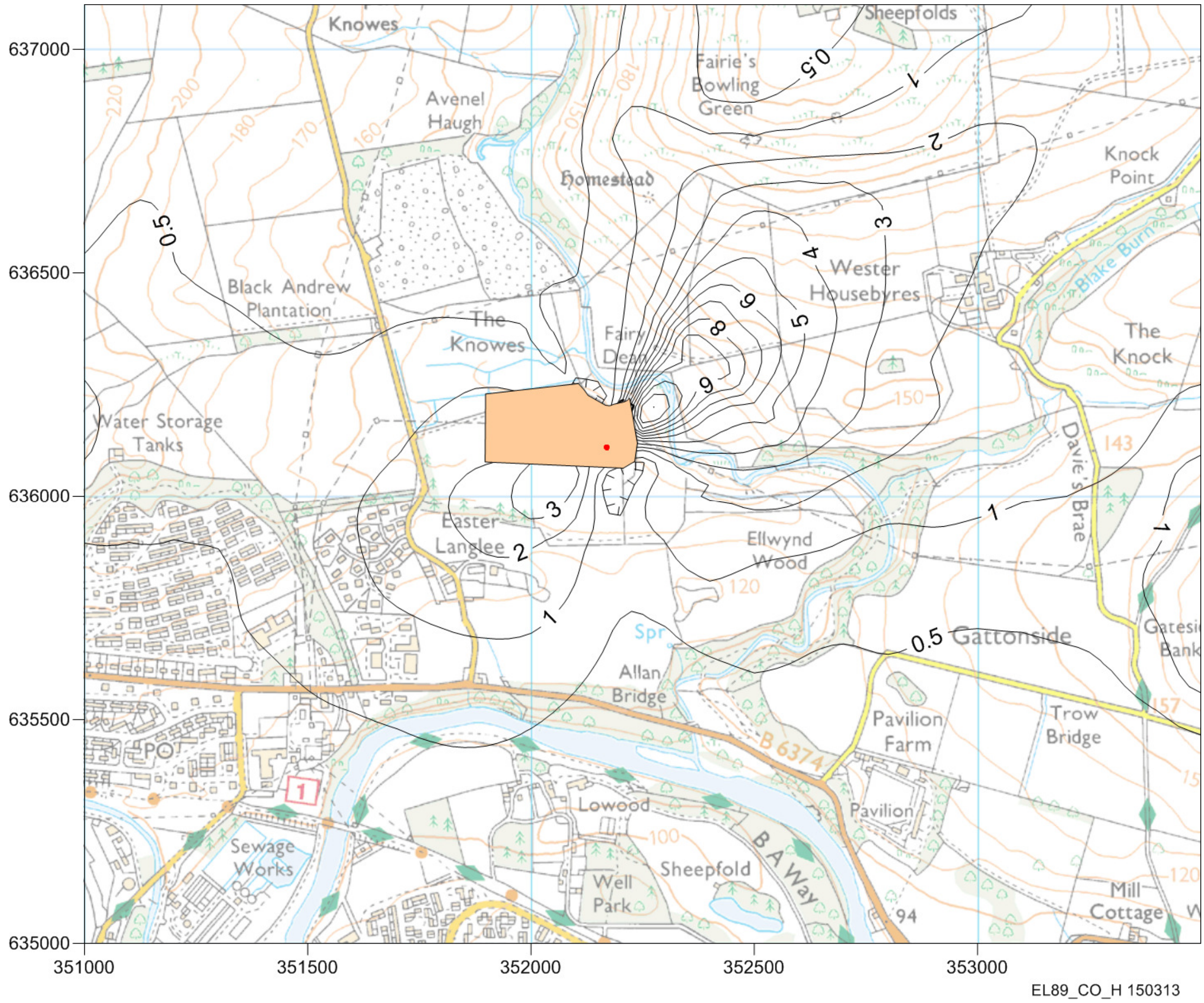



**Figure 8. Maximum Annual Average Carbon Monoxide Concentrations, μg/m³**

### 4.2.4.3. Hydrocarbons (VOC or TOC)

#### 4.2.4.3.1. Annual Mean

The maximum modelled annual mean result for total hydrocarbons of 343 μg/m³ is found approximately 125 metres to the north east of the exhaust; a secondary maximum of 2.5 μg/m³ is found to the south west of the stack. This result represents the total annual mean concentration including non-methane hydrocarbons. Based on the engine emissions data provided by NESSB, which provides the proportion of non-methane hydrocarbons, and using the highly conservative assumption that all non-methane hydrocarbons (nmVOCs) are benzene, it is estimated that the annual mean benzene concentration would comprise 10.4% of the total modelled hydrocarbon concentration. On this basis the maximum annual mean benzene concentration is estimated to be 0.9 μg/m³, the equivalent of 27% of the AQS objective of 3.25 μg/m³.

The highest concentration at any residential receptor is found within the new development to the south of the facility where the annual average concentration is 0.18 μg/m³ as benzene. This represents just 5% of the AQS

(Scotland) objective of 3.25 µg/m³. The measured background concentration of benzene is 0.22 µg/m³. The total PEC of 0.40 µg/m³ is equivalent to 12% of the objective.

#### 4.2.4.3.2. Hourly Mean

The maximum modelled hourly mean result of 36 µg/m³ as benzene, the equivalent of 17% of the hourly EAL of 208 µg/m³, is found approximately 640 metres to the north east of the exhaust. As described above, this concentration has been conservatively estimated based on the assumption that benzene constitutes 10.4% of the total VOC.

The highest concentration at any residential receptor is found at receptor 8, Langlee Mains Farmhouse, where the maximum hourly concentration is 11.1 µg/m³ as benzene. This represents 5 % of the EAL. Adding twice the annual background concentration to the PC gives an estimate of the short-term PEC equal to 11.6 µg/m³, or 6% of the objective.

These results, which use conservative assumptions regarding the composition of nmVOC emissions, demonstrate that the effects of the facility emissions on long-term concentrations are not significant.

### 4.2.4.4. Hydrogen Sulphide

The modelled PCs were shown to be insignificant in the summary table above, in the context of the hourly and annual EALs, and hence are not considered further in terms of health effects. It is noted that the field-wide maximum hourly ground level concentration is 5.6 µg/m³, which is below the odour detection threshold of 7 µg/m³ (equivalent to 0.0047 ppm).

### 4.2.4.5. Heavy Metals

#### 4.2.4.5.1. Groups 1 and 2

The IED emission concentration limits for Group 1 and Group 2 metals from the combustor are both set at 0.05 mg/m³, which is a tenth of the limit of 0.5 mg/m³ for Group 3 metals. A contour plot showing the annual mean concentrations for the Group 1 and 2 metals is shown below. The results for the Group 3 metals would be ten times higher than those shown in this plot. Note that for presentational purposes, the concentrations plotted are nanograms per cubic metre, equal to one thousandth of a microgram per cubic metre.

The maximum annual average modelled result for the Group 1 metals is $1.6 \times 10^{-4}$ µg/m³ (and hence for the Group 3 total is $1.6 \times 10^{-3}$ µg/m³). This value is found just over a hundred metres to the north east of the ATT plant exhaust. The field-wide maximum is confined to a small area to the north east of the site boundary, where there is no relevant exposure. At the modelled residential receptor within the new housing development to the south of the facility, the annual average concentration for Group 1 (total) and Group 2 is an order of magnitude lower at $3.3 \times 10^{-5}$ µg/m³ (and hence for the Group 3 total is 3.3x10-6 µg/m³).

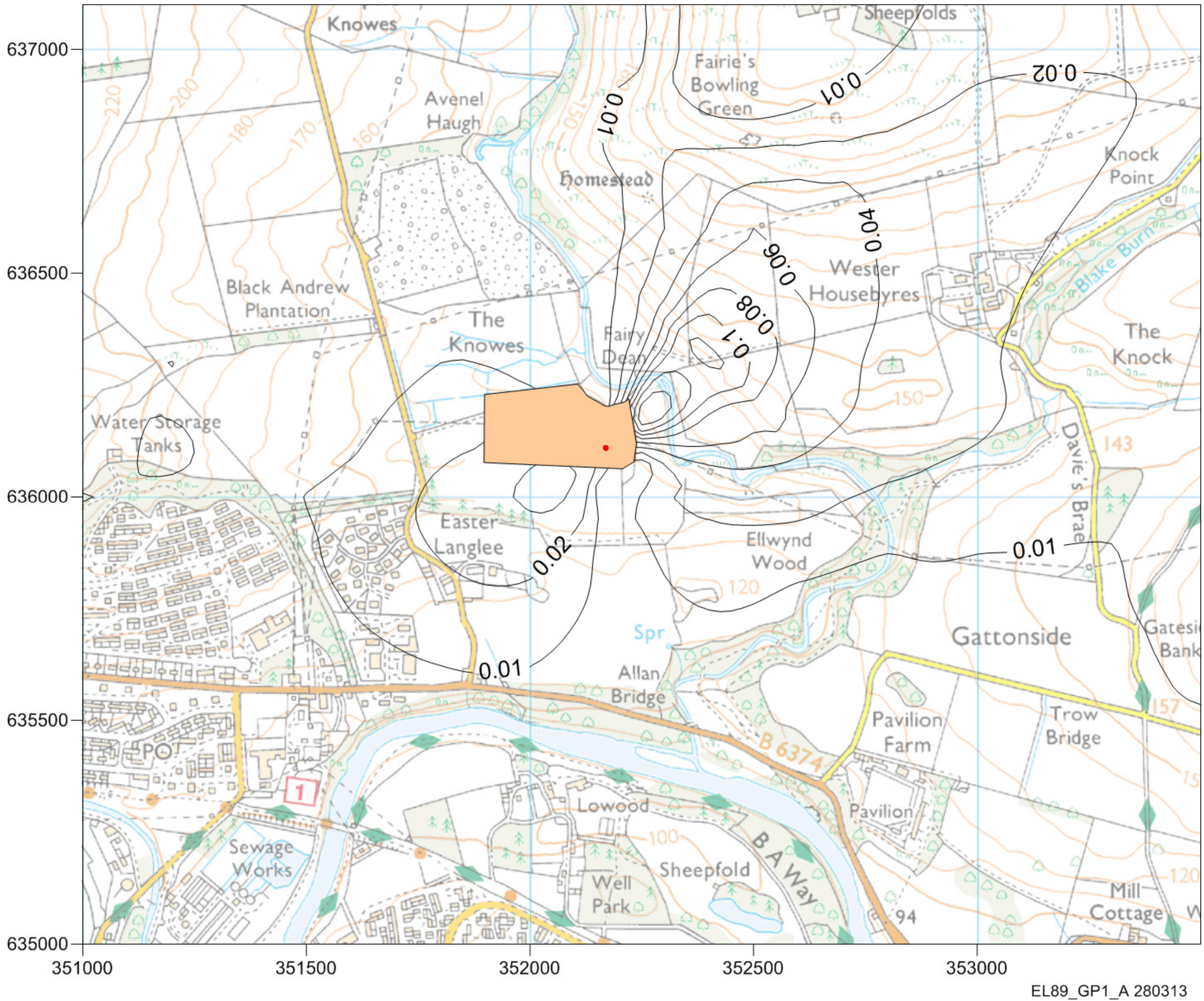



**Figure 9.** **Annual Average Group 1 Metals Concentrations, ng/m$^3$**

### 4.2.4.5.2. Comparison with EALs

The field-wide maximum results for the heavy metals are summarised below for the annual and hourly mean. The PCs and PECs have been calculated and are compared with the EALs for each substance.

**Table 56. Maximum Field-wide Annual Average Concentrations of Heavy Metals**

| Group | Metal | PC, µg/m³ | EAL, µg/m³ | PC / EAL, % | Background, µg/m³ | PEC, µg/m³ | PEC / EAL, % |
|---|---|---|---|---|---|---|---|
| Group 1 | Cd | $7.8x10^{-5}$ | 0.005 | 1.6 | $4.6x10^{-5}$ | $1.2x10^{-4}$ | 2.5 |
| | Tl | $7.8x10^{-5}$ | 1 | <0.1 | n/a | - | - |
| Group 2 | Hg | $1.6x10^{-4}$ | 0.25 | 0.1 | $2.0x10^{-6}$ | $1.6x10^{-4}$ | 0.1 |
| Group 3 | Sb | $1.7x10^{-4}$ | 5 | <0.1 | n/a | - | - |
| | As | $1.7x10^{-4}$ | 0.2 | 0.1 | $2.9x10^{-4}$ | $4.6x10^{-4}$ | 0.2 |
| | Pb | $1.7x10^{-4}$ | 0.5 | 0.1 | $2.5x10^{-3}$ | $2.7x10^{-3}$ | 1.1 |
| | Cr, Cr(II) & Cr(III) | $1.4x10^{-4}$ | 5 | <0.1 | $3.7x10^{-4}$ | $5.1x10^{-4}$ | <0.1 |
| | Cr (VI)* | $3.5x10^{-5}$ | 0.1 | <0.1 | $9.4x10^{-5}$ | $1.3x10^{-4}$ | 0.1 |
| | Co | $1.7x10^{-4}$ | 0.6 | <0.1 | n/a | - | - |
| | Cu | $1.7x10^{-4}$ | 10 | <0.1 | $2.0x10^{-3}$ | $2.1x10^{-3}$ | <0.1 |
| | Mn | $1.7x10^{-4}$ | 1 | <0.1 | $1.2x10^{-3}$ | $1.3x10^{-3}$ | 0.1 |
| | Ni | $1.7x10^{-4}$ | 1 | <0.1 | $5.2x10^{-4}$ | $7.0x10^{-4}$ | 0.1 |
| | V | $1.7x10^{-4}$ | 5 | <0.1 | $6.8x10^{-4}$ | $8.6x10^{-4}$ | <0.1 |

* calculated assuming that Cr (VI) comprises 20% of total emissions and background
n/a – not available

An equal distribution between the component metals has been assumed in producing these results. For instance for cadmium and thallium, which make up Group 1, the maximum field-wide concentration value for an individual metal is calculated to be $7.8x10^{-5}$ µg/m³, or half the Group 2 result. A similar assumption may be made for Group 3 in that the concentration of each individual metal is equal to one-ninth of the total. The field-wide maximum annual average for an individual Group 3 metal is therefore $1.7x10^{-4}$ µg/m³.

The maximum annual average concentration for an individual Group 1 metal of $7.8x10^{-5}$ µg/m³ represents less than 2% of the long-term EAL for cadmium. The calculated PEC, including background, is $1.2x10^{-4}$ µg/m³ or 2.5% of the EAL. The maximum annual average concentration of mercury compounds is $1.6x10^{-4}$ µg/m³; this represents approximately 0.1% of the EAL, an insignificant contribution. On this basis it may be concluded that there is no risk of the EAL being exceeded at any sensitive receptor, for either the Group 1 or 2 metals.

For the Group 3 metals, the PC represents just 0.1% or less of the corresponding EAL for each metal, hence all results can be considered negligible. Further consideration of the PECs is not required, but the results are also presented in the table above for completeness.

The field-wide maximum hourly mean results for the heavy metals are summarised below. The maximum field-wide hourly concentrations for all metals are below the 10% screening criterion, and in fact are all less than 1% of the corresponding EALs. On this basis, the short-term hourly concentrations of all heavy metals can be considered insignificant. Again, the PECs are presented for completeness.

As these results for metals, which have been derived assuming continuous emission at the IED limit values, clearly demonstrate that ground level concentrations would be negligible, an assessment of the human health risk from exposure to certain of the heavy metals via the food chain has not been undertaken.

**Table 57. Maximum Field-wide Hourly Average Concentrations of Heavy Metals**

| Group | Metal | PC, µg/m$^3$ | EAL, µg/m$^3$ | PC / EAL, % | Background, µg/m$^3$ | PEC, µg/m$^3$ | PEC / EAL, % |
|---|---|---|---|---|---|---|---|
| Group 1 | Cd | $3.2 \times 10^{-3}$ | 1.5 | 0.2 | $9.2 \times 10^{-5}$ | $3.3 \times 10^{-3}$ | 0.2 |
| | Tl | $3.2 \times 10^{-3}$ | 30 | <0.1 | - | - | - |
| Group 2 | Hg | $6.3 \times 10^{-3}$ | 7.5 | 0.1 | $4.0 \times 10^{-6}$ | $6.3 \times 10^{-3}$ | 0.1 |
| Group 3 | Sb | $7.0 \times 10^{-3}$ | 150 | <0.1 | - | - | - |
| | As | $7.0 \times 10^{-3}$ | 15 | <0.1 | $5.7 \times 10^{-4}$ | $7.6 \times 10^{-3}$ | 0.1 |
| | Pb | $7.0 \times 10^{-3}$ | N.A. | - | $5.0 \times 10^{-3}$ | $1.2 \times 10^{-2}$ | - |
| | Cr, Cr(II) & Cr(III) | $5.6 \times 10^{-3}$ | 150 | <0.1 | $7.5 \times 10^{-4}$ | $6.4 \times 10^{-3}$ | <0.1 |
| | Cr (VI)[1] | $1.4 \times 10^{-3}$ | 3 | <0.1 | $1.9 \times 10^{-4}$ | $1.6 \times 10^{-3}$ | 0.1 |
| | Co | $7.0 \times 10^{-3}$ | 6 | 0.1 | - | - | - |
| | Cu | $7.0 \times 10^{-3}$ | 200 | <0.1 | $3.9 \times 10^{-3}$ | $1.1 \times 10^{-2}$ | <0.1 |
| | Mn | $7.0 \times 10^{-3}$ | 1500 | <0.1 | $2.3 \times 10^{-3}$ | $9.3 \times 10^{-3}$ | <0.1 |
| | Ni | $7.0 \times 10^{-3}$ | 30 | <0.1 | $1.0 \times 10^{-3}$ | $8.1 \times 10^{-3}$ | <0.1 |
| | V | $7.0 \times 10^{-3}$ | 1 | 0.7 | $1.4 \times 10^{-3}$ | $8.4 \times 10^{-3}$ | 0.8 |

[1] calculated assuming that Cr (VI) comprises 20% of total emissions and background
n/a – not available

### 4.2.4.6. Dioxins and Furans

The maximum annual average results for dioxins are shown below. Note the units are femtograms per cubic metre[17] (fg/m$^3$). Whilst there are no criteria against which to directly compare these results, the figure does show that the extremely low concentrations of just over 0.3 fg/m$^3$ found near to the site decrease markedly with increasing distance from the source such that concentrations at residential receptors are an order of magnitude lower. The maximum concentration at a sensitive receptor was modelled to be 0.06 fg/m$^3$.

An assessment of the potential human health risk from exposure to dioxins and furans via the food chain has been undertaken separately. The methodology and results are presented in Appendix A and the findings summarised below.

[17] One femtogram per cubic metre is 1 x $10^{-9}$ microgram per cubic metre

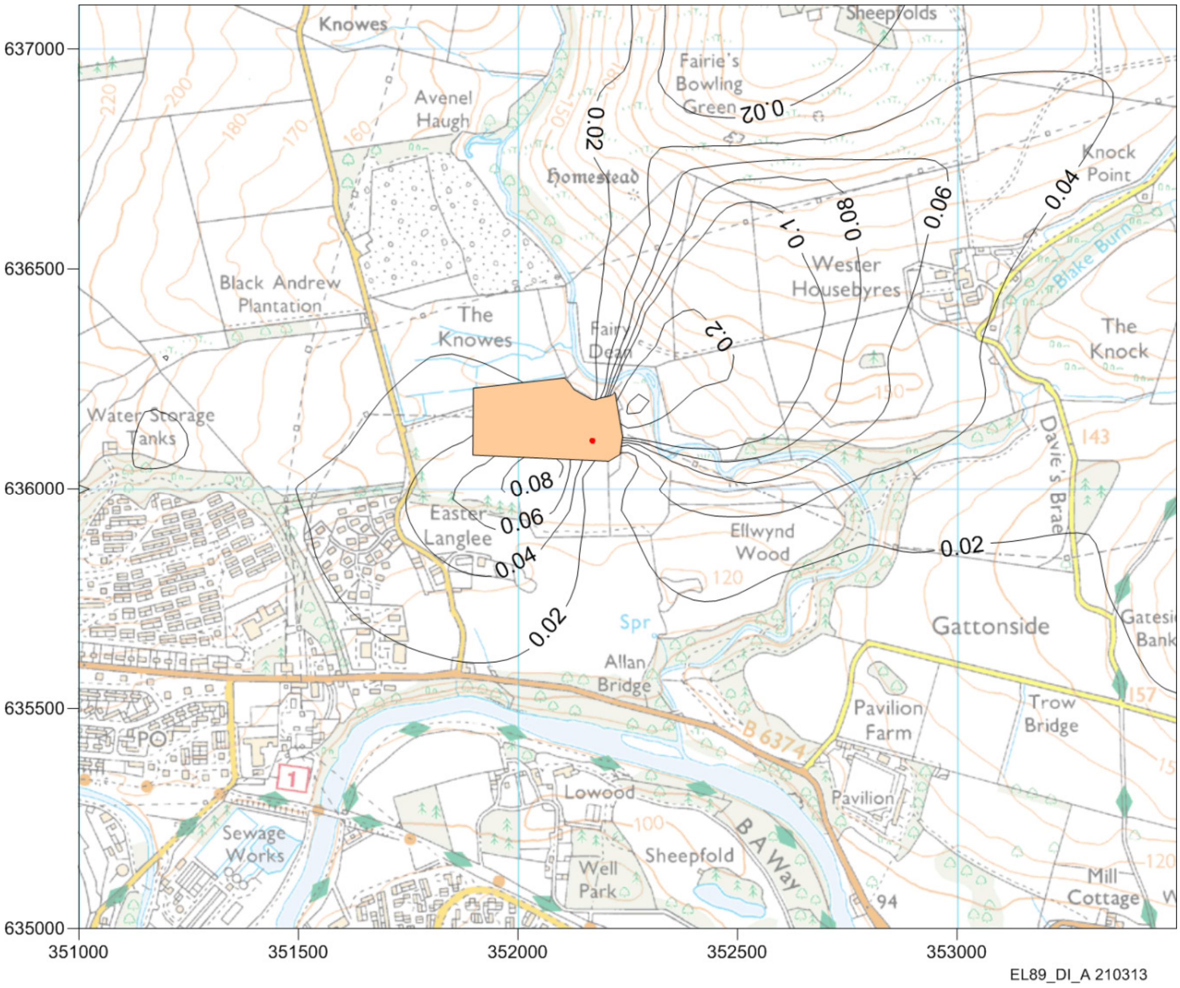



**Figure 10. Maximum Annual Average Dioxins and Furans Concentrations, fg/m³**

## 4.2.5. Ecological Assessment

### 4.2.5.1. Ambient concentrations

The modelled annual average concentrations of oxides of nitrogen and sulphur dioxide at sensitive ecological sites identified within the vicinity of the development are summarised below. The PCs and PECs are compared with the critical levels for these pollutants, which are also set in the national AQS. Background concentrations of 12 μg/m³ and 2 μg/m³ respectively were used to calculate the PECs for oxides of nitrogen and sulphur dioxide.

Table 58. Oxides of Nitrogen and Sulphur Dioxide Concentrations at Ecological Sites

| Site ID | Description | PC, µg/m³ | PC / AQS, % | PEC µg/m³ | PEC / CL, % |
|---|---|---|---|---|---|
| $NO_x$ | | | | | |
| A | River Tweed SAC (1 of 2) | 4.59 | 15.3 | 16.6 | 55.3 |
| B | River Tweed SAC (2 of 2) | 1.52 | 5.1 | 13.5 | 45.1 |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.96 | 3.2 | 13.0 | 43.2 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.22 | 0.7 | 12.2 | 40.7 |
| E | River Tweed SSSI (1 of 2) | 0.25 | 0.8 | 12.3 | 40.8 |
| F | River Tweed SSSI (2 of 2) | 0.11 | 0.4 | 12.1 | 40.4 |
| G | Gattonside Moss SSSI | 0.10 | 0.3 | 12.1 | 40.3 |
| H | Borders Woods SAC | 0.02 | 0.1 | 12.0 | 40.1 |
| I | Threepwood Moss SAC | 0.02 | 0.1 | 12.0 | 40.1 |
| J | Whitlaw and Branxholme SAC | 0.01 | < 0.1 | 12.0 | 40.0 |
| $SO_2$ | | | | | |
| A | River Tweed SAC (1 of 2) | 0.14 | 0.7 | 2.14 | 10.7 |
| B | River Tweed SAC (2 of 2) | 0.04 | 0.2 | 2.04 | 10.2 |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.03 | 0.2 | 2.03 | 10.2 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.01 | < 0.1 | 2.01 | 10.0 |
| E | River Tweed SSSI (1 of 2) | 0.01 | < 0.1 | 2.01 | 10.0 |
| F | River Tweed SSSI (2 of 2) | < 0.01 | < 0.1 | 2.00 | 10.0 |
| G | Gattonside Moss SSSI | < 0.01 | < 0.1 | 2.00 | 10.0 |
| H | Borders Woods SAC | < 0.01 | < 0.1 | 2.00 | 10.0 |
| I | Threepwood Moss SAC | < 0.01 | < 0.1 | 2.00 | 10.0 |
| J | Whitlaw and Branxholme SAC | < 0.01 | < 0.1 | 2.00 | 10.0 |

#### 4.2.5.2. Oxides of Nitrogen

The maximum modelled increment to oxides of nitrogen concentrations, due to emissions from the proposed ATT plant and biofilter, is 4.6 µg/m³ or 15% of the critical level of 30 µg/m³. This increment occurs within the River Tweed SAC, as it falls under the area of maximum plume concentrations. It is clear from the contour plot above that only a small section of the SAC, confined to the contributory branch directly to the east of the facility, would be affected by increments of over 1 µg/m³.

The background concentration of oxides of nitrogen at this general location is 12 µg/m³; the maximum concentration within the River Tweed SAC is hence estimated to be 16.6 µg/m3, around half the critical level for vegetation. On this basis, the contribution of the ATT plant is unlikely to have any material effect on vegetation within this aquatic site. The second highest increment to oxides of nitrogen at a sensitive ecological site occurs at the Avenel Hill and Gorge SSSI. Here, the maximum contribution from the facility is 1 µg/m³ or just over 3% of the critical level. Over the majority of the site, the increment from the facility would be less than 0.3 µg/m³ or just 1% of the critical level. The PEC at the point of maximum ground level concentration within the site is 12 µg/m³, just over a third of the critical level. At all other ecological sites, the ATT plant makes a negligible additional contribution to existing ambient concentrations, equivalent to less than

1% of the critical level. Total concentrations would be around 40% of the criterion in all cases, which is dominated by the background component.

#### 4.2.5.3. Sulphur Dioxide

The maximum modelled increment to sulphur dioxide concentrations due to emissions from the proposed ATT plant also occurs at the River Tweed SAC; it is 0.14 µg/m$^3$ or 0.7% of the critical level of 20 µg/m$^3$. At all other sites the contribution is a negligible 0.2% or less. The total PEC is calculated to be 2.14 µg/m$^3$, less than 11% of the critical level. It may be concluded on this basis that there would be no adverse effect on designated ecological sites as a result of facility emissions of sulphur dioxide.

#### 4.2.5.4. Nitrogen and Acid Deposition

The rates of nitrogen and acid deposition have been calculated at the closest designated sites. The results of the calculations are presented in the table below, which also shows the contribution of the proposed energy facility as a percentage of the lower and upper critical loads for deposition, where these were available. The results for the three SACs further afield are not shown in the table below, as they were all found to contribute less than 0.1% to the relevant critical loads.

**Table 59. Nitrogen and Acid Deposition at Designated Sites, kg N/ha/yr**

| **Nitrogen** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Site ID** | **Description** | **PC as N deposition, kg N/ha/yr** | **Critical load range, kg N/ha/yr** | **PC as % of lower CL** | | **PC as % of upper CL** | |
| A | River Tweed SAC (1 of 2) | 0.66 | n/a | - | | - | |
| B | River Tweed SAC (2 of 2) | 0.22 | n/a | - | | - | |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.28 | 10 - 15 | 2.8 | | 1.8 | |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.065 | 10 - 15 | 0.6 | | 0.4 | |
| E | River Tweed SSSI (1 of 2) | 0.036 | n/a | - | | - | |
| F | River Tweed SSSI (2 of 2) | 0.015 | n/a | - | | - | |
| G | Gattonside Moss SSSI | 0.014 | 15 – 30 | < 0.1 | | < 0.1 | |
| **Nitrogen and Sulphuric Acid** | | | | | | | |
| **Site ID** | **Description** | **N acid dep rate, $kg_{eq}$/ha/yr** | **S acid dep rate, $kg_{eq}$/ha/yr** | **Min CL Max N, $kg_{eq}$/ha/yr** | **Min CL Max S $kg_{eq}$/ha/yr** | **PC as % of N acid CL** | **PC as % of S acid CL** |
| A | River Tweed SAC (1 of 2) | 0.047 | 0.017 | n/a | n/a | - | - |
| B | River Tweed SAC (2 of 2) | 0.016 | 0.005 | n/a | n/a | - | - |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.020 | 0.007 | 1.1 | 0.94 | 1.8 | 0.77 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.005 | 0.002 | 1.1 | 0.94 | 0.43 | 0.18 |
| E | River Tweed SSSI (1 of 2) | 0.003 | 0.001 | n/a | n/a | - | - |
| F | River Tweed SSSI (2 of 2) | 0.001 | < 0.001 | n/a | n/a | - | - |
| G | Gattonside Moss SSSI | 0.001 | < 0.001 | n/a | n/a | - | - |

There are no critical loads available for the River Tweed; however, deposition is not considered to be of concern within this site as this is a fast-flowing water course with a large buffering capacity.

The contribution of the proposed ATT plant within Avenel Hill and Gorge SSSI is between 1.8 and 2.8% of the critical load range for nitrogen deposition of 10 to 15 kg N/ha/yr at the most affected location. The increment to nitrogen deposition would be less than 1% of the lower critical load across the majority of the site. The maximum increment at this sensitive site represents less than 1% of the background deposition rate of 28.9 kg N/ha/yr. On this basis, the effects of the facility emissions are not considered to be significant.

At Gattonside Moss SSSI the facility increment is 0.1% or less of the critical load range for nitrogen deposition, and is thus considered to be negligible.

The woodland habitat at the Avenel Hill and Gorge SSSI is sensitive to acid deposition. The maximum contribution of the ATT plant emissions to the “MinCL MaxN”[18] represents less than 2% of this criterion and less than 1% of the background deposition rate of 2.1 $kg_{eq}$/ha/yr. Only a small area of the SSSI, the south east corner of the site, would be subject to increments of more than 1% of the nitrogen acid deposition criterion of 1.08 keq/ha/yr. The maximum acid deposition rate due to sulphur, within the Avenel Hill and Gorge SSSI, is estimated to be 0.007 keq/ha/yr or 0.8% of the “MinCL MaxS” criterion of 0.94 keq/ha/yr. On this basis, the effects of the facility emissions are not considered to be significant.

The cumulative deposition rates for nitrogen and acid including the contribution from biofilter ammonia emissions (calculated using the modelled results for ammonia in the RPS report) are shown separately below. The results demonstrate that there would be no material cumulative effect at any location due to the combined emissions of the ATT plant and biofilter, as the percent contributions to the available critical loads change by a negligible 0.1% compared to those in the table above.

[18] MinCLMaxN is the relevant criterion for the evaluation of nitrogen-derived acid deposition rate. The Environment Agency’s AQTAG 06 guidance states that a critical load function is specified for acidification via several critical load parameters for sulphur and nitrogen. The Nmax deposition rate is the maximum critical load of acidifying nitrogen, above which the deposition of nitrogen alone would be considered to lead to an exceedence. The Nmin deposition rate is the measure of the ability of a system to “consume” deposited nitrogen. There are comparable criteria for sulphur deposition. The critical load function for acidity uses Nmax and Smax in a graphical approach to define the maximum critical load curve. Given the uncertainty inherent in this methodology there is a more stringent minimum critical load function, which in the absence of sulphur deposition is equal to the Nmin deposition rate. It is this maximum nitrogen deposition rate associated with the minimum critical load function that is referred to as MinCLMaxN.

Table 60. Cumulative Nitrogen and Acid Deposition at Designated Sites, kg N/ha/yr

| Site ID | Description | N dep from ATT & biofilter $NO_x$ kgN/ha/yr | N dep from biofilter $NH_3$ kgN/ha/yr | Total N dep kgN/ha/yr | Total Ndep as % of critical load | Total N acid dep rate keq/ha/yr | Total N acid dep as % of MinCL MaxN |
|---|---|---|---|---|---|---|---|
| A | River Tweed SAC (1 of 2) | 0.66 | 0.073 | 0.734 | n/a | 0.052 | - |
| B | River Tweed SAC (2 of 2) | 0.22 | 0.073 | 0.292 | n/a | 0.021 | - |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.28 | 0.007 | 0.283 | 1.9 – 2.8 | 0.020 | 1.9 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.065 | 0.007 | 0.071 | 0.5 – 0.7 | 0.005 | 0.48 |
| E | River Tweed SSSI (1 of 2) | 0.036 | 0.004 | 0.040 | n/a | 0.003 | - |
| F | River Tweed SSSI (2 of 2) | 0.015 | 0.004 | 0.019 | n/a | 0.001 | - |
| G | Gattonside Moss SSSI | 0.014 | 0.001 | 0.015 | <0.1 - 0.1 | 0.001 | - |

### 4.2.6. Abnormal Emissions

The main assessment presented above was based on the IED daily ELVs as a basis to derive emission rates for the gasifier combustors. Theoretical emission rates may be derived for a worst-case short-term operational scenario using the 30-minute emission limit values given in Annex VI Part 3 of the IED. These emission rates have been used here to assess the entirely hypothetical, abnormal operational scenario whereby a limited number of 30 minute averages of emissions from the combustors may reach those 30 minute ELV concentrations specified in the IED before a regulated plant is required to be completely shut down.

In order not to present a wholly unrealistic figure for the calculation of 24-hour average concentration, the result using the 30-minute emission rate was multiplied by 4/24 (4 is the theoretical maximum number hours before plant would be shut down) and added to 20/24 x the result obtained using the 24-hour emission rate. In effect this weighted mean result represents the normal operation for the first 20 hours of a day and a four hour shutdown period of abnormal emissions.

The results are presented in the table below for the pollutants specified in IED Annex Part 3 for the field-wide maximum modelled ground level concentrations. The abnormal operation PCs, shown in the fourth column of the table, are based on the emission rate associated with the half-hourly IED limit concentration coinciding with the least favourable hour of meteorological data in the five year period used in the dispersion model, a probability of approximately one in 43,000. It is also implied in the calculation that this hour of meteorological data persists for the four hour period of abnormal operation.

In all cases, the PECs (estimated using the simple, screening approach set out in the H1 guidance) are substantially less than the short-term EALs with the exception of nitrogen dioxide, which is just under 40%. The PECs for the field-wide maximum results are all less than half the relevant AQS objectives and EALs;

therefore, there is considered to be a negligible potential for exceedances of the air quality criteria at sensitive receptors.

**Table 61. Maximum Field-wide Concentrations using Abnormal 30-minute Emission Limit Values**

| Pollutant | Averaging Period | Abnormal PC, µg/m³ | PC / EAL, % | Abnormal PEC, µg/m³ | PEC / EAL, % |
|---|---|---|---|---|---|
| Nitrogen dioxide | 1 hour | 77.7 | 38.9 | 97.7 | 48.9 |
| Sulphur dioxide | 15 minute | 34.0 | 12.8 | 38.0 | 10.9 |
| | 1 hour | 25.4 | 7.3 | 29.4 | 8.4 |
| | 24 hour | 2.4 | 2.0 | 6.4 | 5.2 |
| Particulate matter | 24 hour | 0.45 | 0.2 | 7.4 | 14.9 |
| Carbon monoxide | 1 hour | 491 | 4.9 | 911 | 9.1 |
| | 8 hour | 166 | 1.7 | 166 | 1.7 |
| Hydrogen chloride | 1 hour | 11.0 | 1.4 | 11.2 | 1.4 |
| Hydrogen fluoride | 1 hour | 3.6 | 1.4 | <0.1 | <0.1 |
| VOC (as benzene) | 1 hour | 35.7 | 17.2 | 36.1 | 17.4 |

### 4.2.7. Human Health Risk Assessment

There are no EALs in the H1 guidance for dioxins and furans; therefore a human health risk assessment (HHRA) has been carried out using the USEPA HHRAP to investigate the potential effects on public health of the emissions from the proposed facility. The assessment looks specifically at the ingestion pathway at worst case receptor locations using an established detailed method. The results are directly comparable with the UK Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment's (COT) Tolerable Daily Intake (TDI) for dioxin. The HHRA report is included in Appendix D. This report presents the findings of the HHRA for the dioxin emissions from the combustor exhaust. Within this report, mass concentrations of dioxin are described using units of picograms (pg) and femtograms (fg). A picogram is equal to one gram x 10-9 or one millionth of a microgram (mg). A femtogram is equal to one gram x $10^{-12}$ or one thousandth of a picogram.

The assessment has been based on a number of conservative assumptions, including:

- Emission of dioxins modelled at the IED emission limit
- H1 screening approach applied in the estimation of deposition rates
- Assessment for a hypothetical exposure location at the location of the maximum modelled ground level concentration
- Receptor dietary intake is derived predominately from locally grown or reared produce
- All dioxin assumed to be emitted as 2,3,7,8-TCDD, the most toxic congener

These assumptions are expected to have added several orders of magnitude onto what in reality will be the average exposure once the plant is operational.

It was estimated on the above basis that the maximum contribution from the facility at a sensitive location would be equal to 2.3% of the COT lifetime TDI of 2 pg/kg bw/day. This result was found at the location of the maximum ground level concentration, to the north east of the facility, for a farmer child. At this location, there is no associated residential exposure. Results for residential exposure at the same location were less than 0.1% of the COT TDI. Taking the average consumer intake in the absence of the facility to be 0.9 pg/kg bw/day, the total intake for a local receptor, including the maximum contribution from the facility, would remain at less than half the COT TDI. The results are therefore considered to be insignificant.

The additional intake for infants via breast milk is not expected to exceed the COT TDI. The highest proportion of the TDI for a resident infant was estimated to be 0.9%.

Despite the uncertainties inherent within health risk assessment, the methodology - when combined with conservative assumptions such as those used in this case - provides a robust quantitative estimation of the health risks associated with exposure of local receptors. Furthermore, as the findings of this conservative assessment were found to be well below the acceptable level, then it is unlikely that any member of the local population will experience any adverse effects.

The above conclusions for a maximum hypothetical dioxin release from the proposed facility are consistent with the Health Protection Agency's statement on the health effects of municipal solid waste (MSW) incinerators (January 2012)[19]:

> *"Modern, well managed incinerators make only a small contribution to local concentrations of air pollutants. It is possible that such small additions could have an impact on health but such effects, if they exist, are likely to be very small and not detectable."*

It should be noted that this comment refers to MSW facilities which typically have an annual throughput several orders of magnitude higher than the proposed ATT facility.

It should also be appreciated that the technology to be employed fundamentally differs from MSW incineration. The proposed technology is not incineration of a non-homogenous waste stream, but pyrolysis and gasification of homogenous pre-prepared fuel followed by the combustion of a gas in an engine, an inherently cleaner and more controlled process compared with more traditional facilities. The plant is expected to emit pollutants at concentrations well within the levels specified in the IED; hence, the findings of these assessments are very robust.

## 4.3. OTHER EMISSIONS TO AIR

The H1 output indicates that there is no significant environmental impact from waste, global warming potential, energy use, noise or odour associated with the installation. Indeed, the respective chapters of the application demonstrate BAT for these areas; for example, the varied installation will be a net exporter of energy to the National Grid and to local heat customers.

Note that the biofilter was included in the dispersion model for the cumulative effects of oxides of nitrogen emissions. However, there will be a reduction in the overall odour potential from the varied installation due to the removal of the biostabilisation process. The emissions from the biofilter will be reduced with the ATT plant in place because the biostabilisation process will be replaced with mechanical drying, resulting in a lower

[19] http://www.hpa.org.uk/ProductsServices/ChemicalsPoisons/IntegratedPollutionPreventionControlIPPC/ippcIncineration

volume of air and reduced odour input requiring treatment in the biofilter. However, for the purposes of the assessment for the ATT facility, it is assumed that there would be no change, and the values as presented in the RPS report on emissions from the consented waste facility may be taken to represent a conservative assessment. Figure 5 of the RPS report shows that the very limited extent of the 1 $ou_E/m^3$ plume, which represents the limit of detection, extending less than 100 metres from the site boundary.

There is no likely cause for annoyance from dust or odour from the installation. The measures in place are therefore deemed to represent BAT for the varied installation.

## 4.4. EMISSONS TO WATER

There are no anticipated process emissions to water, land or groundwater from the varied installation during normal operation. Preventative measures described in the respective sections above are contended to represent BAT for preventing such emissions from the varied installation.

## 4.5. EMISSIONS TO SEWER

There are no anticipated process emissions to sewer from the varied installation, as there is no available connection in proximity to the facility. Discussions are underway with Scottish Borders Council on the potential of partnering on the development of on-site treatment, potentially using reed bed technology. These discussions are ongoing.

## 4.6. NOISE

Detailed noise assessments have been undertaken as part of the Environmental Impact Assessment that accompanies this application in electronic form. The assessments conclude that no significant residual effects are expected from the normal operation of the plant. Management procedures are to be put in place to manage scheduled noise generating activities so as to minimise the risk of annoyance or public nuisance.

## 5. ENVIRONMENTAL STATEMENTS

This section of the variation application corresponds to Part C5 of the application for variation form, describing the environmental statements associated with this application.

An environmental statement has been prepared for the planning application for the ATT facility. This is attached electronically to this variation application.

# 6. SPECIFIED WASTE MANEGEMENT ACTIVITIES

This section of the variation application corresponds to Part C7 of the application for variation form, describing the operation of specified waste management activities at the installation.

The specified waste management activity (SWMA) already undertaken is covered by the extant permit. There is no addition of further SWMAs as a result of this variation application, and no amendment to the capacity of the existing SWMA.

# APPENDICES

## APPENDIX A. PLANS AND SCHEMATICS

## A.1. Installation Plan as Varied by this Application

ATKINS
5115659/001




| REVISIONS | Drawn By | Checked By | Date |
|---|---|---|---|

| PURPOSE OF ISSUE | Rev. | Authorised for issue | Date |
|---|---|---|---|

KEY:

- APPLICATION BOUNDARY
- GRP TRANSLUCENT ROOF PANELS
- 1 RECEPTION AND MECHANICAL SEPARATION HALL
- 2 FUEL PREPARATION HALLS
- 3 ENERGY RECOVERY BUILDING
- 4 BIOFILTER
- 5 BIOFILTER CHIMNEY
- 6 SITE OFFICE, STAFF WELFARE & VISITOR FACILITIES
- 7 STAFF & VISITOR PARKING
- 8 WATER STORAGE TANKS
- 9 RAISED DROP OFF AREA
- 10 TRANSFORMERS
- 11 LINK BUILDING
- 12 132kV OVERHEAD ELECTRIC POWERLINE
- 13 ADVANCED THERMAL CONVERSION BUILDING
- 14 AIR BLAST CHILLERS
- 15 WEIGHBRIDGE
- 16 ACCESS GATE TO AREA SOUTH OF SITE
- 17 GAS TANKS
- 18 GAS BUFFER & BOOSTER
- 19 EMERGENCY GAS FLARE
- 20 BUNDED OIL TANK
- 21 COMBINED ATC & ENGINE EXHAUST

EMISSION POINTS TO AIR

- A1 BIOFILTER STACK
- A2 CHP ENGINE No. 1 EXHAUST
- A3 CHP ENGINE No. 2 EXHAUST
- A4 CHP ENGINE No. 3 EXHAUST
- A5 CHP ENGINE No. 4 EXHAUST
- A6 COMBINED COMBUSTOR EXHAUST
- A7 FLARE

*Atkins Ltd*
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252



THIS DRAWING IS NOT TO BE SCALED

CLIENT
newEARTH SOLUTIONS

PROJECT
EASTER LANGLEE
PROPOSED ADVANCED THERMAL TREATMENT PLANT

DRAWING TITLE
VARIED INSTALLATION PLAN

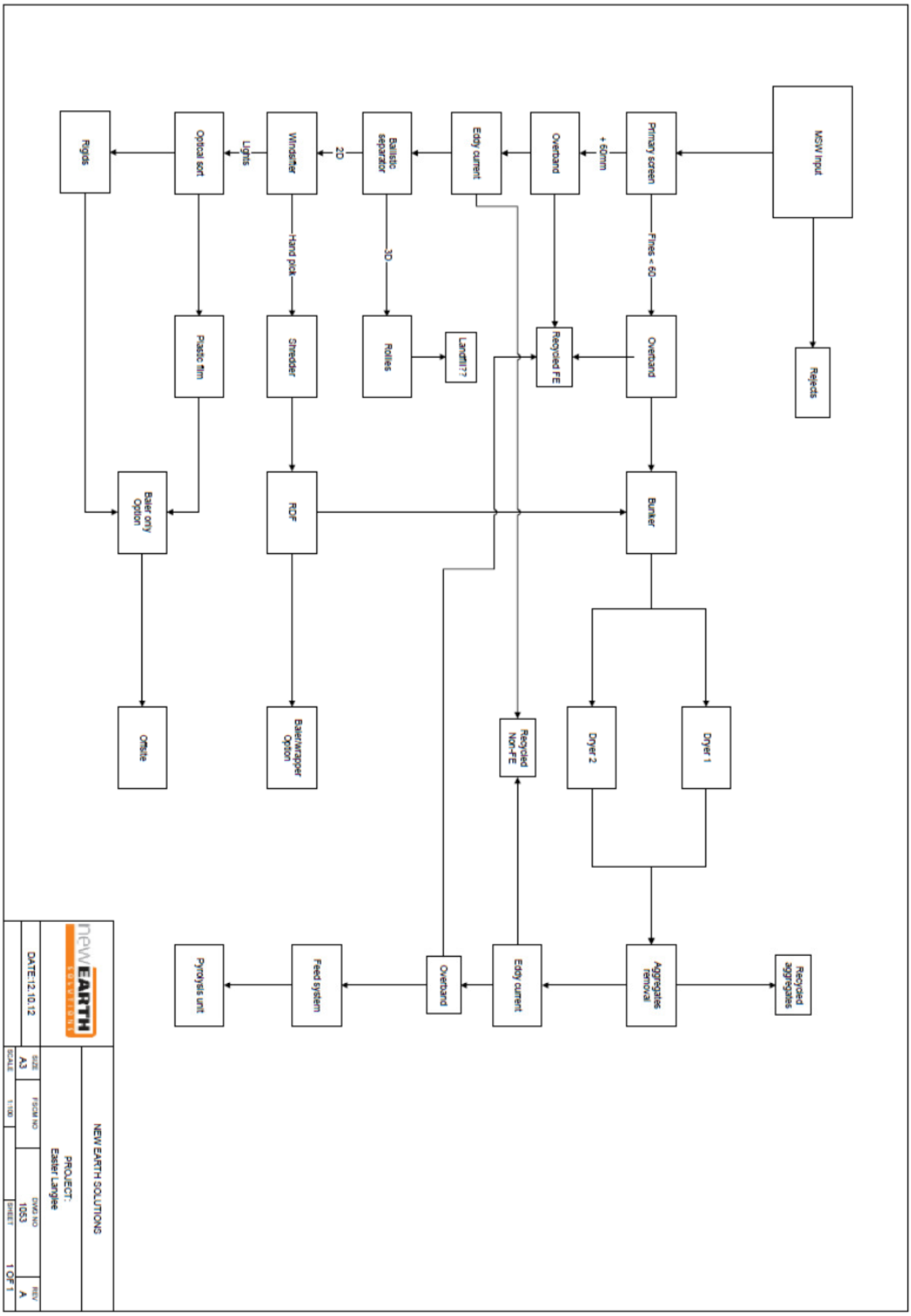
| Scales | DRAWN | CHECKED | CO-ORD CHECK |
|---|---|---|---|
| 1 : 500 | JH | PY | - |
| | DATE 14/05/13 | DATE 14/05/13 | DATE - |

0 25m

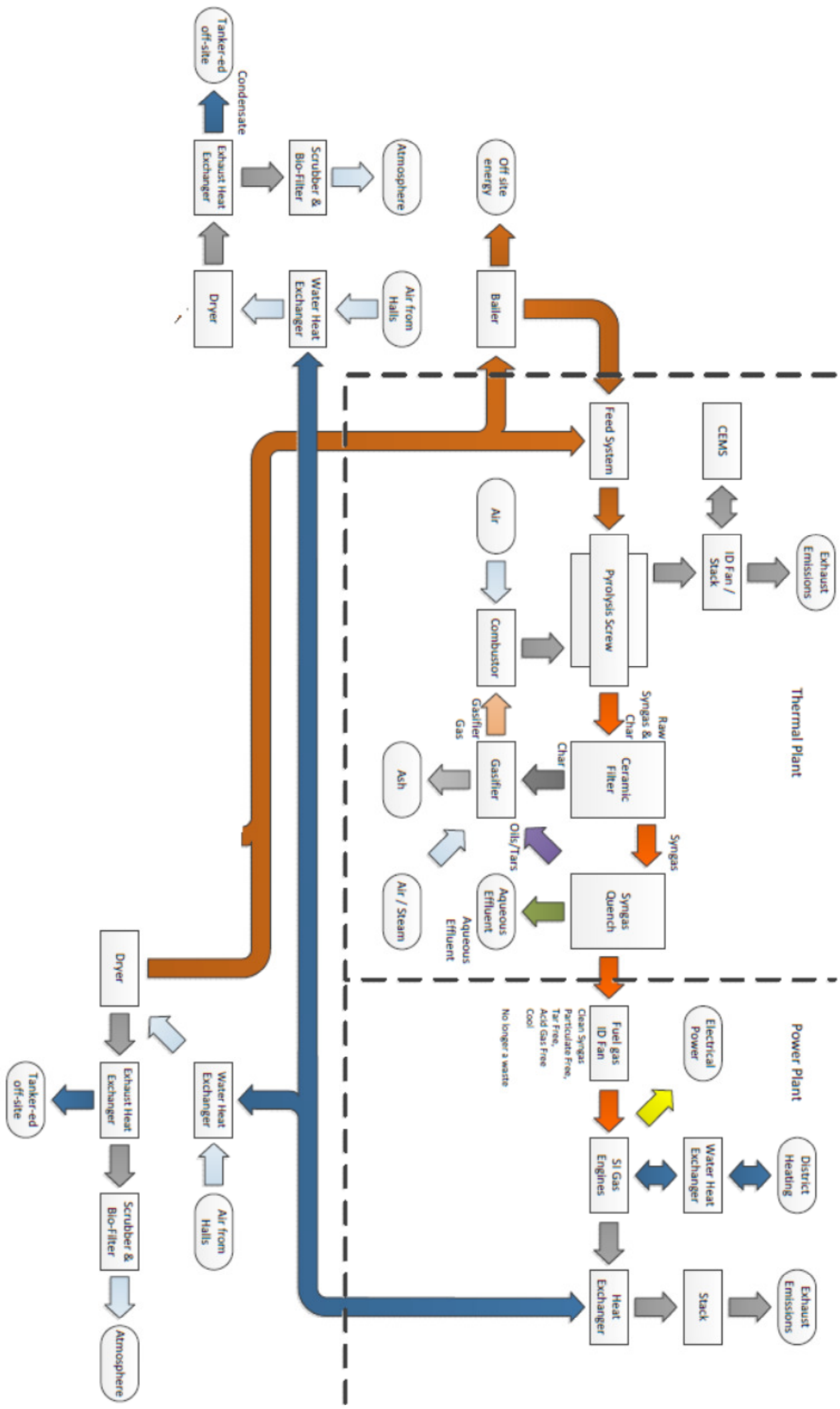
| SHEET | PLOT DATE |
|---|---|
| A1 | - |

| DRAWING NO | REV |
|---|---|
| 5115659/001 | - |

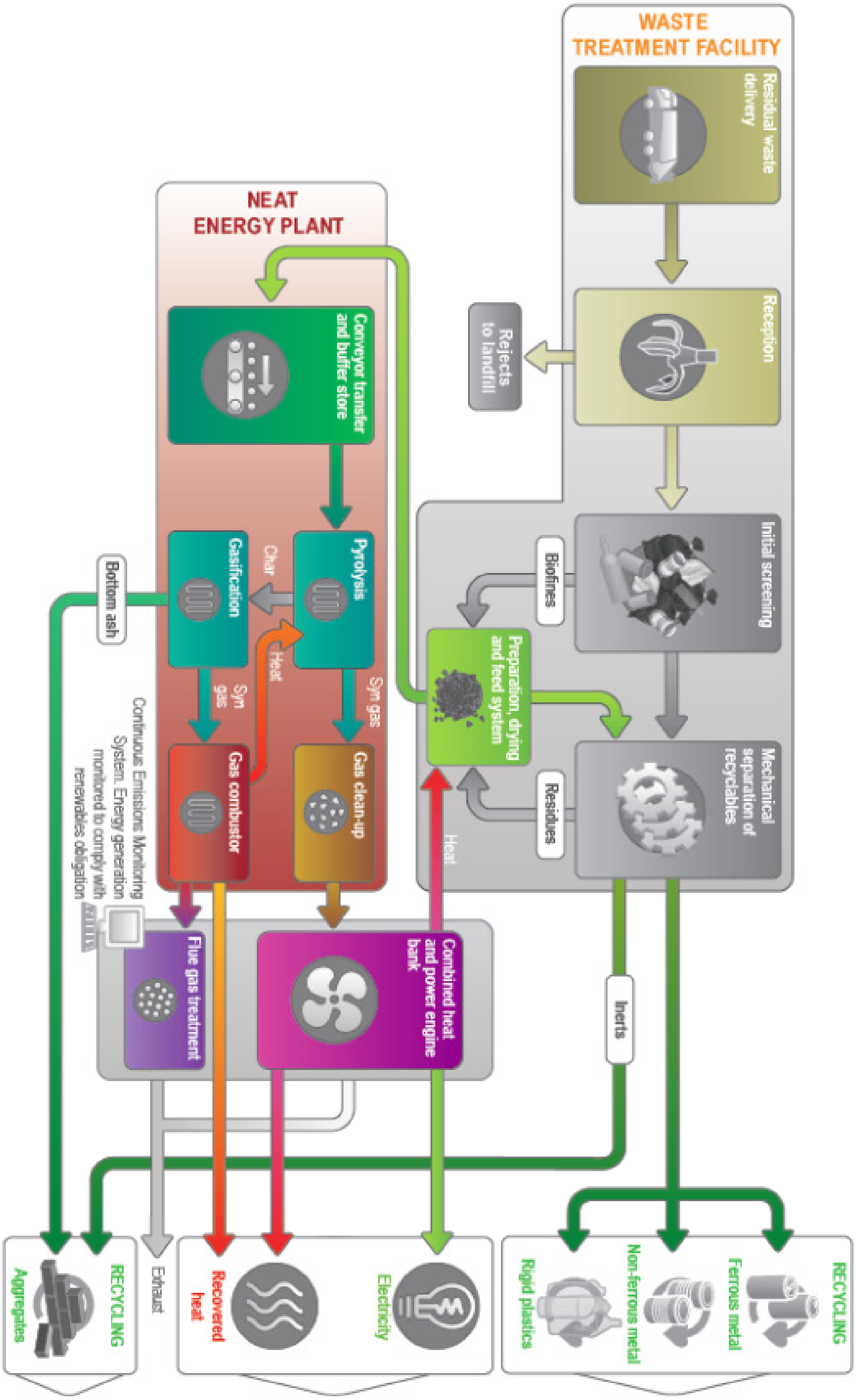
## A.2. Amended Process Flow Diagram for Permitted Waste Facility



## A.3. NEAT Process Flow Diagram



## A.4. NEAT Schematic



## APPENDIX B. H1 ASSESSMENT

Please see electronic version on CD accompanying this application.

## APPENDIX C. AIR DISPERSION MODELLING REPORT

# New Earth Solutions (Scottish Borders) Limited
# Easter Langlee Advanced Thermal Treatment Facility

# Environmental Permit Application
# Air Quality Assessment

## May 2013

### Notice

This air quality assessment was produced by Atkins Ltd for New Earth Solutions (Scottish Borders) Limited (NESSB) for the specific purpose of supporting the PPC Permit application for the Easter Langlee Advanced Thermal Treatment Facility at the Easter Langlee Landfill in Galashiels.

This report may not be used by any person other than NESSB without NESSB's express permission. In any event, Atkins accepts no liability for any costs, liabilities or losses arising as a result of the use of or reliance upon the contents of this report by any person other than NESSB.

Atkins Limited

### Document History

| JOB NUMBER: 5115659 | | | DOCUMENT REF: Easter Langlee AQ EP report_final2_200513.docx | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| 2 | Final inc. Client comments | | SH | RW | PB | 21/05/13 |
| 1 | Final | ML | SH | RW | PB | 17/05/13 |
| 0 | Draft | ML | SH | | | |
| Revision | Purpose Description | Originated | Checked | Reviewed | Authorised | Date |

# Contents



## List of Tables

## List of Inserts

# 1. Introduction

This report describes the atmospheric dispersion modelling study undertaken for the purposes of the Environmental Permit application for the proposed addition of an Advanced Thermal Treatment (ATT) plant to the New Earth Solutions (Scottish Borders) (NESSB) consented waste facility at Easter Langlee, Galashiels. A human health risk assessment for dioxins has also been carried out.

The proposed ATT plant will utilise a pre-prepared feedstock primarily comprising items of biological origin (e.g. paper, card, cotton, wool and plant waste etc) that cannot be recycled. The pre-prepared feedstock will be manufactured at the adjoining fuel preparation facility. The pre-prepared feedstock is converted by means of advanced thermal processes, namely staged pyrolysis and gasification, to produce a synthetic gas. The pyrolysis gas passes through a filter to remove particulates and a wet quench, to rapidly reduce the temperature of the gas and to condense out any tars and oils and prevent the formation of dioxins. This quench would also contain additives that would be specifically designed to remove acid gases. The gasifier gas is used as the heat source for the pyrolysis process, being first burned in a combuster. The gas is then combusted in conventional spark ignition engines to generate electrical energy. The gasifier runs on the solid char material produced in the pyrolysis phase. The engine exhaust gases and a lesser quantity of exhaust gas from the thermal process are discharged via a single multiple flue exhaust.

As a regulated process under the Pollution Prevention and Control (PPC) (Scotland) Regulations, the ATT plant requires a permit from the Scottish Environment Protection Agency (SEPA) in order to operate. The SEPA PPC regulations require the proposed facility to adhere to strict emission limits for discharges to the atmosphere. Once operational, the operator will be required to monitor discharges to the atmosphere and submit records to SEPA demonstrating compliance. The Permit will incorporate emission limits for all substances controlled under the stringent European Waste Incineration Directive (WID, now incorporated in the Industrial Emissions Directive (IED)), for the pyrolysis/gasification process and landfill gas engine limits for the engine exhausts.

To determine the effects of the ATT plant emissions on local air quality for planning purposes, an atmospheric dispersion model has been used. The modelled short-term and long-term ground level concentrations are evaluated in the context of the regulatory air quality criteria for human health and ecological sites, taking into account, as appropriate, the existing background ambient air quality. The main emissions from the ATT plant will be oxides of nitrogen, however the anticipated minor emissions of other regulated pollutants, including trace elements such as heavy metals, are also addressed.

A process description is provided in Section 3 of this report, which addresses the design of the pyrolysis and gasification plant and the associated engines that will generate process heat. Specific information is provided regarding the ATT exhaust discharges to the atmosphere from the single multi-flue exhaust.

The proposed ATT plant and fuel preparation facility would replace elements of the consented waste facility. The consented waste facility was the subject of an air quality assessment in February 2011 that assessed oxides of nitrogen, ammonia and odour emissions from the biofilter ventilation exhaust[1]. The assessment of the ATT plant presented herein evaluates the stand-alone emissions from the exhaust discharge, and also addresses the cumulative effect of the emissions of oxides of nitrogen from the biofilter from the consented waste facility. It is understood that there would be no emissions of ammonia from the ATT plant, and that there

[1] Easter Langlee, Mechanical Biological Treatment Facility, Air Quality Assessment, RPS Planning and Development Ltd. February 2011

should be a reduction in residual odour emissions from the biofilter exhaust as a result of the scheme.

The emissions from the biofilter will be reduced with the ATT plant in place because the biostabilisation process will be replaced with mechanical drying, resulting in a lower volume of air and reduced odour input requiring treatment in the biofilter. However, for the purposes of the current assessment, it is assumed that there would be no change, and the values as presented in the RPS report on emissions from the consented waste facility may be taken to represent a conservative assessment. Figure 5 of the RPS report shows that the very limited extent of the 1 $ou_E/m^3$ plume, which represents the limit of detection, extending less than 100 metres from the site boundary.

A human health risk assessment has been carried out using the results from the dispersion modelling for dioxins. The assessment has been undertaken in accordance with the United States Environmental Protection Agency (US EPA) Human Health Risk Assessment Protocol (HHRAP), and is presented in Appendix A to this report.

In summary, the assessment presented in this report entails:

- A detailed assessment of emissions from the ATT exhaust for both human health and ecological receptors;
- A detailed assessment of nitrogen and acid deposition from the ATT exhaust for ecological receptors;
- A cumulative assessment of oxides of nitrogen emissions from the biofilter and ATT exhausts for both human health and ecological receptors;
- A cumulative assessment of nitrogen deposition from the biofilter and ATT exhausts for ecological receptors;
- A human health risk assessment of dioxins from the ATT exhaust.

## 1.1 Section Structure

The air quality assessment is set out as follows:

- The Regulatory, Planning and Policy Context section describes the local air pollutants, the relevant air quality criteria and the relevant planning guidance in the context of the local authority role in air quality management;
- The Assessment Methodology section presents the approach adopted and includes a process description. The methodology used for the dispersion modelling is presented, including the treatment of meteorological data, receptor grids, buildings, emission limits and proposed ATT plant emissions data;
- The Baseline Conditions section evaluates existing ambient air quality as documented in local authority and national monitoring network reports, and provides background pollutant concentrations. Local meteorological data used in the assessment is also described and nearby receptors identified;
- Assessment of Effects on Air Quality presents the evaluation of the results of the air dispersion modelling of and summarises the findings of the HHRA (presented in Appendix A);
- The Conclusions section summarises the findings of the assessment process.

# 2. Regulatory, Planning and Policy Context

## 2.1 Air Quality Criteria

### 2.1.1 Human Health

The Government's Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland provides details of national air quality standards and objectives for a number of local air pollutants. These criteria are set out in the Air Quality Standards (Scotland) Regulations 2010 SSI 2010/204. These regulations implement the EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe (the Air Quality Directive).

The air quality standards define the level of pollution below which health effects are unlikely to be experienced even by the most sensitive members of the population. These are based upon recommendations of the Expert Panel on Air Quality Standards (EPAQS). The air quality objectives are targets for air pollution concentrations which take account of the costs and benefits of achieving the standard. In the case of short-term targets, the permissible number of hours or days above the objective concentration is also specified. The number of permissible "exceedances" is considered when determining compliance with the short-term objectives over an annual period.

It should be noted that the air quality criteria only apply in locations where there may be a 'relevant exposure'. These human health objectives are applicable where members of the public may be exposed to pollutant levels for periods equal to or exceeding the averaging periods set for these criteria. Locations of relevant exposure include building façades of residential premises, schools, public buildings and medical facilities; places of work (other than certain community facilities) are excluded.

The air quality criteria as set in the regulations and relevant to the dispersion modelling study are presented in Table 2.1.

**Table 2.1 - Air Quality Strategy Objectives**

| Pollutant | Objective | Compliance date | |
|---|---|---|---|
| | | AQS Objectives | EU Limit Values |
| Nitrogen oxides, $NO_x$ | Annual mean concentrations should not exceed 30 µg/m$^3$ for the protection of vegetation and ecosystems. | 31 December 2000 | 19 July 2001 |
| Nitrogen dioxide, $NO_2$ | Hourly average concentration should not exceed 200 µg/m$^3$ more than 18 times a year | 31 December 2005 | 1 January 2010 |
| | Annual mean concentration should not exceed 40 µg/m$^3$ | | |
| Particulates, $PM_{10}$ | 24-hour mean (UK) concentration should not exceed 50 µg/m$^3$ more than 35 times a year | 31 December 2004 | 1 January 2005 |
| | 24-hour mean (Scotland) concentration should not exceed 50 µg/m$^3$ more than 7 times a year | 31 December 2010 | |
| | Annual mean (UK) concentration should not exceed 40 µg/m$^3$ | 31 December 2004 | 1 January 2005 |
| | Annual mean (Scotland) concentration should not exceed 18 µg/m$^3$ | 31 December 2010 | |
| $PM_{2.5}$ | Annual mean (UK) concentration should not exceed 25 µg/m$^3$ | - | 1 January 2015 |
| | Annual mean (Scotland) concentration should not exceed 12 µg/m$^3$ | 2020 | - |
| | Exposure Reduction: UK urban areas: target of 15% reduction in concentrations at urban background. | Between 2010 and 2020 | - |
| | Exposure Reduction: Target of 20% reduction. | - | Between 2010 and 2020 |
| Sulphur dioxide, $SO_2$ | 15 minute mean should not exceed 266 µg/m$^3$ more than 35 times per year | 31 December 2005 | - |
| | Hourly mean should not exceed 350 µg/m$^3$ more than 24 times per year | 31 December 2004 | 1 January 2005 |
| | Daily mean should not exceed 125 µg/m$^3$ more than 3 times per year | 31 December 2004 | 1 January 2005 |
| | Calendar year and winter (1$^{st}$ October to 31$^{st}$ March) mean should not exceed 20 µg/m$^3$ for the protection of ecosystems | 31 December 2000 | 19 July 2001 |
| Carbon monoxide, CO | Running eight-hourly average concentration should not exceed 10,000 µg/m$^3$. | 31 December 2003 | 1 January 2005 |
| Lead, Pb | Annual mean concentration should not exceed 0.5 µg/m$^3$ | 31 December 2004 | 1 January 2005 |
| | Annual mean concentration should not exceed 0.25 µg/m$^3$ | 31 December 2008 | - |
| Benzene | Annual mean (UK) concentration should not exceed 5 µg/m$^3$ | 31 December 2010 | 1 January 2010 |

| | | | |
|---|---|---|---|
| | Running annual mean (Scotland) concentration should not exceed 3.25 µg/m$^3$ | 31 December 2010 | - |

SEPA provides guidance on air quality criteria for use in air quality assessments in the Horizontal Guidance Note H1. This gives long-term and short-term Environmental Assessment Levels (EALs) for numerous substances, many of which do not have statutory criteria. These environmental benchmarks are an indicator of the concentration that can be considered to be acceptable for a particular substance. The EALs use the national AQS objectives where available and supplements these with values derived from Health and Safety Executive Occupational Exposure Limits. The EALs are non-statutory and published statutory air quality criteria such as those included in the AQS are used in preference where they exist.

### 2.1.2 Vegetation and Ecosystems

The European Union has set limit values for the protection of vegetation for $NO_x$ based on the work of the United Nations Economic Commission for Europe (UNECE) and World Health Organisation (WHO); these limit values have been incorporated into the regulations in SSI 2010/204. The limit values for $NO_x$ and $SO_2$ for the protection of vegetation are also shown in Table 2.1.

Assessment of compliance with the limit values for the protection of vegetation is undertaken at locations more than 20 kilometres from towns with more than 250,000 inhabitants or more than five kilometres from other built-up areas, industrial installations or motorways. The AQS objectives do not apply in these areas where assessment of complicance with the limit value is not required; however, as the UNECE and the WHO have set these critical levels for the protection of vegetation, the Statutory Nature Conservation Agencies' (in Scotland, Scottish Natural Heritage) policy is to apply the criteria as a benchmark, on a precautionary basis, in internationally designated conservation sites and Sites of Special Scientific Interest (SSSI).

Critical loads for nitrogen and acid deposition have been set by the UNECE that represent (according to current knowledge) the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem. The critical loads vary by type of ecosystem. Ranges for critical loads rather than fixed values are used to allow for natural variation, uncertainties about deposition effects and temporal variability of available data.

## 2.2 Regulatory Control

The proposed ATT plant comprises a listed activity under Schedule 1 of the Pollution Prevention and Control (Scotland) Regulations 2000. Pollutant emission concentrations from the pyrolysis and gasification stage of the ATT plant will be required to meet the stringent limits specified in the Waste Incineration Directive (2000/76/EC) (WID), which have recently been incorporated in the Industrial Emissions Directive (2010/75/EU) (IED). The emission limits for the spark ignition gas engines reflect the standards for landfill gas engines set out in SEPA technical guidance[2].

Emissions of most of the IED regulated substances will be considerably below emission limits as the ATT plant will employ proven technology involving pyrolysis and gasification of a pre-prepared feedstock, rather than the direct combustion of a mixed waste stream. Nevertheless, all regulated substances are addressed in this study and have been modelled as if emitted at the emission limits.

## 2.3 Local Air Quality Management

Under Part IV of the Environment Act 1995 all local authorities are responsible for Local Air Quality Management (LAQM), the mechanism by which the Government's air quality objectives are to be achieved. As part of this LAQM role, local authorities are required to periodically review

[2] http://www.sepa.org.uk/waste/waste_regulation/landfill.aspx

air quality in their area and to assess the present and likely future air quality against the objectives defined in Regulations. Where a local authority anticipates an objective is expected to be breached within their district, they must designate an AQMA and develop an action plan to improve pollution levels. Under the LAQM regime, a local authority is responsible for regular review and assessment of local air quality, reports on which are published following public consultation and review by the Department for Environment, Food and Rural Affairs (DEFRA) and devolved administrations.

# 3. Assessment Methodology

To determine the effects of the proposed ATT plant emissions on local air quality, an atmospheric dispersion model has been used. The study uses information provided by New Earth Solutions (Scottish Borders) Limited (NESSB). The modelling study considers the atmospheric discharges of all WID regulated substances, from the pyrolysis and gasification units, and emissions from the associated engines. Four such process lines will be installed with one unit out of use as a standby. The modelling addresses the maximum rate of operation of the development entailing three pyrolysis and gasification units and three engines operating concurrently.

For the purposes of this assessment, it has been assumed that pollutants will be continuously emitted from the ATT plant at their concentration limits throughout the year, a highly conservative assumption. It is noted that the principal exhaust emission, however, will be that of oxides of nitrogen emissions from the spark ignition engines. As a conservative assumption, from the engines are modelled assuming a continuous release at the limit specified for landfill gas engines.

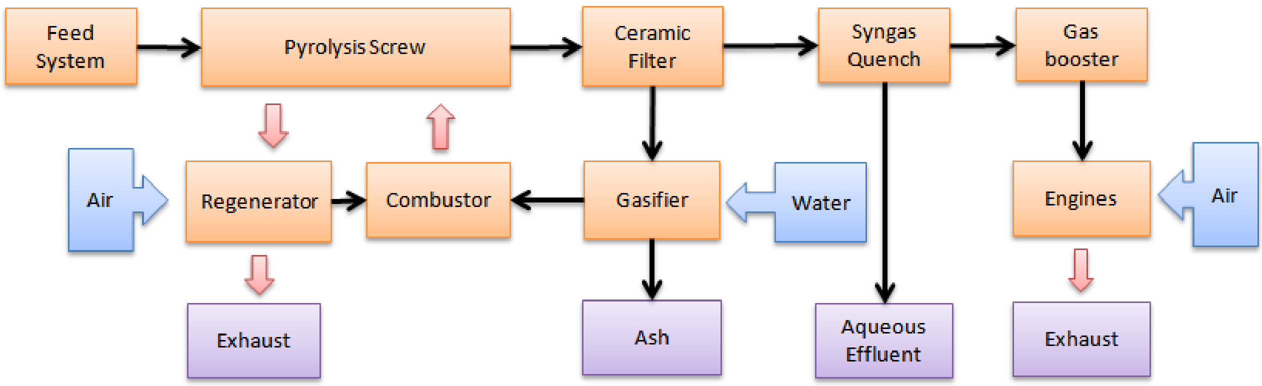
## 3.1 Process Description

The circa 24,000 tonnes per annum (tpa) capacity ATT plant will use a pre-prepared feedstock produced from non-hazardous residual municipal waste at the co-located fuel preparation facility. The pre-prepared feedstock comprises sorted residual waste that cannot be readily recovered for recycling.

The pre-prepared feedstock is converted by means of advanced thermal processes to produce a synthetic gas. The facility will employ “New Earth Advanced Thermal” (NEAT) technology, which involves both pyrolysis and gasification. The resultant gas from the pyrolysis process passes through a filter and quench system before being combusted in conventional spark ignition engines to generate electrical energy. The gasifier gas is used as the heat source for the pyrolysis process, being first burned in a combuster. The gasifier runs on the solid char material produced in the pyrolysis phase. The engine exhaust gases and a lesser quantity of exhaust gas from the thermal process are discharged via a single multiple flue exhaust. The main exhaust emissions are oxides of nitrogen; there are also insignificant quantities of carbon monoxide and other trace elements emitted.

The technology is summarised in Insert 3.1 below:

**Insert 3.1 – Schematic Presentation of the ATT Plant Processes**




The ATT plant will be capable of receiving direct deliveries of fuel feedstock; however, it is envisaged that feedstock will generally be manufactured and stored within the fuel preparation facility until such time as it is called upon. The pre-prepared feedstock will be conveyed from the fuel preparation facility to a buffer store located within the reception area of the building serving the ATT plant. Each NEAT unit comprises its own pyrolysis chamber, ceramic filter, char gasification chamber, combustion chamber and regenerator. Each NEAT unit will serve a single engine.

The feedstock will enter a pyrolysis chamber via an enclosed compactor. This will compress the incoming material to create a seal to prevent the ingress of air. In the pyrolysis unit the feedstock will be indirectly heated in the absence of oxygen to between 850ºC and 1,000ºC. The retention time is in the order of 40 minutes and hence the process is compliant with the IED in that all organic compounds are completely destroyed. The pyrolysis chamber initially dries the feedstock before breaking it down into a pyrogas (consisting of methane, hydrogen, carbon monoxide and water vapour) and a solid carbon char.

The syngas from the pyrolysis chamber is drawn under negative pressure, through a ceramic filter to remove particulates, organic tars and associated organic contaminants. From there it passes through a wet quench, to rapidly reduce temperature and prevent de novo dioxin formation. This quench is dosed with sodium hydroxide and sodium hypochlorite, to remove acid gases such as hydrogen chloride, hydrogen fluoride and sulphur dioxide. The halogens originating in the pyrolysis feed material are removed from the gas phase at this stage and are absorbed into the aqueous effluent.

The solid carbon char is then fed into a gasification chamber. The gasification chamber is injected with high pressure steam and a limited amount of oxygen. The carbon char breaks down into additional syngas formed by the water gas reaction and a solid non-hazardous ash residue. The syngas from the gasification chamber is ducted to a combustion chamber, the exhaust from which provides the energy to the pyrolysis chamber. The char material is essentially free from halogens, and hence the potential for formation of dioxins from the subsequent combustion of the gas produced, and reformation post-filtration, is severely limited.

Exhaust gases drawn off from the fuel feed zone of the gasification chamber pass though a regenerator, which heats the process air required prior to it entering the combustion chamber. These gases are released to the atmosphere via a multiple-flue exhaust, incorporating a common flue for the NEAT units and individual flues for each of the spark ignition engines. The exhaust will be discharged at a height of 23 metres, as determined by D1 calculation using the HMIP methodology[3] and then verified and adjusted as deemed to be appropriate, based on the initial atmospheric dispersion modelling findings.

[3] Guidelines on Discharge Stack Heights for Polluting Emissions, HMIP Technical Guidance Note (Dispersion) D1, 1993. A copy of the calculation is presented in Appendix B.

The engine exhaust emissions will meet the pollutant concentration limits specified in the currently relevant SEPA guidance[4] for oxides of nitrogen, carbon monoxide and hydrocarbons.

## 3.2 Dispersion Modelling

### 3.2.1 Model Choice

The dispersion modelling of exhaust emissions was carried out using the United States Environmental Protection Agency (US EPA) model AERMOD PRIME version 12060[5]. This model is the result of many years development by the US EPA and the American Meteorological Society. It has been developed as a regulatory model that incorporates the current understanding of atmospheric physical processes. AERMOD is used by regulatory agencies, consultants and industry worldwide to assess the impact of air emissions from point, area, line, flare and volume sources. It is commonly used in the UK for planning and regulatory applications.

AERMOD simulates essential atmospheric physical processes and provides refined concentration estimates over a wide range of meteorological conditions and modelling scenarios. The modelling system includes:

- an advanced meteorological pre-processor to compute site-specific planetary boundary layer (PBL) parameters;
- highly developed dispersion formulations that incorporate current PBL understanding and variables for both convective and stable boundary inversions;
- enhanced treatment of plume rise and plume penetration for elevated inversions allowing for effects of strong updrafts and downdrafts that occur in unstable conditions;
- improved computation of vertical profiles of wind, turbulence and temperature; and
- a “dividing streamline” approach for computations in complex terrain.

AERMOD includes two data pre-processors for streamlining data input: AERMET, a meteorological pre-processor, and AERMAP, a terrain pre-processor. The model can address both local topography and building downwash effects concurrently, where relevant to the study. The model provides reasonable estimates over a wide range of meteorological conditions and modelling scenarios. The building downwash algorithms in AERMOD PRIME, using parameters calculated by the Building Parameter Input Program (BPIP), distinguish this model from earlier versions of AERMOD, which used simpler procedures to address downwash.

### 3.2.2 Meteorological Data

The most appropriate meteorological station for the dispersion modelling study is the Charterhall RAF Met Office site. An hourly sequential meteorological data file from Charterhall for the five year period 2006 to 2010 was used in the modelling. The meteorological station is located at grid reference NT 7592 4618 (10 m precision) approximately 27.8 kilometres to the east north east of Easter Langlee, and hence the data is considered to be representative of the application site.

The five year meteorological data file from Charterhall contains over 43,000 hourly records, and is quite adequate to characterise local meteorology in terms of both extreme events and long-term average conditions for the purposes of dispersion modelling. This meteorological data is presented as a wind rose in Insert 4.1 of the Baseline Conditions section.

The meteorological pre-processor AERMET was used to process the data and estimate the necessary boundary layer[6] parameters for dispersion calculations in AERMOD. The data were

[4] LFTGN 08, Guidance for monitoring landfill gas engines, Environment Agency, 2004

[5] AERMOD software provided by Trinity Consultants Inc, http://www.breeze-software.com/

[6] The atmospheric boundary layer is that region between the earth’s surface and the overlying, free flowing atmosphere. The fluxes of heat and momentum drive the growth and structure of this boundary layer. The depth of this layer and the dispersion of pollutants within it are influenced on a local scale by surface characteristics, such as the roughness of the underlying surface, the reflectivity of the surface (albedo) and the amount of moisture available at the surface (Bowen ratio). From these inputs AERMET calculates severable

processed to take account of the location and surroundings of the meteorological station and of the modelled facility. These parameters, together with observed near-surface wind and temperature data, were used to model how pollutants disperse in the atmosphere. The data incorporates numerous limited mixing height measurements within the extensive hourly records, thus adequately representing temperature inversion conditions.

The meteorological data pre-processor AERMET was used to create the site-specific surface and upper air data files required by AERMOD PRIME.

Surface characteristics were specified to reflect the nature of the area surrounding the facility. According to latest US EPA guidance, the near-field land use within a one kilometre circle was evaluated to determine the surface roughness length[7]. Land use may be specified by several directional sectors. In this case a sector between 220º and 262º was considered to be of an urban nature and the remaining area principally cultivated land.

The Bowen ratio[8] and albedo[9] were determined by the dominant land use categories within the far-field, a 10 by 10 kilometre square. A subjective determination of the percentages of each type of land use was made based on maps and aerial photographs. The land use proportions are simply averaged over the area and are independent of distance or direction from the site. The categories of cultivated land, urban, deciduous woodland and coniferous woodland comprised 77%, 14%, 5% and 4% respectively. Based on the land use information, the AERMET pre-processor generated the appropriate default annual average values for the surface parameters, as shown in Table 3.1.

**Table 3.1 – Surface Characteristics**

| Direction Degrees | Land Type | Albedo | Bowen Ratio | Roughness Length, m |
|---|---|---|---|---|
| 220 – 262 | Urban | 0.2625 | 0.882 | 1.0000 |
| 262 – 220 | Cultivated land | 0.2625 | 0.882 | 0.0725 |

### 3.2.3 Receptors

Ground level concentrations were modelled using a Cartesian receptor grid at 100 metre resolution. In a local area around the facility a second grid of 25 metre resolution ensures that the maximum concentrations were found.

The model was set up to report the maximum hourly, 24-hourly and the annual average pollutant concentrations found at each point on the receptor grid. As a five-year meteorological data file was used the maximum hourly result is the highest in over 43,000 hours processed. The model results presented thus robustly characterise the effects of the plant emissions on ambient concentrations due to both extreme short-term meteorological events and to long-term average meteorological conditions.

Terrain elevations for all model objects (i.e. exhausts and buildings) and receptors were used in the dispersion model, as derived from Ordnance Survey digital terrain data files. The inclusion of elevation data for the receptor grids ensures that complex terrain (i.e. terrain above the height of the stack) in the surrounding area is taken into account by the model when calculating ground level concentrations. The application site was assumed to be levelled at 133 m above ordnance datum (AOD).

---

boundary layer parameters which in turn influence pollutant dispersion, including surface friction velocity, sensible heat flux, Monin-Obukhov length, daytime mixing layer height and nocturnal surface layer height, and the convective velocity scale.

[7] Surface roughness length is a measure of the height of obstacles to wind flow. It is not equal to the physical dimensions of obstacles, but is generally proportional to them.

[8] The Bowen ratio is a measure of the amount of moisture at the earth's surface. This influences other parameters which in turn affect atmospheric turbulence.

[9] Noon-time albedo is the fraction of incoming solar radiation reflected from the ground when the sun is directly overhead. Adjustments are made in AERMET to incorporate the variation in the albedo with solar elevation angle.

### Human health receptors

A selection of sensitive properties representative of those closest to the facility has been included in the model as discrete receptors; these receptors are shown in Insert 3.2 (numbers 1 to 10) and are identified in Table 3.2 , which also shows to the nearest 10 metres the distance of each location from the ATT plant exhaust (shown as a small red dot on the figure, near the eastern site boundary).

The nearest existing residential property is at Easter Langlee farmhouse to the south west of the ATT exhaust. There are a number of houses on Loan View 450 metres to the west south west of the exhaust and at Wester Housebyres, approximately 850 metres to the east north east of the exhaust. To the west, north and east of the site the land is predominantly agricultural. Permission has recently been granted for a new residential development to the south of the application site, the nearest property within this development will be around 200 metres from the exhaust.

**Insert 3.2 – Residential Receptors Included in Model**

**Table 3.2 – Key to Residential Receptors**

| Receptor | Address | Location | | Distance, m |
|---|---|---|---|---|
| | | Eastings, m | Northings, m | |
| 1 | 10 Loan View | 351718 | 635940 | 480 |
| 2 | 1 Easter Langlee | 351918 | 635844 | 370 |
| 3 | 9 Loan View | 351724 | 635976 | 470 |
| 4 | Wester Housebyres | 352975 | 636435 | 870 |
| 5 | Lowood | 352101 | 635364 | 750 |
| 6 | Pavilion Farm | 352731 | 635421 | 890 |
| 7 | Gattonside Mains | 353634 | 635420 | 1620 |
| 8 | Langlee Mains Farmhouse | 350857 | 636588 | 1400 |
| 9 | Glendearg | 351750 | 637995 | 1930 |
| 10 | Proposed development | 352000 | 635925 | 200 |

### Ecological receptors

The SEPA H1 guidance requires an air quality assessment to address designated ecological sites. This entails evaluation against critical levels specified for oxides of nitrogen and against critical loads for nitrogen deposition. The H1 guidance recommends that designated sites including Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites and SSSI be considered where they fall within ten kilometres of the installation. For smaller facilities such as the one proposed at Easter Langlee, a search radius of just a few kilometres is normally adequate to demonstrate the effects on air quality. The DEFRA "Magic" website[10] was used to find information regarding nationally designated ecological sites in the vicinity of the proposed development. Further information on specific designated sites is published by Scottish Natural Heritage (SNH)[11]. There are no SPAs or Ramsar sites within ten kilometres of the proposed facility, but there are four SACs. In addition there are three SSSIs within two kilometres. These designated ecological sites are shown in Table 3.3, together with their qualifying interest features for designation.

**Table 3.3 – Designated Ecological Sites**

| Name | Designation | Qualifying Interest |
|---|---|---|
| River Tweed | SAC, SSSI | River lamprey, Brook lamprey, Otter, Sea lamprey, Atlantic salmon. Rivers with floating vegetation often dominated by water-crowfoot. |
| Avenel Hill and Gorge | SSSI | Broadleaved, mixed and yew woodland (upland oak woodland), butterflies |
| Gattonside Moss | SSSI | Basin fen (medium to rich), beetle assemblages |
| Borders Woods | SAC | Mixed woodland on base-rich soils |
| Threepwood Moss | SAC | Active raised bog, degraded raised bog |
| Whitlaw and Branxholme | SAC | Base-rich fens, feather-moss, transition mires with unstable, quaking surface |

[10] http://magic.defra.gov.uk/
[11] http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/local-designations/local-nature-conservation/

Locations representing the nearest boundary of the designated sites were selected as discrete receptors in the dispersion model; in some cases two points were chosen where the designated feature covers an extensive area. The ecological receptors included in the model are shown graphically in Insert 3.3 and are listed in Table 3.4.

**Insert 3.3 – Ecological Receptors Included in Model**

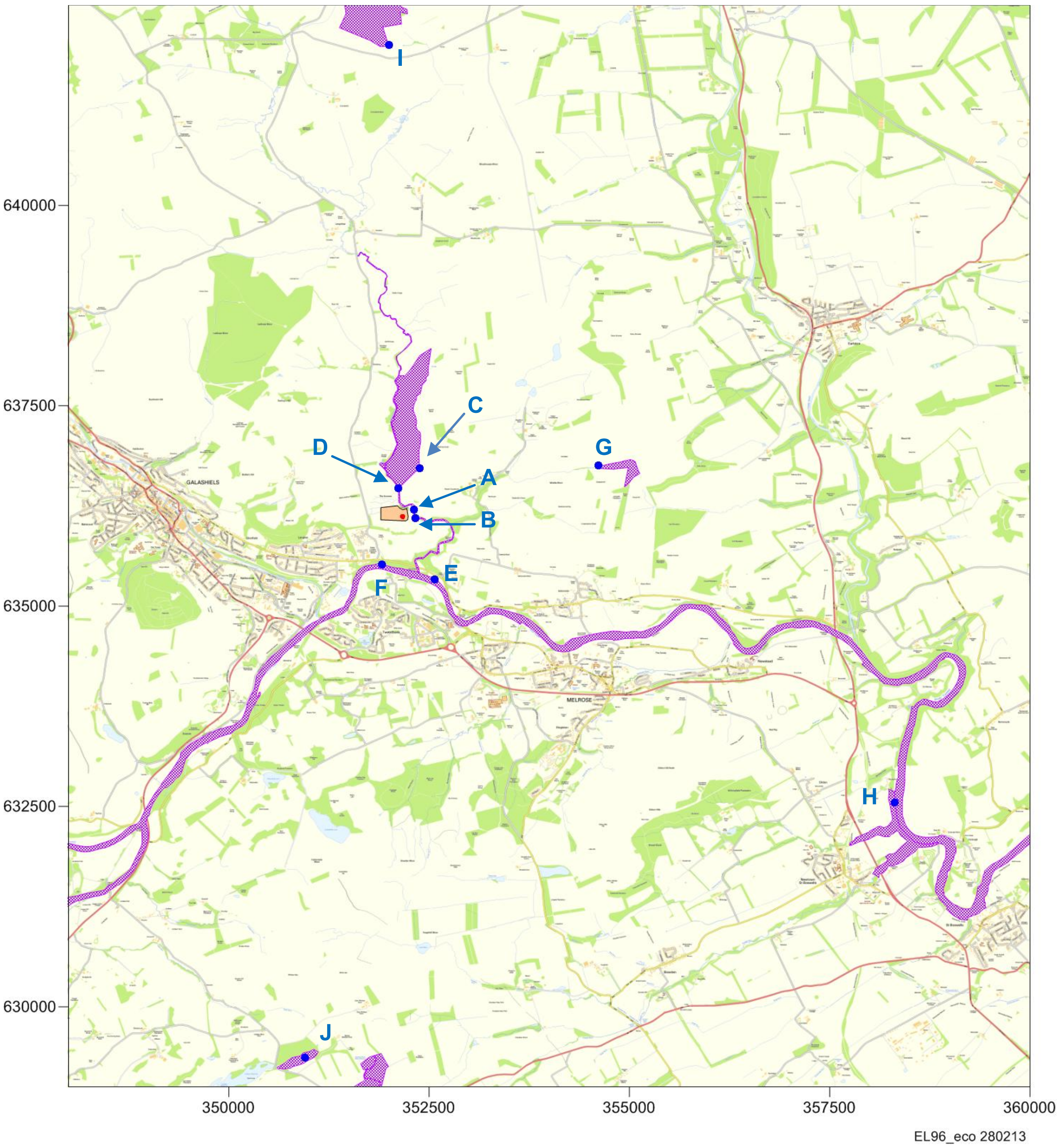



*Figure Contains Ordnance Survey data © Crown copyright and database right 2013*

**Table 3.4 – Key to Discrete Ecological Receptors**

| Receptor ID | Site | Location | | Distance*, m |
|---|---|---|---|---|
| | | Eastings, m | Northings, m | |
| A | River Tweed SAC (1 of 2) | 352310 | 636204 | 170 |
| B | River Tweed SAC (2 of 2) | 352326 | 636097 | 160 |
| C | Avenel Hill and Gorge SSSI (1 of 2) | 352380 | 636720 | 650 |
| D | Avenel Hill and Gorge SSSI (2 of 2) | 352120 | 636470 | 370 |
| E | River Tweed SSSI (1 of 2) | 351912 | 635522 | 640 |
| F | River Tweed SSSI (2 of 2) | 352573 | 635330 | 880 |
| G | Gattonside Moss SSSI | 354618 | 636757 | 2520 |
| H | Borders Woods SAC | 358310 | 632550 | 7100 |
| I | Threepwood Moss SAC | 352000 | 642000 | 5890 |
| J | Whitlaw and Branxholme SAC | 350950 | 629360 | 6860 |

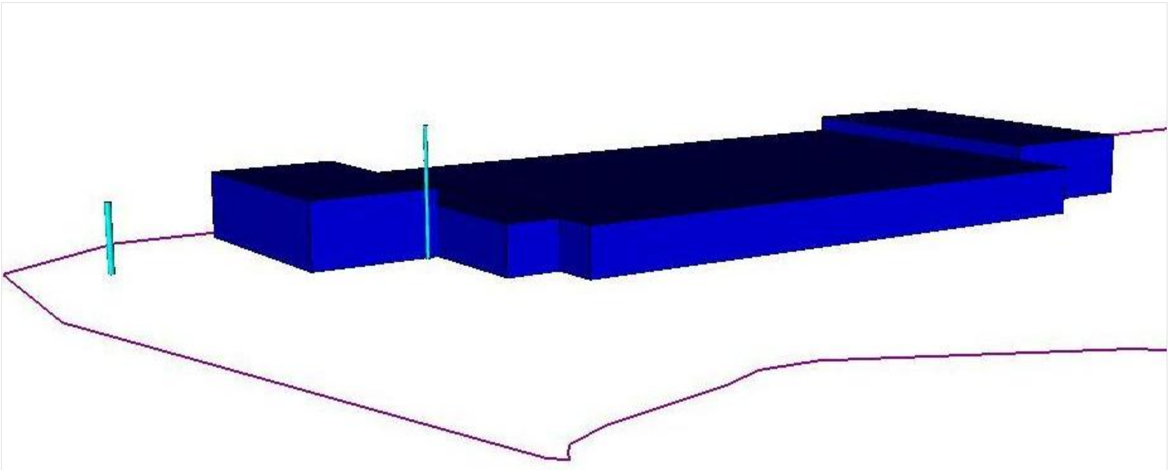
* from ATT plant exhaust

### 3.2.4 Building Downwash

Buildings close to point source plume discharges that are more than 40% of the exhaust stack height away may potentially cause downwash effects. The BPIP programme was used to calculate for each wind sector the direction specific building downwash parameters for the ATT plant exhaust to be used by AERMOD PRIME in the dispersion calculations.

The ATT plant is shown in Insert 3.4 as viewed from the north east. The thin blue line to the left of the figure near the eastern site boundary (left in the figure below) is the biofilter exhaust; the biofilter itself is a low structure and hence it is not shown in the figure. The central thin blue line represents the 23 metre multiple-flue ATT plant exhaust. The adjacent building to the left as shown is 12 metres high, as is the reception hall at the opposite end of the facility. The central part of the facility is 9 metres high.

**Insert 3.4 – Site Structures Included in Model**



### 3.2.5 Emission Characteristics

#### ATT plant

The multiple-flue exhaust discharge incorporates a single flue for the NEAT units and one flue for each of the engines. There are four engine flues although there is always one engine on standby and up to three engines in operation. For clarity, the relevant flue gas parameters for the NEAT units and the engines are shown separately below. The dispersion model treats the exhaust as a single combined discharge and hence the appropriately combined parameters were calculated; these are then presented in the last of the three tables below. The mass emission rates and emission concentrations, determined using the relevant emission limit values, are shown in Table 3.8.

The NEAT units' exhaust discharge characteristics are shown in Table 3.5. These input data have been derived from the engineering design information provided by NESSB, in February 2013.

**Table 3.5 – NEAT Units Exhaust Discharge Characteristics**

| Parameter | Value |
|---|---|
| Flue diameter, m (single) | 0.293 |
| Exhaust gas temperature, °C | 293 |
| Exhaust gas exit velocity, m/s | 25.05 |
| Actual exhaust gas flow rate, $m^3/s$ | 1.689 |
| Oxygen content of actual wet gas flow, % | 5.2 |
| Water content of actual gas flow, % | 13.3 |
| Exhaust gas flow rate at WID reference conditions (273 K, 101.3 kPa, 11% $O_2$ dry basis), $Nm^3/s$ | 1.063 |

The overall engine exhaust discharge characteristics, at the normal maximum load operational condition of three engines operating concurrently, are shown in Table 3.6.

**Table 3.6 – Engine Exhaust Discharge Characteristics**

| Parameter | Value |
|---|---|
| Equivalent flue diameter, m (three flues each 0.344 m) | 0.596 |
| Exhaust gas temperature, °C | 250 |
| Exhaust gas exit velocity, m/s | 25.0 |
| Actual exhaust gas flow rate, $m^3/s$ | 6.986 |
| Oxygen content of actual wet gas flow, % | 5.7 |
| Water content of actual gas flow, % | 12.9 |
| Exhaust gas flow rate at Landfill Gas Engine reference conditions (273 K, 101.3 kPa, 5% $O_2$ dry basis), $Nm^3/s$ | 2.868 |

The combined discharge characteristics for the ATT plant exhaust as modelled are summarised in Table 3.7 . The flue diameter quoted is equivalent to the total cross-sectional area of the various flues, and the flow rates are the total flue gas discharge. The proposed exhaust discharge height for the combined flue meets the D1 minimum height requirements[12] for operation at full capacity as described above.

**Table 3.7 – Multiple-Flue ATT Plant Exhaust Discharge Characteristics**

| Parameter | Value |
|---|---|
| Location of ATT exhaust (National Grid Ref.), m | 352170, 636110 |
| Height of release point above ground level, m | 23 |
| Equivalent flue diameter, m | 0.664 |
| Exhaust gas temperature, °C | 258 |
| Exhaust gas exit velocity, m/s | 25.04 |
| Actual exhaust gas flow rate, $m^3/s$ | 8.675 |

The mass emission rates of regulated emissions for the NEAT units were derived from the normalised flow rate in Table 3.5 and the IED daily emission concentration limit values (ELVs) as set out in Annex VI of the Directive. The mass emission rates of regulated emissions for the engines were derived from the normalised flow rate in Table 3.5 and the WID daily emission concentration limit values (ELVs) as set out in Annex V(a) of the Directive. The substances regulated in the WID and the mass emission rates for the proposed energy facility are shown in Table 3.8.

[12] Guidelines on Discharge Stack Heights for Polluting Emissions, HMIP Technical Guidance Note (Dispersion) D1, 1993

**Table 3.8 – Emission Limits and Mass Emission Rates for the Engines and NEAT Units**

| Emission | Engine | | NEAT | | Combined Emission Rate g/s |
|---|---|---|---|---|---|
| | LFTGN Emission Limit Value $mg/Nm^3$ | Mass Emission Rate g/s | WID Emission Limit Value $mg/Nm^3$ | Mass Emission Rate g/s | |
| Oxides of nitrogen ($NO_x$) | 500 | 1.434 | 200 | 0.213 | 1.647 |
| Sulphur dioxide ($SO_2$) | n/a | - | 50 | 0.053 | 0.053 |
| Carbon monoxide (CO) | 1400 | 4.016 | 50 | 0.053 | 4.069 |
| Total dust (particulates) | n/a | - | 10 | 0.011 | 0.011 |
| Total organic carbon | 1000 | 2.868 | 10 | 0.011 | 2.879 |
| Hydrogen chloride (HCl) | n/a | 0.028* | 10 | 0.011 | 0.039 |
| Hydrogen fluoride (HF) | n/a | 0.026* | 1 | 0.001 | 0.027 |
| Group 1 (Cd + Tl) total | n/a | - | 0.05 | $5.3x10^{-5}$ | $5.3x10^{-5}$ |
| Group 2 (Hg) total | n/a | - | 0.05 | $5.3x10^{-5}$ | $5.3x10^{-5}$ |
| Group 3 (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V) total | n/a | - | 0.5 | $5.3x10^{-4}$ | $5.3x10^{-4}$ |
| Dioxins and furans (as TCDD) | n/a | - | $1.0x10^{-7}$ | $1.1x10^{-10}$ | $1.1x10^{-10}$ |
| Hydrogen sulphide ($H_2S$) | n/a | 0.044* | n/a | 0.003* | 0.047 |

** based on predicted actual emission concentration, from NESSB mass balance*

### Biofilter

In order to address the potential for cumulative effects of oxides of nitrogen emissions, the biofilter was also included in the dispersion model. The exhaust characteristics are shown in Table 3.9, and have been taken from the RPS report for the consented waste facility. Emissions of ammonia and odour were not included in the model as these pollutants will not be emitted from the ATT plant, hence there is no potential for cumulative impacts[13].

---

[13] A comment is made in the results section on the odour potential of the hydrogen sulphide emissions

**Table 3.9 – Biofilter Exhaust Discharge Characteristics**

| Parameter | Value |
|---|---|
| Location of biofilter exhaust (National Grid Ref.), m | 352218, 636089 |
| Height of release point above ground level, m | 12 |
| Equivalent flue diameter, m | 1.2 |
| Exhaust gas temperature, °C | 30 |
| Exhaust gas exit velocity, m/s | 15 |
| Actual exhaust gas flow rate, $m^3/s$ | 14.8 |
| Oxides of nitrogen emission rate, g/s | 0.027 |

### 3.2.6 Abnormal operation

An assessment of the potential short-term emissions during abnormal emissions episodes was undertaken using the half-hourly average emission limit limits specified in the IED. These results represent highly exceptional occurrences. The relevant half-hourly average IED emission limits are shown in Table 3.10.

**Table 3.10 - IED Half Hour Average Emission Limit Concentration Values**

| Emission | Half-hour Average ELV $mg/Nm^3$ |
|---|---|
| Oxides of nitrogen (NOx) | 400 |
| Total dust (particulates) | 30 |
| Sulphur dioxide ($SO_2$) | 200 |
| Total organic carbon | 20 |
| Hydrogen chloride (HCl) | 60 |
| Hydrogen fluoride (HF) | 4 |

Note: Emission limit values are expressed at WID reference conditions of: 273 K, 101.3 kPa, 11% oxygen, dry basis.

## 3.3 Ecological assessment

An assessment of the effect of the ATT plant emissions at the closest designated ecological sites was undertaken to assess whether the annual average criterion (critical level) for oxides of nitrogen and sulphur dioxide, set for the protection of vegetation, would be exceeded.

For the statutory designated ecological sites, where the modelled increment to ground level concentrations exceeds one percent of the vegetation limit value, the modelled increments are used to calculate the dry nitrogen and acid deposition rates due to the emissions from the facility. All of the oxides of nitrogen were conservatively assumed to be as nitrogen dioxide in undertaking this assessment. The equation for the calculation of nitrogen deposition is shown in Equation 1. Acid deposition rates for nitrogen and sulphur were calculated using conversion factors in guidance for Appropriate Assessment[14]. A deposition velocity for forest was used for Avenel Hill and Gorge SSSI, while that for grassland was used for Gattonside Moss and the River Tweed

[14] Environment Agency Air Quality Technical Advisory Group (AQTAG)06 - Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. April 2010. Version 10.

### Equation 1 – Calculation of Nitrogen Deposition

Deposition rate (kg N/ha/yr) = NOx conc'n * deposition velocity[(a)] * 14/44 * 31557600/100000

*taken from AQTAG06 = 0.0015 m/s, for grassland, 0.003 for woodland.*

The increment in total deposition rate is then added to the background rate of deposition available from the Air Pollution Information System (APIS) website[15] and the total compared with the relevant UNECE critical load, which varies according to the type of sensitive ecosystem present. The critical loads for the statutory designated ecological sites considered in the assessment are presented in Table 3.11. The River Tweed is not shown in this table as there are no nitrogen or acidity critical loads set for freshwater; however, the freshwater habitat is stated on APIS as being potentially sensitive, hence it is included in the assessment in Section 5 of this chapter.

**Table 3.11 – Critical Loads for Nearby Sensitive Habitats**

| Site | Habitat type | Nitrogen critical load, kg N/ha/yr | Acid (N) MinCL Max N keq/ha/yr | Acid (S) MinCL Max S keq/ha/yr |
|---|---|---|---|---|
| Avenel Hill and Gorge SSSI | Upland oak woodland | 10 – 15 | 1.08 | 0.94 |
| Gattonside Moss SSSI | Rich fens | 15 – 30 | n/a | n/a |
| Borders Woods SAC | Mixed woodland | 15 – 20 | 1.17 | 0.88 |
| Threepwood Moss SAC | Active raised bog | 5 – 10 | 0.55 | 0.23 |
| Whitlaw and Branxholme SAC | Quaking fens | 10 – 15 | 0.57 | 0.25 |

Note: n/a = value not available because site not sensitive

## 3.4 Assessment Criteria

The results of the air dispersion modelling study are evaluated in terms of increments or "process contributions" (PC) to existing concentrations, in the context of the relevant air quality criteria for human health and vegetation. The long-term and short-term PCs were also considered in the context of the existing background concentrations, in order to derive total "predicted environmental concentrations" (PEC), as outlined in the SEPA Horizontal Guidance Note H1.

In terms of oxides of nitrogen emissions, the criteria for human health are set for nitrogen dioxide. The oxides of nitrogen emissions from combustion processes are released almost entirely in the form of nitrogen monoxide. As the plume travels and mixes with air, the nitrogen monoxide slowly oxidises to form nitrogen dioxide. This slow atmospheric reaction depends upon the availability of both ozone and sunlight to proceed. The plume travel time to the nearest residential receptors is in the order of several minutes only, thus restricting the degree of oxidation. A secondary reaction with oxygen may take place without sunlight, but this is extremely slow and hence is not a relevant consideration in the context of the local study area. Given the lower rate of oxidation at night time, it appears reasonable to assume that long-term average conversion factors would in fact be lower than the short-term daytime factor.

For the short travel distances between the proposed ATT plant and the nearest sensitive receptors, a conversion factor of up to 20% could be regarded as being a relatively conservative assumption for short term averaging periods. Studies by Janssen[16] of oxidation rates in power

---

15 http://www.apisdev.ceh.ac.uk/
16 Janssen L.H.J.M., van Wakeren J.H.A., van Durren H. and Elshout A.J. (1988) *A classification of NO oxidation rates in power plant plumes based on atmospheric conditions*. Atmospheric Environment 22, 43-55.

station plumes found conversions below 20% for distances of up to at least two kilometres from the source, other than during high ozone episodes.

The H1 SEPA guidance describes a very conservative procedure for the conversion of oxides of nitrogen to nitrogen dioxide. This uses unrealistically high conversion ratios of 50% for short-term and 100% for long-term average concentrations. The Environment Agency's Air Quality Modelling and Assessment Unit (AQMAU) suggests a phased approach, which begins with these H1 screening values, then proposes a second phase which is termed a "worse case scenario" *sic,* and uses conversion ratios of 35% for short-term and 70% for long-term average concentrations. These conversion ratios are used in the current assessment, which is consistent with the RPS (2011) report for the consented waste facility.

The modelled long-term PCs are added to the background annual mean concentration to determine the PEC. Short-term concentrations are added to twice the background annual mean concentration and compared to the relevant air quality criteria.

The rates of nitrogen and acid deposition based on modelled concentrations of oxides of nitrogen and sulphur dioxide at sensitive ecological sites are assessed with reference to background deposition rates and the recommended ranges of critical loads. The nitrogen-derived acid deposition rate is compared with "MinCL Max N" and the sulphur-derived acid deposition rate with "MinCL Max S".[17]

## 3.5 Areas of Uncertainty or Assumptions

All air dispersion modelling is inherently subject to a degree of uncertainty. However, conservative assumptions have been made throughout the assessment, for instance by assuming the ATT plant would continuously operate throughout the year, and that all substances from the NEAT units would be emitted at the IED Annex V(a) daily emission limits. The use of five years of meteorological data ensures the least favourable hours have been modelled. A "worse case" conversion rate of oxides of nitrogen to nitrogen dioxide has been applied, and deposition rates are compared to the lower range of critical loads for ecological receptors.

The conclusions drawn are therefore considered to be robust, as the uncertainty in the modelling is considered to be small in comparison with the overall scale of the factors built into the above conservative assumptions.

# 4. Baseline Conditions

## 4.1 Local Air Quality

To provide an indication of existing air quality, publicly available information has been drawn from the DEFRA UK-Air database[18] and the most recent air quality review and assessment reports published by Scottish Borders Council.

Scottish Borders Council routinely reviews air quality conditions within the authority area in accordance with national requirements under the LAQM regime. The 2012 Air Quality Updating and Screening Assessment Report[19] reconfirmed conclusions from earlier rounds of assessment, i.e. that no exceedances of AQS pollutant objectives were anticipated, and there was no requirement to move to detailed assessment. No other new/proposed industrial installations have been identified in the Galashiels area, other than the consented waste facility at Easter Langlee.

[17] The maximum critical load of sulphur (CLmaxS) is the critical load for acidity expressed in terms of sulphur, i.e. when nitrogen deposition is zero. The maximum critical load of nitrogen (CLmaxN) is the critical load of acidity expressed in terms of nitrogen only (when sulphur deposition is zero).
[18] http://uk-air.defra.gov.uk/
[19] Scottish Borders Council, 2012 Air Quality Updating and Screening Assessment for Scottish Borders Council, April 2012 (report provided via email by David Brown, Environment and Infrastructure Division)

### 4.1.1 Monitoring data

Within the Scottish Borders, the Peebles continuous monitoring site (CMS) is operated as part of the DEFRA Automatic Urban and Rural Network (AURN). It is an urban background site, located approximately 27 km west of the Easter Langlee site. It measures oxides of nitrogen, nitrogen dioxide and ozone. The nearest site in the AURN measuring sulphur dioxide and carbon monoxide is Edinburgh St Leonards, an urban background site around 45 kilometres to the north west of Easter Langlee.

DEFRA currently operates two "supersites" as part of the co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP). The sites measure an extensive range of species as part of a range of DEFRA monitoring programmes. The northern supersite is located at Auchencorth, an elevated rural location approximately 16 km to the north west of the Easter Langlee site and 18 kilometres south of Edinburgh city centre.

#### Nitrogen Dioxide

Monitoring statistics available from the DEFRA UK-Air website[20] report an annual mean $NO_2$ concentration of 8 µg/m$^3$ in 2012. Annual mean $NO_x$ concentrations are reported as 12 µg/m$^3$ in 2012.

Nitrogen dioxide concentrations are also measured by the local authority using passive diffusion tubes. The results for the monitoring sites closest to the study area are shown in Table 4.1 below. The annual mean objective of 40 µg/m$^3$ was met at all sites including kerbside (K) locations. Concentrations at the urban background (UB) site in Galashiels (site no. 2) were between 10 and 12 µg/m$^3$, slightly higher than at Peebles and Melrose but nonetheless well below the objective.

**Table 4.1 – Nitrogen Dioxide Diffusion Tube Measurements (µg/m$^3$)**

| Site ID | Location | Grid reference | | Site type | Annual mean | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2008 | 2009 | 2010 | 2011 |
| 1 | Council Chamber, Galashiels | 349298 | 635928 | K | 23 | 18 | 17 | 15 |
| 2 | Stanley / Meigle St. Galashiels | 348587 | 636142 | UB | 10 | 10 | 12 | 10 |
| 3 | High St., Galashiels | 348953 | 636445 | K | 37 | 35 | 38 | 38 |
| 4 | Gladstone Pl., Peebles | 324757 | 640643 | UB | 9 | 9 | 10 | - |
| 5 | High St., Peebles | 325085 | 640389 | K | 23 | 21 | 24 | - |
| 15 | St. Dunstan's Park, Melrose | 354548 | 634038 | UB | 7 | 10 | 8 | - |
| 16 | Rogerson's High St Galashiels | 349063 | 636287 | K | - | 33 | 32 | 32 |
| 17 | Border Angling, High St, Galashiels | 348976 | 636371 | K | 35 | 36 | 38 | 39 |
| 18 | Edingtons, High St, Galashiels | 348982 | 636384 | K | 29 | 28 | 35 | 31 |
| 19 | Iceland, High St, Galashiels | 349063 | 636272 | K | 35 | 33 | 35 | 37 |

The annual mean nitrogen dioxide concentration measured by diffusion tube at the urban background site in Galashiels in 2011 has been selected for use as a background concentration in the assessment of impacts on human health as it is the closest site. This value of 10 µg/m$^3$ is consistent with the value used in the RPS report for the consented waste facility and is slightly conservative compared to the 2012 AURN measurement at Peebles[21].

[20] http://uk-air.defra.gov.uk/data/exceedence
[21] We note that a higher value in 2010 of 12 ug/m$^3$ was measured. DEFRA advises that 2010 is an atypical year due to prevailing meteorological conditions. For this reason the assessment does not use this value.

### Particulates

$PM_{10}$ is measured at the Auchencorth Moss site as part of the AURN network. The annual average $PM_{10}$ concentration in 2012 was less than half the objective, at 7 µg/m$^3$. There were no exceedences of the short term air quality objective at this site. There was only a single exceedence of the daily standard (of which 35 exceedences are allowed per year) between 2008 and 2012.

$PM_{2.5}$ is also measured at Auchencorth Moss; in 2012, the annual average concentration was 4 µg/m$^3$.

### Sulphur dioxide

The annual mean concentration measured at Edinburgh St Leonards in 2012 was 2 µg/m$^{3.}$ There were no exceedences of any of the short term air quality objectives at this site between 2008 and 2012.

### Carbon monoxide

In 2012 the annual average concentration measured at Edinburgh St Leonards was 0.21 µg/m$^3$. There were no exceedences of the short term air quality objective at this site between 2008 and 2012.

### Acid gases

Auchencorth Moss is part of the acid gas monitoring network run by DEFRA. The annual mean hydrogen chloride concentration measured in 2011 was 0.13 µg/m$^3$. Hydrogen fluoride is not currently measured as part of the network.

### Metals

Auchencorth Moss is also part of heavy metals monitoring network run by DEFRA. The annual average concentrations measured in 2011, the most recent year for which data are available, are presented in Table 4.2 below.

**Table 4.2 – Heavy Metal Concentrations at Auchencorth Moss, ng/m$^3$**

| Heavy Metal | 2011 Concentration |
|---|---|
| As | 0.22 |
| Cd | 0.031 |
| Cr | 0.27 |
| Cu | 0.92 |
| Fe | 41.9 |
| Mn | 1.1 |
| Ni | 0.38 |
| Pb | 1.6 |
| V | 0.38 |
| Zn | 4.2 |
| Hg(p)* | n/a |
| Hg(v)* | 0.97 |

* (p) = particulate phase, (v) = vapour phase

### Volatile Organic Compounds (VOC)

A wide range of hydrocarbon compounds is measured at the Auchencorth Moss site as part of the automatic hydrocarbon monitoring network. Benzene currently has the most stringent EAL, and as such forms the focus of the VOC assessment. The annual mean benzene concentration measured in 2012 at Auchencorth Moss was 0.22 µg/m$^3$, less than a tenth of the objective for Scotland of 3.25 µg/m$^3$ as a running annual mean.

#### Dioxins and furans

A wide variety of organic compounds are measured at the Auchencorth Moss site as part of the toxic organic micro pollutants (TOMPS) monitoring network. The annual mean total TEQ for dioxins and furans measured in 2009 (the most recent year for which data has been published[22]) was 0.56 fg TEQ/m$^3$.

### 4.1.2 Nitrogen and Acid Deposition

The APIS website contains estimates of background concentrations and deposition rates for use in ecological assessments. Annual mean background concentrations of oxides of nitrogen, and rates of nitrogen and acid (nitrogen only) deposition, for each of the designated sites have been downloaded from the website. The data for the statutory ecological sites considered in this assessment are presented in Table 4.3.

**Table 4.3 – Background Concentrations and Deposition Rates at Ecological Sites**

| Site | Habitat type | Oxides of nitrogen, µg/m$^3$ | Sulphur Dioxide, µg/m$^3$ | Nitrogen deposition, kg N/ha/year | Acid (N) deposition keq/ha/year | Acid (S) deposition keq/ha/year |
|---|---|---|---|---|---|---|
| River Tweed SAC & SSSI | Water course | 7.5 | 0.57 | 14.46 | 1.03 | 0.36 |
| Avenel Hill and Gorge SSSI | Oak woodland | 7.3 | 0.57 | 28.94 | 2.07 | 0.36 |
| Gattonside Moss SSSI | Rich fens | 7.1 | 0.57 | 17.68 | 1.26 | 0.29 |
| Borders Woods SAC | Mixed woodland | 7.5 | 0.56 | 28.56 | 2.04 | 0.40 |
| Threepwood Moss SAC | Active raised bogs | 6.4 | 0.59 | 15.96 | 1.14 | 0.26 |
| Whitlaw and Branxholme SAC | Quaking fens | 7.5 | 0.53 | 17.78 | 1.27 | 0.34 |

Note that the oxides of nitrogen and sulphur dioxide concentrations given in the table above were taken from the relevant 5 by 5 km grid square within which each designated site is situated. As the measured oxides of nitrogen and sulphur dioxide concentrations, 10 and 2 µg/m$^3$ respectively in 2012, are higher than the mapped values, the measured concentrations have been used in the assessment to allow a more conservative evaluation.

## 4.2 Meteorological Data

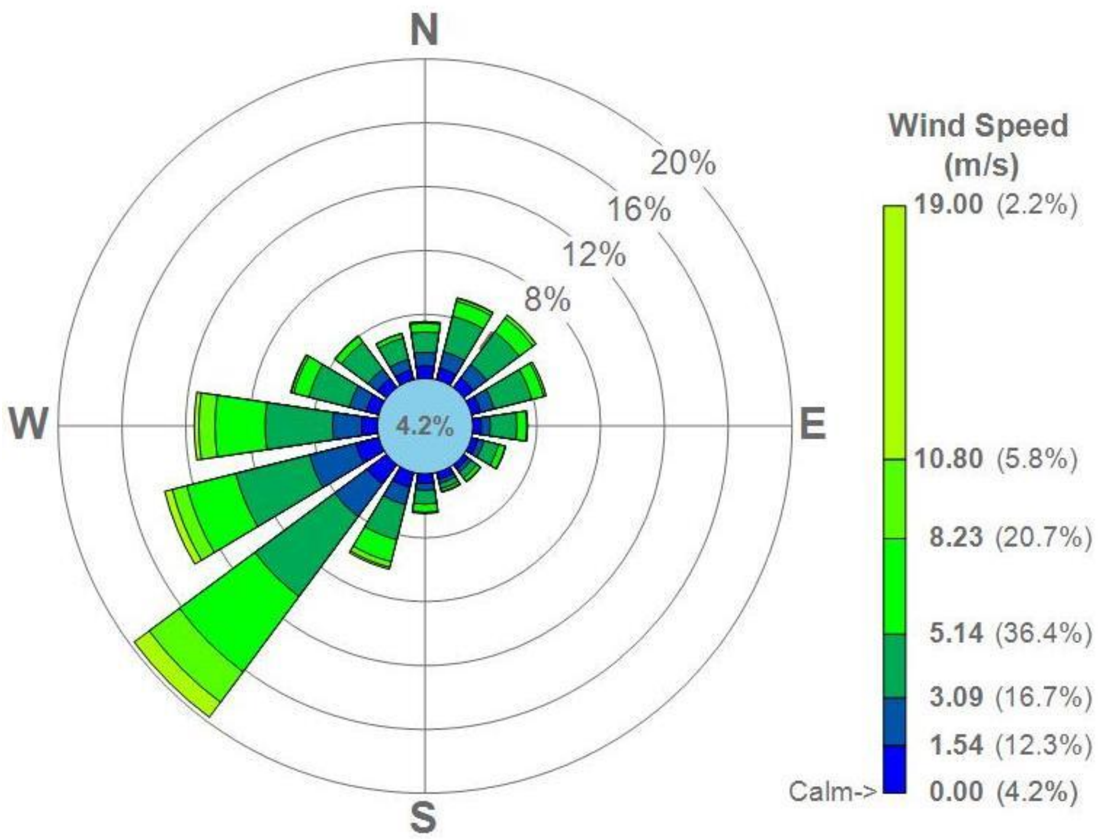
As discussed in Section 3.2.2, the most appropriate meteorological station for the dispersion modelling study is the Charterhall RAF Met Office site.

The meteorological data were used to generate a frequency distribution of wind speed and direction. The data are presented as a wind rose diagram in Insert 4.1. It is evident from the data that there is a strongly prevailing wind from the south-west, and there are also higher than average wind frequencies from the west south west and from the west. Winds from these five sectors comprise over 53% of total winds, rather than the 30.8% that would arise from an evenly distributed case. In contrast, winds from the north north-east and the adjoining sectors are

[22] http://uk-air.defra.gov.uk/reports/cat13/1006220914_TOMPs_report_2009.pdf

particularly infrequent. Calms are shown as 4.2% of the data and there are less than 1.8% missing hours.

**Insert 4.1 – Wind Rose Diagram for Charterhall, 2006 to 2010**



# 5. Assessment of Effects on Air Quality

## 5.1 Summary of Results

The maximum field-wide short-term and long-term ground level concentrations (PCs) resulting from the air dispersion modelling exercise, together with the relevant air quality criteria (AQS or EAL), are presented in Table 5.1. The table also shows in the final column the maximum percentage contribution that the plant is expected to make to the air quality criteria.

**Table 5.1 – Summary of Atmospheric Dispersion Results for Field-Wide Maximum**

| Pollutant | Averaging Period | PC | Criterion | | PC / EAL |
|---|---|---|---|---|---|
| | | µg/m³ | µg/m³ | Source | % |
| Nitrogen oxides | Hourly | 197 | - | - | - |
| | Annual | 4.9 | 30 | AQS (veg) | **16.4** |
| Nitrogen dioxide | Hourly | 68.8 | 200 | AQS | **34.4** |
| | Annual | 3.4 | 40 | AQS | **8.6** |
| Particulates | Daily | 0.34 | 50 | AQS | 0.7 |
| | Annual | 0.03 | 18 | AQS | 0.2 |
| Sulphur dioxide | 15-minute | 8.5 | 266 | AQS | 3.2 |
| | Hourly | 6.3 | 350 | AQS | 1.8 |
| | Daily | 1.6 | 125 | AQS | 1.3 |
| | Annual | 0.16 | 20 | AQS (veg) | 0.8 |
| Carbon monoxide | Hourly | 485 | 30,000 | EAL | 1.6 |
| | 8-hourly | 164 | 10,000 | AQS | 1.6 |
| | Annual | 12.0 | 350 | EAL | **3.4** |
| Hydrogen chloride | Hourly | 4.6 | 800 | EAL | 0.6 |
| | Annual | 0.12 | 20 | EAL | 0.6 |
| Hydrogen fluoride | Hourly | 3.2 | 250 | EAL | 1.3 |
| Hydrogen sulphide | Hourly | 5.6 | 150 | EAL | 3.7 |
| | Annual | 0.14 | 140 | EAL | 0.1 |
| VOC (non methane) | Hourly | 35.6 | 208 | EAL Benzene | **17.1** |
| | Annual | 0.88 | 3.25 | AQS Benzene | **27.1** |
| Group 1 metals (total) | Hourly | $6.3 \times 10^{-3}$ | 1.5 | EAL Cd | 0.4 |
| | Annual | $1.6 \times 10^{-4}$ | 0.005 | EAL Cd | **3.1** |
| Group 2 metals (total) | Hourly | $6.3 \times 10^{-3}$ | 7.5 | EAL Hg | 0.1 |
| | Annual | $1.6 \times 10^{-4}$ | 0.25 | EAL Hg | 0.1 |
| Group 3 metals (total) | Hourly | 0.06 | See section 5.2.5 | | - |
| | Annual | $1.6 \times 10^{-3}$ | | | - |
| Dioxins and furans | Annual | $3.2 \times 10^{-10}$ | See section 5.2.6 | | - |

The maximum results tabulated in Table 5.1 above do not necessarily represent a relevant location for exposure of a sensitive human health or ecological receptor. The geographical locations of the long-term and short-term maximum modelled process contributions presented in the above table are discussed over the following pages in the context of the graphical results for specific pollutants, alongside tables with the maximum concentrations at the discrete modelled sensitive receptors.

The SEPA Guidance Note H1 describes a screening procedure in which process contributions of less than one percent of the long-term environmental benchmark, or less than 10 percent of the short-term benchmark, are considered not to warrant further assessment.

In Table 5.1 a comparison is made with the AQS or EALs for human health. The maximum percentage that the PC makes to the criterion is at most 34% for hourly nitrogen dioxide. The results for particulates[23], sulphur dioxide, hydrogen chloride, hydrogen fluoride, hydrogen sulphide, and Group 2 metals are all deemed to be insignificant on the basis that the PC contributes less than one percent to the long term EAL and/or 10 percent to the short term EAL for human health.

The next section of this chapter describes the results in more detail with respect to the EALs for human health and where appropriate, i.e. where the PC alone cannot be considered insignificant as it exceeds the H1 screening criteria, the calculated PECs are provided (these have been estimated using the simple H1 method of combining with a background concentration).

The potential effects on vegetation are discussed in the section entitled “ecological assessment” in section 5.3 of this chapter.

## 5.2 Human health

### 5.2.1 Oxides of nitrogen

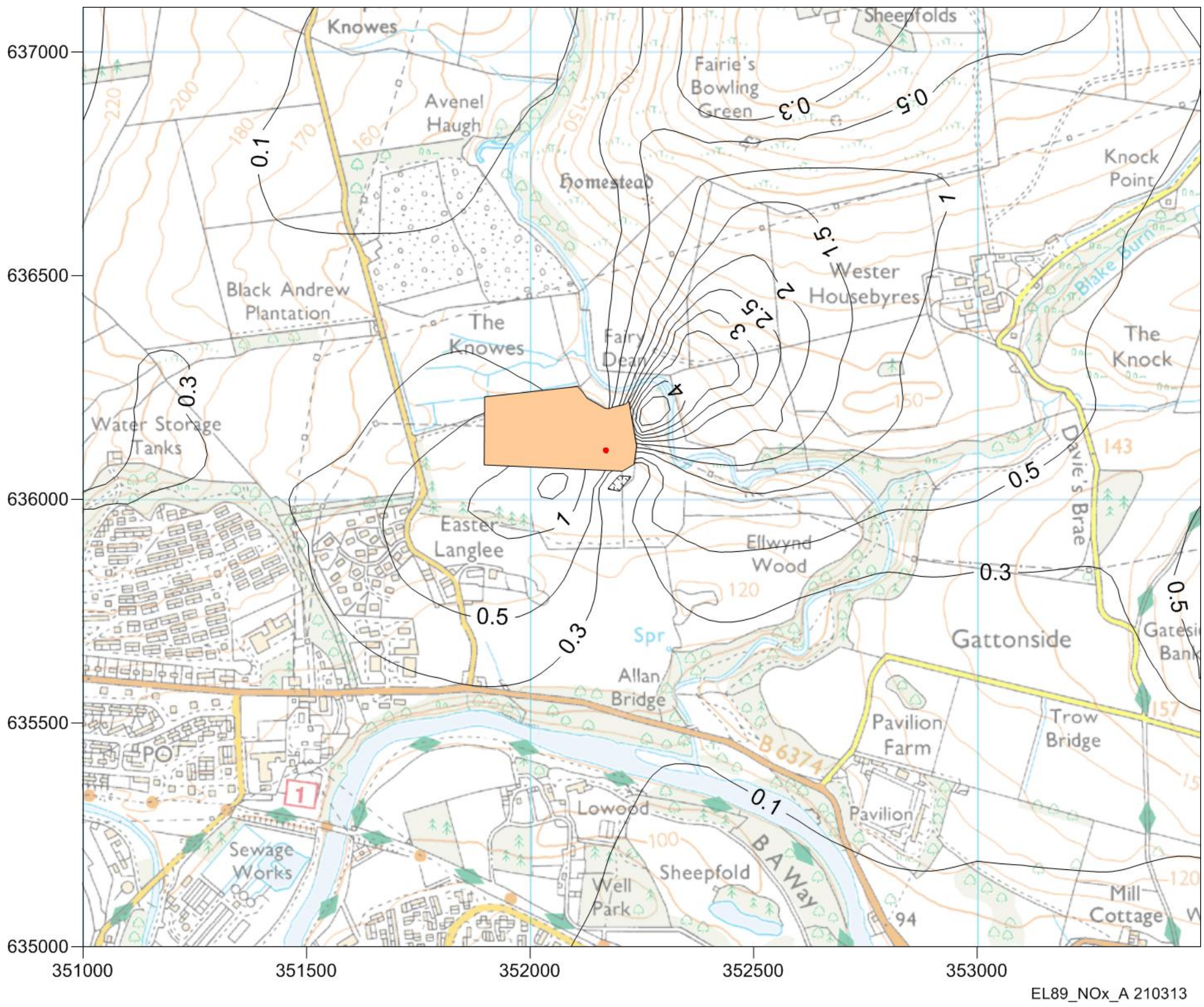
#### Annual average

The modelled annual average ground level oxides of nitrogen concentrations resulting from the proposed ATT plant emissions are shown graphically in Insert 5.1. The contour plot demonstrates the dispersion pattern of off-site ground level concentrations. The interaction of the meteorological data on plume dispersion and the varying terrain heights in the surrounding area is evident in the figure.

The pattern of dispersion reflects the long-term frequencies of winds depicted in the wind rose in Insert 4.1. The effects of the proposed ATT plant emissions are relatively localised, the highest annual average oxides of nitrogen concentration of 4.9 µg/m$^3$ occurring 150 metres to the north-east of the ATT plant exhaust, beyond the site boundary over land that encompasses a car park. There is a secondary maximum to the south west, where concentrations are 1.6 µg/m$^3$ or less. Concentrations reduce rapidly with increasing distance from these maxima, such that in the majority of the surrounding area, increments in the annual average are less than 1 µg/m$^3$.

[23] The maximum annual average increment for particulates of 0.03 µg/m$^3$ is also less than one percent of the annual mean objective for $PM_{2.5}$ of 12 µg/m$^3$.

**Insert 5.1 - Maximum Annual Average Oxides of Nitrogen Concentrations, µg/m³**




The annual average nitrogen dioxide PCs at nearby residential receptors are shown in Table 5.2, which have been calculated assuming a conservative 70% conversion rate from oxides of nitrogen. The highest concentration at any residential receptor is found at receptor 10, located on the northern edge of the planned new residential development to the south of the facility. Here the maximum increment to annual average oxides of nitrogen concentrations is 1 µg/m³. The modelled increment is equivalent to 0.7 µg/m³ as nitrogen dioxide, less than two percent of the AQS objective of 40 µg/m³.

**Table 5.2 - Annual Average Oxides of Nitrogen Results at Discrete Receptors**

| ID | Receptor | Annual $NO_x$, µg/m$^3$ | Annual $NO_2$, µg/m$^3$ | PC/EAL, % | PEC $NO_2$, µg/m$^3$ | PEC/EAL, % |
|---|---|---|---|---|---|---|
| 1 | 10 Loan View | 0.6 | 0.4 | 1.1 | 10.4 | 26.1 |
| 2 | 1 Easter Langlee | 0.8 | 0.6 | 1.4 | 10.6 | 26.4 |
| 3 | 9 Loan View | 0.6 | 0.4 | 1.1 | 10.4 | 26.1 |
| 4 | Wester Housebyres | 0.8 | 0.6 | 1.4 | 10.6 | 26.4 |
| 5 | Lowood | 0.1 | 0.1 | 0.2 | 10.1 | 25.2 |
| 6 | Pavilion Farm | 0.1 | 0.1 | 0.2 | 10.1 | 25.2 |
| 7 | Gattonside Mains | 0.2 | 0.1 | 0.3 | 10.1 | 25.3 |
| 8 | Langlee Mains Farmhouse | 0.1 | 0.1 | 0.2 | 10.1 | 25.2 |
| 9 | Glendearg | 0.1 | 0.1 | 0.1 | 10.1 | 25.1 |
| 10 | New development | 1.0 | 0.7 | 1.8 | 10.7 | 26.8 |

As the PC exceeds one percent of the EAL at some of these properties, the total PEC was calculated, as shown in the sixth column of Table 5.2. This calculation was undertaken by adding the 2011 nitrogen dioxide concentration measured in Galashiels, 10 µg/m$^3$, to each modelled PC. The total concentration at a property within the new development was thus estimated to be 10.7 µg/m$^3$.

The final column of the table shows the PEC as a percentage of the EAL, the annual mean AQS objective of 40 µg/m$^3$. The estimated total nitrogen dioxide concentrations using this conservative procedure demonstrates that at all receptors where there may be a relevant exposure over a long-term time period the ambient concentrations will remain well below the objective, at around a quarter of that value. These results demonstrate that the effects of the facility emissions are not significant.

Given the highly conservative assumptions used in the assessment of 70% conversion to nitrogen dioxide, and that emissions are continuously emitted at the regulatory limits, the actual increments to annual average nitrogen dioxide concentrations are likely to be considerably lower than those presented[24].

It is noted that there are two landfill gas engines at the Easter Langlee landfill site approximately 700 metres to the north west of the facility. Due to the separation between the two facilities, any potential for cumulative impacts is extremely limited. This is evident from the figure above, which demonstrates that the contribution to ground level concentrations from the ATT plant at the location of the facility is in the order of 0.1 µg/m$^3$. There are no sensitive receptors in the immediate surroundings of the landfill site, or in particular within a few hundred metres to the north east of the engines, where the maximum annual average concentrations associated with the landfill gas engines would be found.

### Hourly average

The contour plot for maximum hourly average oxides of nitrogen concentrations is shown in Insert 5.2. The maximum ground level concentration of 197 µg/m$^3$ occurs over 600 metres north of the facility, on an area of elevated terrain at Fairies Bowling Green. There is a secondary maximum

[24] Even were the higher background of 12 µg/m$^3$ measured in the atypical year of 2010 to be used in this assessment, it is clear that the total concentration (12.7 µg/m$^3$) would remain well below the AQS objective of 40 µg/m$^3$.

approximately 1.2 km to the west north west of the site, on high ground near Langlee Mains, with concentrations around 150 µg/m$^3$.

For comparison with the short-term EAL for nitrogen dioxide of 200 µg/m$^3$, a 35% conversion ratio was applied to the maximum modelled hourly concentrations of oxides of nitrogen. The results for the nearest residential properties are summarised in Table 5.3.

**Table 5.3 - Hourly Average Oxides of Nitrogen Results at Discrete Receptors**

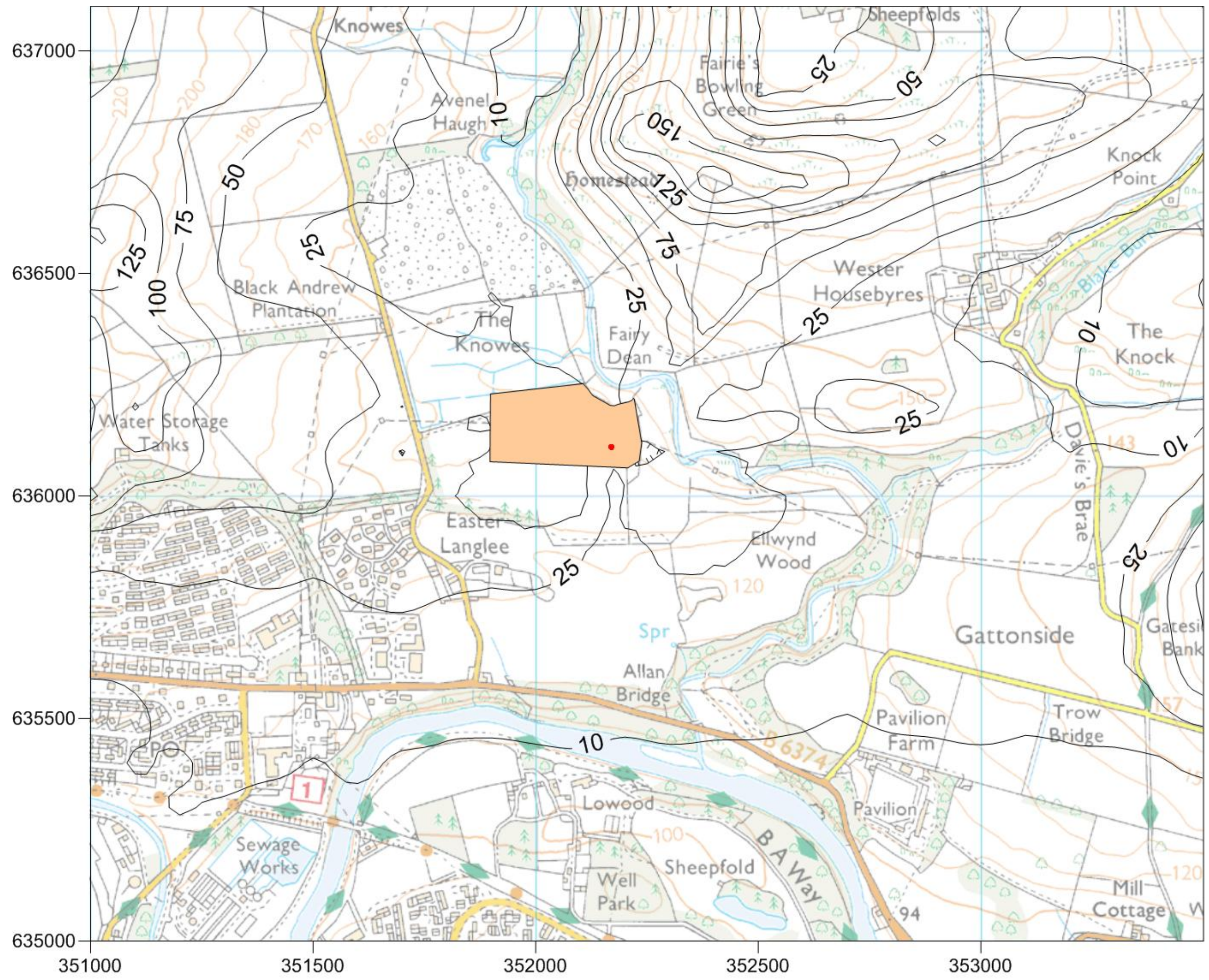
| ID | Receptor | Hourly NOx, µg/m$^3$ | Hourly $NO_2$, µg/m$^3$ | PC/AQS, % | PEC $NO_2$, µg/m$^3$ | PEC/AQS % |
|---|---|---|---|---|---|---|
| 1 | 10 Loan View | 36.0 | 12.6 | 6.3 | 32.6 | 16.3 |
| 2 | 1 Easter Langlee | 33.0 | 11.6 | 5.8 | 31.6 | 15.8 |
| 3 | 9 Loan View | 39.4 | 13.8 | 6.9 | 33.8 | 16.9 |
| 4 | Wester Housebyres | 10.1 | 3.5 | 1.8 | 23.5 | 11.8 |
| 5 | Lowood | 9.2 | 3.2 | 1.6 | 23.2 | 11.6 |
| 6 | Pavilion Farm | 8.9 | 3.1 | 1.6 | 23.1 | 11.6 |
| 7 | Gattonside Mains | 16.6 | 5.8 | 2.9 | 25.8 | 12.9 |
| 8 | Langlee Mains Farmhouse | 61.6 | 21.6 | 10.8 | 41.6 | 20.8 |
| 9 | Glendearg | 43.5 | 15.2 | 7.6 | 35.2 | 17.6 |
| 10 | New development | 46.8 | 16.4 | 8.2% | 36.4 | 18.2 |

The maximum short-term concentration at any residential receptor is found at Receptor 8, Langlee Mains Farmhouse, where the maximum hourly average increment as nitrogen dioxide is 21.6 µg/m$^3$, the equivalent of just under 11% of the AQS objective. Adding twice the annual background concentration to the PC gives an estimate of the short-term PEC. It is evident from the table that at this at most a fifth of the short-term AQS objective of 200 µg/m$^3$, exceedance of which is permitted up to 18 times a year

It can be seen that total concentrations are well below the AQS short-term criterion at all residential receptors. At the location of the maximum ground level concentration shown in Table 5.1, which can conservatively be used to represent all public open space, the PEC would be 89 µg/m$^3$, or less than half the criterion. These results demonstrate that the effects of the facility emissions on short-term concentrations are not significant[25].

[25] Even were the higher background of 12 µg/m$^3$ measured in the atypical year of 2010 to be used in this assessment, the total concentration (45.6 µg/m$^3$) would remain well below the AQS objective of 200 µg/m$^3$.

**Insert 5.2 - Maximum Hourly Average Oxides of Nitrogen Concentrations, µg/m³**




EL89_NOx_H 150313

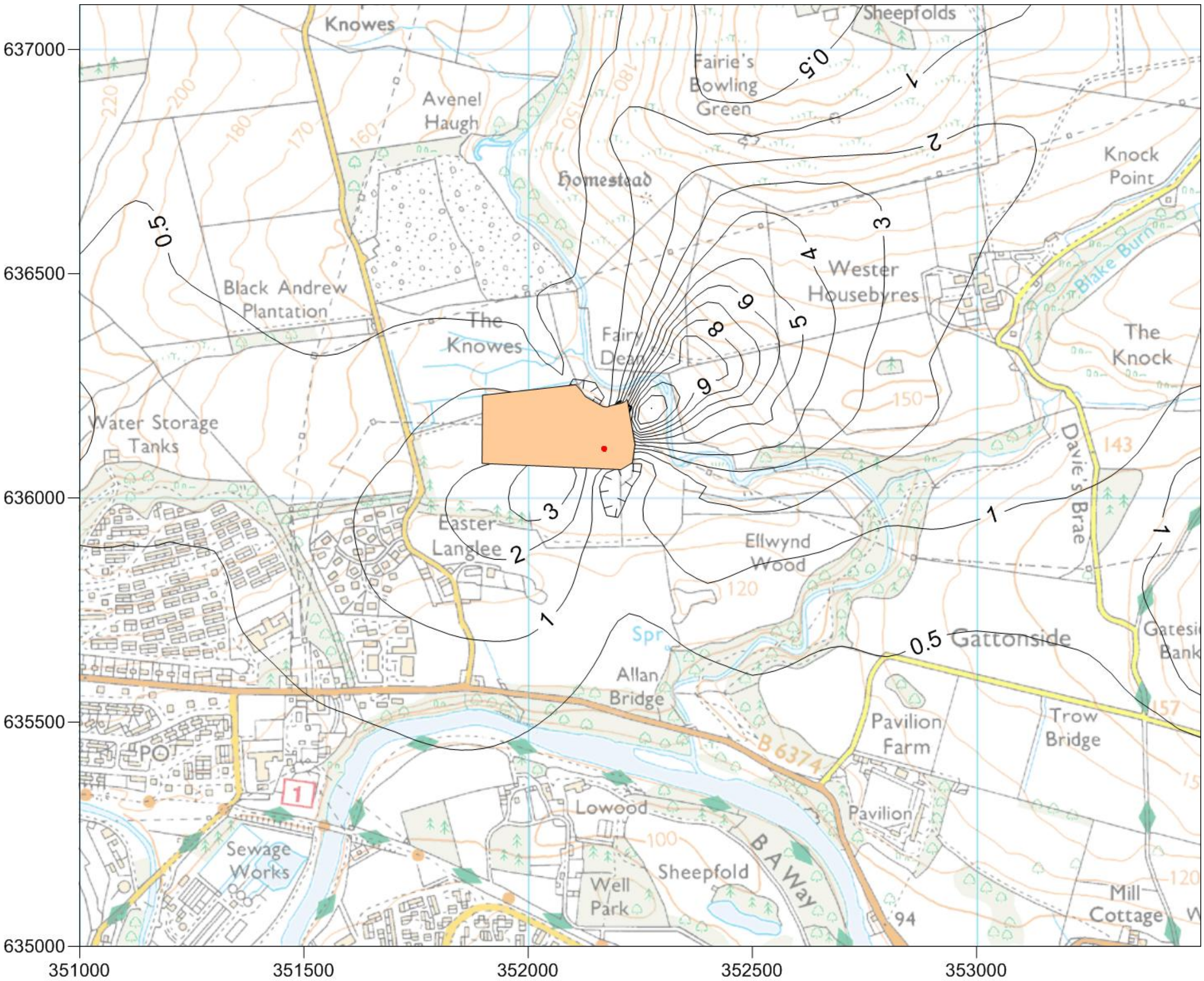
### 5.2.2 Carbon Monoxide

The maximum annual average carbon monoxide PCs are shown graphically in Insert 5.3. The effects of the proposed ATT plant emissions are relatively localised, the highest annual average carbon monoxide concentration of 12.0 µg/m³ occurring 110 metres to the north-east of the ATT plant exhaust. The modelled increment is equivalent to 3.4 percent of the EAL of 350 µg/m³.

The maximum annual mean concentration at any residential receptor is found at Receptor 10, within the proposed housing development, where the annual mean increment is 2.5 µg/m³. This result is negligible in the context of the EAL of 350 µg/m³, as it represents less than one percent of the criterion.

The hourly mean PCs were shown to be insignificant in Table 5.1, in the context of the hourly EAL and eight hourly AQS objective, and hence are not considered further.

**Insert 5.3 - Maximum Annual Average Carbon Monoxide Concentrations, µg/m$^3$**




EL89_CO_H 150313

### 5.2.3 Hydrocarbons (VOCs)

#### Annual mean

The maximum modelled annual mean result for total hydrocarbons of 343 µg/m$^3$ is found approximately 125 metres to the north east of the exhaust; a secondary maximum of 2.5 µg/m$^3$ is found to the south west of the stack. This result represents the total annual mean concentration including non-methane hydrocarbons. Based on the engine emissions data provided by NESSB, which provides the proportion of non-methane hydrocarbons, and using the highly conservative assumption that all non-methane hydrocarbons (NMVOCs) are benzene, it is estimated that the annual mean benzene concentration would comprise 10.4% of the total modelled hydrocarbon concentration. On this basis the maximum annual mean benzene concentration is estimated to be 0.9 µg/m$^3$, the equivalent of 27% of the AQS objective of 3.25 µg/m$^3$.

The highest concentration at any residential receptor is found within the new development to the south of the facility where the annual average concentration is 0.18 µg/m$^3$ as benzene. This represents just five percent of the AQS (Scotland) objective of 3.25 µg/m$^3$. The measured background concentration of benzene is 0.22 µg/m$^3$. The total PEC of 0.40 µg/m$^3$ is equivalent to 12 percent of the objective.

#### Hourly mean

The maximum modelled hydrocarbon hourly mean result of 36 µg/m$^3$ in terms of benzene, the equivalent of 17% of the hourly EAL of 208 µg/m$^3$, is found approximately 640 metres to the north east of the exhaust. As described above, this concentration has been conservatively estimated based on the assumption that benzene constitutes 10.4% of the total VOC.

The highest concentration at any residential receptor is found at Receptor 8, Langlee Mains Farmhouse, where the maximum hourly concentration is 11.1 $\mu g/m^3$ as benzene equivalent. This represents five percent of the EAL. Adding twice the annual background concentration to the PC gives an estimate of the short-term PEC equal to 11.6 $\mu g/m^3$, or six percent of the objective.

These results, which use conservative assumptions regarding the composition of NMVOC emissions, demonstrate that the effects of the facility emissions on long-term concentrations are not significant.

### 5.2.4 Hydrogen sulphide

The modelled PCs were shown to be insignificant in Table 5.1, in the context of the hourly and annual EALs, and hence are not considered further in terms of health effects. It is noted that the field-wide maximum hourly ground level concentration is 5.6 $\mu g/m^3$, which is below the odour detection threshold of 7 $\mu g/m^3$ (equivalent to 0.0047 ppm).

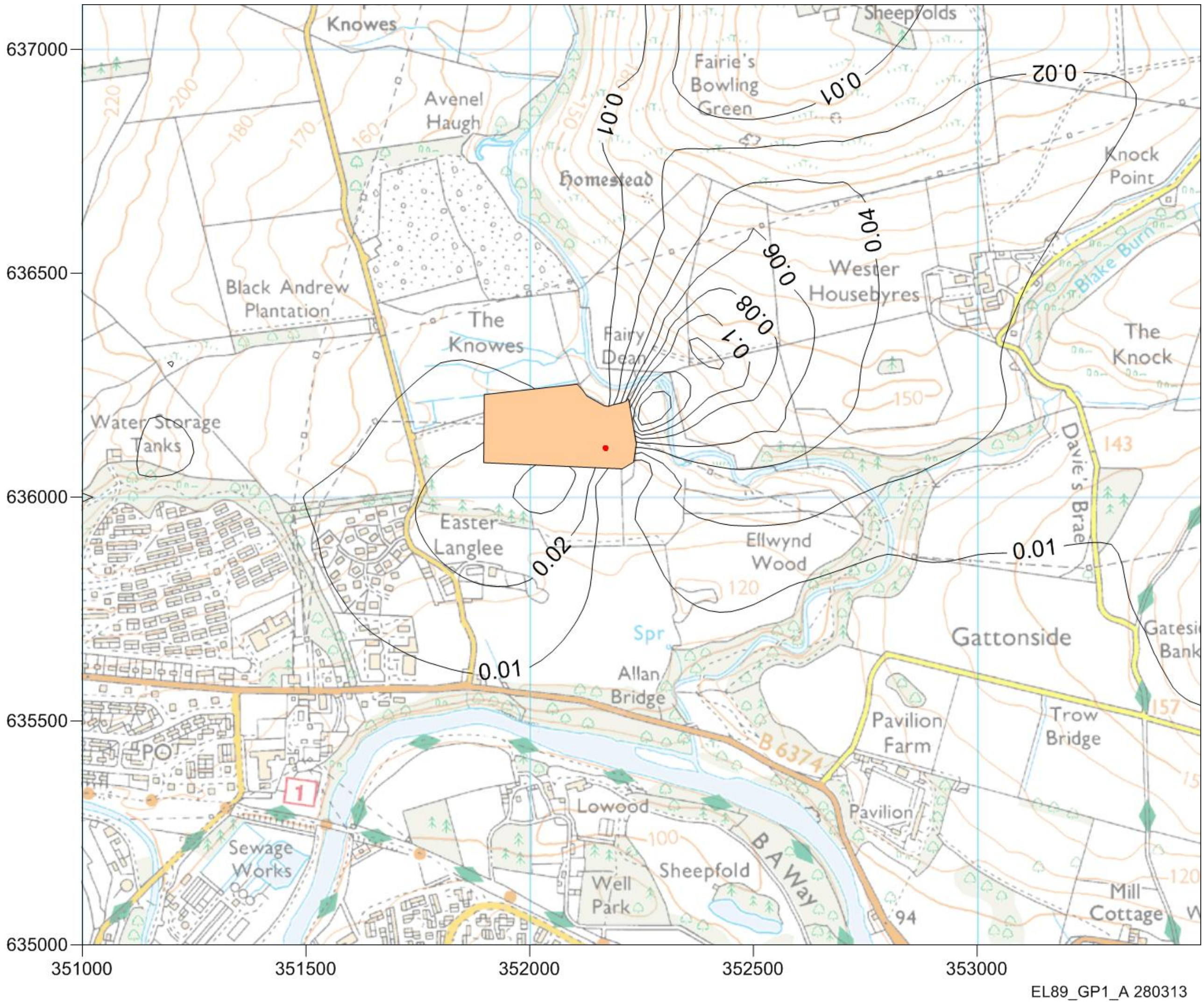
### 5.2.5 Heavy Metals

#### Groups 1 and 2

The IED emission concentration limits for Group 1 and Group 2 metals are both set at 0.05 $mg/m^3$, which is a tenth of the limit of 0.5 $mg/m^3$ for Group 3 metals. A contour plot showing the annual mean concentrations for the Group 1 and 2 metals is shown in Insert 5.4. The results for the Group 3 metals would be ten times higher than those shown in this plot. Note that for presentational purposes, the concentrations plotted are nanograms per cubic metre, equal to one thousandth of a microgram per cubic metre.

The maximum annual average modelled result for the Group 1 metals is $1.6 \times 10^{-4}$ $\mu g/m^3$ (and hence for the Group 3 total is $1.6 \times 10^{-3}$ $\mu g/m^3$). This value is found just over a hundred metres to the north east of the ATT plant exhaust. The field-wide maximum is confined to a small area to the north east of the site boundary, where there is no relevant exposure. At the modelled residential receptor within the new housing development to the south of the facility, the annual average concentration for Group 1 (total) and Group 2 is an order of magnitude lower at $3.3 \times 10^{-5}$ $\mu g/m^3$ (and hence for the Group 3 total is $3.3 \times 10^{-6}$ $\mu g/m^3$).

**Insert 5.4 - Annual Average Group 1 Metals Concentrations, ng/m$^3$**



### Comparison with EALs

The field-wide maximum results for the heavy metals are summarised in Table 5.4 for the annual mean and in Table 5.5 for the hourly mean. The PCs and PECs have been calculated and are compared with the EALs for each substance.

**Table 5.4 – Maximum Field-wide Annual Average Concentrations of Heavy Metals**

| Group | Metal | PC $\mu g/m^3$ | EAL $\mu g/m^3$ | PC / EAL % | Back-ground $\mu g/m^3$ | PEC $\mu g/m^3$ | PEC / EAL % |
|---|---|---|---|---|---|---|---|
| Group 1 | Cd | $7.8x10^{-5}$ | 0.005 | **1.6** | $4.6x10^{-5}$ | $1.2x10^{-4}$ | 2.5 |
| | Tl | $7.8x10^{-5}$ | 1 | <0.1 | n/a | - | - |
| Group 2 | Hg | $1.6x10^{-4}$ | 0.25 | 0.1 | $2.0x10^{-6}$ | $1.6x10^{-4}$ | 0.1 |
| Group 3 | Sb | $1.7x10^{-4}$ | 5 | <0.1 | n/a | - | - |
| | As | $1.7x10^{-4}$ | 0.2 | 0.1 | $2.9x10^{-4}$ | $4.6x10^{-4}$ | 0.2 |
| | Pb | $1.7x10^{-4}$ | 0.5 | 0.1 | $2.5x10^{-3}$ | $2.7x10^{-3}$ | 1.1 |
| | Cr, Cr(II) & Cr(III) | $1.4x10^{-4}$ | 5 | <0.1 | $3.7x10^{-4}$ | $5.1x10^{-4}$ | <0.1 |
| | Cr (VI)* | $3.5x10^{-5}$ | 0.1 | <0.1 | $9.4x10^{-5}$ | $1.3x10^{-4}$ | 0.1 |
| | Co | $1.7x10^{-4}$ | 0.6 | <0.1 | n/a | - | - |
| | Cu | $1.7x10^{-4}$ | 10 | <0.1 | $2.0x10^{-3}$ | $2.1x10^{-3}$ | <0.1 |
| | Mn | $1.7x10^{-4}$ | 1 | <0.1 | $1.2x10^{-3}$ | $1.3x10^{-3}$ | 0.1 |
| | Ni | $1.7x10^{-4}$ | 1 | <0.1 | $5.2x10^{-4}$ | $7.0x10^{-4}$ | 0.1 |
| | V | $1.7x10^{-4}$ | 5 | <0.1 | $6.8x10^{-4}$ | $8.6x10^{-4}$ | <0.1 |

* calculated assuming that Cr (VI) comprises 20 percent of total emissions and background

n/a – not available

An equal distribution between the component metals has been assumed in producing these results. For instance for cadmium and thallium, which make up Group 1, the maximum field-wide concentration value for an individual metal is calculated to be $7.8x10^{-5}$ µg/m$^3$, or half the Group 2 result. A similar assumption may be made for Group 3 in that the concentration of each individual metal is equal to one-ninth of the total. The field-wide maximum annual average for an individual Group 3 metal is therefore $1.7x10^{-4}$ µg/m$^3$.

The maximum annual average concentration for an individual Group 1 metal of $7.8x10^{-5}$ µg/m$^3$ represents less than two percent of the long-term EAL for cadmium. The calculated PEC, including background, is $1.2x10^{-4}$ µg/m$^3$ or 2.5 percent of the EAL. The maximum annual average concentration of mercury compounds is $1.6x10^{-4}$ µg/m$^3$; this represents approximately 0.1 percent of the EAL, an insignificant contribution. On this basis it may be concluded that there is no risk of the EAL being exceeded at any sensitive receptor, for either the Group 1 or 2 metals.

For the Group 3 metals, the PC represents just 0.1 percent or less of the corresponding EAL for each metal, hence all results can be considered negligible. Further consideration of the PECs is not required, but the results are also presented in the table above for completeness.

The field-wide maximum hourly mean results for the heavy metals are summarised in Table 5.5. The maximum field-wide hourly concentrations for all metals are below the 10 percent screening criterion, and in fact are all less than one percent of the corresponding EALs. On this basis, the short-term hourly concentrations of all heavy metals can be considered insignificant. Again, the PECs are presented for completeness.

As these results for metals, which have been derived assuming continuous emission at the IED limit values, clearly demonstrate that ground level concentrations would be negligible, an assessment of the human health risk from exposure to certain of the heavy metals via the food chain has not been undertaken.

**Table 5.5 – Maximum Field-wide Hourly Average Concentrations of Heavy Metals**

| Group | Metal | PC µg/m$^3$ | EAL µg/m$^3$ | PC / EAL % | Back-ground µg/m$^3$ | PEC µg/m$^3$ | PEC / EAL % |
|---|---|---|---|---|---|---|---|
| Group 1 | Cd | $3.2x10^{-3}$ | 1.5 | 0.2 | $9.2x10^{-5}$ | $3.3x10^{-3}$ | 0.2 |
| | Tl | $3.2x10^{-3}$ | 30 | <0.1 | - | - | - |
| Group 2 | Hg | $6.3x10^{-3}$ | 7.5 | 0.1 | $4.0x10^{-6}$ | $6.3x10^{-3}$ | 0.1 |
| Group 3 | Sb | $7.0x10^{-3}$ | 150 | <0.1 | - | - | - |
| | As | $7.0x10^{-3}$ | 15 | <0.1 | $5.7x10^{-4}$ | $7.6x10^{-3}$ | 0.1 |
| | Pb | $7.0x10^{-3}$ | N.A. | - | $5.0x10^{-3}$ | $1.2x10^{-2}$ | - |
| | Cr, Cr(II) & Cr(III) | $5.6x10^{-3}$ | 150 | <0.1 | $7.5x10^{-4}$ | $6.4x10^{-3}$ | <0.1 |
| | Cr (VI)* | $1.4x10^{-3}$ | 3 | <0.1 | $1.9x10^{-4}$ | $1.6x10^{-3}$ | 0.1 |
| | Co | $7.0x10^{-3}$ | 6 | 0.1 | - | - | - |
| | Cu | $7.0x10^{-3}$ | 200 | <0.1 | $3.9x10^{-3}$ | $1.1x10^{-2}$ | <0.1 |
| | Mn | $7.0x10^{-3}$ | 1500 | <0.1 | $2.3x10^{-3}$ | $9.3x10^{-3}$ | <0.1 |
| | Ni | $7.0x10^{-3}$ | 30 | <0.1 | $1.0x10^{-3}$ | $8.1x10^{-3}$ | <0.1 |
| | V | $7.0x10^{-3}$ | 1 | 0.7 | $1.4x10^{-3}$ | $8.4x10^{-3}$ | 0.8 |

* calculated assuming that Cr (VI) comprises 20 percent of total emissions and background

n/a – not available

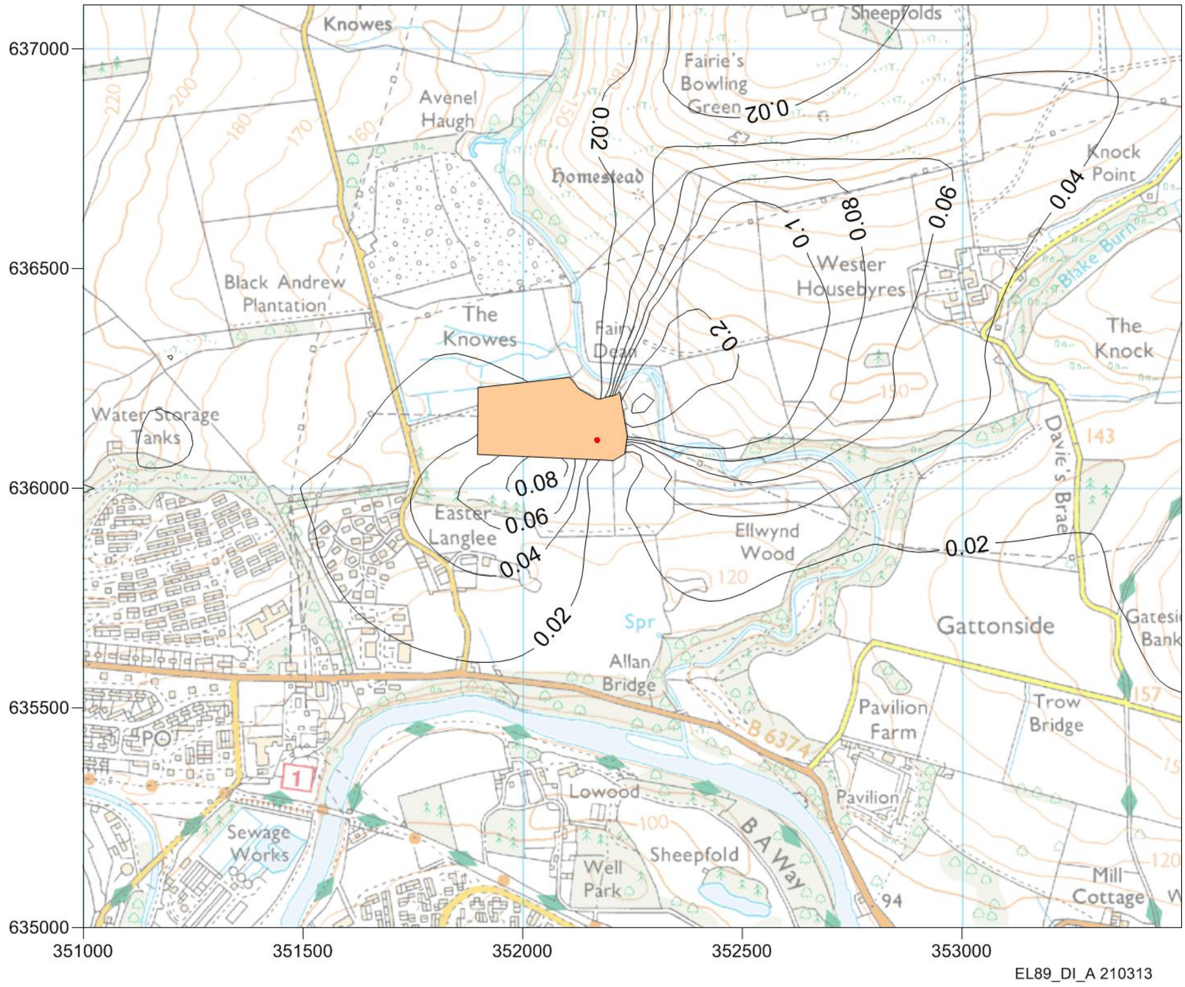
### 5.2.6 Dioxins and Furans

The maximum annual average results for dioxins are shown in Insert 5.5. Note the units are femtograms per cubic metre[26] (fg/m$^3$). Whilst there are no criteria against which to directly compare these results, the figure does show that the extremely low concentrations of just over 0.3 fg/m$^3$ found near to the site decrease markedly with increasing distance from the source such that concentrations at residential receptors are an order of magnitude lower. The maximum concentration at a sensitive receptor was modelled to be 0.06 fg/m$^3$.

An assessment of the potential human health risk from exposure to dioxins and furans via the food chain has been undertaken separately. The methodology and results are presented in Appendix A and the findings summarised in Section 5.5 of this report.

[26] One femtogram per cubic metre is 1 x $10^{-9}$ microgram per cubic metre.

**Insert 5.5 - Maximum Annual Average Dioxins and Furans Concentrations, fg/m$^3$**




# 5.3 Ecological Assessment

## 5.3.1 Ambient concentrations

The modelled annual average concentrations of oxides of nitrogen and sulphur dioxide at sensitive ecological sites identified within the vicinity of the development are summarised in Table 5.6. The PCs and PECs are compared with the critical levels for these pollutants, which are also set in the national AQS. Background concentrations of 12 µg/m$^3$ and 2 µg/m$^3$ respectively were used to calculate the PECs for oxides of nitrogen and sulphur dioxide.

**Table 5.6 - Oxides of Nitrogen and Sulphur Dioxide Concentrations at Ecological Sites**

| Site ID | Description | PC µg/m$^3$ | PC / AQS % | PEC µg/m$^3$ | PEC / CL % |
|---|---|---|---|---|---|
| **NOx** | | | | | |
| A | River Tweed SAC (1 of 2) | 4.59 | 15.3 | 16.6 | 55.3 |
| B | River Tweed SAC (2 of 2) | 1.52 | 5.1 | 13.5 | 45.1 |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.96 | 3.2 | 13.0 | 43.2 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.22 | 0.7 | 12.2 | 40.7 |
| E | River Tweed SSSI (1 of 2) | 0.25 | 0.8 | 12.3 | 40.8 |
| F | River Tweed SSSI (2 of 2) | 0.11 | 0.4 | 12.1 | 40.4 |
| G | Gattonside Moss SSSI | 0.10 | 0.3 | 12.1 | 40.3 |
| H | Borders Woods SAC | 0.02 | 0.1 | 12.0 | 40.1 |
| I | Threepwood Moss SAC | 0.02 | 0.1 | 12.0 | 40.1 |
| J | Whitlaw and Branxholme SAC | 0.01 | < 0.1 | 12.0 | 40.0 |
| **$SO_2$** | | | | | |
| A | River Tweed SAC (1 of 2) | 0.14 | 0.7 | 2.14 | 10.7 |
| B | River Tweed SAC (2 of 2) | 0.04 | 0.2 | 2.04 | 10.2 |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.03 | 0.2 | 2.03 | 10.2 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.01 | < 0.1 | 2.01 | 10.0 |
| E | River Tweed SSSI (1 of 2) | 0.01 | < 0.1 | 2.01 | 10.0 |
| F | River Tweed SSSI (2 of 2) | < 0.01 | < 0.1 | 2.00 | 10.0 |
| G | Gattonside Moss SSSI | < 0.01 | < 0.1 | 2.00 | 10.0 |
| H | Borders Woods SAC | < 0.01 | < 0.1 | 2.00 | 10.0 |
| I | Threepwood Moss SAC | < 0.01 | < 0.1 | 2.00 | 10.0 |
| J | Whitlaw and Branxholme SAC | < 0.01 | < 0.1 | 2.00 | 10.0 |

### Oxides of nitrogen

The maximum modelled increment to oxides of nitrogen concentrations, due to emissions from the proposed ATT plant and biofilter, is 4.6 µg/m$^3$ or 15 percent of the critical level of 30 µg/m$^3$. This increment occurs at the within the River Tweed SAC, as it falls under the area of maximum plume concentrations. It is clear from the contour plot in Insert 5.1 that only a small section of the SAC, confined to the tributory branch directly to the east of the facility, would be affected by increments of over 1 µg/m$^3$.

The background concentration of oxides of nitrogen at this general location is 12 µg/m$^3$; the maximum concentration within the River Tweed SAC is hence estimated to be 16.6 µg/m$^3$, around half the critical level for vegetation. On this basis, the contribution of the ATT plant is unlikely to have any material effect on vegetation within this aquatic site.

The second highest increment to oxides of nitrogen at a sensitive ecological site occurs at the Avenel Hill and Gorge SSSI. Here, the maximum contribution from the facility is 1 µg/m$^3$ or just over 3 percent of the critical level. Over the majority of the site, the increment from the facility would be less than 0.3 µg/m$^3$ or just one percent of the critical level. The PEC at the point of maximum ground level concentration within the site is 12 µg/m$^3$, just over a third of the critical level.

At all other ecological sites, the ATT plant makes a negligible additional contribution to existing ambient concentrations, equivalent to less than one percent of the critical level. Total concentrations would be around 40% of the criterion in all cases, which is dominated by the background component.

**Sulphur dioxide**

The maximum modelled increment to sulphur dioxide concentrations due to emissions from the proposed ATT plant also occurs at the River Tweed SAC; it is 0.14 µg/m$^3$ or 0.7 percent of the critical level of 20 µg/m$^3$. At all other sites the contribution is a negligible 0.2 percent or less. The total PEC is calculated to be 2.14 µg/m$^3$, less than 11 percent of the critical level. It may be concluded on this basis that there would be no adverse effect on designated ecological sites as a result of facility emissions of sulphur dioxide.

### 5.3.2 Nitrogen and Acid Deposition

The rates of nitrogen and acid deposition have been calculated at the closest designated sites. The results of the calculations are presented in Table 5.7, which also shows the contribution of the proposed energy facility as a percentage of the lower and upper critical loads for deposition, where these were available. The results for the three SACs further afield are not shown in the table below, as they were all found to contribute less than 0.1 percent to the relevant critical loads.

**Table 5.7 - Nitrogen and Acid Deposition at Designated Sites, kg N/ha/yr**

| Nitrogen | | PC as N deposition kg N/ha/yr | Critical load range, kg N/ha/yr | PC as % of lower CL | PC as % of upper CL |
|---|---|---|---|---|---|
| Site ID | Description | | | | |
| A | River Tweed SAC (1 of 2) | 0.66 | n/a | - | - |
| B | River Tweed SAC (2 of 2) | 0.22 | n/a | - | - |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.28 | 10 - 15 | 2.8 | 1.8 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.065 | 10 - 15 | 0.6 | 0.4 |
| E | River Tweed SSSI (1 of 2) | 0.036 | n/a | - | - |
| F | River Tweed SSSI (2 of 2) | 0.015 | n/a | - | - |
| G | Gattonside Moss SSSI | 0.014 | 15 – 30 | < 0.1 | < 0.1 |

| Nitrogen and Sulphur Acid | | N acid dep rate keq/ha/yr | S acid dep rate keq/ha/yr | MinCL Max N keq/ha/ yr | MinCL Max S keq/ha/ yr | PC as % of N acid CL | PC as % of S acid CL |
|---|---|---|---|---|---|---|---|
| Site ID | Description | | | | | | |
| A | River Tweed SAC (1 of 2) | 0.047 | 0.017 | n/a | n/a | - | - |
| B | River Tweed SAC (2 of 2) | 0.016 | 0.005 | n/a | n/a | - | - |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.020 | 0.007 | 1.1 | 0.94 | 1.8 | 0.77 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.005 | 0.002 | 1.1 | 0.94 | 0.43 | 0.18 |
| E | River Tweed SSSI (1 of 2) | 0.003 | 0.001 | n/a | n/a | - | - |
| F | River Tweed SSSI (2 of 2) | 0.001 | < 0.001 | n/a | n/a | - | - |
| G | Gattonside Moss SSSI | 0.001 | < 0.001 | n/a | n/a | - | - |

There are no critical loads available for the River Tweed, however, deposition is not considered to be of concern within this site as this is a fast-flowing water course with a large buffering capacity.

The contribution of the proposed ATT plant within Avenel Hill and Gorge SSSI is between 1.8 and 2.8 percent of the critical load range for nitrogen deposition of 10 to 15 kg N/ha/yr at the most affected location. The increment to nitrogen deposition would be less than one percent of the lower critical load across the majority of the site. The maximum increment at this sensitive site represents less than one percent of the background deposition rate of 28.9 kg N/ha/yr. On this basis, the effects of the facility emissions are not considered to be significant.

At Gattonside Moss SSSI the facility increment is 0.1 percent or less of the critical load range for nitrogen deposition, and is thus considered to be negligible.

The woodland habitat at the Avenel Hill and Gorge SSSI is sensitive to acid deposition. The maximum contribution of the ATT plant emissions to the “MinCL MaxN”[27] represents less than two percent of this criterion and less than one percent of the background deposition rate of 2.1 keq/ha/yr. Only a small area of the SSSI, the south east corner of the site, would be subject to increments of more than 1 percent of the nitrogen acid deposition criterion of 1.08 keq/ha/yr. The maximum acid deposition rate due to sulphur, within the Avenel Hill and Gorge SSSI, is estimated to be 0.007 keq/ha/yr or 0.8% of the “MinCL MaxS” criterion of 0.94 keq/ha/yr. On this basis, the effects of the facility emissions are not considered to be significant.

The cumulative deposition rates for nitrogen and acid including the contribution from biofilter ammonia emissions (calculated using the modelled results for ammonia in the RPS report) are shown separately in Table 5.8. The results demonstrate that there would be no material cumulative effect at any location due to the combined emissions of the ATT plant and biofilter, as the percent contributions to the available critical loads change by a negligible 0.1% compared to those in Table 5.7 above.

**Table 5.8 – Cumulative Nitrogen and Acid Deposition at Designated Sites, kg N/ha/yr**

| Site ID | Description | N dep from ATT & biofilter $NO_x$ kgN/ha/yr | N dep from biofilter $NH_3$ kgN/ha/yr | Total N dep kgN/ha/yr | Total Ndep as % of critical load | Total N acid dep rate keq/ha/yr | Total N acid dep as % of MinCL MaxN |
|---|---|---|---|---|---|---|---|
| A | River Tweed SAC (1 of 2) | 0.66 | 0.073 | 0.734 | n/a | 0.052 | - |
| B | River Tweed SAC (2 of 2) | 0.22 | 0.073 | 0.292 | n/a | 0.021 | - |
| C | Avenal Hill and Gorge SSSI (1 of 2) | 0.28 | 0.007 | 0.283 | 1.9– 2.8 | 0.020 | 1.9 |
| D | Avenal Hill and Gorge SSSI (2 of 2) | 0.065 | 0.007 | 0.071 | 0.5 – 0.7 | 0.005 | 0.48 |

[27] MinCLMaxN is the relevant criterion for the evaluation of nitrogen-derived acid deposition rate. The Environment Agency’s AQTAG 06 guidance states that a critical load function is specified for acidification via several critical load parameters for sulphur and nitrogen. The $N_{max}$ deposition rate is the maximum critical load of acidifying nitrogen, above which the deposition of nitrogen alone would be considered to lead to an exceedence. The $N_{min}$ deposition rate is the measure of the ability of a system to “consume” deposited nitrogen. There are comparable criteria for sulphur deposition. The critical load function for acidity uses $N_{max}$ and $S_{max}$ in a graphical approach to define the maximum critical load curve. Given the uncertainty inherent in this methodology there is a more stringent minimum critical load function, which in the absence of sulphur deposition is equal to the $N_{min}$ deposition rate. It is this maximum nitrogen deposition rate associated with the minimum critical load function that is referred to as MinCLMaxN.

| Site ID | Description | N dep from ATT & biofilter $NO_x$ kgN/ha/yr | N dep from biofilter $NH_3$ kgN/ha/yr | Total N dep kgN/ha/yr | Total Ndep as % of critical load | Total N acid dep rate keq/ha/yr | Total N acid dep as % of MinCL MaxN |
|---|---|---|---|---|---|---|---|
| E | River Tweed SSSI (1 of 2) | 0.036 | 0.004 | 0.040 | n/a | 0.003 | - |
| F | River Tweed SSSI (2 of 2) | 0.015 | 0.004 | 0.019 | n/a | 0.001 | - |
| G | Gattonside Moss SSSI | 0.014 | 0.001 | 0.015 | <0.1 - 0.1 | 0.001 | - |

## 5.4 Abnormal Emissions

The main assessment presented in Section 5.2 was based on the IED daily ELVs as a basis to derive emission rates for the NEAT units. Theoretical emission rates may be derived for a worst-case short-term operational scenario using the 30-minute emission limit values given in Annex VI Part 3 of the IED. These emission rates have been used here to assess an entirely hypothetical abnormal operational scenario, whereby a limited number of 30 minute averages reach the 30 minute ELV concentrations specified in the IED, thus requiring the regulated plant to be completely shut down within four hours.

In order not to present a wholly unrealistic figure for the calculation of 24-hour average concentration, the result using the 30-minute emission rate was multiplied by 4/24 (as four hours is the maximum permitted period to achieve complete plant would be shut down) and added to 20/24 x the result obtained using the 24-hour emission rate. In effect this weighted mean result represents the normal operation for the first 20 hours of a day and a subsequent four hour shutdown period of abnormal emissions.

The results are presented in Table 5.9 for the pollutants specified in IED Annex Part 3 for the field-wide maximum modelled ground level concentrations. The abnormal operation PCs, shown in the fourth column of the table, are based on the emission rate associated with the half-hourly WID limit concentration coinciding with the least favourable hour of meteorological data in the five year period used in the dispersion model, a probability of approximately one in 43,000. It is also implied in the calculation that this hour of meteorological data persists for the four hour period of abnormal operation.

In all cases the PECs (estimated using the simple, screening approach set out in the H1 guidance) are substantially less than the short-term EALs with the exception of nitrogen dioxide, which is just under 40 percent. The PECs for the field-wide maximum results are all less than half the relevant AQS objectives and EALs, therefore there is considered to be a negligible potential for exceedances of the air quality criteria at sensitive receptors.

**Table 5.9 – Maximum Field-wide Concentrations using Abnormal 30-minute Emission Limit Values**

| Pollutant | Averaging period | Abnormal PC $\mu g/m^3$ | PC / EAL % | Abnormal PEC $\mu g/m^3$ | PEC / EAL % |
|---|---|---|---|---|---|
| Nitrogen dioxide | 1 hour | 77.7 | 38.9 | 97.7 | 48.9 |
| Sulphur dioxide | 15 minute | 34.0 | 12.8 | 38.0 | 10.9 |
| | 1 hour | 25.4 | 7.3 | 29.4 | 8.4 |
| | 24 hour | 2.4 | 2.0 | 6.4 | 5.2 |
| Particulate matter | 24 hour | 0.45 | 0.2 | 7.4 | 14.9 |
| Carbon monoxide | 1 hour | 491 | 4.9 | 911 | 9.1 |
| | 8 hour | 166 | 1.7 | 166 | 1.7 |
| Hydrogen chloride | 1 hour | 11.0 | 1.4 | 11.2 | 1.4 |
| Hydrogen fluoride | 1 hour | 3.6 | 1.4 | <0.1 | <0.1 |
| VOC (as benzene) | 1 hour | 35.7 | 17.2 | 36.1 | 17.4 |

## 5.5 Health risk assessment

An EAL for the health risk of exposure to dioxins and furans in ambient air is not available, hence it is necessary to undertake an assessment of the potential human health risk from exposure to dioxins and furans via the food chain. This assessment is presented in Appendix A. Heavy metals were modelled to have an insignificant contribution (as defined in SEPA H1 guidance[28]) to ground level concentrations at the nearest receptor, and hence were not considered in the HHRAP.

The assessment found that the facility contribution to the tolerable daily intake (TDI) for dioxins and furans was equivalent to 1.6 to 2.3 percent for the hypothetical maximum exposed individuals (farmer adult and farmer child respectively) at the location of the maximum ground level concentration, assuming a diet composed only of locally sourced meat and produce.

The same health risk assessment methodology can also be applied to metals, however, the comparison with EALs for inhalation exposure presented in Section 5.2 clearly demonstrated that ground level concentrations due to emissions from the ATT plant would be negligible. The assessment for metals presented in Section 5.2 was undertaken using conservative assumptions, such as continuous emission at the IED limit values. Therefore, further assessment of the human health risk from exposure via the food chain has not been undertaken.

[28] H1 Horizontal Guidance Note : Assessment & Appraisal of BAT, available at http://www.sepa.org.uk/air/process_industry_regulation/pollution_prevention__control/uk_technical_guidance/uk_horizontal_guidance/h1.aspx

# 6. Conclusions

Stack emissions of regulated pollutants will not affect the achievement of the relevant air quality criteria in the local area. In most cases, the modelled process contributions were less than one percent of the long-term or 10 percent of the short term human health criteria. Total predicted environmental concentrations for all pollutants remain below the criteria at the nearest residential receptors, including at the proposed new development to the south west, when background is included. On this basis, the effect of the facility is concluded to be insignificant.

The potential cumulative effects of the proposed ATT plant when operating concurrently with the fuel preparation facility would not result in any change in the conclusions of this assessment, either in terms of human health or ecology.

The effect of the facility in terms of the contribution to critical levels and critical loads at designated ecological sites in the area is also concluded to be insignificant.

An assessment of the effects of abnormal emissions demonstrated that such infrequent abnormal events are unlikely to result in an exceedance of the relevant air quality criteria, even were they to coincide with the most adverse meteorological conditions.

The air dispersion modelling took into account the facility design including the inherent mitigation that will ensure that the ATT plant performance is within the regulatory limits for all prescribed substances. The dispersion modelling used the highly conservative assumption that emissions of all substances (including, for instance, heavy metals which in fact would be removed from the feedstock), will be at the regulatory limits. This robust approach has demonstrated that there would be no exceedances of air quality criteria as a result of facility emissions. In many cases, the ATT plant contribution to ambient concentrations will be negligible.

A human health risk assessment for dioxins found that the risk due to ingestion via the food chain would be not significant. The maximum contribution to the lifetime dioxin TDI, based on extremely conservative assumptions, was 2.3 percent at the hypothetical worst case receptor, a famer child. The additional intake for farmer infants via breast milk at this hypothetical location would be less than half the COT TDI, and for non-farmer resident infants less than one percent of the COT TDI. As the findings of this conservative assessment were well below the acceptable level, it is hence unlikely that any member of the local population will experience any adverse effects.

# DISCHARGE STACK HEIGHT CALCULATION

## COMBUSTION GASES

### Physical Parameters

| Parameter | Value |
|---|---|
| Exhaust Gas Volume Flow Rate, @T (m3/s) | 8.675 |
| Stack Inside Diameter, D (m) | 0.664 |
| Gas Discharge Velocity, V (m/s) | 25.05 |
| Discharge Gas Temperature, T (K) | 531.5 |

### Pollutant Data

| Compound | Emission Rate 'D' | Guideline Concs 'Gd' | Backgrd Concs 'Bc/e' | Pollution Index 'Pi' |
|---|---|---|---|---|
| | (g/s) | (mg/m3) | (mg/m3) | (m3/s) |
| *Sulphur dioxide* | 0.0532 | 0.3500 | 0.013 | 158 |
| *Hydrogen chloride* | 0.0392 | 0.7500 | 0.003 | 52 |
| *Hydrogen fluoride* | 0.0265 | 0.1600 | 0.002 | 167 |
| Acid gases | | | | 378 |
| Particulate matter (PM10) | | 0.3000 | | - |
| Nitrogen dioxide | 1.6469 | 0.2000 | 0.032 | 9,803 |
| Nitric oxide | - | 1.0000 | 0.010 | - |
| Carbon monoxide | - | | | - |
| Cadmium & Thallium (total) | - | | | - |
| Mercury & compounds | - | | | - |
| Heavy metals (total) | - | | | - |

### Building Information - All Buildings Within Distance (m) of: 62

| Building | Height 'H' (m) | Width 'B' (m) | `K' (m) | `T' (m) |
|---|---|---|---|---|
| Screening Hall | 12.0 | 24.0 | 12.0 | 30.0 |
| Covered Link | 9.0 | 60.0 | 9.0 | 22.5 |
| Bio- hall | 9.0 | 72.0 | 9.0 | 22.5 |
| | | | 0.0 | 0.0 |
| | | | 0.0 | 0.0 |
| | | | 0.0 | 0.0 |
| | | | 0.0 | 0.0 |
| | | | 0.0 | 0.0 |
| **Hm:** | **12** | | **Tm:** | **30.0** |

### Calculation

| | |
|---|---|
| Pollution Index (m3/s) | 9,803 |
| Heat Released at Discharge Stack (MW) | 1.40 |
| Coefficient `a' | -1.143 |
| Coefficient `b' | 0.493 |
| Uncorrected Discharge Stack Height for Bouyancy, Ub (m) | 6.70 |
| Minimum Value of Ub (m) | 2.04 |
| Selected Value of Ub (m) | 6.70 |
| Discharge Momentum, M | 115.72 |
| Coefficient `x' | -1.78 |
| Coefficient `y' | 4.61 |
| Coefficient `z' | -10.13 |
| log10Um | 1.10 |
| Uncorrected Discharge Stack Height for Momentum, Um (m) | 12.49 |
| Minimum Value of Um (m) | 3.75 |
| Selected Value of Um (m) | 12.49 |
| Uncorrected Chimney Height, U (m) | 6.70 |
| Coefficient `A' | 1.863 |
| Final Discharge Height (m) | **20.1** |

Calculation procedure taken from `Technical Guidance Note D1 - Guidelines on Discharge Stack Heights for Polluting Emissions' June 1993, issued by the Environment Agency.

Procedure applies to dispersion in multiple and tall building environment

## APPENDIX D. HUMAN HEALTH RISK ASSESSMENT

The HHRA calculation spreadsheet is provided separately electronically. Please see electronic version on CD accompanying this application.

# Easter Langlee
# Advanced Thermal Treatment Facility

# Human Health Risk Assessment

## May 2013

### Notice

This report was produced by Atkins Ltd for New Earth Solutions (Scottish Borders) Limited for the specific purpose of supporting the PPC Permit application for the Easter Langlee Advanced Thermal Treatment Facility at the Easter Langlee Landfill in Galashiels.

This report may not be used by any person other than NESSB without NESSB's express permission. In any event, Atkins accepts no liability for any costs, liabilities or losses arising as a result of the use of or reliance upon the contents of this report by any person other than NESSB.

### Document History

| JOB NUMBER: 5115659 | | | DOCUMENT REF: Appendix D Easter Langlee HHRA for dioxins_final | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 1 | | | | | | |
| 0 | Draft for comment | SH | MLM | RHW | PB | 18/04/13 |
| Revision | Purpose Description | Originated | Checked | Reviewed | Authorised | Date |

# Contents

# 1. Introduction

1.1.1 On behalf of New Earth Solutions (Scottish Borders) (NESSB), Atkins has prepared a PPC Permit Application for the addition of an Advanced Thermal Treatment (ATT) plant to the consented waste facility at Easter Langlee, Galashiels. As part of the permit application, a detailed air dispersion modelling study of the facility emissions was undertaken. This examined all of the pollutants with emission concentration limit values specified for incineration processes in the Industrial Emissions Directive (IED). The results of the modelling were compared with Environmental Assessment Levels (EALs) contained in SEPA Horizontal Guidance IPPC H1 Environmental Assessment and Appraisal of BAT.

1.1.2 There are no EALs in the H1 guidance for dioxins and furans, therefore a human health risk assessment (HHRA) has been carried out to investigate the potential effects on public health of the emissions from the proposed facility. The assessment looks specifically at the ingestion pathway at worst case receptor locations using an established detailed method. The results are directly comparable with the UK Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment's (COT) Tolerable Daily Intake (TDI) for dioxin. Heavy metals were modelled to have an insignificant contribution (as defined in SEPA H1 guidance[1]) to ground level concentrations at the nearest receptor, and hence are not considered.

1.1.3 This report presents the findings of the HHRA for the dioxin emissions from the ATT exhaust. Within this report, mass concentrations of dioxin are described using units of picograms (pg) and femtograms (fg). A picogram is equal to one gram x $10^{-9}$ or one millionth of a milligram (mg). A femtogram is equal to one gram x $10^{-15}$ or one thousandth of a picogram.

[1] H1 Horizontal Guidance Note : Assessment & Appraisal of BAT, available at http://www.sepa.org.uk/air/process_industry_regulation/pollution_prevention__control/uk_technical_guidance/uk_horizontal_guidance/h1.aspx

# 2. Methodology

## 2.1 Human health risk assessment

2.1.1 HHRA is a technique for evaluating the toxic properties of substances, assessing human exposure to the substances to ascertain the likelihood that the exposure will lead to adverse effects, and characterising the nature of the effects. It looks at effects of persistent pollutants emitted to air from industrial facilities and their deposition to soil and transfer through the food chain. It uses the results of the air dispersion modelling study, to estimate the likely exposure of humans following deposition of atmospheric pollutant emissions to soil, and their consequent uptake through various routes of exposure, both direct (inhalation) and indirect (ingestion of fruit, vegetables, meat and fish; contact with soil and water; ingestion of breast milk).

2.1.2 There is no legislation in the UK relating to HHRA, although HHRAs are produced for UK projects, in particular waste to energy facilities. HHRA is widely practised in the United States (US) with the Environmental Protection Agency (EPA) being one of the major practitioners. The US EPA has written a detailed protocol on how to undertake a human health risk assessment (HHRAP) for hazardous waste combustion facilities[2], to assess human exposure to substances that are emitted to atmosphere and subsequently deposited onto soil and incorporated into the food chain. The HHRAP enacts the "source – pathway – receptor" approach, which is consistent with SNIFFER guidance (2007) "Environmental Legislation and Human Health – Guidance for Assessing Risk." The HHRA presented herein equates to a Detailed Quantitative Risk Assessment.

2.1.3 An assessment of the risk from dioxin exposure as a result of the emissions from the ATT plant at Easter Langlee has been carried out using the USEPA's HHRAP. The protocol has been incorporated into the computer software programme "Breeze Risk Analyst" which is produced by Trinity Consultants Incorporated[3] as an ESRI ArcView GIS extension. This software was used in order to estimate local exposure to dioxins.

2.1.4 The assessment methodology as described in the HHRAP is composed of the following stages:

- Air dispersion and deposition modelling
- Characterising facility emissions
- Exposure scenario identification
- Estimating media concentrations
- Quantifying exposure
- Characterising risk and hazard.

2.1.5 In this assessment, the potential hazard is the emission of dioxins to atmosphere from the ATT exhaust. As a conservative approach, it has been assumed that all of the dioxin emitted from the facility would be in the form of the most toxic congener, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). In reality, however, the dioxin emission will be composed of a mixture of congeners including some with lower levels of toxicity.

2.1.6 These atmospheric emissions may be subsequently deposited to land and absorbed into the food chain. The exposure assessment considers the potential for sensitive receptors in the surrounding area to be exposed to concentrations of dioxin in the food chain. The toxicity assessment compares the daily intake of sensitive receptors to the COT TDI. The final stage, risk characterisation, applies only in the US and hence is not performed here.

---

[2] http://www.epa.gov/osw/hazard/tsd/td/combust/risk.htm
[3] http://www.breeze-software.com/riskanalyst/

2.1.7 The key input to the HHRAP model is the deposition rate of dioxin, which is derived from the results of the dispersion modelling. The approach to dispersion modelling is described in detail in the Air Quality chapter of the Permit Application.

## 2.2 Dispersion modelling and deposition

2.2.1 The dispersion model input data is summarised in Table 2.1. For the purposes of this assessment, the normal operational scenario was considered, in which three NEAT units and three engines operate at full load. In order to provide a highly conservative assessment, it was assumed that the IED regulated emissions from the NEAT units would be at 100% of the permitted Annex VI limit for dioxins. In reality, the plant is expected to emit dioxins at several orders of magnitude below this level due to the type of advanced treatment technology employed.

**Table 2.1 – Multiple-flue ATT plant exhaust discharge characteristics**

| Parameter | Value |
|---|---|
| Location of ATT exhaust (National Grid Ref.), m | 352170, 636110 |
| Height of release point above ground level, m | 23 |
| Equivalent flue diameter, m | 0.664 |
| Exhaust gas temperature, °C | 258 |
| Exhaust gas exit velocity, m/s | 25.04 |
| Actual exhaust gas flow rate, $m^3/s$ | 8.675 |
| Dioxin emission rate, g/s | $1.1x10^{-10}$ |

2.2.2 The dispersion modelling results are shown in the form of a contour plot in Figure 2.1 below (Insert 5.5 of the main Air Quality chapter).

2.2.3 The simple approach to estimating dioxin deposition rates set out in Section 3.4 of the SEPA H1 guidance has been applied to the results of the dispersion modelling. A value of 0.01 m/s for the estimation of dry deposition was applied to the ground level concentration, and multiplied by a factor of three to give an estimate of the total (wet and dry) deposition. The wet deposition rate is the difference between the total and dry deposition values. This is considered to be an extremely conservative approach as wet deposition would typically be lower than dry deposition.

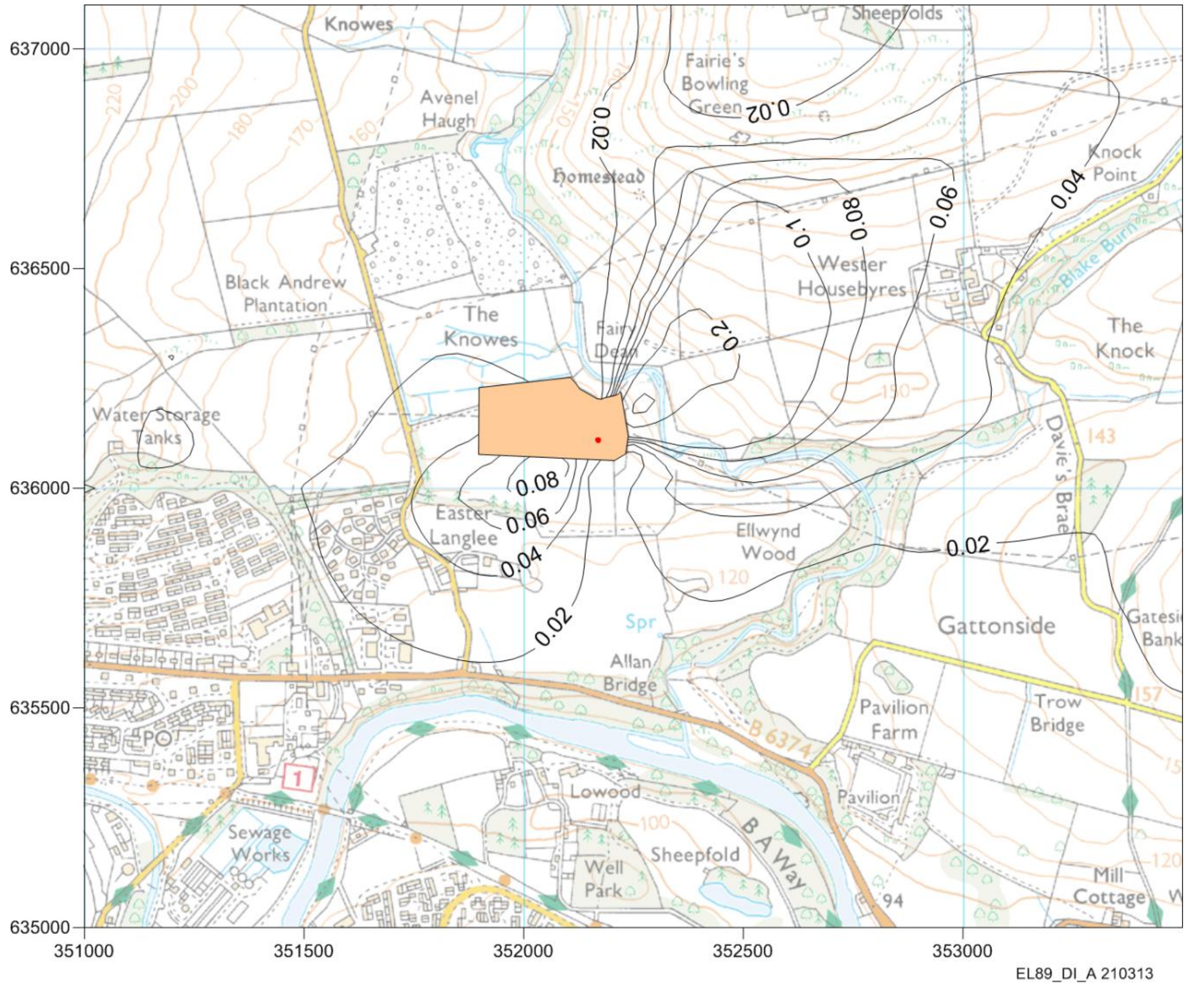
2.2.4 For the purposes of this assessment, the calculated deposition rates were applied to both the applicable deposition phases used in the HHRAP calculations i.e. vapour and particulate phase. This may imply that deposition is double counted; however, such an assumption is considered acceptable for a screening assessment such as this.

2.2.5 The calculated dioxin deposition rates (unitised for a 1 g/s emission rate) are shown in Table 2.2.

**Table 2.2 – Unitised concentrations and deposition rates at location of maximum ground level concentration**

| Receptor | OS Easting m | OS Northing m | Unitised ground level conc. ($\mu g/m^3$) | Unitised dry deposition rate ($g/m^2/yr$) | Unitised wet deposition rate ($g/m^2/yr$) | Unitised total deposition rate ($g/m^2/yr$) |
|---|---|---|---|---|---|---|
| Maximum ground level concentration | 352275 | 636200 | 2.95 | 0.93 | 1.86 | 2.79 |

**Figure 2.1 – Maximum annual average dioxin concentrations, fg/m$^3$**




## 2.3 Characterising facility emissions

2.3.1 The first step in exposure assessment involves describing the site for the proposed facility with respect to its physical characteristics, including:

- climate, e.g. temperature and rainfall;
- meteorology, including wind speed and direction;
- geological setting, including location and characterisation of underlying strata;
- soil type;
- vegetation, including types or species present;
- hydrology, including depth, direction and type of flow; and
- presence and location of surface water bodies.

2.3.2 Wind speed and direction data are presented in Chapter 3 of the main air quality modelling report, which also describes the site surroundings including vegetation type. Climate data have been obtained from the Met Office website for the Galashiels station[4].

[4] http://www.metoffice.gov.uk/public/weather/climate/galashiels#?tab=climateTables

2.3.3 Information on soil type has been derived from the James Hutton Institute “Soil Indicators For Scottish Soils” website[5]. This gives the soil composition as: 62% sand, 31% silt, and 7% clay.

2.3.4 The Easter Langlee site is surrounded by agricultural land which is used for grazing. To the south west of the site is a residential area, while a new residential development is currently being developed immediately to the south of the facility. Immediately to the east of the site is the Allan Water river system, and approximately one kilometre to the south runs the River Tweed.

2.3.5 The HHRAP default parameters as specified within the software were used in the risk assessment, with the exception the following site-specific values:

- soil density value (BD):1.2 g/cm$^3$ was taken from CLEA report (Table 4.4)[6] for a sandy silt loam soil type.
- annual average evapo-transpiration rate (Ev): 57 cm/yr (assumed to be 70% of total precipitation rate);
- annual average irrigation rate (I_irr): 0 cm/year;
- annual average rainfall rate (P): 81 cm/year (thirty year average value from Met Office climate data set for Galashiels, 1981-2010);
- annual average run-off rate (RO): 8.1 cm/year (assumed to be 10% of total rainfall rate); and
- ambient air temperature (Ta): 285K (11.5°C, thirty year average maximum value from Met Office climate data set for Galashiels, 1981-2010), in place of the USEPA default of 298K;
- annual average windspeed (W): average value taken from the four year meteorological data file used in the modelling of 4.3 m/s instead of the US EPA default of 3.9 m/s;
- soil mixing zone (Zs) was assumed to be 10 cm depth (approximate mid-point between tilled and untilled soil defaults).

2.3.6 The US EPA default time period over which deposition occurs (tD) of 30 years (the assumed lifetime of the facility) was retained.

## 2.4 Exposure scenario identification

### Pathways

An exposure “pathway” is the course a chemical takes from its source to the person being exposed and links the source, location and type of environmental release with the population location.

A pathway generally consists of the following four elements:

- the source and mechanism of release of the substance;
- the retention or transport medium or media for the substance;
- the point of exposure for the population; and
- an exposure route at the exposure point.

2.4.1 Exposure scenarios i.e. combinations of exposure pathways to which a single receptor may be subjected, have been identified for the energy facility. These will be evaluated in the risk assessment to estimate the type and magnitude of human exposure to pollutant emissions from the facility.

[5] http://sifss.hutton.ac.uk/SSKIB_Stats.php
[6] http://www.environment-agency.gov.uk/static/documents/Research/CLEA_Report_-_final.pdf

The predominant exposure pathways are considered to be:

- inhalation; and
- ingestion of food.

2.4.2 The inhalation pathway deals with the direct inhalation of polluted air in the vicinity of the site. The ingestion pathway assesses the ingestion of substances which occurs as a result of eating locally grown fruit and vegetables, or through eating meat, dairy products or eggs from animals which have ingested contaminated feed (grass, grain, or soil). The risk from unintentional ingestion of soil (pica) is also assessed.

2.4.3 The River Tweed has an international reputation both as a famous salmon river and an excellent trout water. For this reason, the ingestion of fish from the local river systems (including the River Tweed and Allan Water tributary) is a relevant pathway; however, in terms of exposure it has been excluded from the assessment as the water body is fast flowing and hence the build up of dioxins following deposition is unlikely to occur to a significant degree. The subsequent intake from fish in the local diet is not considered to be a material consideration compared to the ingestion of local produce and locally reared meat, for which conservative scenarios have been considered. Information gathered for the River Tweed and its tributaries is presented in Appendix A.

2.4.4 An assessment of exposure of infants to dioxins in breast milk has been undertaken. There is a potential for contamination of breast milk for dioxin-like compounds such as these, as they are highly lipophilic (fat soluble) and hence likely to accumulate in breast milk. This exposure is measured by the Average Daily Dose (ADD) on the basis of an averaging time of one year.

2.4.5 Exposure via consumption of drinking water would require the contamination of drinking water sources local to the point of consumption. Galashiels and the surrounding area does not lie within a Drinking Water Protected Area (either for rivers or lochs)[7] therefore this pathway of exposure was not included.

2.4.6 The likelihood of contamination reaching a level of concern in the local water sources and ground water supplies is extremely low, particularly where there is no large scale storage (e.g. reservoirs) or catchment areas for local water supplies. The ingestion of groundwater as a source of local drinking water is not considered in the HHRAP as it is considered to be an insignificant exposure pathway for combustion emissions.

2.4.7 In accordance with USEPA advice, dermal exposure (via soil and water) was not considered as the contribution to overall risk is typically small compared with the risk from other exposure pathways including through the diet, and there are significant uncertainties associated with estimating potential exposure.

2.4.8 Similar arguments are relevant with respect to the elimination of other aquatic pathways from consideration: swimming and other recreational activities in the area are likely to be sporadic and will not lead to significant exposure or uptake of any contaminants into the human body via dermal contact with water.

### Receptors

2.4.9 The Risk Analyst software considers three types of receptor, for an adult and child:

- resident – eats home grown produce (fruit and vegetables), and involuntary ingestion of soil;
- farmer – eats home grown produce and locally-reared animal products (chicken, beef, pork, milk and eggs), and involuntary ingestion of soil;
- fisher – eats home grown produce, and locally-caught fish.

---

[7] http://www.scotland.gov.uk/Resource/Doc/1057/0055691.pdf

2.4.10 For the reasons discussed above, the fisher pathway is not considered to be relevant in this instance.

2.4.11 The facility surroundings are shown in Figure 2.1, which shows the results of the air dispersion modelling for dioxins. For the purposes of the HHRA, a single exposure location is considered: the location of the maximum ground level concentration is considered because it represents a hypothetical maximum exposed individual.

2.4.12 This location of maximum ground level concentration falls just beyond the north east corner of the site boundary, where the small area enclosed by an unlabelled contour represents 0.3 fg/m$^3$. The calculated deposition rate at this location will be conservative value compared to likely rates on grazing land in the surrounding area, and are at least an order of magnitude higher compared to rates at residential properties.

2.4.13 It should be noted that no associated farm house was identified at the location of the maximum ground level concentration; the assessment is for a hypothetical, worst case location since despite its proximity to grazing land, there would not be any residential exposure at this point.

2.4.14 Furthermore, the exposure assessment is very conservative as it assumes that an adult receptor is exposed for a lifetime (70 years) at the same location and that a high proportion of the diet is derived from locally grown produce and or locally reared meat.

## 2.5 Estimating media concentrations

2.5.1 The inputs to this stage are the results of the dispersion modelling in terms of ground level concentrations and pollutant deposition rates. The maximum annual average ground level concentrations for dioxins are given in Table 5.1 of the Air Quality chapter of the Environmental Permit Application. The maximum annual average ground level concentration has been used in the HHRA to assess chronic effects that may potentially arise from the operation of the energy facility through ingestion of contaminated food products.

2.5.2 In order to quantify pollutant intake from the diet, the concentration of the substance in vegetation and meat must first be calculated. The HHRAP software contains a large number of equations that are used to estimate the concentration of a chemical in a particular medium (air, water, soil) and its consequent transfer and uptake through the food chain. US EPA default factors present in the Risk Analyst software for the estimation of the transfer of chemicals through the food chain were used.

### Accumulation in vegetation

2.5.3 The accumulation of contaminants in vegetation may occur via:

(i) deposition of contaminants onto soil and consequent uptake by plant via roots;

(ii) direct deposition of contaminants onto the plant surface; and

(iii) transfer of contaminants in air in vapour phase to the leaf.

2.5.4 Some fruit and vegetables may be ‘protected’ from pathways (ii) and (iii), for instance if they grow below ground or in a pod, therefore contaminants will only accumulate in these product types via pathway (i). All the exposure pathways described will affect produce that grows above ground. Vapour phase transfer of contaminants from air to leaf is not expected to be a significant pathway.

### Accumulation in animal products

2.5.5 If animals consume plants or crops that are contaminated, the pollutants may accumulate in the muscle and fat tissue. Therefore animal products such as meat, milk and eggs may become contaminated. The transfer of pollutants from plant to animal is calculated using biotransformation factors. The concentrations of each pollutant in each type of food consumed by animals are calculated by employing these factors. Animals may also consume contaminated soil as part of their diet. The concentration of pollutants in soil that was calculated for the vegetation pathway is used here. This report takes the worst-case scenario whereby all forage, grain and soil consumed by animals is assumed to have been grown at the point of maximum deposition of pollutants.

2.5.6 This pathway is particularly applicable to dioxins and furans, as they are strongly lipophilic (i.e. have an affinity for fat).

### Accumulation in breast milk

2.5.7 An assessment has been made of the potential for contamination of breast milk by dioxin-like compounds, as they are highly lipophilic and hence likely to accumulate in breast milk. This exposure is measured by the Average Daily Dose (ADD), and is calculated on the basis of an averaging time of one year.

## 2.6 Quantifying exposure

2.6.1 This involves quantification of the magnitude, frequency and duration of exposure for the exposure scenarios that have been selected for analysis.

2.6.2 Toxicity assessment involves the process of quantitatively evaluating the relationship between the dose received and the incidence of adverse health effects in the exposed population. Toxicity values e.g. reference doses or tolerable daily intakes (TDI) are derived from quantitative dose-response relationships. These toxicity values are used to estimate the incidence or potential for adverse effects as a function of human exposure.

2.6.3 For the purposes of this assessment, the toxicity value of interest is the TDI, the amount of a substance that can be ingested daily over a lifetime without appreciable health risk. It is typically expressed in terms of the mass of pollutant per kilogram of body weight (kg-bw) per day. For dioxins, the TDI is for the toxic equivalent (TEQ) of the compound 2,3,7,8-TCDD.

2.6.4 The World Health Organisation (WHO) TDI is given as a range of 1 to 4 pg TEQ/kg bw/day. The UK COT has set a value of 2 pg TEQ/kg bw/day, which is designed to protect the most sensitive individuals over a lifetime’s exposure. The UK COT value is used in this assessment. The assessment assumes that the total dioxin emission is of the compound 2,3,7,8-TCDD, a conservative approach.

## 2.7 Uncertainty

2.7.1 A number of assumptions are made throughout the risk assessment procedure, concerning exposure and toxicity.

2.7.2 Hazard identification includes uncertainties concerning the substances selected to characterise the exposure and risk. Air dispersion modelling additionally has uncertainty attached to it, for instance emissions from the facility have been based on the emission limit for dioxins set out in the IED as opposed to real-time monitoring data. The facility is expected to easily meet the IED limit for this pollutant.

2.7.3 The sources of uncertainty associated with reference values may include:

- use of dose-response information obtained from effects observed at high doses over the short-term to predict adverse health effects at low doses over the long-term;
- use of dose-response information from animal studies to predict effects in humans; and
- use of dose-response information obtained from homogeneous animal populations or healthy human populations to predict effects in the general population consisting of individuals with a wide range of sensitivities.

2.7.4 The above listed sources of uncertainty are allowed for in the methodology employed by toxicologists to derive robust reference values from dose-response information.

2.7.5 The assumption of dose additivity for multiple substance exposure does not take into account possible synergisms or antagonisms among substances and assumes similarities in mechanisms of action and metabolism. However, current scientific understanding does not allow for any other approach to the consideration of multiple substance exposure.

2.7.6 Highly conservative assumptions concerning exposure have been made through the assessment. For instance, the assessment considers a hypothetical maximum exposed individual present at the location of the maximum modelled ground level concentration of pollutants. Exposure is assumed to occur 24 hours a day, whereas most people spend 90% of their time indoors hence exposure to pollutants will be somewhat lower. The individual's diet is assumed to come from the same point of maximum deposition, and that grazing occurs at the same location. In reality many members of the population buy their groceries from supermarkets where food will not have been exposed to emissions from the facility.

2.7.7 Despite the uncertainties within this assessment, therefore, the selected approach provides a highly robust and conservative quantitative estimation of the health risks associated with exposure of the local population to the relatively small quantities of substances released from the proposed facility.

ATKINS

# 3. Results

## 3.1 Exposure assessment results

3.1.1 The HHRAP Risk Analyst software was run in order to obtain estimates of the total daily intake rate of dioxin at the location of a hypothetical maximum exposed individual. The software also provides a breakdown of the intake for each ingestion route (soil, produce and animal product). These results are provided in Table 3.2 below in summary form for the two types of receptor, farmer and resident; the units are milligrams per kilogram bodyweight per day. The full set of intermediate calculations is provided in Appendix B in electronic spreadsheet form.

**Table 3.1 – Dioxin ingestion rates for all receptors and pathways, mg/kg bw/day**

| Pathway | Type | Soil | Produce | Animal | Total |
|---|---|---|---|---|---|
| Farmer | Adult | $6.95\times10^{-14}$ | $6.98\times10^{-13}$ | $3.03\times10^{-11}$ | $3.10\times10^{-11}$ |
| | Child | $6.49\times10^{-13}$ | $1.62\times10^{-12}$ | $4.27\times10^{-11}$ | $4.49\times10^{-11}$ |
| Resident | Adult | $6.95\times10^{-14}$ | $5.26\times10^{-13}$ | - | $5.96\times10^{-13}$ |
| | Child | $6.49\times10^{-13}$ | $1.22\times10^{-12}$ | - | $1.87\times10^{-12}$ |

3.1.2 The results of the HHRAP for dioxins in terms of the ADD for infants via breast milk are summarised in Table 3.3.

**Table 3.2 - ADD for infants via breast milk**

| Receptor | Additional daily dose (pg/kg bw/day) |
|---|---|
| Farmer infant | 0.91 |
| Resident infant | 0.02 |

## 3.2 Toxicity assessment

3.2.1 The results for total intake of hypothetical maximum exposed individuals in Table 3.3 above have been converted into units of picograms per kilogram of body weight per day to allow a direct comparison with the COT TDI for dioxin.

3.2.2 The results in Table 3.4 show that the maximum contribution to dioxin ingestion as a result of facility emissions would be 0.05 pg/kg bw/day. This is the result for a local farmer child at a hypothetical maximum location of exposure. The incremental intake is equivalent to just 2.3% of the TDI for dioxin of 2 pg/kg bw/day. Note that there is not currently a residential property at this location and hence the site is, at most, representative of grazing land only.

3.2.3 The farmer adult intake at the same location is equal to 1.6% of the TDI. The results for a residential receptor are an order of magnitude or more lower than those for the farmer; the calculated rates of ingestion are equivalent to less than 0.1 percent of the TDI for both adult and child residents.

**Table 3.3 – Toxicity assessment for all receptors and pathways**

| Pathway | Type | Intake due to facility, pg/kg bw/day | Increment as percent of TDI | Intake including background, pg/kg bw/day |
|---|---|---|---|---|
| Farmer | Adult | $3.10 \times 10^{-2}$ | 1.6% | 0.93 |
| | Child | $4.49 \times 10^{-2}$ | 2.3% | 0.95 |
| Resident | Adult | $5.96 \times 10^{-4}$ | <0.1% | 0.90 |
| | Child | $1.87 \times 10^{-3}$ | <0.1% | 0.90 |

3.2.4 Recent intake estimates for the UK population put the average exposure at 0.9 pg/kg bw/day for the average consumer[8]. Taking the result for the hypothetical farmer child, the total intake for the average consumer would remain well below the TDI, at 0.95 pg/kg bw/day.

3.2.5 The results of the toxicity assessment of dioxins in breast milk are summarised in Table 3.5, for the farmer and resident pathways at the location of the maximum ground level concentration.

**Table 3.4 – Toxicity assessment for dioxins in breast milk**

| Pathway | ADD as percent of TDI |
|---|---|
| Farmer | 45% |
| Resident | 0.9% |

3.2.6 In both cases, the ADDs are substantially less than the COT TDI despite the extremely conservative nature of the assessment (based on the IED emission limit, assuming all is 2,3,7,8-TCDD and that exposure occurs for a year at the location of maximum ground level concentration). Exposure of breast-fed infants in the surrounding area would typically be less than that reported for the resident pathway, which is just 0.9% of the TDI.

3.2.7 The average consumer intake of dioxins does not apply in this case, as breast-feeding infants would only be exposed to a very small proportion of locally grown produce. Furthermore, the WHO recognises that breast-fed infants will be exposed to higher intakes for a short duration but that breast feeding itself provides associated benefits[9]. Nonetheless the total intake including the facility contribution would remain below the TDI.

[8] http://www.food.gov.uk/multimedia/pdfs/fsis38_2003.pdf
[9] http://www.who.int/ipcs/publications/en/exe-sum-final.pdf

# 4. Conclusions

4.1.1 A health risk assessment has been carried out using the USEPA HHRAP in order to consider the potential exposure of the local population to dioxins from the proposed facility. The assessment has been based on a number of conservative assumptions, including:

- emission of dioxins modelled at the IED emission limit;
- H1 screening approach applied in the estimation of deposition rates;
- assessment for a hypothetical exposure location at the location of the maximum modelled ground level concentration;
- receptor dietary intake is derived predominately from locally grown or reared produce; and
- all dioxin assumed to be emitted as 2,3,7,8-TCDD, the most toxic congener.

4.1.2 These assumptions are expected to have added several orders of magnitude onto what in reality will be the average exposure once the plant is operational.

4.1.3 It was estimated on the above basis that the maximum contribution from the facility at a sensitive location would be equal to 2.3% of the COT lifetime TDI of 2 pg/kg bw/day. This result was found at the location of the maximum ground level concentration, to the north east of the facility, for a farmer child. At this location, there is no associated residential exposure. Results for residential exposure at the same location were less than 0.1% of the COT TDI. Taking the average consumer intake in the absence of the facility to be 0.9 pg/kg bw/day, the total intake for a local receptor, including the maximum contribution from the facility, would remain at less than half the COT TDI. The results are therefore considered to be insignificant.

4.1.4 The additional intake for infants via breast milk is not expected to exceed the COT TDI. The highest proportion of the TDI for a resident infant was estimated to be 0.9%.

4.1.5 Despite the uncertainties inherent within health risk assessment, the methodology - when combined with conservative assumptions such as those used in this case - provides a robust quantitative estimation of the health risks associated with exposure of local receptors. Furthermore, as the findings of this conservative assessment were found to be well below the acceptable level, then it is unlikely that any member of the local population will experience any adverse effects.

4.1.6 The above conclusions for a maximum hypothetical dioxin release from the proposed facility are consistent with the Health Protection Agency's statement on the health effects of municipal solid waste (MSW) incinerators (January 2012)[10]: "Modern, well managed incinerators make only a small contribution to local concentrations of air pollutants. It is possible that such small additions could have an impact on health but such effects, if they exist, are likely to be very small and not detectable." It should be noted that this comment refers to MSW facilities which typically have an annual throughput several orders of magnitude higher than the proposed ATT facility.

4.1.7 It should also be appreciated, that the technology to be employed fundamentally differs from MSW incineration. The proposed technology at Easter Langlee is not incineration of a non-homogenous waste stream, but pyrolysis and gasification of homogenous pre-prepared fuel followed by the combustion of a gas in an engine, an inherently cleaner and more controlled process compared with more traditional facilities. The ATT plant is expected to emit pollutants at concentrations well within the levels specified in the IED; hence the findings of this assessment are very robust.

[10] http://www.hpa.org.uk/ProductsServices/ChemicalsPoisons/IntegratedPollutionPreventionControlIPPC/ippcIncineration

# Appendix A

# Water Pathway

## A.1 Water Pathway Parameters

The River Tweed is 160 km (100 miles) long, is the second largest river in Scotland, has a catchment area of 5000 square km (1930 square miles) and has a flow rate which varies from 10 cu. m. per second (190 million gallons /day) to >1500 cu. m. per second (28500 million gallons per day)

River Tweed at Gala Water (Galashiels): average level 0.361 metres
http://www.sepa.org.uk/water/river_levels/river_level_data.aspx?sd=t&lc=9683

Pervious land cover: Land cover types for the entire Tweed catchment - improved grassland (26%), rough grassland (16%), woodland (16%), heather/peatland (10%) and arable (18%)
http://data.ecn.ac.uk/sites/ecnsites.asp?site=R16

Average volumetric flow rate = 3.715 $m^3/s$ (from CEH website)

Velocity measurements at fourteen hydrometric stations in the Tweed basin (Ledger, D. C. (1981) The velocity of the River Tweed and its tributaries. Freshwater Biology, 11: 1–10) "*The velocity at most stations rarely exceeds 3.0 m/s and for most of the time it lies between 0.25 and 1.0 m/s.*"

Information on fishing areas from:
http://www.scottishriverfishing.co.uk/

River levels & fishing
http://www.fishpal.com/Scotland/Tweed/Map.asp

Galafoot catchment area
http://data.ecn.ac.uk/sites/sites/largermaps/R16.jpg

SEPA river basin management
http://gis.sepa.org.uk/rbmp/Data_Download.aspx

River dimensions taken from DEFRA MAGIC map website

# Appendix B

# HHRAP Calculations

## B.1 HHRAP Calculations

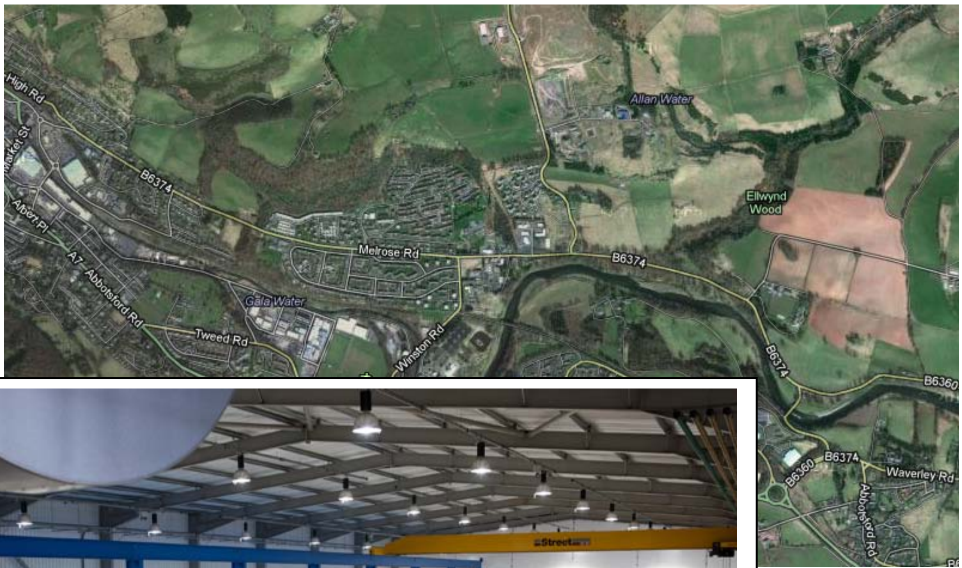
See accompanying MS Excel spreadsheets provided electronically, which contain details of the intermediate calculations performed by the modelling software and the associated input data:

AppendixB_HRAresults.xlsx

# APPENDIX E. HEAT AND POWER PLAN

# New Earth Solutions Group Ltd

# EASTER LANGLEE
# ADVANCED THERMAL TREATMENT (ATT) FACILITY
# HEAT AND POWER PLAN




MOFFAT HOUSE, AYTON
BERWICKSHIRE TD14 5QJ

**T** 018907 81463 / 018907 60156
**M** 07885 648854
**WWW**.ENERGETICPM.COM
**E** scott.robertson@energeticpm.com

**TABLE OF CONTENTS:**

## 8. APPENDICES;

| | | |
|---|---|---|
| 1. | Electrical power export | a. SPEN connection offer and acceptance<br>b. connection schematic |
| 2. | Waste composition | a. Zero Waste Scotland "The Composition of Municipal Solid waste in Scotland" final report, April 2010<br>b. Scottish Borders Council; Household (Rural) waste Analysis, June 2009 |
| 3. | SBHA Data | a.SBHA supplied estate data<br>b.Ditto, heat load estimates added<br>c.Heating system replacement profile analysis |
| 4. | Scottish Borders College | a. Boiler replacement study report (the Carbon Trust/ EMS consultants, September 2012<br>b. SBCollege supplied AMR gas usage readings |
| 5. | Heriot-Watt University | a. H-WU supplied residences gas consumption data<br>b. Assessment of heat loads and annual profile |
| 6. | Scottish Borders Council | a. SBC supplied estate data<br>b. ditto, heat load estimates added |
| 7. | Industry – SBC Timber Kiln Drying study brief | |
| 8. | Contracts | a. Draft Heat Supply Agreement<br>b. CHPA Heat Customer Charter |
| 9. | Policy background | a.SBC Low Carbon Strategy draft documents<br>b. BEA Constitution and Objects |
| 10. | Land ownership | a. map of major land ownerships<br>b. SBC adopted roads network<br>c. Network Rail route and land ownership |
| 11. | Copies of Consultees Response letters to this report | |

# 1. Purpose and Limitations of Report

**This report has been commissioned by New Earth Solutions Group Ltd (NES) in support of planning and PPC Variation applications to Scottish Borders Council (SBC) and the Scottish Environmental Protection Agency (SEPA) for an energy recovery plant to be associated with, fuelled by and collocated with a waste management plant at Easter Langlee, Galashiels.**

**Information contained herein has been supplied by NES with regard to design and plant operation and in consultation with planning authorities and potential users for heat use and distribution. Figures on heat use and loads are based on data supplied by consultees and has been accepted as given. Where assumptions are made regarding efficiencies of existing heat plant and loads, these are noted.**

**This report is the property of NES and is intended for their sole use in connection with the applications for statutory consents and is not to be used, quoted or reproduced, in part or whole, without their express consent.**

**Scott A Robertson**
**TD, MA(hons), DipArch, RIBA, ARIAS, MBEng, MIAA**
**Managing Director, For Energetic project management Ltd**

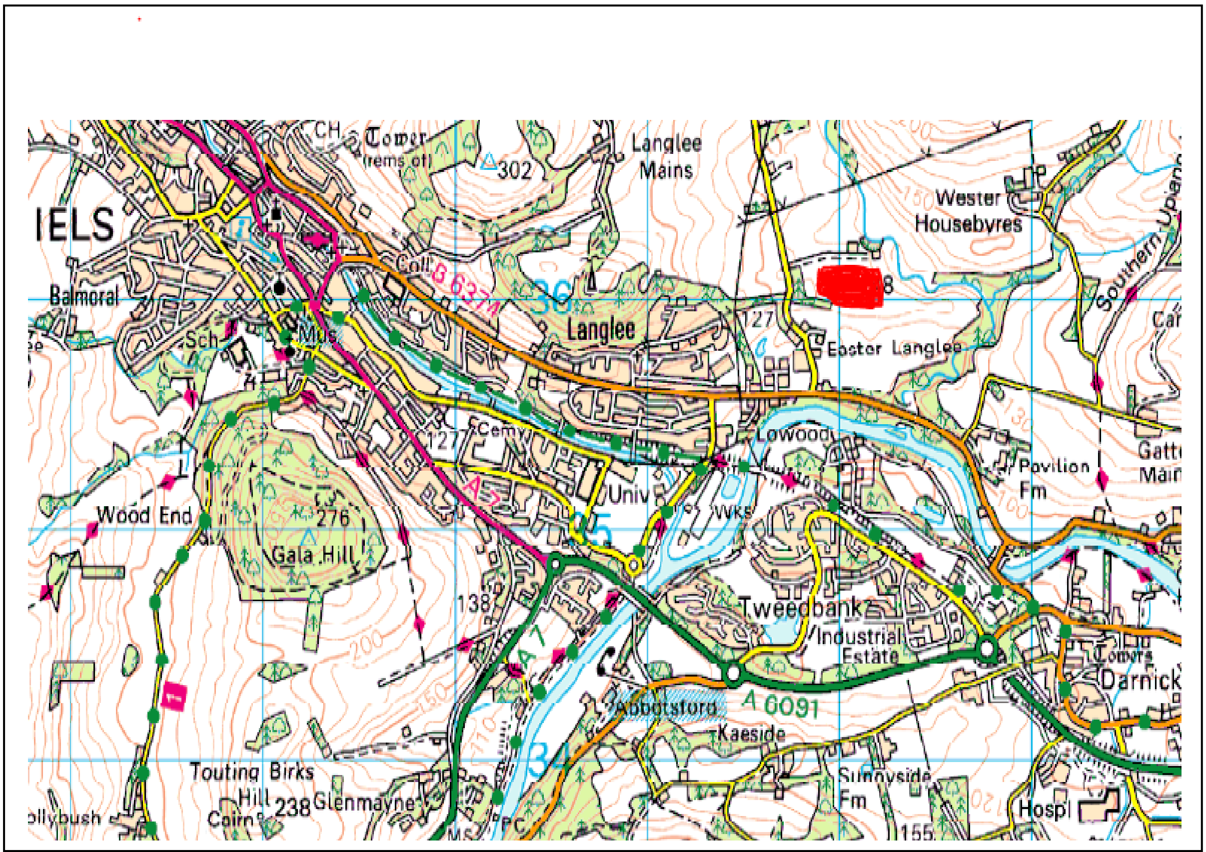
# 2. Introduction to Facility

## 2.1 Overview

NES has been awarded the contract for waste management by SBC with effect from 2011 and has previously secured both planning and PPC consents for the construction and operation of an MBT plant at SBC's existing main waste site at Easter Langlee, Galashiels.

In 2012, in light of their experience at other UK sites and developments in technology (particularly with small scale Advanced Conversion Technology (ACT)) NES proposed the modification of the proposals to include an Energy Recovery Facility adjacent to the consented waste management plant, with construction and commissioning to run concurrently with that of the already consented facility.

Location plans and diagrams of the proposed changes to the already consented buildings are shown below on the following two pages.



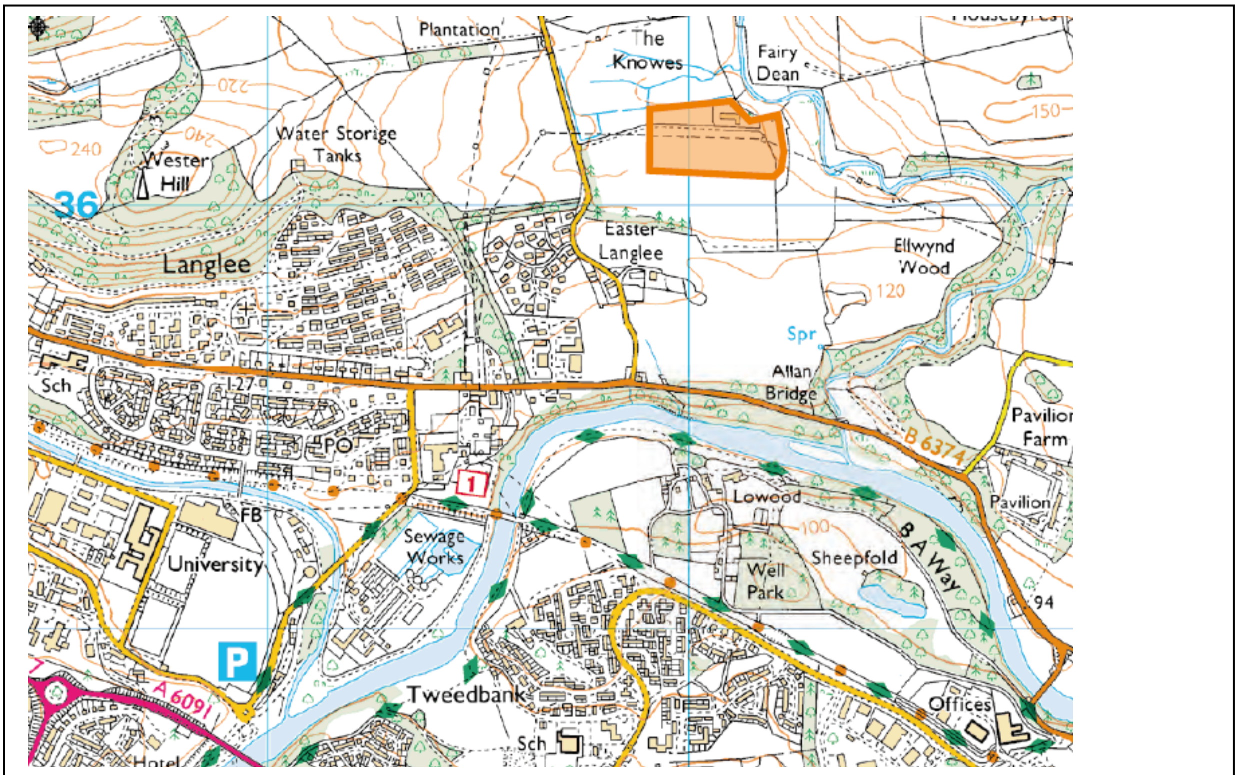
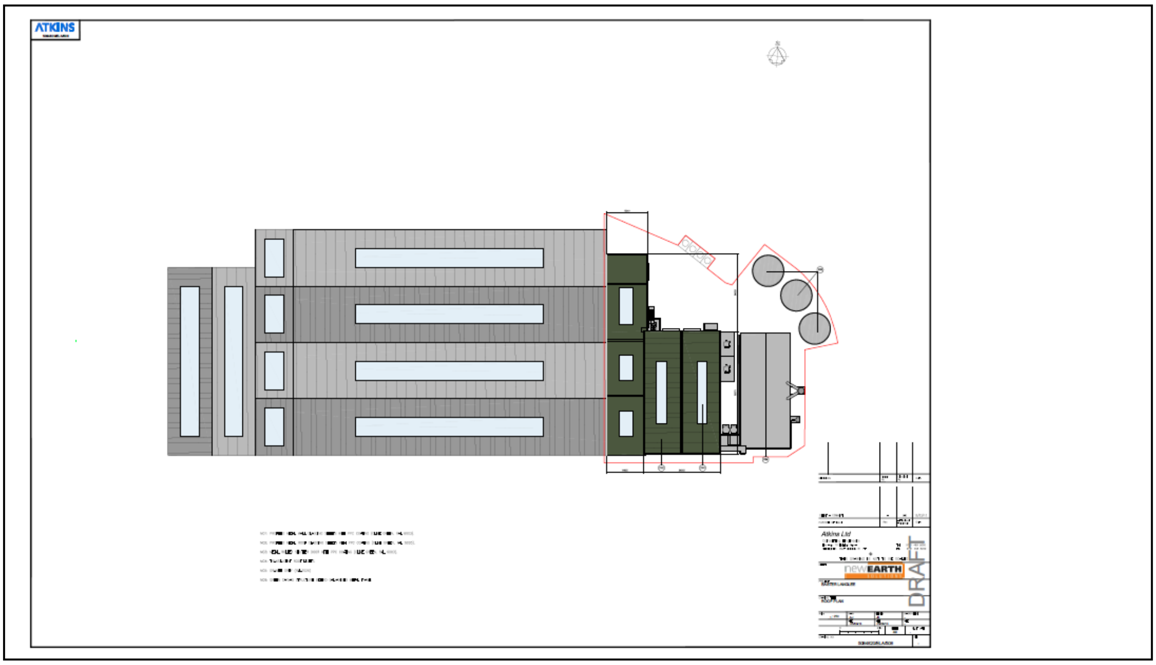
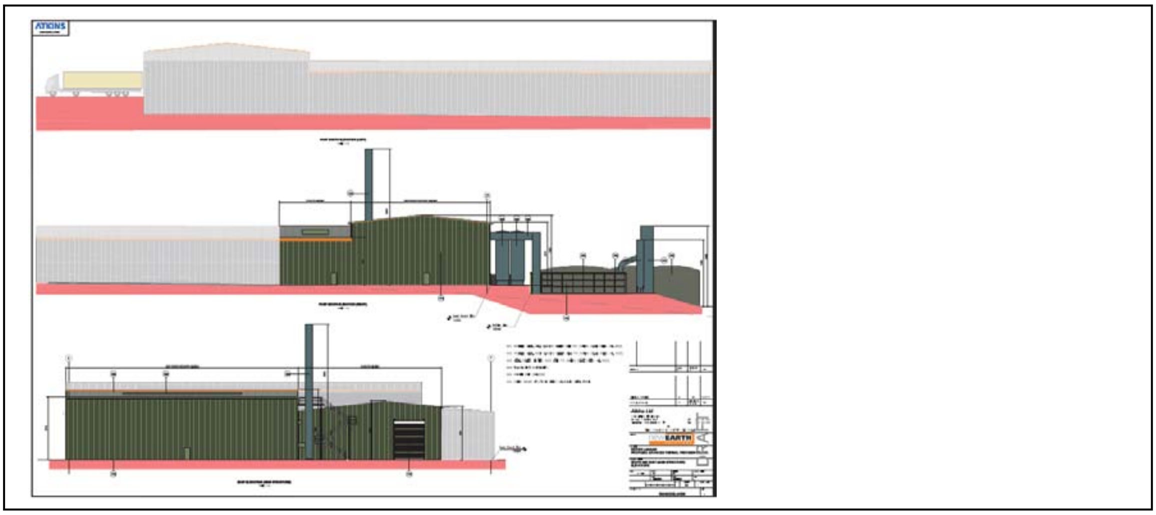




**Fig 1; Site location     Fig 2; Detailed plant location**



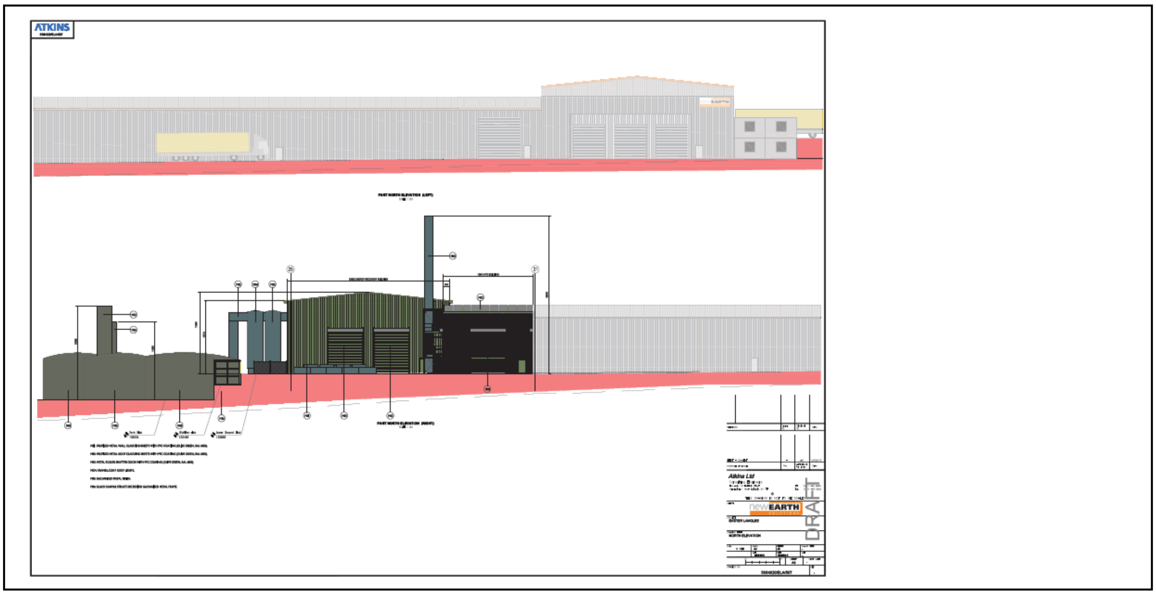




**Fig 3; Changes to o/a plant layout Fig 4& 5; Changes to elevations**

The waste management plant processes up to 65,000 tonnes of residual municipal waste collected from across the Scottish Borders area. After the removal of plastic, metal and inert material for recycling, shredding, and the removal of unusable items for landfill disposal, approximately 24,000 tonnes per annum of Refuse derived Fuel (RDF)will be produced. It was previously intended that this RDF would be exported, via road transport, for use by other parties outwith the region, most likely in northern mainland Europe.

Sorted and screened RDF will be mechanically fed to four New Earth Advanced Thermal (NEAT) staged pyrolysis and gasification units, each feeding an electrical power producing reciprocating gas engine with heat recovery from both jacket cooling and flue gases. Under SEPA's Thermal Treatment of Waste Guidelines 2009 (May 2011 Amdts) and Renewable Obligations Guidance, this system is classed as Advanced Conversion Technology (ACT).

Detailed figures on system efficiencies, input gas power values, electrical power and heat outputs and parasitic and export values are given in the following sections of this report, and repeated in the QI calculations.

A non-technical system summary diagram and illustrations of NEAT units at an existing NES plant at Avonmouth (Bristol) are included on the following two pages;

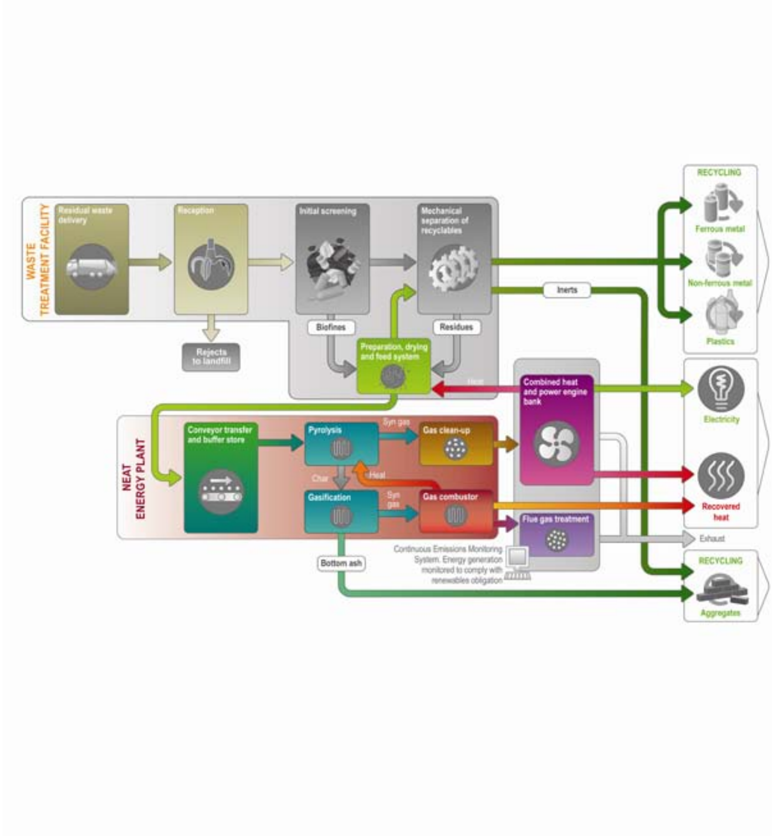



**Fig 5; System Diagram**

## Figs 6 & 7; typical NEAT units at Avonmouth

Fig 7 shows eight NEAT units currently installed at Avonmouth, compared to the four proposed at Easter Langlee. The Avonmouth building is sized to accommodate sixteen NEAT units and a second phase of eight is now in construction alongside the eight shown.

The following sections detail the arrangements for heat and power recovery and export and a concept for distribution based on the consultations in sections 4 and 5 and in the appendices.

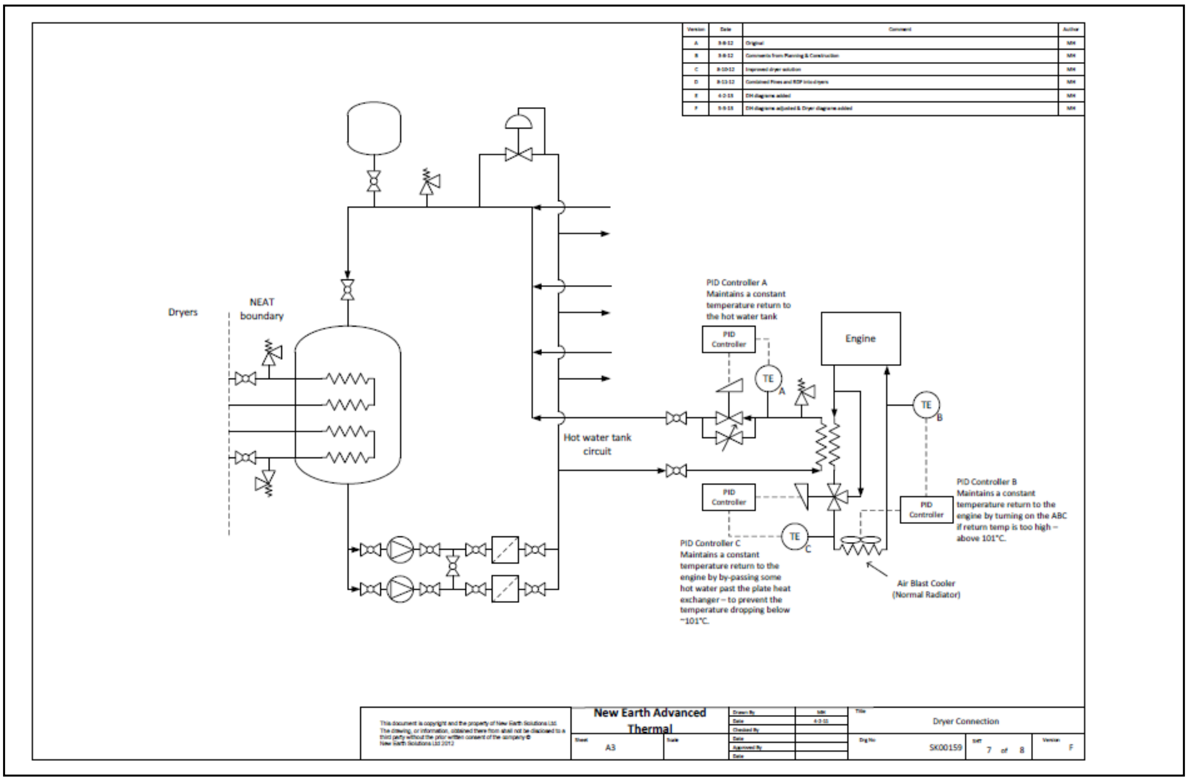
## 2.2 Arrangements for heat recovery and export

As noted above, the 24,000 tonnes per annum of RDF will be fed to four NEAT units and associated gas reciprocating engines. The assessed calorific value of the RDF is 13MJ/kg (3.1kW/kg) or some 312,000,000MJ per annum (74,666 MWhr per annum). Pyrolysis of this feedstock will produce a continuous gas output with a CV estimated at 18.7MJ/$Nm^3$ (Gross CV) and 17MJ/$Nm^3$ (Net CV). Current assumptions are that whilst feedstock can be evenly fed across all four NEAT units, three NEATs and three gas engines will be in continuous operation.

The planning assumption of engine efficiency is ca 32% producing a net output of a 2.7MWe across the plant. This may be improved if turbo-compounding is utilised.

Heat recovery will be from two sources within the process (see Fig 5 above). Heat from jacket cooling, estimated output 3.0MWth, will be recovered through a collection tank and heat exchangers for re-use in waste treatment processes to improve recyclate production and improve material handling and generate RDF at the desired moisture content (20%MC). Conventional engine cooling by air blast coolers (ABCs) will also be included to ensure that engines can remain fully operational regardless of the operational status of the dryers, but it is anticipated that these ABCs will mainly operate at a fraction of their capacity. Waste heat from engine flue gases will be recovered by plate heat exchangers and transferred by a large collection/ buffer tank accumulator to feed the District Heating (DH) system. This output is estimated as ca 2.0MWth at stack, with an outflow temperature to collection of 120$^{o}$C. For the purposes of DH system planning, a continuous export potential of 1.2MWth is assumed.

Indicative P&ID on the page below shows the collection arrangements for heat recovery from engine jacket cooling (for dryers) and stack heat recovery (for export to the DH system).



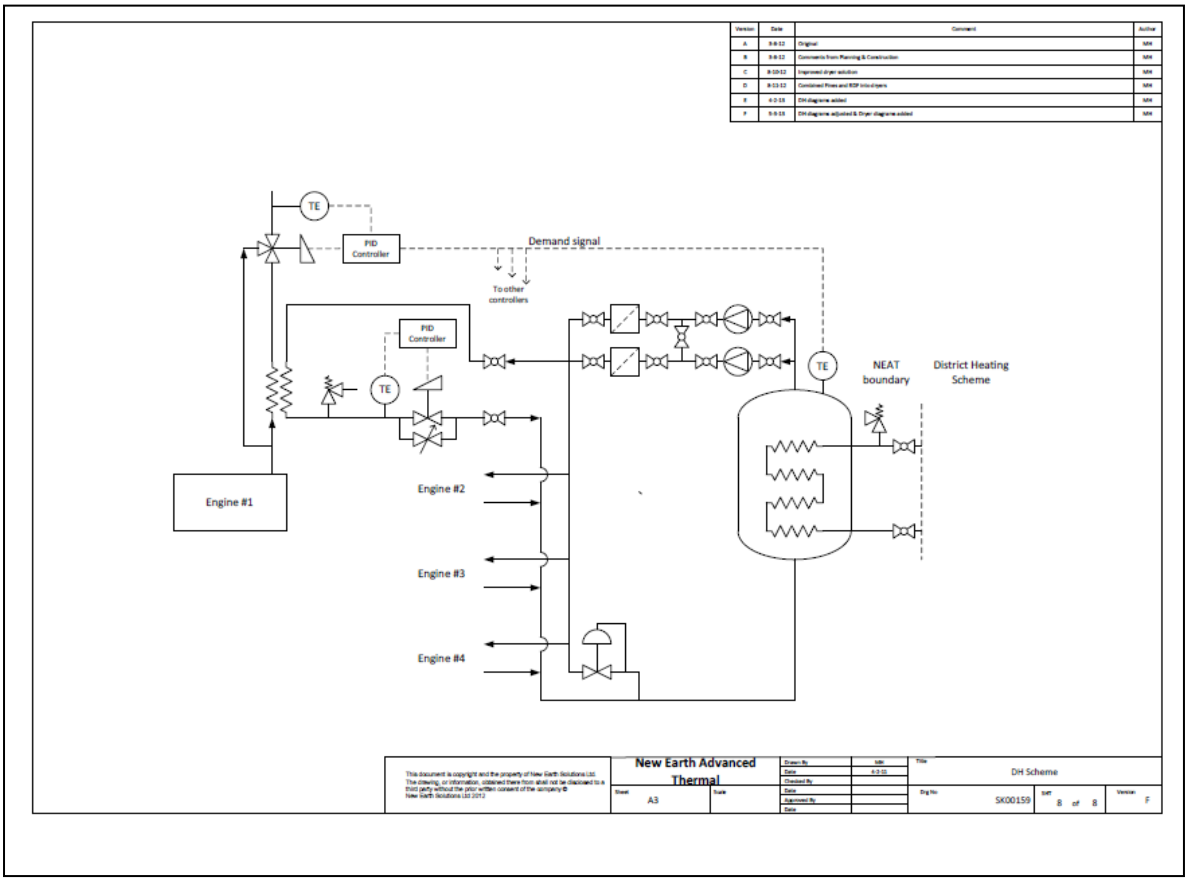




**Fig 8 & 9; Heat Capture PI&Ds for dryers (Jacket cooling) and DH export (Exhaust heat)**

Given this engineering solution, it is anticipated that the DH system will be fed and managed from an Energy Centre (EC) located within the footprint of the facility, with flow and return pipework shown above feeding a large heat accumulator in the EC. Greater detail on the EC systems and distribution are given below in section 2.4.

## 2.3 Arrangements for electrical power export

As noted above, assumed gross electrical output will be in the region of 2.9MWe. Parasitic loads for fuel feed, pumps, controls heat exchangers etc will be in the region of 180KWe, giving an export potential of 2.72MWe net. On the basis of an industry standard Power Purchase Agreement (PPA) based on 8,000hrs per annum, this will provide an annual export of not less than 21.76GWHe to grid.

Export will be by an 11KV underground cable (3 phase, 50 Hz) to connect to Scottish Power Energy Networks (SPEN) in the vicinity of the junction of Tweed Road and Winston Road, Galashiels (Point of Connection (PoC) Location, OS Grid NT 350840/634664).

Full details of the connection offer and acceptance from SPEN are copied in full in the appendices following the main report. This offer has recently been extended and NES is in dialogue with the Distribution Network Owner (DNO) (SPEN).

## 2.4 Heat Distribution

As noted above, continuous export of 1.2MWth is assumed as the basis for operating a DH system. (Heat recovered from gas engine jacket cooling will be taken for waste treatment parasitic load via a separate distribution system, although 3 port valves and a parallel feed pipe network may be incorporated to allow heat from jacket cooling to be diverted to the DH collection system in the event of an emergency shutdown within waste treatment, thus allowing gas engines to continue to run, using the DH accumulator as engine cooling).

The feed will go to a large heat buffer/ accumulator (initial estimate 55,000l) which will feed the main DH circuits. This accumulator will have secondary parallel feeds from three gas fired back-up boilers each with a rating of 500kW (it should be noted that an MP gas main runs close to the facility and EC site), giving a capacity to replace in full the exported heat and provide resilience in case of heat export failure from the plant and also to address any peak heat load going outwith normal parameters. It should be noted that this will also ensure complete hydraulic separation between the waste heat feed and DH circuits.

High Temperature Hot Water (HTHW) from the accumulator, at 100$^{o}$C+, will then be fed, via large plate heat exchangers, to the separate DH circuits. Each circuit shall have paired pumpsets with inverter soft-starts and summer duty pumps (which will also provide resilience). From consultation to date, it is suggested that there will be initially four circuits, each with the potential for an extension loop; one to Langlee housing (Hawthorn Road, Broom Drive, Primrose Bank, Marigold Drive) with the potential for an extension loop to housing at Beech Avenue, Laurel Grove and Larch Grove to the west); one to Netherdale, via Langlee Drive and Woodstock Avenue to Dale Street and High Mill, Borders College(with the potential for an extension later to Heriot-Watt University Residences at Tweed Street); and one to Melrose Gait, immediately south of the facility, primarily supplying the affordable housing to be provided in phases by local Registered Social Landlords (RSLs)and a further route north to serve agricultural and biomass/ wood drying developments.

For planning purposes, and assuming the potential to eventually export up to 2MWth from the plant, estimated pipe sizes for each loop are as follows:

| **Circuit** | **Pipe Diameter** | **Type/ Remarks** |
|---|---|---|
| Main feed from and return to ERC to DH EC | 300 mm int Dia x 2 | Bonded pre-insu steel |
| Main circuit loops | 200 mm int dia | Pre-insu steel or HDPE |
| Street loops | 100 mm int dia | Pre-insu HDPE |
| Feeds to Indiv house/flat feeds/ culs-de-sac etc | 75 mm int dia | Pre-insu HDPE |

It should be noted that there are proposed to be four stages of hydraulic separation within the system:

- Heat recovery from gas engines/flue gas to collection tank
- Feed from collection tank to EC/ DH accumulator
- Circuit and street loops to house feeds
- Domestic internal circuits from connection at individual Hydraulic Interface Units (HIUs).

Heat delivery within individual connected premises will vary. Within houses and flats, there will be individual metered Hydraulic Interface Units (HIUs) with either 4 or 6 port connections dependant on existing internal domestic systems (i.e. whether acting as a combi-boiler or connected to existing Hot water Cylinders (HWC) with electric immersion heater (resilience)). A typical installation domestic installation P&ID is shown on the page below.

Institutional/ commercial users are anticipated to install large plate heat exchangers, and to balance loads may also (in a few cases) utilise buffer tanks/ accumulators and/or may opt to retain existing boiler systems in place (dormant) for emergency resilience.

The use of buffering/ accumulator storage will be critical to the efficient operation of the DH system and ensuring maximum use of heat, particularly when loading of the heat plants drops below 50% of nominal output. It is anticipated that buffering may best be achieved by the location of large stores at the sites of large users with predictable demand profiles. In this respect, the Schofields, Borders College and Kiln-drying sites are the most likely buffer store locations. As well as being the most consistent and predictable loads, are also situated beneficially at the probable extremities of the network.

Figure 10 illustrates how demand management and buffering will address miss-matches in supply and demand. The figure illustrates a typical day. Whereas actual variations will be different day to day, with a strong seasonal element to the variation, the indicative diagram shows how energy can be managed. The curve represents the unmitigated demand curve whilst the straight line at 1.2MW represents the unmitigated supply. The area beneath the3 curve and line represents the direct supply from the engine heat exchangers to the district heating scheme. The areas beneath the horizontal supply line at 1.2MW but above the demand curve represents excess energy supply over instant demand. The areas beneath the curve and above the straight line represent excess instantaneous demand over instantaneous supply.

Without mitigation, heat would be wasted when demand is below 1.2MW and the gas back up boilers would need to deploy every time demand exceeded 1.2MW. However, the diagram shows how the “troughs” can be filled and the “peaks” lopped though demand management and buffer storage. Demand management essentially means customers timing when the3y take heat. As an example for industrial customers, the proposed kiln drying operation may be expected to take heat at any time during the day or night and hence are shown as drawing heat to an accumulator/ buffer store during the night. This would fit a work pattern of loading and unloading kilns during daytime working and running kilns overnight, a likely scenario.

Buffering is the storage of heat as hot water in buffer tanks such that it can be drawn down to top up supply during periods of high demand. There will be some buffer storage in the Energy Centre and, additionally, institutional users (Borders College, school, University buildings etc( are expected to be able to use their own hot water tanks as buffer stores.

The indicative day illustrated is one during which there is a perfect match of supply to demand. In reality, it is expected that during the summer there may be occasions when heat has to be spilled, and this will be achieved by turning down the engine exhaust heat exchangers and allowing the heat to go to exhaust. In winter, there will be occasions when the supply of heat has to be supplemented. The first means by which this will be done will be by connection of the landfill gas engine cooling circuit to the system. The second means will be by connecting the ATT engine jacket cooling circuits to the flue heat exchanger circuits. This will mean a temporary reduction in drying capability but with the benefit that additional heat can be put into the district heating circuit. Use of this heat will compensate over the annual heat budget for heat lost during the summer. If both of these mitigations have been done so far as is possible, but there remains an excess of demand, then the gas back up boilers will be deployed to provide peak lopping.

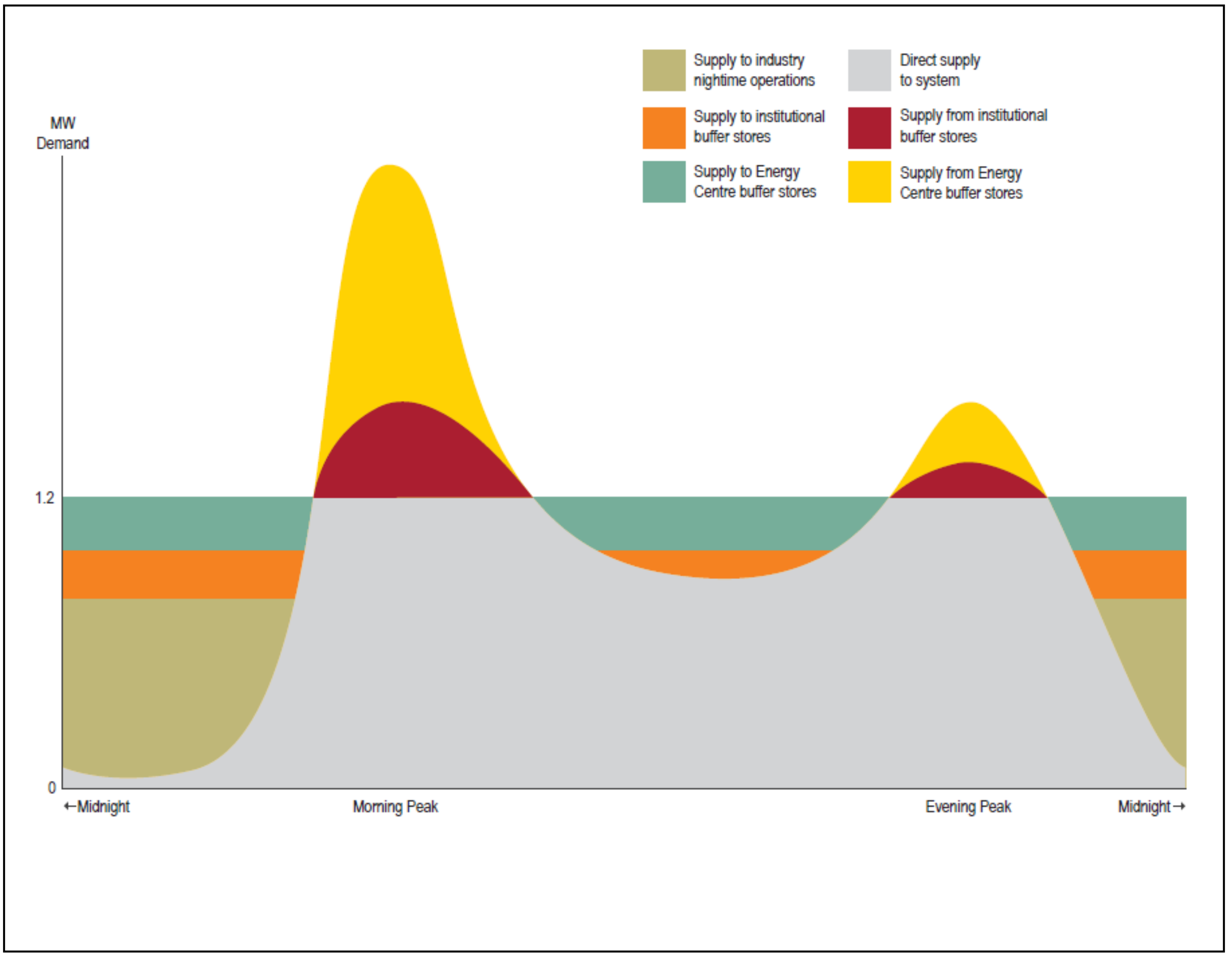



**Figure 10- Buffering principle**

## 2.5 Distribution Contracts and Network Management

It is intended that all of the distributed heat will be supplied to a single Energy Supply Company (ESCO) which will contract Heat Off-take agreements with the various customers listed below in sections 4 and 5 of this report. The ESCO, Scottish Borders District Heating Company Ltd, is currently being established as a Scottish Company, limited by shares, with a registered office in the Scottish Borders and a number of consultees/ customers have already expressed interest in joining the company, which will ensure local governance and accountability. Copies of the draft heat off-take agreements and CHPA Heat Customer Charter are included in the appendices to this report.

The ESCO will also obtain and manage access consents, wayleaves and servitudes for installation and maintenance of the heat network, and confirmation of land-ownerships (Primarily with Jim Hewit Properties, Scottish Borders Council (SBC) and Scottish Borders Housing Association (SBHA) are underway). Most of the network will be constructed in adopted roads and liaison has been established with SBC Transport and Streets and the full extent of all SBC adopted roads and footpaths in the area has now been confirmed with a view to the carrying out of works under the New Roads and Streetworks Act 1991 (NRSA).

Extension of the network to Netherdale will require the crossing, at one or more points, of the restored Scottish Borders railway (estimated completion, July 2015). Discussions with Network Rail have confirmed their willingness to accommodate network pipe culverts within their build (as they are doing for the Shawfair Business park development in Midlothian) and for which works to install pipes will require a Network Rail Basic Asset Protection Agreement (BAPA). This southern section of network will also require a crossing of Gala Water, and this will be achieved by directional drilling.

With the anticipated participation of SBC in the ownership of Scottish Borders District Heating Company Ltd (SBDHCL), its' Compulsory Purchase powers may be available to SBDHCL if required.

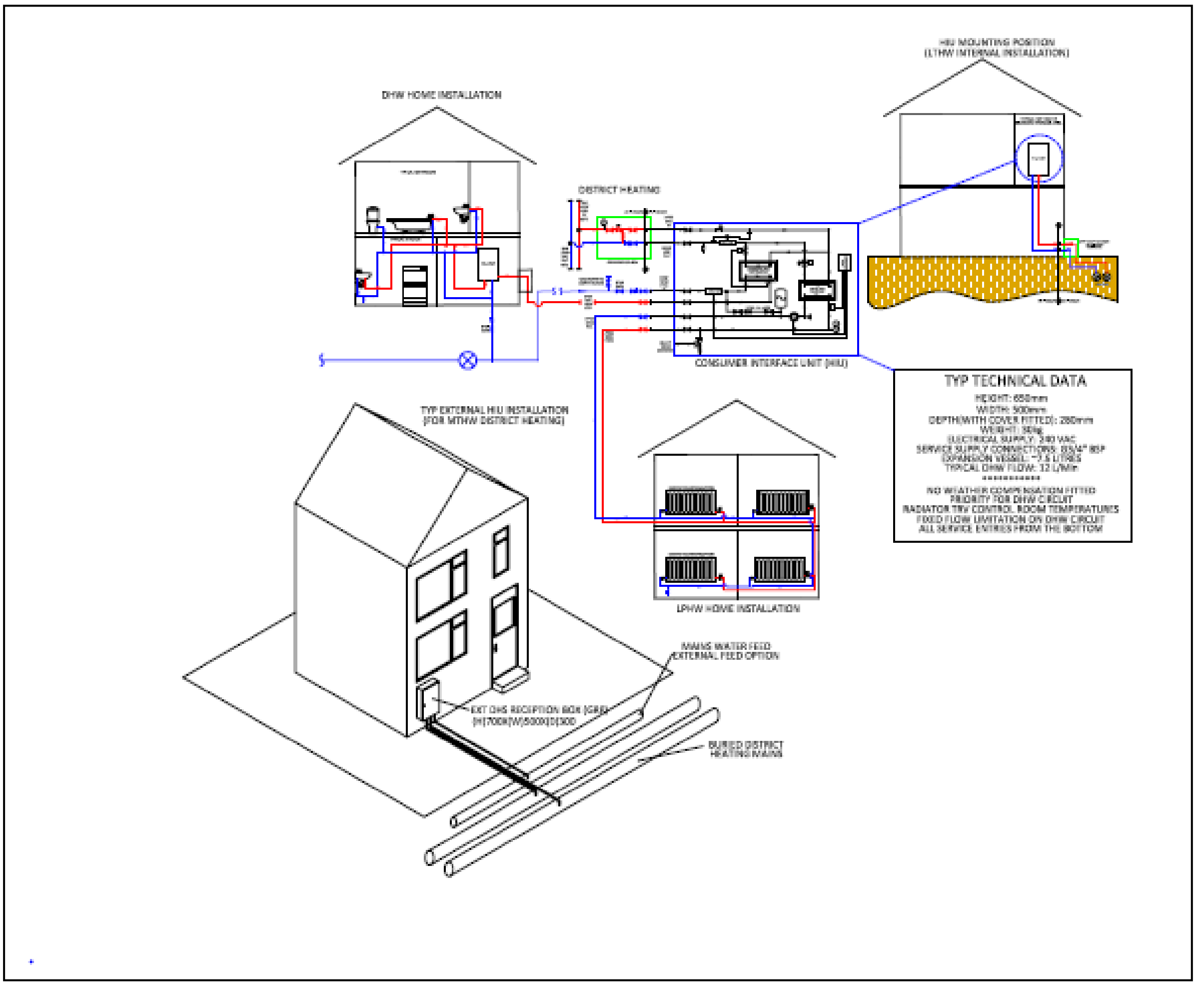



**Figure 11; typical housing installation P&ID**

# 3 Waste to be Treated and Energy values

## 3.1 Waste types and volumes

The waste plant will treat residual municipal waste collected within the Scottish Borders, producing approximately 24,000 tonnes per annum of Refuse Derived Fuel (RDF) (It was previously intended that this would be exported, via road transport, for use by other parties outwith the region).

An early (2009) audit of the MSW collected from across Scottish Borders Council's area has been produced and is attached at Appendix 2 to this report, and it is understood that the split reflects that found in surveys of MSW streams from a number of Scottish Local Authorities. Whilst SBC was not one of the eight participating Local Authorities, the survey data from the Zero Waste Scotland (ZWS) report "The Composition of Municipal Solid Waste in Scotland; Final report" April 2010 by WasteWorks and AEA Consultants, provides comparable data from a number of LA's with similar economic and demographic profiles to SBC, including detailed information on card, paper and other combustibles.

Copies of the full reports are included in the appendices to the main report.

## 3.2 CV of wastes

As noted above, the 24,000 tonnes per annum of RDF will be shredded, screened and fed to four NEAT units and associated gas reciprocating engines.

The assessed calorific value of the RDF is 13MJ/kg (3.111kWHr/kg) or some 312,000,000MJ per annum (74,666 MWH per annum).

Pyrolysis of this feedstock will produce a continuous gas output with a CV estimated at 18.7MJ/Nm$^3$ (Gross CV) and 17MJ/Nm$^3$ (Net CV). Current assumptions are that whilst feedstock will be evenly fed across all four NEAT units, three out of the four engines will be running continuously (in rotation).

## 3.3 Breakdown of energy from facility

The figures below (from NES' consultants, Fichtner) show the energy produced from the RDF and the outputs for electricity and the two heat sources. These figures are the basis for the QI calculations in section 6 of this report, and include full electrical and heat production, parasitic loads and available for export outwith the Advanced Thermal Treatment facility.

| Global Calculations | | |
|---|---|---|
| Operating hours | hrs p.a. | 8000 |
| RDF Processed | tph | 3.00 |
| | tpa | 24000 |
| RDF Gross CV | MJ/kg | 15.25 |
| RDF Net CV | MJ/kg | 12.63 |
| Thermal Input (GCV) | MW | 12.71 |
| Thermal Input (NCV) | MW | 10.53 |
| | | |
| Pyrogas produced | Nm3/hr | 1874 |
| Density of pyrogas | kg/Nm3 | 1.049 |
| Pyrogas Gross CV | MJ/Nm3 | 18.70 |
| Pyrogas Net CV | MJ/Nm3 | 17.00 |
| Thermal energy in pyrogas (GCV) | MW | 9.73 |
| Thermal energy in pyrogas (NCV) | MW | 8.85 |
| Conversion efficiency (GCV) | | 76.60% |
| Conversion efficiency (NCV) | | 84.08% |
| | | |
| Engine electrical output | MWe | 2.90 |
| Parasitic Load | MWe | 0.20 |
| Parasitic Load (engines only) | MW | 0.04 |
| Engine electrical efficiency (GCV) | | 29.79% |
| Engine electrical efficiency (NCV) | | 32.77% |
| Heat in stack | MWth | 1.90 |
| Heat in jacket water | MWth | 3.00 |

From these outputs, the following performances are derived:

Engine thermal input; 77,875MWh
Engine electrical output; 23,200MWh (i.e. 2.9MW x 8,000hours)
Engine heat output; 13,200MWh (i.e. 1.65MW(compromising 1.2mw in the District Heating (DH) system and 0.45MW used in the dryers to support recycling).
(20,400MWh, amount representing the balance of the 3MW (ie 2.55MW) used in the drying process)

Power efficiency; 29.70%
Heat efficiency; 16.95%
Total efficiency; 46.74%

Stack Heat to DH system; 1.2MWth
Jacket heat to dryers; 3.0MWth (of which 450MWth, 15% for CHPQI calculation)

## 3.4 Operating assumptions

As noted above, the plant will have four engines, with three running at any time, allowing for continuous operation and cover for any maintenance, repair or breakdown, giving a potential for 8,760 Hrs per annum. For the purposes of the PPA/export agreements, however, annual operation is assumed to be 8,000 hours per annum. Averaged over three engines, this gives 24,000 hours per annum. The design point for the NEAT units is 1t/hr, hence this matches the predicted availability of RDF.

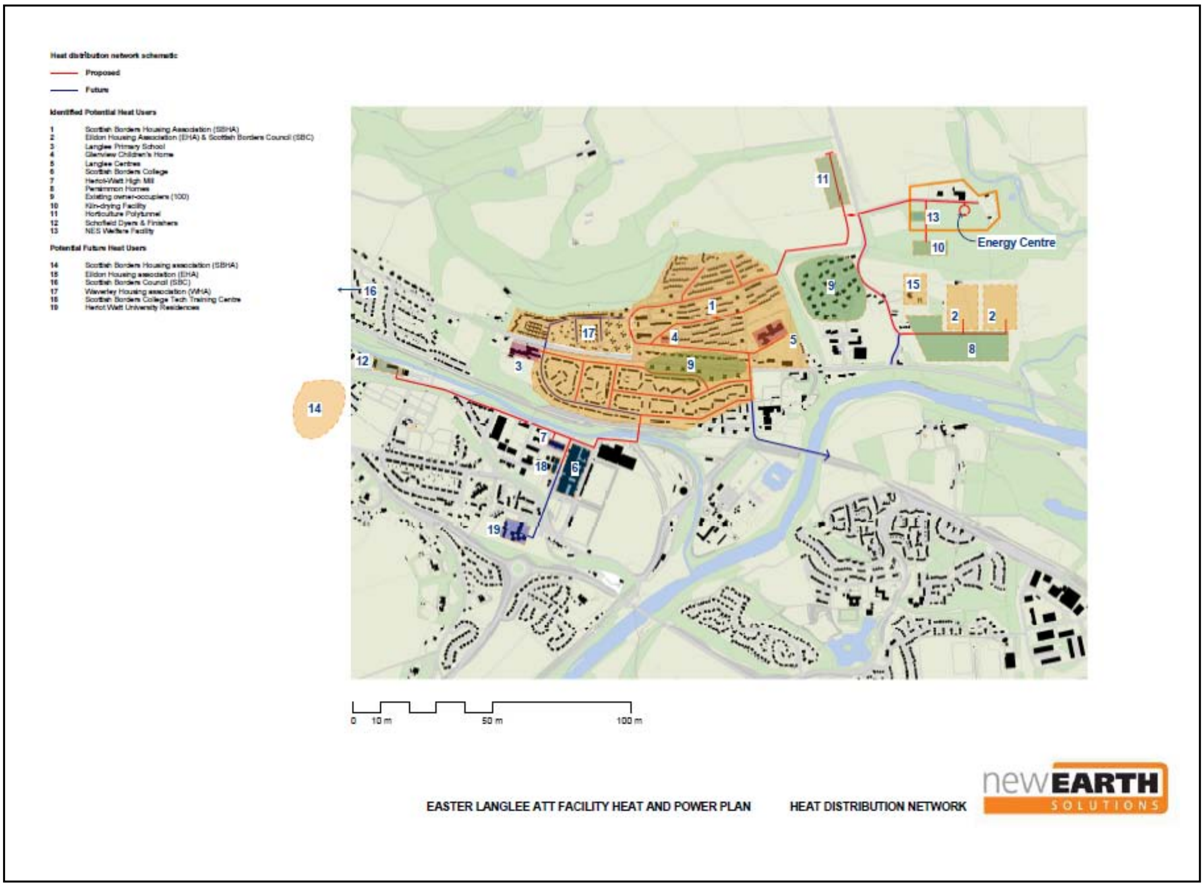
## 3.5 Renewables Obligation Certificates (ROCs)

For Advanced Conversion Technologies (ACT) such as NEAT, up to 2 x ROCs per MWHe are available provided that gas CV exceeds 2MJ/$m^3$ as demonstrated in the table above. This award of ROCs is in proportion to the biomass energy content of the RDF, which it is assessed will be in excess of 60%.

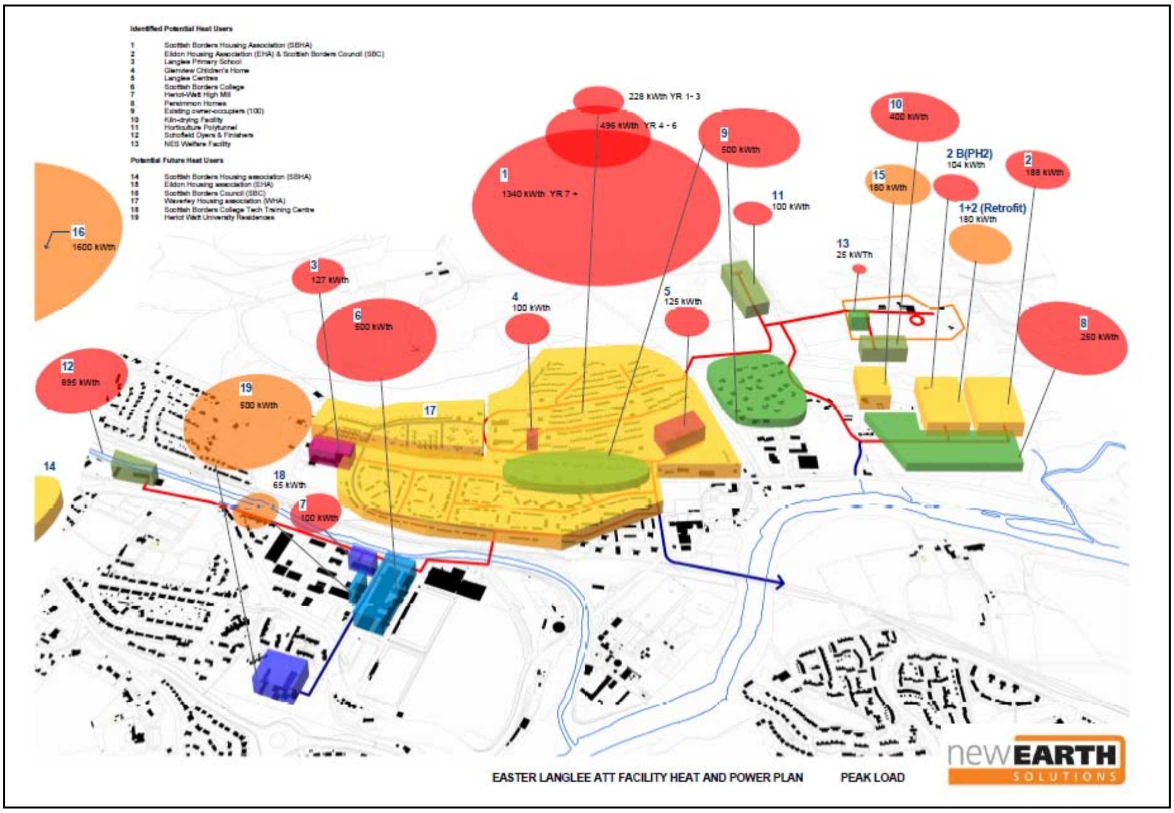
## 3.6 Indicative distribution networks for heat

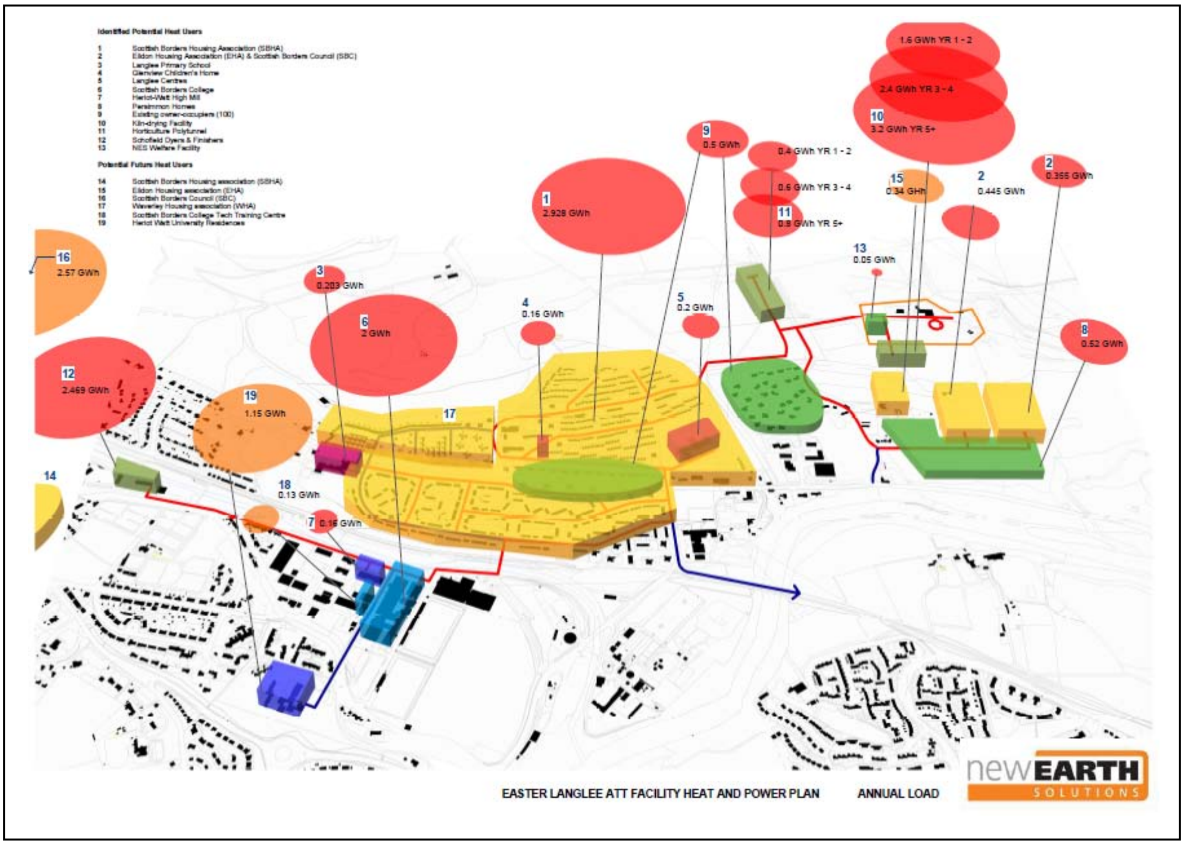
The plans below shows indicative routing for the DH system, including export F&R pipes from the MBT plant to the DH EC, initial distribution loops and potential future loops for development. The energy centre and proposed initial loops are shown in red and future loops in blue.

**Fig 12; Heat distribution network schematic**



**Figures 13 & 14; mapping of peak and annual loads**



# 4 Identified Potential Heat Users

## 4.1 Users, facilities and demands

The heat mapping exercise to determine potential customers and loads for a DH network was conducted by a series of meetings and interviews with estates, facilities and technical managers at a number of organisations. The estimated loads below are based on the information supplied at or following these meetings.

It should be noted that in most cases, no detailed load profiles have been supplied or derived, but the figures on overall demand split over an average year are based on the interpretation of data from some of the consultations and comparator analysis of similar DH projects with mixed domestic and institutional loads.

**Registered Social Landlords (RSLs)**

The Langlee area has the benefit (for a DH scheme) of having a high proportion of publicly owned and maintained housing stock in close proximity to the facility and DH EC. Much of this is legacy stock from SBC and the former Scottish Special Housing Association (SSHA) and presents issues for landlords in addressing the Scottish Housing Quality Standards (SHQS), as well as the continuing requirement for annual Gas safe Inspections on each property.

**Scottish Borders Housing Association (SBHA)**

SBHA are the largest RSL and their housing is closest to the proposed EC site. Their stock is located in Hawthorn Road, Broom Drive, Aster Court, Heather Court, Kenilworth Avenue, Langlee Avenue, Langlee Drive, Langlee Road, Marigold Drive, Marmion Road, Primrose Bank, Rose Court, Talisman Avenue, Winston Place, Winston Road and Woodstock Avenue.

Their stock comprises some 485 units, mostly flats but also cottages, maisonettes and 4-in-a-block units. Of these, 199 have gas fired wet heating systems, 281 have electric storage heating and 5 are classed as "other heat source". Heat demand loads have been conservatively estimated as between 5 and 7.5 kWth peak per unit (to allow for energy efficiency and demand reduction measures for SHQS and general stock improvement) giving a total peak demand for all units of 1.34MWth.

However, it is recognised that many of the existing heating systems still have unexpired life and, based on information from SBHA, it is suggested that, if SBHA wished to connect all units, the demand would build up over a period of around 7 years as follows;

| | | | |
|---|---|---|---|
| Years 1-3 | +17% | total 17% | 228kWth peak load |
| Years 4-6 | +20% | total 37% | 496kWth peak load |
| Years 7+ | +63% | total 100% | 1.34MWth peak load |

(an analysis of this load split is in the appendices to this report)

**Eildon Housing Association (EHA)**

EHA do not have an extensive legacy estate in the area, but are involved, as a Communities Scotland framework delivery partner, in the construction of new homes for rent. In the

Langlee area, they are building these as part of the Melrose Gait development on land owned by Persimmon Homes immediately to the south of the facility.

The RSL element will be delivered in 3 phases. Phase 1, 20 units, is currently on site and will be completed and occupied before the plant is completed. It is therefore unlikely that EHA would wish to connect these units to a DH network until initial condensing boiler life is expired (not before 2024). The following two phases are not due to complete until 2015 (25 units) (and likely to be completed and occupied before the DH system is operational, so discounted as early connections (as with Phase 1) but potential connections at first boiler replacement) and 2016 (26 units). As these will be built to the Scottish Building Standards (Domestic) 2013, most of their demand will be for hot water and so can be conservatively estimated at ca 4kWth per unit.

This would give an initial load of 104kWth in 2016. There will also be the opportunity to replace the boilers in phase 1 and 2 houses once they have reached planned end of life around 2024, giving a further 180kWth load (potential noted in section 5 below).

**Scottish Borders Council (SBC)**

Whilst stock transfer has moved most housing from SBC to other RSLs, it is intended that SBC Social Work will develop and own 47 units in the north east corner of the Melrose Gait development, built in phase 4 (see above). It is probable that the delivery partner will be EHA (see above) and that design standards and unit loads will be as for the phases two and three EHA units, giving a potential peak load of 188kWth.

This would give a load concentration for RSLs in Melrose gait of some 292kWTh peak.

**Waverley Housing Association (WHA)**

The other RSL with a substantial legacy estate in the area is WHA, with a single long block of maisonettes in Beech Avenue and cottages in Beech Avenue, Laurel Grove and Larch Grove.

Several attempts have been made to include WHA in this exercise (by telephone and post), but they have declined to respond. It may be that this will change when the project is in development, so the DH network layout shows the potential to include this area as a future potential user (see section below).

**Institutional Users**

Whilst it would appear that the domestic loads noted above can take all of the heat output of the plant, this will only be during the twice daily peaks and with total assumed domestic running times of between two and ten hours a day dependant on season. Therefore, demands from institutional/ public sector users in the area have been assessed for balancing loads during the remaining hours.

It will be the case that there will be some overlap in peak demands, so consideration has been given to the use of load buffering by use of accumulator stores both at the EC and at demand sites.

Peak lopping and load buffering within individual customers buildings might be as simple as drawing heat to on-site hot water tanks overnight for use during the next day.

**Scottish Borders College**

Located to the south of Langlee at Netherdale, this is potentially a single site anchor load for a DH network and the College is currently considering replacing its several existing boilers, spread across the campus. The rated outputs of these units are listed below.

| *Boiler Location* | *Equipment* | *Rated Input (kW)* | *Rated Output (kW)* |
|---|---|---|---|
| Main Boiler Room | 2 x MHS 923 UltraMax gas boilers | 966 | 906 |
| | 2 x Andrews R300 Direct fired gas water heaters | 147 | 139 |
| Lab Block Boiler Room | 3 x MHS UltraMax gas boilers | 112.4 | 109.8 |
| Old Union Boiler Room | 2 x Hamworthy gas boilers | unknown | 70 |
| High Mill Boiler Room | 4 x Hamworthy gas boilers with Permanent Pilot Light | unknown | Estimated 100 |
| Steam Boiler Room | 1 x Steam boiler for dye plant | n/a | 1,050lbs/hr steam production |
| Technical Training Centre Plant Room | Qty 2 x ACV Heatmaster Gas Boiler | 69.9 | 63.5 |

For the main building, this gives a notional boiler capacity of over 1MWth, and recorded gas use of around 2,800MWh per annum. If a low efficiency of 75% is assumed across all plant, this would equate to an annual heat demand of around 2,000 MWh per annum. Following a study conducted for the College by the Carbon Trust and EMS Ltd, there is a proposal to install a 500kW Biomass pellet boiler with peak loading addressed by use of a 10,000 l accumulator.

For the purposes of this exercise, it is therefore assumed that average loading is 500kWth.

**Heriot Watt University (H-WU)**

Heriot-Watt University have long had a presence in the Borders and have two facilities co-located with Scottish Borders College, their textiles department at High Mill, which is managed for them by the College (see above) and a residences complex immediately to the south of the College at Tweed Road which is managed by their Estates Services Department from their main campus at Riccarton.

The High Mill building is not covered by the College current proposal for a biomass boiler and in consultation HWU expressed an interest in connecting that to a DH system, possibly evening out loads with a small accumulator tank – say 2,000 l. Peak load is estimated to be in the region of 100kWth.

The residences complex has recently been rebuilt and whilst some data was available, this did not cover a full year of the new buildings, so loads have been estimated based on partial information and historic data on gas use for the former buildings (similar numbers of residents and occupancy/use patterns). Given the age of this site, it is assessed as a future potential customer and included in section 5 below.

**Scottish Borders Council (SBC)**

Property managers at SBC supplied data on a total of 29 buildings in two groups; 9 closer than 1 mile to the facility and DH EC and 20 between 1 and 2 miles. The first group are, for reasons of proximity, included in this section of the report and the second in section 5, below.

Of the nine buildings, one is heated by oil boilers (Langlee School) and two by gas (Glenview Children's Home and Tweedbank Community centre). The remaining buildings have electric storage and warm air heating. In discussions with property managers, they have indicated that due to capital constraints, they are not currently considering full boiler system replacements, but in some cases where plate heat exchangers could allow relatively low cost change onto a DH network, this would be considered. SBC staff have indicated that electrically heated buildings would not, currently, be considered for connection as conversion to full wet system heating would be too expensive and, for this reason the Langlee Centre and Langlee Community Centre, the Langlee Hub, had been excluded from the first phase of the potential DH network, although ideally located for connection. However, given the proximity to the DH EC and a longer period to resolve CAPEX issues, it may be assumed that connection within the first 7 years of DH operation will be achieved. Whilst no energy consumption figures were provided, it is noted that the footprint and construction are very similar to that of Langlee Primary School, indicating a potential load of 125kWth. On the basis of 1600 hours Full Load Hours Equivalent (FLHE), this produces an annual demand of 200MWhth.

Of the three local wet system buildings, Langlee Primary School is closest and, with oil heating, the most expensive to run and most likely to be connected. From the 5 year energy consumption figures supplied, working on the basis of 1600 Hours FLHE, this would give a demand of 127kWTh, say 203MWhth per annum.

If the two gas heated buildings are also included, these would take potential SBC loads in this inner area up to 227 kWth demand, and 363MWhth per annum.

**Private Developers and House Builders**

The Melrose Gait site, referred to above, is also being developed by Persimmon Homes and a meeting took place to gauge their interest in connecting to a DH network. Traditionally, UK house builders have been averse to DH projects and regard them as unattractive to buyers. However, if the capital costs of HIUs are comparable with condensing gas boiler installation and DH connection can be procured without prejudice to developers existing multi-utility supplier contracts, they will consider connection.

Part of the site is already built out and retrofit is not an option, but some 110 units remain to be constructed. As build rate will reflect market demand, a firm programme was not available, but is likely to run out to 2016. For the purposes of this exercise, the same design assumptions as for EHA and SBC new build units are made, but as these will be larger units, average demand is predicted to be between 4.5 – 5.0 kWth, giving a total potential demand in the region of 520kWth.

Recent public consultation events held by NES and SBC have also provided indications of interest from individual owner-occupiers in connecting to a DH system. A market testing exercise will take place once system costs and potential individual house/flat connection costs are known, but (leaving aside the as-yet to be constructed Persimmon units) a planning figure of 100 units is assumed. These will include some of the newer housing at Coopersknowe, older detached houses along the eastern section of Melrose Road (B 6374) but also a number of “right to buy” purchasers, particularly within the SBHA estate at Broom Crescent/Hawthorn Drive/ Primrose Bank and, to the south, Woodstock, Kenilworth and Talisman Avenues. For planning purposes, an average demand of 5kWth per dwelling is assumed, giving an overall demand of 500MWhth per annum.

**Industry and Commercial developments**

Four industrial/ business uses have been identified; one at the facility, two potential developments close to the site and one established large energy user in eastern Galashiels.

The NES facility will be staffed and operated on a continuous basis and 30-40 staff will be based at the site. The existing SBC waste operations at the site include messing, welfare, changing, showering and canteen facilities for staff with a demand in the region of 25kWth that can be met. Given that this is not a 24/7 operation, demand is assumed to be in the region of 1,400 hrs FLHE, giving an annual demand of 35MWth. NES have identified a heat requirement distinct from process and parasitic heat for control room/offices and canteen/welfare/changing/shower facilities with a further load of 25kWth. Given the nature of the NES operation, it is assumed this will run at 2,000h FLHE, giving an annual demand of 50MWhth per annum. These are likely to draw their supply directly from the buffer tank within the engine shed.

Together, these facilities will give a total demand of 8rMWhth.

Two potential operations are envisaged close to the facility and DH EC; one to establish a timber kiln-drying facility to sustain and develop the forestry and timber processing industry in the Borders and; two, a Social Enterprise company to create employment in specialist horticulture and food production using polytunnels.

The kiln-drying project is being led by SBC with a study now underway (with funding from Scottish Government) and a copy of the study brief is included in the appendices to this report. It is focussed on the potential for a 400kW unit which would run on a 24 hour basis with 3 day drying cycles. On the assumption that this business will take time to grow its customer base, a phased increase in heat demand is assumed; if the facility is to start operating in Q4 2015, concurrently with operation of the DH system, in years 1 and 2, it might run for some 4,000 hours per annum, this would give a total demand of some 1,600MWhth.; in years 3 and 4, it could increase this to 6,000 hours per annum (2,400 MWhth per annum) and from year 5+, full capacity at 8,000 hours per annum, giving a full load of 3,200MWhth per annum. Given the variations in daily loads, it is envisaged that this might draw all of its’ heat to an accumulator between 23.00-0.500 daily and draw down continuously. The study will also consider how such a facility could operate seasonally to utilise surplus (and potentially cheaper) heat in summer months. A second work stream will look at the potential for using summer surplus heat to dry woodchip from timber by-products.

The social enterprise project (still at an early development stage) would be based on replication of a pilot project in East Lothian (but which does not have access to heat supply) and is yet to confirm details of potential heat use. Using comparator models from other parts of the UK, a relatively small development of 500m$^2$ (5 no 5 x 20m units) with a demand of 200W/m$^2$ would produce a load of 100kWth. It is assumed that on the same basis as the kiln-drying facility, the business would develop customer demand over a number of years, with increasing cropping cycles. This might create annual demands of; years 1-2, 4,000 h operation, 400MWhth per annum; years 3-4, 6,000h operation, 600MWhth per annum, and year 5+, 8,000h operation, 800MWhth per annum.

Slightly further from the plant and DH EC, on Huddersfield Street, are Schofield Dyers and Finishers, a long established local textile company and also a major energy user, consuming around 7GWHrs of gas a year. Much of this is used to produce steam at up to 130$^o$C and the hot water within the DH system will not be able to match this element of gas use. However, there are other parts of their processes which would benefit from access to continuous, economically priced heat. Schofield's processes require considerable volumes of water, drawn from a lade off Gala Water. This averages some 1,500m$^3$ (1,500,000 litres) a week and needs fed into their systems at 35$^o$C (river temperature varies between 1-2$^o$C in winter and 5-6$^o$C in summer. Raising this volume by an average 30$^o$C would create a demand of 51,000 kWh a week, or 2,397MWHrs (2.4GWh) PA. On demand profile, heat taken would be between 05.00-17.00 daily, Monday to Friday. Schofield's operate with three shutdown periods a year; a week in April, two weeks at Trades (July/August) and two weeks at Christmas/ New Year, giving 47 weeks of load, with a total of 2,820 demand hours.

Apart from this main load, the DH system could also replace two gas boilers used for space heating, one of 20KW serving the offices and canteen building, and one of 25KW providing heating for staffed areas within the plant. These demands, assuming 1600 FLHE (Full load Hours Equivalent) would add a further 32,000 and 40,000kWh.

Overall, connection to the DH system could create an annual demand of 2,469MWh and replace some 35.3% of Schofield's current gas consumption.

## 4.2 Overall usage and demand

From the information in the preceding section, the following overall loads and demand are derived, with the phasing assumptions noted and final demand figures used for totals in the table on the following page. It will be noted that the potential demand is almost 20% higher than the planned annual output figure. Any shortfall in NES ability to supply the system could be met by linking a heat recovery circuit to the existing SBC owned landfill gas engine which is located approximately 500m north of the EC and which has the potential to supply a further 1MWth.

| Customer | Peak demand | Annual load (GWh) | Annual load (MWh)/ GJ | Remarks |
|---|---|---|---|---|
| SBHA | 1,340kWth | 2.928 | 2,928 / 10,541 | |
| Eildon HA & SBC | 204kWth | 0.445 | 445 / 1,602 | |
| | 188kWth | 0.355 | 355 / 1,278 | |
| SBC School | 127kWth | 0.203 | 203 / 731 | |
| Home & CC | 100kWth | 0.16 | 160 / 576 | |
| Langlee Ctrs | 125kWth | 0.2 | 200 / 720 | |
| Scottish Borders College | 500kWth | 2.0 | 2,000 / 7,200 | Based on biomass study with buffering |
| Heriot-Watt University | 100kWth | 0.16 | 160 / 576 | |
| Persimmon (New build) | 525kWth | 0.52 | 520 / 1,872 | Potential for connection low |
| Existing owner-occupiers (100) | 500kWth | 0.5 | 500 / 1,800 | |
| Industry; kiln-drying; yr1-2 | 400kWth | 1.6 | 1,600 / 5,760 | Based on 4,000h PA |
| Kiln-drying;yr3-4 | 400kWth | 2.4 | 2,400 / 8,640 | 6,000 h PA |
| Kiln-drying;yr5+ | 400kWth | 3.2 | 3,200 / 11,520 | 8,000 h PA |
| Social enterprise Horticulture;yr1-2 | 100kWth | 0.4 | 400 / 1,440 | Based on 4,000h PA |
| Horticulture; yr 3-4 | 100kWth | 0.6 | 600 / 2,160 | 6,000 h PA |
| Horticulture; yr 5+ | 100kWth | 0.8 | 800 / 2,880 | 8,000 h PA |
| Schofield Dyers & Finishers | 895kWth | 2.469 | 2,469 / 8,888 | based on 2,820h water heating |
| Industry – Langlee<br>NES<br>SBC | 25kWth<br>25kWth | 0.05<br>0.035 | 50 / 180<br>35 / 126 | |
| **Total** | **5,154 (hypothetical)** | **14.025** | **14,025 / 50,490** | **146.1% of annual heat available** |

Note; the above figures do not take account of system transmission losses**.**

The table on the following page gives the overall heat demand profiles for the year (based on comparator mixed use DH projects) and predicted household system running hours per day for each month. The third column shows (for illustration) the profile for the Heriot-Watt University residences, showing that even with different occupation and use patterns, the general profile of different users will not vary hugely from the norm.

| Month | % of annual demand | Daily running hours (domestic properties) | H-WU % of annual demand |
|---|---|---|---|
| **January** | 15.11% | 10 | 10.7% |
| **February** | 12.54% | 10 | 12.1% |
| **March** | 12.17% | 10 | 11.0% |
| **April** | 7.68% | 8 | 11.2% |
| **May** | 5.22% | 6 | 7.9% |
| **June** | 3.40% | 4 | 2.2% |
| **July** | 2.08% | 2 | 3.3% |
| **August** | 2.82% | 4 | 3.9% |
| **September** | 4.25% | 6 | 6.1% |
| **October** | 7.23% | 8 | 9.0% |
| **November** | 10.60% | 10 | 9.5% |
| **December** | 16.90% | 10 | 12.9% |

## 4.3 Nature of consultations

To gather and review the information used to populate this and the following sections of this report, the following consultations took place:

| Organisation | Contact | Position | Date of Consultation |
|---|---|---|---|
| **SBHA** | Ms Julia Mulloy<br>Mr Alan Vass<br>Mr Donald Shearer | Chief Executive<br>Technical Director<br>Technical Services manager | 26th November 2012<br>15th January 2013<br>1st March 2013 |
| **Eildon HA** | Mr Ronnie Dumma<br><br>Mr Jake Irvine | Development Manager<br>Property Manager | 15th January 2013 |
| **Waverley HA** | No contacts established | | |
| **Persimmon Homes** | Mr Neil Parry<br>Mr Ken Smith<br>Mr Duncan Garry | Design Manager<br>Chief Engineer<br>Technical Director | 15th January 2013 |
| **SBC** | Mr Rob Dickson<br><br>Mr Carlos Clarke<br>Mr Martin Wanless | Director, Environment and Infrastructure<br>Principal planning officer<br>Principal planning officer | 17th January 2013<br><br>6th December 2012<br>6th December 2012 |
| | Mr Stuart Mawson | Property Manager | 19th December 2012 |
| | Ms Louise Cox | Environmental Strategy Coordinator | 17th December 2012<br>25th January 2013 |
| | Mr Jim Knight<br>Mr Chris Trotman<br>Mr Ewan Doyle | SBC Landscape<br>Business gateway<br>Langlee project manager | 17th January 2013 |
| **Scottish Borders College** | Mr Robert Hewitt | Facilities Manager | 18th December 2012 |

| | | | |
|---|---|---|---|
| **Heriot-Watt University** | Mr Peter Kerr<br>Mr John Monaghan<br>Mr David Jack | Head of Estates<br>Dep Head of Estates<br>Environment & Energy Manager | 1st February 2013 |
| **Industry; Forth Resource Management Ltd** | Mr Tommy Dale<br>Mr.Douglas Whiteford | Managing director<br>Finance & Business admin | 30th January 2013 |
| **Schofield Dyers and Finishers** | Mr. Douglas Ormiston | General Manager | 20th February 2013 |
| **NES (facility support/welfare)** | Mr Robert Asquith | Director | 21st & 22nd February 2013 |
| **Infrastructure; Network Rail** | Mr Colin MacDonald | Project Manager, Route Delivery Scotland | 24th January 2013<br>6th March 2013 |
| **Borders Energy Agency** | Mr Ian Lindley<br>Mr Ian Jarvie | Chairman<br>Treasurer | 25th January 2013<br>26th February 2013 |

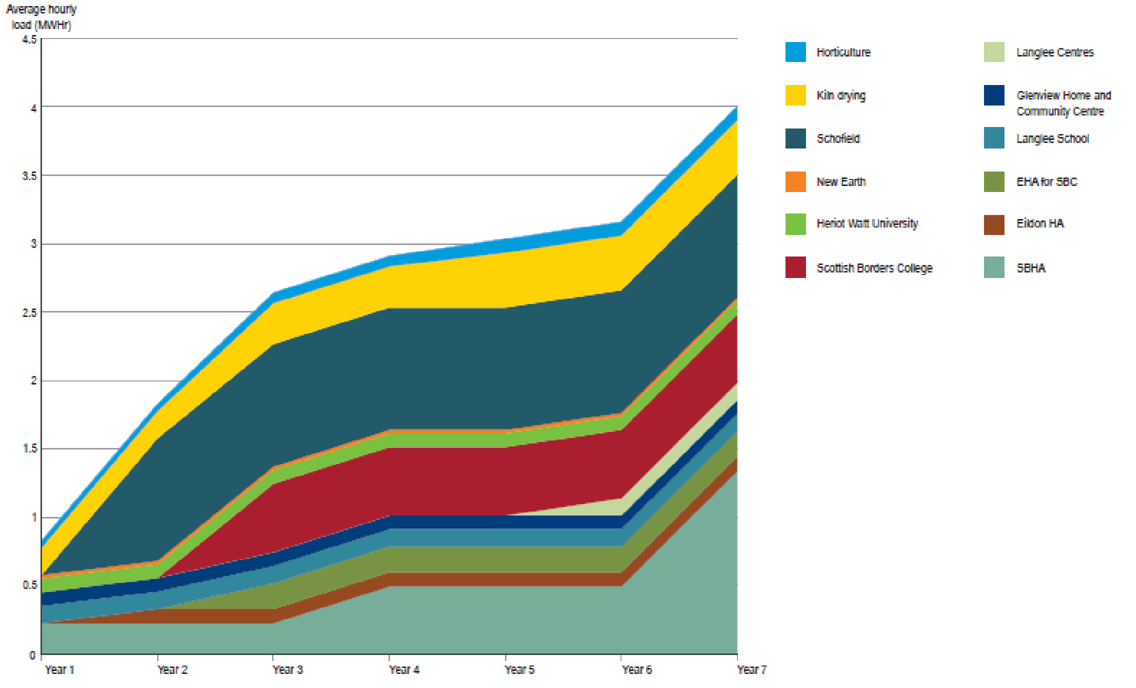
The draft copy of this report was circulated to all consultees for them to confirm the accuracy of content relating to their organisation. Copies of responses received are attached at Appendix 11 to the report.

## 4.4 Implementation timescales

Drawing together potential user requirements from section 4.1 would give the following build up, based on an assumption that the EC plant and network could be operational for Q4 2015;

| | | | | |
|---|---|---|---|---|
| SBHA | Years 1-3 (2015-18) | +17% | total 17% | 228kWhh |
| | Years 4-6 (2019-21) | +20% | total 37% | 496kWth |
| | Years 7+ (2022+) | +63% | total 100% | 1.34MWth |
| Eildon HA | 2015 – 25 units | | | 100kWth |
| | 2016 - 26 units | | | 104kWtH |
| EHA for SBC | 2017+ - 47 units | | | 188kWth |
| | | | | 392kWtH |
| Scottish Borders College 2015 | | | | 500kWth |
| Heriot Watt University (High Mill) 2015-16 | | | | 100kWth |
| SBC- | Langlee School 2015 | | | 127kWth |
| | Glenview Home & TCC 2016 | | | 100kWth |
| | Langlee Centre & Langlee Community Ctre 2020 | | | 125kWth |

| | | |
|---|---|---|
| Industry – 3 phases – | kiln drying | 400kWth |
| | Yrs 1-2 50% | |
| | Yrs 3-4 75% | |
| | Yr 5+ 100% | |
| | horticulture | 100kWth |
| | Yrs 1-2 50% | |
| | Yrs 3-4 75% | |
| | Yr 5+ 100% | |
| | NES – single phase | |
| | 2015- 100% | 25kWth |
| Single Phase – Schofield Q4 2015/Q1 2016 | | 895kWth |



# 5 Potential Future Heat Users

## 5.1 Users, facilities and demands

**Registered Social Landlords (RSLs)**

For the purposes of this section of the report, the same potential customer groups have been assumed and consulted regarding their longer term plans for the northern and eastern areas of Galashiels.

**Scottish Borders Housing association (SBHA)**

SBHA have further properties in the Croft street area, but this would require a considerable extension of the DH network, mainly west along Huddersfield Street from the Netherdale loop. Taken in isolation, the capital cost of this might be prohibitive unless other users, mainly SBC properties around Gala park, were also included, but if a long tail is taken from Netherdale to Schofield Dyers and Finishers (see section 4 above), then the additional capital costs of connection would be considerably lower.

**Eildon Housing association (EHA)**

Officers at EHA could not predict any additional new build in the vicinity of the facility and DH EC beyond that set out in section 4 above. However, as noted above, those houses at Melrose Gait completed in the first two phases will reach the end of initial boiler life around 2024 and, with mains infrastructure in the vicinity, retrofitting may be a viable option (and would equalise the heat provision and fuel costs between groups of tenants). This would add a load of 180kWth (as noted in section 4, above) giving an additional annual load of 340MWhth

**Scottish Borders Council (SBC)**

SBC officials have not advised any future residential/ domestic development in the area.

**Waverley Housing association (WHA)**

As noted in section 4, above, WHA has a substantial estate in the Beech Avenue area and one whose layout would make installation of a DH network very straightforward, and could be achieved by extension of the primary loop serving Hawthorn Road. It may be assumed that loads for these properties would be very similar to those estimated from SBHA supplied data, but confirmation will require WHA staff to engage in an information sharing process in the near future.

**Institutional Users**

For the purposes of this section of the report, the same potential customer groups have been assumed and consulted regarding their longer term plans for the northern and eastern areas of Galashiels.

One area requiring further exploration is the potential for third sector public buildings with intermittent loads, such as churches and voluntary and youth groups. These are more likely to provide small loads, but with greater use in evenings, weekends and school holidays, taking up a part of normal cycle demand reductions.

**Scottish Borders College**

For the purposes of this section of the report, the only addition assumed is the connection of the College's Technical training centre (excluded, along with High Mill (Heriot-Watt University facility) from the current biomass boiler replacement study. This would add a load of around 65kWth.

**Heriot Watt University**

The residences complex has recently been rebuilt and whilst some data was available, this did not cover a full year of the new buildings, so loads have been estimated based on partial information and historic data on gas use for the former buildings (similar numbers of residents and occupancy/use patterns).

The site has new boiler capacity of some 660kW, but allowing for some load spreading by use of local accumulator and potential demand reduction measures in the coming years, maximum peak load is estimated at 500kWth with an annual demand in the region of 1,150mWhth.

**Scottish Borders Council**

As noted in section4, above, SBC supplied information on some 20 buildings located between 1 and 2 miles of the facility and DH EC. Of these, 7 are heated by oil boilers and 9 by gas boilers. As above, buildings with electric storage and warm air systems are excluded from consideration for reasons of capital costs.

Analysis of the detailed loads from the included buildings indicates potential demand of some 1.6MWth, and annual demand of around 2,570 MWhth per annum.

However, it should be noted that the largest loads in these properties are in the centre of Galashiels and therefore much more difficult to access economically and without major disruption to existing services and roads infrastructure. The demands would also exceed the capacity of the proposed DH system, even if utilising the gas back-up boilers to address peak loading.

**Private Developers and House Builders**

There are no other consented private development sites close to the facility and DH EC. The local plan identifies the Crotchetknowe area (west of Langlee) as having potential for some 75 units, but most other identified housing development sites are to the north and west of the town centre and therefore unsuitable for DH connection.

**Industry and Commercial Developments**

No detailed study of further industrial use has been undertaken, given that currently assumed loads will take almost all heat export, but discussions with SBC planners (see section 7 below) have indicated that SBC and others would wish to see improvements in the use and development of the Tweedbank Industrial Estate, and the supply of cheap/ low cost heat to sustain local businesses. Whilst little surplus heat is envisaged in the initial years of this plan, it is likely that energy efficiency and demand reduction improvements by customers will create an, as yet unquantified, "headroom" in heat export for such use.

## 5.2 Overall usage and demand

The table should be read in conjunction with that in section 4.2 of this report.

| Customer | Peak demand | Annual load (GWHr) | Annual load (MWHr)/ GJ |
|---|---|---|---|
| Eildon HA phase 1& 2A retrofit | 180kWth | 0.34 | 340 / 1,224 |
| Scottish Borders College (technical training centre) | 65kWth | 0.13 | 130 / 468 |
| Heriot Watt University (residences) | 500kWth | 1.15 | 1,150 / 4140 |
| **Totals sect 4 & above** | **5,784** | **15.375** | **15,340/ 55,224** |
| SBC (Various schools etc) | 1.6MWth | 2.57 | 2,570 / 9,252 |
| **Total future Potential** | **2.165MWth** | **3.445** | **3,445 / 12,402** |
| **Totals (sect 4 & 5)** | **7,384MWth** | **17.935** | **17,935 / 64,566** |

It is assumed for this section of the report that the annual load split is similar to that shown in the table in section 4 above.

## 5.3 Nature of consultations

Details of the consultations used to inform this section of the report are included in the table in section 4.3, above.

## 5.4 Implementation timescales

No assessment has been made of the likely staging of these potential future connections as they will, in large part, be dependent on the economic circumstances of each organisation. However, in the case of the University residences, this is unlikely until 10 years of boiler life are expired, ie 2022, or year seven of the facility/ DH EC operation. The College technical training centre might also be included on that extension to the system.

# 6 QI Rating

## 6.1 Installation Boundary

Following discussions between NES and SEPA, it is proposed that the boundary of the installation for the purposes of compliance with the Thermal Treatment Guidelines should be defined in a relatively complex way. The facility is based on an Advanced Conversion Technology, which means that the fuel used to generate electricity is defined as the pyrogas, rather than the solid waste. However, the pyrolysis process which produces the pyrogas also produces a solid char, which is subsequently gasified, and a pyrolysis oil. The process is illustrated in Figure 5, albeit this does not indicate the relatively small amount of energy from pyrolyser oil that will be used, with this being fed directly to the combuster unit. Both the syngas from the char and the pyrolysis oil are combusted and the heat is recovered. Therefore, it is proposed that the facility should be treated as two separate installations.

(1) The first installation starts with the cleaned pyrogas and includes the gas engines. This installation converts the pyrogas into electricity, high grade heat from the stack gases and low grade heat from the engine jacket.

(2) The second installation starts with the char and pyrolysis oil and includes the pyrolyser and syngas combustion plant. This installation converts the char into heat, which is used to heat the pyrolysis chamber and enable the process to happen.

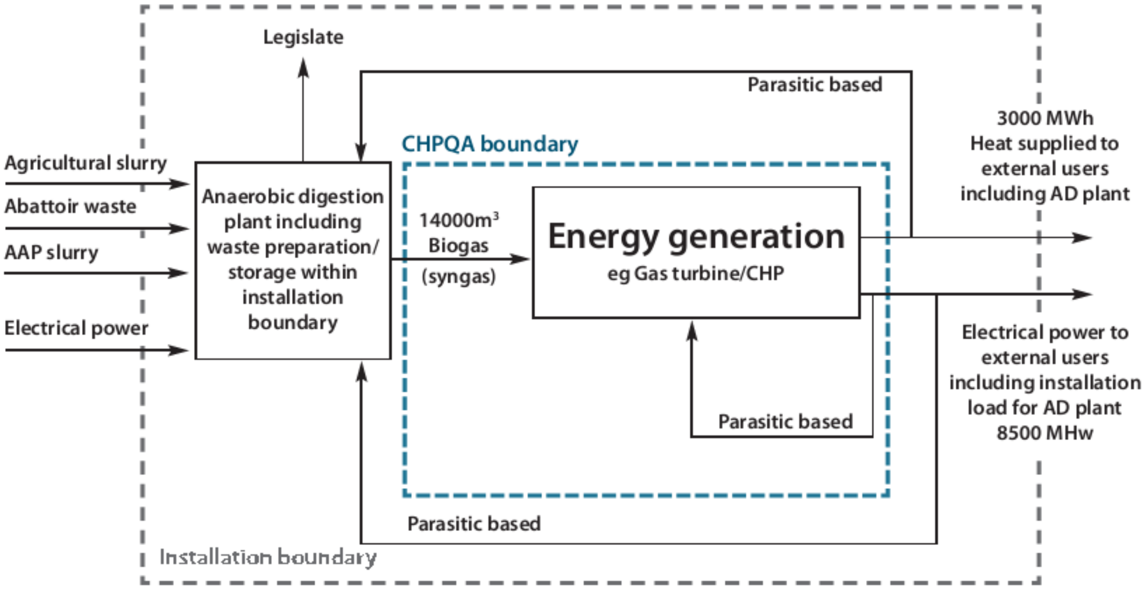
The efficiency of each installation is considered later in this section, along with justifications that the various heat uses are qualifying heat uses.

This approach is, in effect, treating the pyrolyser itself as a preparation plant which produces three fuels – the pyrogas, the pyrolysis oil and the char. The char is subsequently gasified before it is combusted. This means that the RDF fed to the pyrolyser is entirely converted into liquid or gaseous fuels before being combusted, so that the plant is defined as advanced conversion technology.

## 6.2 Pyrogas Installation

The energy recovery plant would produce two forms of heat, both of which are exported from the pyrogas installation.

- Heat from the flue gases will be recovered and used in the proposed district heating scheme, which is discussed in detail in section 5. This is clearly a qualifying heat use.
- Heat from the gas engine cooling jackets will be recovered and used in the driers in the adjacent mechanical treatment plant. Example 3 in Annex 4 to the TTWG considers an anaerobic digestion (AD) plant, with the boundaries and heat flows shown below:




The example calculation makes it clear that the 3000 MWh heat load to external users and the AD plant should be taken fully into account. The AD plant specifically includes waste preparation and storage. NES considers that the Easter Langlee plant would be analogous to the AD plant in this example, with the pyrolysers and driers replacing the AD box, which suggests that the heat use in the waste preparation plant should be treated as useful heat.

Using the driers to dry the partially-processed waste allows further recyclable material to be recovered from the residual waste so that less RDF is produced. It is also necessary to dry the RDF before the pyrolysis chamber, as this allows the pyrolyser to operate more effectively, generating a higher quality pyrogas. This emphasises that the heat used in the mechanical processing plant should all be treated as useful heat.

On this basis, the energy flows in the process and the Quality Index can be calculated. The table below shows the calculation for the opening year, when it is assumed that no heat is exported to the district heating scheme, year 7, when it is assumed that the scheme will be fully operational, and two intermediate years.

| Year of Operation | | 1 | 3 | 5 | 7 |
|---|---|---|---|---|---|
| Pyrogas flow | $Nm^3$/hr | 1,874 | 1,874 | 1,874 | 1,874 |
| Pyrogas Gross CV | MJ/$Nm^3$ | 18.7 | 18.7 | 18.7 | 18.7 |
| Thermal Input to gas engines (GCV) | MWth | 9.73 | 9.73 | 9.73 | 9.73 |
| | MWh p.a. | 78,195 | 78,195 | 78,195 | 78,195 |
| Power Generated | MWe | 2.90 | 2.90 | 2.90 | 2.90 |
| | MWh p.a. | 23,200 | 23,200 | 23,200 | 23,200 |
| Heat Exported (jacket heat) | MWth | 3.00 | 3.00 | 3.00 | 3.00 |
| Heat Exported (stack gas) | MWth | 0.00 | 0.30 | 0.60 | 1.20 |
| Total Heat Exported | MWh p.a. | 24,000 | 26,400 | 28,800 | 33,600 |
| Parasitic Load (gas engines only) | MWe | 0.04 | 0.04 | 0.04 | 0.04 |
| | MWh p.a. | 320 | 320 | 320 | 320 |
| **QI Calculation Approach 1 (Gas engines only)** | | | | | |
| Power efficiency | % | 29.67% | 29.67% | 29.67% | 29.67% |
| Heat efficiency | % | 30.69% | 33.76% | 36.83% | 42.97% |
| Total efficiency | % | 60.36% | 63.43% | 66.50% | 72.64% |
| Current X | | 251 | 251 | 251 | 251 |
| Current Y | | 120 | 120 | 120 | 120 |
| Current Quality Index | | 111.3 | 115.0 | 118.7 | 126.0 |
| Proposed X | | 195 | 195 | 195 | 195 |
| Proposed Y | | 120 | 120 | 120 | 120 |
| Proposed QI | | 94.7 | 98.4 | 102.1 | 109.4 |

It can be seen that the current Quality Index is consistently higher than the threshold for Advanced Conversion Technology of 100 and the overall efficiency is higher than the indicative efficiency of 45%.

## 6.3 Char Gasification Installation

The energy from the combustion of syngas from char and from pyrolysis oil is recovered in two ways.

- The exhaust gases are used to provide heat to the pyrolyser via an external heating jacket. The heat which is transferred to the pyrogas is subsequently lost when the pyrogas is quenched, so none of the heat from the exhaust gases is used to generate electricity. However, if this heat were not provided by the exhaust gases, it would be necessary to burn fossil fuels or use electricity to provide the heat, so the exhaust gas heat is displacing a necessary heat user. Therefore, we consider that this is a qualifying heat use.
- The exhaust gases are cooled further, to about 230°C, and this heat is used to generate steam. However, this steam is then used in the gasifier, so we consider that this is an internal heat use which is not a qualifying heat use.

Since no electricity is generated from the syngas or pyrolysis oil, it is not appropriate to use the CHPQA formulae. Instead, the thermal efficiency of the char installation has been calculated below. As this is not affected by the development of the district heating scheme, it will remain consistent through the life of the project.

| | Unit | Value |
|---|---|---|
| Char produced | tph | 0.22 |
| Gross CV of Char | MJ/kg | 9.70 |
| Energy in char | MW | 0.593 |
| Energy in pyrolysis oil | MW | 0.195 |
| Energy absorbed by pyrolyser | MW | 0.490 |
| Heat efficiency | % | 62.20% |

It can be seen that the heat efficiency is greater than the indicative efficiency for advanced conversion technology of 45%.

# 7 Discussions with Planning Authorities

## 7.1 Policy overview and discussions

The fit of the Easter Langlee project with, and support to, wider SBC policy has been discussed on a number of occasions, most recently on 17th December with Mr Rob Dickson, Director Environment and Infrastructure at SBC. This has particularly focussed on the Council's emerging Low Carbon Strategy (LCS) (see draft policy documents in Appendix 9 to this report).

The project also has a significant fit with the objectives of the Borders Energy Agency, a Scottish Charitable Incorporated organisation (SCIO) established with Council support in 2012 and which will be an SBC delivery partner for the LCS policy. The Board of BEA have written expressing support for the development of a DH system and have offered to work with the developers on project delivery. (A copy of BEA's constitution is attached at part two of Appendix 9 to this report).

## 7.2 Development opportunities

Particular development opportunities which might be linked with Easter Langlee were raised and discussed with SBC planning officers on 6th December.

Whilst most potential housing development sites in the local plan are to the north and west of Langlee, the plan identifies Crotchetknowe, immediately west of Langlee as suitable for 75 units, and there are a number of former industrial and infill sites close to Netherdale.

The potential for employment development was highlighted and several options have been addressed in this report. The kiln-drying study is intended to ensure the sustainability and potential future growth of the timber winning and processing industries in the Borders and if low cost heat can reduce the cost base and provide a commercial advantage, planners are keen to assist. Such a plant might also include, or be in proximity to a biomass and woodchip preparation and drying facility. Apart from employment gain, this would help to secure higher quality woodfuel in the area and bring down transport cost by reduced weight, one of the objectives in the SBC LCS.

The potential for a horticulture social enterprise also fits with SBC policies, both in addressing Scottish Government policy on increased and more diverse food production and particularly in developing opportunities and pathways to work for hard-to-employ groups such as NEETs and ex-offenders.

The land owned by Jim Hewit Properties immediately to the west of the facility, whilst not deemed immediately suitable for large scale and residential development is recognised as providing some opportunities for employment development due to its proximity to the facility and DH EC, and applications for suitably scaled projects would be considered.

This land has been identified previously as a potential major development site. It was excluded from the current Local Plan mainly because of concerns relating to its' proximity to the landfill site (as made clear in the reporter's commentary following the Local Plan inquiry). However, as activity at the landfill site will be considerably reduced as a consequence of the waste management facility to be delivered by NES, it is possible that this situation may change in the future.

## 7.3 Strategic opportunities

Further strategic opportunities arise from the completion of the Borders Rail link, programmed for completion in late 2015. SBC officials see this, with the potential to remove freight from the existing north south road routes as something which can add value to existing industrial sites such as Tweedbank Industrial Estate, and the potential to generate surplus heat (through the level of demand reduction required by the national targets set out in the EU 20;20;20 Plan of 2009) across the DH network in coming years would allow network to be pushed further out to this area and assist in reducing businesses cost base. The railway will not preclude further development of a DGH network, and discussions with Network rail have identified a number of potential sites to build in in-situ cast concrete culverts to future proof network routes (similar to plans already in hand at Shawfair, Midlothian).

Lastly, SBC are keen to secure successful early DH project as a demonstrator to other areas and capable of replication at scale for other Borders towns and in a wider Scottish context.

# APPENDICES;

**Appendix 1;**
**Electrical power export**

**a. SPEN connection offer and acceptance**
**b. Connection schematic**

SP ENERGY NETWORKS

New Earth Solutions Group Ltd
Key House
35 Blackmoore Road
Ebblake Industrial Estate
Verwood
Dorset

RECEIVED
-7 MAY 2013

SP Power Systems Ltd
Shared Service Centre
3rd Floor
Avondale House
Phoenix Crescent
Strathclyde Business Park
Bellshill
ML4 3NJ

For the attention of: Mr Peter Golden

Our Ref : 91351
Your Ref :
1st May.2013

Dear Sirs,

**Offer by SP Distribution Ltd for a Load and Distributed Generation Connection to the Electricity Distribution System**
**Re Easter Langlee ATT Fuel Preparation and Energy Production Facility, Langlee Road, Galashiels, Scottish Borders, TD1 (the "site")**

We, SP Power Systems Limited, thank you for your request to the Distributor regarding electricity connection(s) at the Site. The Distributor as a licensed distributor of electricity has appointed us to act as its agent regarding your request for electricity connection(s) to the Distributor's System. We have pleasure in submitting the following offer to you to provide Connection(s) on the terms and conditions set out in this offer, the Schedule and the Conditions which is in accordance with Section 16A(5) of the Electricity Act 1989. The provisions in the Schedule and the Conditions are incorporated into and form part of this offer.

1. **Meanings**

The meanings set out in this paragraph apply in this letter, the Schedule and the Conditions:

**"Conditions"** the General Terms and Conditions for Connection to the Electricity Distribution System dated 1st May 2012 (the "conditions")

**"Distributor"** SP Distribution Ltd (Company Number SC189125) having its registered office at 1 Atlantic Quay, Glasgow, G2 8SP;

**"Site"** the area of land at the location given in the heading to this letter;

and all other capitalised terms shall have the meanings given to them in the Conditions.

2. **Charge(s)**

The Charge(s) are payable in accordance with Part 1 of the Schedule and amount to:

The Connection Charge quoted is indicative and may be subject to revision by the Distributor. The Distributor shall provide a revised Connection Charge and payment profile at a later date, following your unconditional acceptance of the Adoption Agreement and once tender returns for all major plant items, works and any other material expenditure associated with the Distributor's Works have been received. The Distributor reserves the right to revise the indicative Connection Charge to reflect actual costs following receipt of such tender returns;

New Alderston House, Dove Wynd, Strathclyde Business Park, Bellshill ML4 3FF
Telephone 01698 413000, Fax 01698 413070
www.scottishpower.com

| | |
|---|---|
| The cost for this work will be | £771,943.09 (exclusive of VAT) |
| VAT will be charged at | £154,388.60 |
| This equates to a total cost of | £926,331.69 (inclusive of VAT) |

Further detail regarding the Charge(s) and payment options, if applicable, are detailed in Part 1 of the Schedule.

## 3. Payment

Payment terms will be in accordance with the Conditions and Part 1 of the Schedule.

## 4. Scope of Works

### 4.1 General

This offer is based on your original enquiry dated 06/07/12 and the following information (where applicable):

You have requested permission to connect the proposed Load and Distributed Generator(s) in parallel with a new HV three phase power supply at Easter Langlee ATT Fuel Preparation and Energy Production Facility, Langlee Road, Galashiels, Scottish Borders, TD1.

### 4.2 Distributor's Works

The Distributor's Works are set out in Part 3 of the Schedule.

### 4.3 Customer's Works

The Customer's Works are set out in Part 4 of the Schedule.

### 4.4 On Site Works

This offer assumes that all permanent reinstatement of our excavations at the Site will be your responsibility, as will the installation of mains ducting, service ducting and the supply and installation of meter board(s) in a position acceptable to the Distributor. A plan of the proposed routes may be forwarded to you on request after receipt of your signed and dated unqualified acceptance of this offer. Substation Accommodation, if applicable, shall be provided as set out in Part 5 of the Schedule.

Cable ducting is available on request.

## 5. Connection Characteristics

The Connection(s) shall have the Connection Characteristics (including earthing requirements) as detailed in Part 2 of the Schedule. Connection Conditions are detailed in Part 8 of the Schedule. Please note that an electricity supplier should only offer supply terms based on these Connection Characteristics and Connection Conditions.

## 6. Assumptions and Clarifications

The Distributor has made assumptions in respect of the preparation of this offer. Details of these assumptions and other clarifications in respect of this offer are set out in Part 7 of the Schedule.

7. **Appointment of Electricity Supplier**

This letter is an offer for **Connection(s) to the Distributor's System ONLY**. Please note that it is essential that an electricity supplier is appointed by the Customer for each new Connection in order to have that Connection energised. If you intend to export onto the distribution system from your site it will also be necessary to agree an export contract with a supplier/purchaser.

On our receipt of your signed and dated unqualified acceptance of this offer, we will send you the Electricity Supply Number(s) for the Connection(s).
This information is unique to each Connection and will be required by the chosen electricity supplier(s) to supply and fit metering and register a Connection.

The Distributor cannot provide an energised Connection until the Distributor has received an instruction to do so from the registered electricity supplier for that Connection. Please note that there will be a period of time between the appointment of an electricity supplier and that electricity supplier instructing the Distributor to energise a Connection.

8. **Revision of Offer**

The Distributor is entitled to determine, in its sole discretion, whether further studies are required as a result of the actual connection and design parameters of the Customer's Electrical Installation differing from that provided by the Customer to the Distributor in the Customer's application for this offer. Where such studies are required the Distributor shall be entitled to revise the Distributor's Works, the Charge and all dates specified in this Agreement by giving written notice to this effect to the Customer and this Agreement shall be read and construed as if such revisions were incorporated in it.

9. **Important Safety Matters**

You shall follow the guidance notes enclosed with this letter in respect of the requirements set out as to what you must do prior to the Distributor's Works commencing and read all other enclosures with this letter and comply with any other requirements set out in them.

To avoid danger from cables and overhead lines, it is very important that you, your contractors and subcontractors follow the advice given in documents HSE HSG 47 Avoiding Danger from Underground Services & HSE GS 6 Avoidance of Danger from Overhead Electric Power Lines available from the HSE.

10. **Customer's Electrical Installation**

It is essential that you procure that the Customer's Electrical Installation is constructed and installed according to the British Standard Requirements for Electrical Installations BS 7671:2001 IEE Wiring Regulations 17$^{th}$ Edition. You must procure that the Customer's Electrical Installation is inspected and tested in accordance with the general provisions of such British Standard Requirements and, where applicable, the Electricity Safety, Quality and Continuity Regulations 2002. If requested by us at any time, you must complete and sign a Confirmation of Electrical Installation/Extension Form W33/2 before a Connection can be energised.

11. **Connection Agreement and Site Responsibility Schedule**

All standard LV demand connections, single phase generation and micro generation (connected under Engineering Recommendation G38) are subject to the National Terms of Connection (NTC) as published by the Electricity Networks Association (ENA) at http://www.connectionterms.co.uk.

For all other connection types, a Site-specific Connection Agreement and interface Site Responsibility Schedule will require to be completed and entered into prior to the Connection being energised.

When the Distributor's Works have been completed and commissioned the Connection Agreement will, except to the extent that any obligations in this offer Letter remain to be implemented, supersede these terms and conditions but without prejudice to any outstanding liabilities.

For your information and further guidance a partially completed DRAFT Connection Agreement is enclosed with this offer.

## 12. Competition in Connections

You have the right to seek a competitive quotation for certain elements of the work required to make your Connection to the Distribution System (the "Contestable Works"). Only suitably accredited connection companies may carry out these Contestable Works. Information on accredited connection companies currently operating within the Distributor's area can be found: http://www.lloydsregister.co.uk/scheme_search.php

Other activities must remain under the Distributor's responsibility (the "Non-contestable Works").

Further information relating to the process by which a quotation can be obtained from the Distributor for the Non-contestable Works only (and competition in connections generally) can be found at:

http://www.sppowersystems.co.uk/NewConnections/specifications.asp.

## 13. Quotation Accuracy Scheme

Our Quotation Accuracy Scheme (QAS) is open to certain types of connection and service alteration requests. The QAS is a mechanism under which you are able to challenge the accuracy of charges quoted. Should our charges fall outside the corresponding ranges of costs published in our Connection Charging Statement (without adequate explanation for the difference) you may be entitled to a compensation payment of up to £500.

Further details regarding the types of services covered by the QAS and how challenges might be made can be found at:

http://www.spenergynetworks.com/NetworkConnections/quotation_accuracy.asp

Our Connection Charging Statement can be found at:

http://www.scottishpower.com/ConnectionsUseMetering.htm

## 14. Acceptance

Should you wish to proceed with your request for the Connection(s), as has been provided in this offer, please sign, date and return the enclosed acceptance form with payment of the Charge(s) in full and a completed, signed and dated CDM Information Request Form **without delay.**

This offer is open for unqualified acceptance by you, reaching us no later than 3 months from the date of this letter, after which date we shall have the option to decline such acceptance. This offer may be withdrawn by us at any time prior to such acceptance.

This offer may include a contribution towards an element of network reinforcement, which has been identified by the Distributor. If not the situation may change and on expiry of this offer any new or revised offer issued subsequently may be subject to a contribution towards any reinforcement assets identified by the Distributor. Any contribution towards reinforcement costs will be apportioned in accordance with our Condition 14 (1b) Connection Charging Methodology Statement.

We would however, advise you not to rely on any expired offer and we reserve the right to revise the terms (including the Connection Change and scope of the Distributor's Works) of any offer not accepted by you within the 3 month acceptance period.

Following receipt of your unqualified acceptance of this offer we will contact you in accordance with the requirements of the Electricity (Connection Standards of Performance) Regulations 2010 to discuss and agree your delivery requirements. Subject to the terms and conditions of this offer we will commence the Distributor's Works as soon as is reasonably practicable thereafter. The commencement of the Distributor's Works will be conditional on:

(i) All relevant Consents having been obtained;

(ii) You having complied with all the relevant provisions of the Agreement placing obligations on you in respect of such connection; and

(iii) If you are required to provide the Substation Accommodation, our acceptance of the Substation Accommodation and associated building work.

Please note: the date upon which we will be able to commence the Distributor's Works may be subject to you providing us with at least 16 weeks' prior written notice. We would ask that you take account of this when determining your delivery requirements.

If all of the Distributor's Works are not completed within 12 months from the date of our receipt of your unqualified acceptance of this offer, we shall be entitled, to amend and/or vary any terms and conditions of this offer and/or the Agreement, including, without limitation, the Charge(s) and/or other payments, to the extent that it is reasonable to do so.

This offer only relates to Connection(s) at the Site, it does not cover work on the Customer's Electrical Installation beyond the point of Connection.

Once this offer has been accepted the project manager for this project will be notified to you. If you wish further clarification of this offer and enclosures, please do not hesitate to contact me on 0141 614 1235.

Yours faithfully,

Scott Mathieson
For and on behalf of SP Distribution Ltd

Second Signatory

Enclosures:

1. Acceptance copy of this offer
2. General Terms and Conditions for Connection to the Electricity Distribution System dated 1st May 2012
3. CDM Information Request Form
4. Site Conditions for the Installation of SP Distribution Ltd Equipment
5. **SP Power Systems Limited Guidance Documents:** Getting it Right ; Your On-Site Responsibilities; Wayleaves and Consents; NRSWA (New Roads and Street Works Act 1999)
6. Draft Connection Agreement

**THIS IS THE SCHEDULE REFERRED TO IN THE FOREGOING OFFER BY SP DISTRIBUTION LTD FOR CONNECTION(S) TO THE ELECTRICITY DISTRIBUTION SYSTEM**

## Part 1

## Charge(s)

### 1. Charge Breakdown

A breakdown of the Charge(s) (exclusive of VAT) is provided in the table below:

| Category | Connection | Diversion | Reinforcement |
|---|---|---|---|
| Circuit Land & Fees | 4,560.00 | £0.00 | £0.00 |
| Ground-Mounted Substation | 124,454.88 | £0.00 | £0.00 |
| Substation Land & Fees | 9,848.00 | £0.00 | £0.00 |
| 11kV Underground Line | 633,080.21 | £0.00 | £0.00 |

### 2. Additional Charges

In addition to the Charge stated in this Part 1 of the Schedule the Distributor may require the Customer to pay additional charges as detailed below. Such charges will be payable in accordance with the provisions of this Agreement. The Distributor will notify the Customer from time to time of any such additional charges.

This offer is based on the following:

a) The proposed route is based upon a desk-top assessment and initial survey. If an alternative route is required or deviations to the proposed route increase the overall route length the Customer will pay for any reasonable and necessary additional costs incurred to facilitate the provision of that new route including any additional cables, lines or works and the Distributor will revise the Charge accordingly.

b) No allowance has been made in this offer for any noise studies, ground surveys, earthing studies, environmental impact surveys, studies and/or statements. If these studies, etc. are required the Customer will pay the Distributor's reasonable costs (including the costs of using external specialists and legal costs) associated with this work. If any reasonable additional costs arise out of the need to meet the requirements of these studies then the Customer will pay for the cost of this work.

c) The Customer is responsible for the removal (and disposal) and for the cost of the removal and disposal of any contaminated land, soil, etc from the Site and making good the Site.

## 3. Payment

The Charge(s) are payable in three staged payments, each payable in full prior to the commencement of any of the Distributors works.

The indicative Connection Charge for the plant and engineering works is £771,943.09 (Seven hundred and seventy One thousand Nine hundred and Forty Three pounds and Nine pence, plus VAT). The Connection Charge has been calculated in accordance with the Distributor's Connection Charging Methodology Statement.

http://www.scottishpower.com/uploads/statementofmethodology.pdf

The Connection Charge will be paid in the following stages:

| | | |
|---|---|---|
| 1. | Payment on acceptance of the Offer | £50,000.00 plus VAT |
| 2. | Payment ten working days in advance of placing contract for switchgear and cable procurement. | £200,000.00 plus VAT |
| 3. | Payment ten working days in advance of placing cable laying contract and substation installation. | £521,943.09 plus VAT |
| | **Connection Charge** | **£ 771,943.09 plus VAT** |

## 4. CUSC REQUIREMENTS - STATEMENT OF WORKS

You are advised that the Distributor may be required to request a Statement of Works for the Easter Langlee ATT Fuel Preparation and Energy Production Facility and that NGET may as a result impose upon the Distributor certain costs or restrictions that could result in the Distributor being required to vary the scope of the Distributor's Works, the Target Date, the Connection Charge and any other provision contained within this Offer, For this reason this offer is made conditional upon the results of any Statement of Works subsequently provided by NGET and the Distributor reserves the right to modify the provisions of this offer to take account of any such costs or restrictions imposed upon it by NGET.

A Statement of Works provided by NGET may impose on the Distributor certain costs or restrictions that could result in the Distributor being required to vary the scope of the Distributor Works, the target date, the Connection Charge and any other provision contained within this offer. For this reason, this Offer is made conditional upon the results of any Statement of Works subsequently provided by NGET and the Distributor reserves the right to modify the provisions of this offer to take account of any such costs or restrictions imposed upon it by NGET. Further costs (to cover NGET fees) shall be levied upon you, should NGET determine that the Distributor is required to submit a modification application as a result of the request for a Statement of Works. Any failure by you to comply with the requirements to pay to the Distributor the costs in respect of NGETs fees will result in this quotation being withdrawn.

## Part 2

## Connection Characteristics

A supply of 1.1MVA with an Export capacity of 4.7368MVA (4.5MW with a power factor range of 0.97lagg to 0.95lead) will apply with the power balanced over three phases. The supply will be 11kV (+ or - 6%) 3 phase, 3 wire, 50 hertz (+ or - 1%) AC. The design fault level is 250MVA at 11kV.

The point of connection will be the high voltage metered circuit breakers within the substation and it is your responsibility to install suitable cables from that board to your own switchgear and materials required for termination in a dry cable box. Your switchgear must be located in the switchroom immediately adjacent to the substation building provided for the Distributors equipment.

**Earthing System**

TT earthing will apply in accordance with the British Standard Requirements for Electrical Installations BS 7671:2008 (IEE Wiring Regulations 17th Edition). An earth terminal will not be provided, consequently you will be required to make your own earthing arrangements.

## Part 3

## Distributor's Works

The Distributor will carry out, the following works, which will remain the property of the Distributor:

1. The Distributor will provide this connection by looping in the new on-site 11kV metered connection point from a new 11kV switching station in the vicinity of Boleside Road, Galashiels which will connect to a suitable point on the existing 11kV circuit and extending the existing 11kV circuit by installing 5.64km of new 11kV 185(3) XLPE underground cable. The 2.82km double 11kV cable circuit track will comprise of a route that will consist of road and verge and will include a trenchless river crossing.

2. Install and commission all switch gear and associated equipment in the Distributors on-site secondary substation and off-site secondary switching station. Obtain all consents for, installing and commissioning of new network to connect your substation to the Distributors existing distribution system.

3. Oversee termination of the customer's cable at the Distributors metered circuit breakers.

4. Issue a Connection Agreement for the site.

5. Witnessing of Customers G59/2 compliance tests up to a maximum period of one normal working day.

There are no reinforcement costs included or required within this quotation.

The Point of Connection to the existing network is: 350840, 634664

## Part 4

## Customer's Works

All on site excavation including road crossing, mains and service ducting, backfill and permanent reinstatement will be the customer's responsibility. Please note that all trenches to be blinded with graded sand before and after cable(s) are laid, the trench then to be back-filled with fine-fill excavated material and reinstatements carried out by you. See above Section (On Site Work).See enclosed Power Systems Guidance Documents. You will be required to provide and attach a backboard of suitable size and fireproof material to the wall at the new meter position. Our equipment will then be fixed to this board. An Energy Networks representative will visit your site before the programmed date to check your ducting is installed correctly, all excavations are completed, and that the site is generally ready for our works to commence. Should the site not be ready your job may be postponed. Your electrical contractor is responsible for your wiring installation. Your contractor will make the final connection to the outgoing terminals of the metering circuit breaker.

Distributed Generation Subject to the provisions of this Letter of Offer, the Customer will carry out or provide or procure the carrying out and provision of the following works and other matters:

1) Installation of site works including generators, transformers, cables, protection and telecommunications equipment. Installation of the Customers 11kV circuit breakers, protection, earthing systems, telecommunications equipment and meters.

2) Provision of a levelled and drained substation site, and indoor facility to accommodate the Distributors 11kV switchgear, associated metering, protection and telecommunications equipment.

3) Provision of suitable access from the public highway to the compound/substation location, suitable for the transport of all of the Distributors equipment and future operational access.

4) Provision of a 230 volt single phase supply for the Distributors battery charger and accommodation for this equipment.

## Part 5

## Substation, Metering and Protection Equipment Accommodation

You will be required to make available suitable accommodation for the Distributor's 11,000 volt metering switchgear by provision of a levelled and drained substation site and indoor accommodation to be agreed with the Distributor. Provision of suitable access from the public highway to the compound/substation location, suitable for the transport of all of the Distributors equipment and future operational 24 hour unrestricted access shall be provided by the customer. In addition you will be required to provide suitable accommodation, including a backboard, for the Distributors metering equipment, battery charger and NVD protection relay. Each space provided should be 1000mm high, 1000mm wide, and 1000 mm deep, and between 500mm and 2000mm above floor level. A minimum of 750mm access in front of the equipment should be provided. Any variations to these dimensions must be agreed with the Distributor.

The above will be provided to the satisfaction of the Distributor at your expense. Notwithstanding any other provisions of this Agreement, any obligation on the Distributor to provide the Substation Accommodation, carry out the Distributors Works and meet any time scales is subject to the Customer, if required by the Distributor, granting, or procuring the grant, to the Distributor of a lease (free of charge save for a nominal premium of £1) to occupy the substation site(s) in such form and on such terms as required by the Distributor. A copy of the Distributors standard form of lease is available on request. Where the Distributor requires that such lease be provided, the Customer shall immediately instruct a lawyer to urgently progress the legal work which requires to be undertaken on behalf of the Customer in order to produce that lease, as any delay in that legal work being undertaken may cause delay to the Distributor providing the Substation Accommodation, carrying out the Distributors Works and meeting any time scales.

## Part 6

## Information Relevant to Competition in Connections

### NON-CONTESTABLE WORKS AND ASSOCIATED COSTS

| Charge Description | Total Cost |
|---|---|
| Charge for the non contestable connection to the network | £ 40,273.76 |
| Reinforcement costs | £ 0 |
| Diversionary works costs | £ 0 |
| **Total Non-Contestable Cost Exclusive of VAT** | £ 40,273.76 |

The Non Contestable Works costs are indicative only and do not include the fees for design approval, inspection and monitoring, witness of testing etc. You have the right to seek a competitive quotation for certain elements of the work required to make your Connection to the Distribution System (the "Contestable Works"). Only suitably accredited connection companies may carry out these Contestable Works. Information on accredited connection companies currently operating within the Distributor's area can be found: http://www.lloydsregister.co.uk/scheme_search.php.

A suitably accredited connection company once appointed can apply for and accept a formal Point of Connection quotation.

## Part 7

## Assumptions and Clarifications

The Distributor has assumed the following within this offer:

This offer and the enclosed design are based upon a desk-top assessment utilising information from existing utility records and information provided by you at the time of application. On occasion the enclosed design may require to be altered. It will be your responsibility to pay for any reasonable and necessary additional costs incurred, including any additional cables, lines or works, in the following circumstances:

a) Where, following completion of a survey of the route, an alternative route is required or deviations to the proposed route are required; and/or
b) Where technical investigations of ground conditions demonstrate that additional work or amendments to the proposed works are required

We will notify you of any additional charges which shall be payable in accordance with the provisions of this Agreement. Where the findings of the survey(s) and/or technical investigations result in a rebate of charges, you shall be notified by us of the amount of the rebate and the timescales within which payment shall be returned to you.

We have provided an undefined provisional sum of £43,470.00 to cover the directional drilling works required to cross the Gala River and any variance to this allowance will constitute a variation to the connection charge.

Should you otherwise require any changes to the enclosed design, please inform us as soon as possible in order that we might consider any necessary changes to the scope of Our Works.

The offer is based on all works being carried out during normal working hours (Monday to Friday 08.30hrs to 16.30hrs). Should there be a third party requirement which results in us having to work out-with normal working hours or reduce the working day, we will notify the Customer of this variation to the works and the Customer shall reimburse the Distributors in accordance with the relevant Conditions. We have not seen or been provided with copies of any reports pertaining to environmental, animal welfare, archaeological digs, areas of special scientific interest, hydrological and topographical matters. We have made no allowance within the Offer sum to cover such matters.

Security for the on-site works shall be provided free of charge by you. You are responsible for insuring the works against loss, theft or damage for the duration of our works. Any loss or damage necessarily incurred by us, howsoever caused, shall be recompensed to us.

We would require a variation order to be instructed to cover any specific matters arising during the course of the works. As we have not been provided with site investigation and / or trial hole details along the route we have made no time or monetary allowance for excavation and reinstatement of any alternative route and / or secondary sub-surface categories subsequently encountered or required for whatever reason. Any additional costs and time incurred in the re-routing, removal and / or making good of same shall constitute a variation to the contract and shall be reimbursed to the Distributor in accordance with the relevant Conditions.

We have made no time or monetary allowance for any noise studies, ground surveys, earthing studies, environmental impact surveys, studies and/or statements. If these studies, etc. are required they shall constitute a variation to the contract and shall be reimbursed to the distributor in accordance with the relevant Conditions (including the cost of using external specialists and legal costs) associated with this work together with any reasonable additional costs arising out of the need to meet the requirements of these studies. We are entitled to determine, in its sole discretion, whether further studies are required as a result of the aforementioned. Where such studies are required we shall be entitled to revise the Scope of the works, the Connection Charge and any dates specified within this Offer by giving written notice to this effect to the Customer and this Offer shall be read and construed as if such revisions were incorporated init.

We have made no allowance for dealing with the excavation and removal of any unforeseen hard materials. e.g. rock, concrete or reinforced concrete etc.

We have made no allowance for costs associated with specialist contractor excavation /reinstatement of non standard surface types. e.g Granite Sets, Caithness slabs etc.

We have made no allowance for working in or the treatment of and/or removal of contaminated /hazardous materials or for the rectification of unavoidable land damage. e.g. field drains, crop damage etc.

## Part 8

## Connection Conditions

### *Connection Agreement*

A Connection Agreement will be required, and needs to be completed before the Customer's installation can be energised. The site specific details (including these in the Offer Letter) will need to be included and any technical or other conditions we may need to impose.

### *Connection/Energisation of Generating Plant*

We are not obliged to permit connection of the Customers Installation (including the Generating Plant) directly or indirectly to the Distribution System unless we are satisfied such Generating Plant will not cause danger to or undue interference with our Distribution System or supply to others. The point of connection will be at the outgoing terminals of the Distributors metering unit. The Distributor shall not be obliged to permit connection of the Customers Installation to the Distribution System nor to energise the Connection Point unless all payments due under this Agreement at that time have been made.

### *Phase Balance and Power Factor*

The Generating Plant output and connected load must be balanced over the three phases and across the circuits, complying with Engineering Recommendation P29 (Planning Limits for Voltage Unbalance). The vector sum of the real and reactive power should not exceed the kVA limit as specified.

### *Distribution Code, etc*

Both parties shall comply with their respective obligations as in the Distribution Code. Other relevant regulations include the Electricity Safety, Quality and Continuity Regulations 2002.Your attention is drawn to the provisions of our Distribution Code under which we are required to prepare and agree with you a responsibility schedule and an operation diagram showing the agreed ownership boundaries. We also refer you to the Electricity at Work Regulations 1989 and the need to ensure that high voltage equipment is operated by competent persons

### *Emergency Trip Facilities*

An individual emergency trip facility will be provided adjacent to the Connection Point metering panel for connection. This will enable you to disconnect your own incoming high voltage supply in an emergency. (The Distributor will be required to re-set this trip facility and re-energise the supply).

### *Variations in Voltage and Frequency*

On occasions incidents outside our control may cause variations in the voltage and frequency referred to above. This may affect the normal operation of sensitive electronic equipment. If there are any problems, we should be contacted on the published telephone number.

### *Disturbance on our Distribution System*

The Generating Plant output and connected load must not cause disturbances on our Distribution System and it is essential that your load characteristics comply with the requirements of Engineering Recommendations G5/4-1 (Limits for Harmonics), P13/1 (Electric motors - Starting Conditions) and P28 (Planning Limits for Voltage Fluctuations). You must submit full details of any load which might cause disturbances, before connection of the Customers Installation (including the Generating Plant) whether covered by these guidance documents or not, for our consideration. Further information is available on request.

***Protection Relays***

It will be necessary for you to contact this office in order to discuss the settings on the protection relays. Protection arrangements and details will be made available on request.

***Generation***

Any installation for generation must comply with the requirements of the Electricity Safety, Quality and Continuity Regulations 2002 and the principles of Engineering Recommendation G59/2 and G75/1 issued by the Energy Networks Association and with the requirements embodied in G5/4-1 and P28 at the connection point. Precise methods of protection and mode or restriction of operation (e.g. Voltage regulation) to be agreed subsequently between the Customer and the Distributor and written into the Connection Agreement. In addition to P28 if your generation causes a voltage depression greater than 1%, no similar voltage depression should be caused within two hours. This is to be achieved by a timing relay. Precise methods of protection and mode or restriction of operation (e.g. Voltage regulation) to be agreed subsequently between the Customer and the Distributor and written into the Connection Agreement.

***Substation***

You are required to provide the Substation Accommodation civil works in a position approved by us and in accordance with our guidance drawings and specifications which will be submitted to you. All builders working drawings must be submitted to us for comment before the commencement of any civil works. You are also required to ensure that the land upon which the Substation Accommodation will be constructed is free from any environmental hazards contamination or pollution and also free from any conducting media including mains drains, sewers, pipes, wires or cables which would prevent or restrict or interfere with the operation of the substation equipment or impose any financial obligations or burdens on the Distributor. The Customer shall be responsible for any works or costs required to comply with the obligations and conditions contained in this paragraph.

The following conditions also apply:-

The Substation Accommodation must be provided by you at your cost on land you own or lease and hold good title to the reasonable satisfaction of the Distributor`s solicitors and you must obtain all Consents of any kind necessary to allow such provision (including any Consents to enable a valid substation Lease to be granted). You must complete the Substation Accommodation civil works:-

a) in a good and workmanlike manner in accordance with good sound working practices and you must obtain at your expense all necessary Consents required (including planning permission and building regulation approval);

b) in accordance with all requisite Consents (including planning permission and building regulation approval);

c) in accordance with the builders working drawings submitted to and approved by us (such approval not to be unreasonably withheld or delayed) and to our reasonable satisfaction; and

d) in accordance with all statutory requirement and subordinate legislation relating in any way to the Substation Accommodation or the construction of it including the Construction and Design Management regulations.

No plant or equipment will be installed in the Substation Accommodation by us or our contractors until we have notified you in writing that the building work (including the construction of the access road) associated with the construction of the Substation Accommodation has been completed to the reasonable satisfaction of our building surveyor and ownership and access rights have been secured by the Distributor.

You shall make available a main 100 amp, 1 phase, 400/230V 50Hz AC electricity supply within the Substation Accommodation and install, maintain and provide these services together with any other services reasonably required by us.

These low voltage supplies must be made available on handover of the Substation Accommodation and the Customer is responsible for the ongoing provision of these supplies. The supplies shall be from secure sources (stand-by generators are not acceptable) to support battery chargers supplying protection.

Where the Distributor gives any approval under the provisions of this Agreement such approval shall be given solely for the purpose of this Agreement and save where express written representations are made the Distributor does not give any warranty or guarantee express or implied as the matter the subject of the approval and the Customer must rely on its own skill and judgement as regards such matters.

The Distributor will provide the Customer with details of the Distributor requirements for the Substation Accommodation to assist with the Customer`s obligations under this Offer Letter including the planning application.

***Metering***

You or your chosen supplier must appoint an approved meter operator who will be responsible for the installation of the necessary import/export metering which must comply with the relevant metering code of practice.

***Special Generation Connection Conditions***

Schedule 4 of the Connection Agreement sets out the details of these conditions. Some of these conditions will apply prior to the connection being made. The following restrictions and constraints on the availability of the export capacity shall apply:-

a) The connection provided is "Unfirm".

b) During System Normal the maximum export capacity is as stated in part 2 Connection Characteristics above.

c) The Distributor may plan and execute other outages of its distribution system as mentioned in the Connection Agreement.

The above special conditions do not cater for the emergency situations, which may occur from time to time. The Distributor also reserves the right to instruct generators to reduce or curtail power export and reactive power import during time of operational difficulties (or as so directed by our control engineer).

The provision of this clause will be repeated in the Connection Agreement.

## ACCEPTANCE COPY - TO BE RETURNED TO SP POWER SYSTEMS LIMITED

| | |
|---|---|
| TO<br>SP Power Systems Ltd<br>Shared Service Centre<br>3rd Floor Avondale House<br>Phoenix Crescent<br>Strathclyde Business Park<br>Bellshill ML4 3NJ | From<br>New Earth Solutions Group Ltd<br>Key House<br>35 Blackmoore Road<br>Ebblake Industrial Estate<br>Verwood Dorset |

**Offer of Load and Distributed Generation – Re QAS 91351 Easter Langlee ATT Fuel Preparation and Energy Production Facility, Langlee Road, Galashiels, Scottish Borders, TD1**

The cost for this work will be £771,943.09 (exclusive of vat) The Connection Charge will be paid in the following stages:

1. Payment on acceptance of the Offer — £50,000.00 plus VAT
2. Payment ten working days in advance of placing contract for switchgear and cable procurement. — £200,000.00 plus VAT
3. Payment ten working days in advance of placing cable laying contract and substation installation. — £521,943.09 plus VAT

**[Cheques should be made payable to SP Distribution Ltd for the staged payment amount.]**

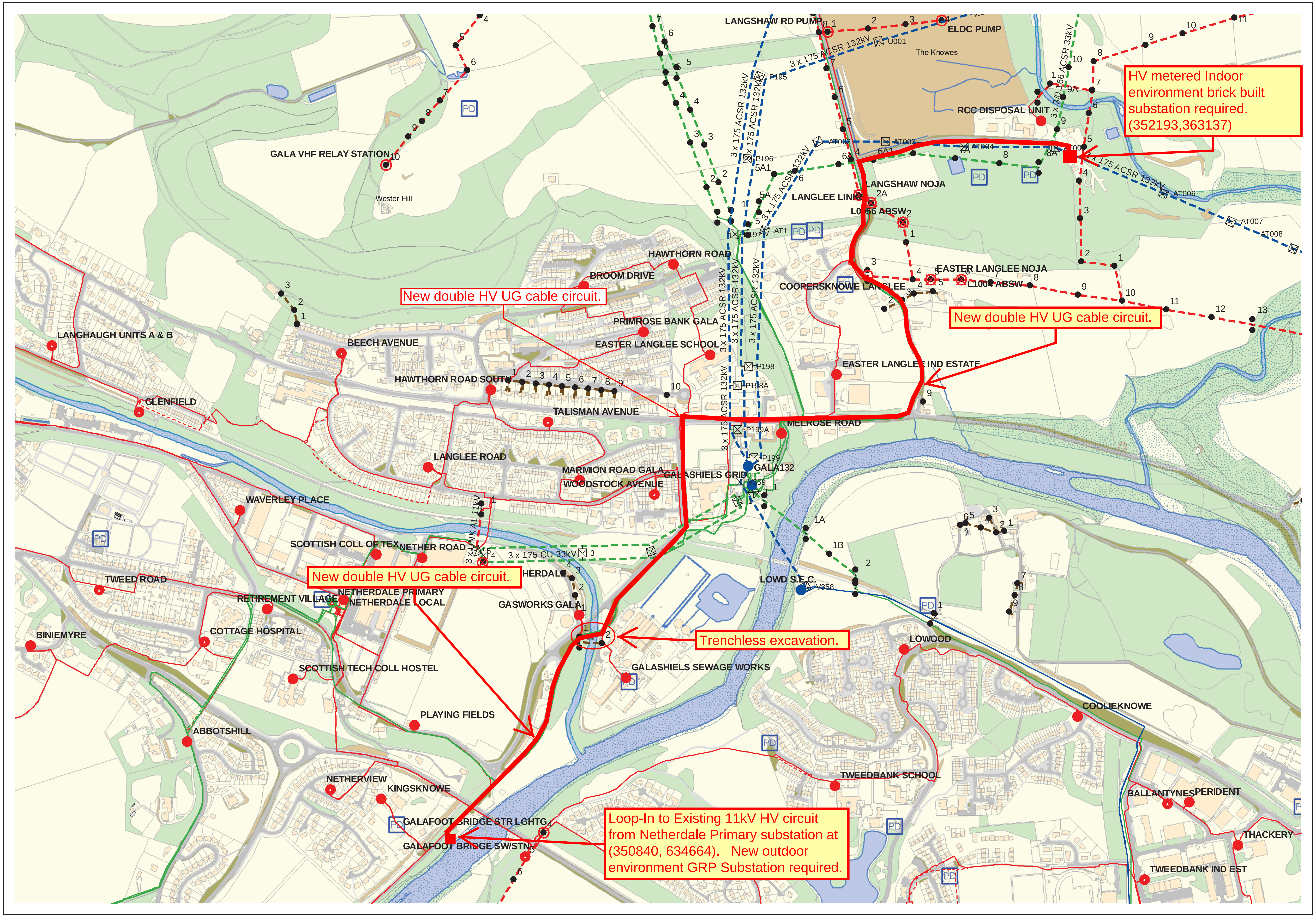
A supply of 1.1MVA with an Export capacity of 4.7368MVA will apply to the site. Please refer to Part 2 of the above Schedule for the full Connection Characteristics. TT earthing will apply in accordance with the British Standard Requirements for Electrical Installations BS 7671:2008 (IEE Wiring Regulations 17th Edition).

**Acceptance and Declaration**

1. I/We accept the offer and agree to the terms and conditions set out in the offer letter referenced above.
2. I/We enclose the first of the Charge(s) associated with the above connection made payable to SP Distribution Ltd
3. I/We warrant that I/we will employ a competent electrical contractor who will ensure that the Customer's Electrical Installation is constructed and installed according to the British Standard Requirements for Electrical Installations BS 7671:2001 IEE Wiring Regulations 17th Edition.
4. I/We warrant that I am/we are not the nominee or agent of an undisclosed principal and that I/we will assume sole and complete responsibility for the performance of the Customer's obligations under the Agreement.
5. I warrant that I am appointed by and acting with the authority of the Customer and that I am an authorised signatory for the Customer with full authority to enter into the Agreement on behalf of the Customer. If I do not have such authority, I shall be personally liable under the Agreement.
6. I/We warrant that SP Distribution Ltd will be informed of a change of responsibility for the electricity supply and / or connection.
7. I/We understand that an electricity supplier must be appointed before a meter can be installed to complete the connection.
8. I/We understand that there is a choice of Electricity Suppliers available. **Upon payment and acceptance SP Power systems Ltd will issue the MPAN reference number(s) which I/we will need in order to enter into a contract with a chosen Energy Supplier.**
9. **Once I/we have entered into a supply contract I/we shall return the Supplier Notification Letter with the relevant information.**
10. I/We understand that 1/we will have to enter into a contract with an Energy Purchaser who will issue an export MPAN reference number. **Once I/we have entered into an export contract and have an export MPAN reference number I/we will return the Supplier Notification letter with the relevant information.**

| | |
|---|---|
| **For and on behalf of the Customer:** | **Date:** |
| **Print Full Name:** | **Position:** |
| Site contact name: | Site telephone number: |
| Requested connection date: | I enclose payment of: £50,000 (plus VAT) |

**This acceptance requires to be signed by a person with the necessary authority to bind the Customer, e.g. a Director.** Please complete and return the following with your acceptance: CDM Information Request Form



HV metered Indoor environment brick built substation required. (352193,363137)
New double HV UG cable circuit.
New double HV UG cable circuit.
New double HV UG cable circuit.
Trenchless excavation.
Loop-In to Existing 11kV HV circuit from Netherdale Primary substation at (350840, 634664). New outdoor environment GRP Substation required.
LANGSHAW RD PUMP
ELDC PUMP
The Knowes
RCC DISPOSAL UNIT
GALA VHF RELAY STATION
Wester Hill
LANGSHAW NOJA
LANGLEE LINKS
L0056 ABSW
EASTER LANGLEE NOJA
L1004 ABSW
COOPERSKNOWE LANGLEE
HAWTHORN ROAD
BROOM DRIVE
PRIMROSE BANK GALA
EASTER LANGLEE SCHOOL
EASTER LANGLEE IND ESTATE
LANGHAUGH UNITS A & B
BEECH AVENUE
HAWTHORN ROAD SOUTH
GLENFIELD
TALISMAN AVENUE
MELROSE ROAD
LANGLEE ROAD
MARMION ROAD GALA
GALASHIELS GRID
GALA132
WOODSTOCK AVENUE
WAVERLEY PLACE
SCOTTISH COLL OF TEX
NETHER ROAD
3 x 175 CU 33kV
HERDALE
GASWORKS GALA
LOWD S.E.C.
TWEED ROAD
RETIREMENT VILLAGE
NETHERDALE PRIMARY
NETHERDALE LOCAL
BINIEMYRE
COTTAGE HOSPITAL
LOWOOD
GALASHIELS SEWAGE WORKS
SCOTTISH TECH COLL HOSTEL
PLAYING FIELDS
ABBOTSHILL
COOLIEKNOWE
NETHERVIEW
KINGSKNOWE
TWEEDBANK SCHOOL
BALLANTYNES
PERIDENT
GALAFOOT BRIDGE STR LGHTG
GALAFOOT BRIDGE SW/STN
THACKERY
TWEEDBANK IND EST
3 x 175 ACSR 132kV
3 x 300 66 ACSR 33kV

**Appendix 2;**
**Waste composition**

**a. Zero Waste Scotland "The Composition of Municipal Solid waste in Scotland" final report, April 2010**
**b. Scottish Borders Council; Household (Rural) waste Analysis, June 2009**
**c. NES Comparator waste data from NES Avonmouth facility, 2013**

ZERO WASTE SCOTLAND

natural scotland
SCOTTISH GOVERNMENT

**Final report**

# The composition of municipal solid waste in Scotland


A report that describes the composition of municipal solid waste in Scotland from the physical analysis of waste collected by a representative sample of local authorities. The information can be used by national and local governments and by the waste management industry to inform waste management policy and practice.

**Project code:** EVA098-001
**Research date:** March to December 2009
**ISBN:**
**Date:** April 2010

Zero Waste Scotland is the new programme created by the Scottish Government to support delivery of its Zero Waste Plan.

It will integrate the activities of WRAP Scotland, Waste Aware Scotland, Keep Scotland Tidy, Remade Scotland, Envirowise in Scotland, NISP in Scotland, and some programmes delivered by the Community Recycling Network for Scotland.

Our vision is a world without waste, where resources are used sustainably.

Find out more at www.zerowastescotland.org.uk

**Written by:** WastesWork and AEA

**Front cover photography:** [Image of plastic bottles © Zero Waste Scotland.]

# Executive summary

**Aims and objectives**

The Scottish Government is committed to a more sustainable approach to waste management. Scotland has increased its municipal waste recycling rate from less than 5% in 2000 to over 34% by 2008/09. In 2009 the Scottish Government consulted on a new 'Zero Waste' plan for Scotland, which included a target to recycle or compost 70% of municipal waste by 2025. Although some local authorities in Scotland have conducted analyses of a number of the waste streams that comprise municipal waste (e.g. normal or “residual” household collected waste and waste arising at household waste recycling centres), knowledge about the overall composition of municipal waste in Scotland is limited. The Scottish Government identified the need to commission a full-scale waste composition analysis of municipal solid waste (MSW) in Scotland. The analysis will increase overall confidence in the available data and help underpin future service and policy decisions.

A steering group, with representatives from Scottish Government, SEPA, and Zero Waste Scotland was set up to oversee the project. Also participating in the steering group were the local authorities selected to take part in the study. The work was commissioned for Scottish Government by Zero Waste Scotland. It was delivered by WastesWork, supported by AEA, between March and December 2009.

**What was done**

Waste composition analysis was carried out in eight of the 32 local authorities in Scotland. The participating local authorities were selected to represent Scotland as a whole, according to a sampling framework based on the following factors; frequency of residual waste collection (weekly or fortnightly), frequency of recycling collection (weekly or fortnightly), population density (urban or rural), and multiple deprivation (more or less deprived). The study was not designed to compare the waste management practices and/or recycling performance of the eight authorities which participated in the project.

The eight local authorities selected were Edinburgh, Glasgow, East Dunbartonshire, Highland, Moray, Orkney Islands, Renfrewshire and South Ayrshire. All those selected agreed to participate in the study. Sampling areas within each local authority were then selected using socio-economic profile data to provide a suitably representative sample of the overall Scottish population and the local authority.

Compositional analyses were conducted in two seasons; spring (April) and autumn (September) 2009. Analyses of the following MSW streams were conducted in all eight participating authorities; residual household collected waste, kerbside collected dry recyclables and green waste, residual waste at household waste recycling centre (HWRC) sites, litter, trade waste collected by local authorities and schools waste. Analyses were also conducted for parks & garden waste and beach cleaning waste where samples were available. Two local authorities provided records of their bulky household collections, and these were used to determine the composition of this stream. Data from the compositional analysis was then used alongside WasteDataFlow records to determine the overall composition of MSW in Scotland and to identify material types that might be targeted for further recycling or composting.

**The composition of waste**

The study analysed a total of 85 tonnes of municipal waste. The composition of each waste stream, together with an analysis of the overall composition of MSW in Scotland, provides local authorities in Scotland with sufficiently robust information to enable them to further develop their recycling and composting strategies.

The three main waste streams (based on Waste data flow data for 2008/9) that comprised MSW in Scotland are:

- Residual household collected (dustbin) waste – 47% of overall MSW arisings
- Residual waste arisings at household waste recycling centre (HWRC) sites – 8% of overall MSW arisings
- Trade waste collected by local authorities – 8% of overall MSW arisings.

Other waste streams, which include litter and bulky household waste, represent about 5% by weight of overall MSW arisings in Scotland. The remainder was recycled.

### Overall composition of MSW in Scotland

Figure E1 shows that the main components of MSW in Scotland are paper & card (21%) and food/kitchen waste (18%); which between them represent approximately 39% by weight of total MSW arisings. The third largest component is garden waste, which represents 13% by weight of the total MSW arisings in Scotland. The overall composition of MSW in Scotland is similar to both that determined in a study in Wales in 2002/03 and the composition determined by the Defra review of compositional analyses (mostly conducted in England) published in 2009. Thus the datasets used to determine the overall composition of MSW in Scotland are considered to be robust.

The overall biodegradable content of municipal solid waste in Scotland is 62.9%. The 95% confidence intervals for the biodegradable content of MSW in Scotland were ±1.5%, which means that there is a 95% probability that the biodegradable content of MSW in Scotland is between 61.4% and 64.4%.

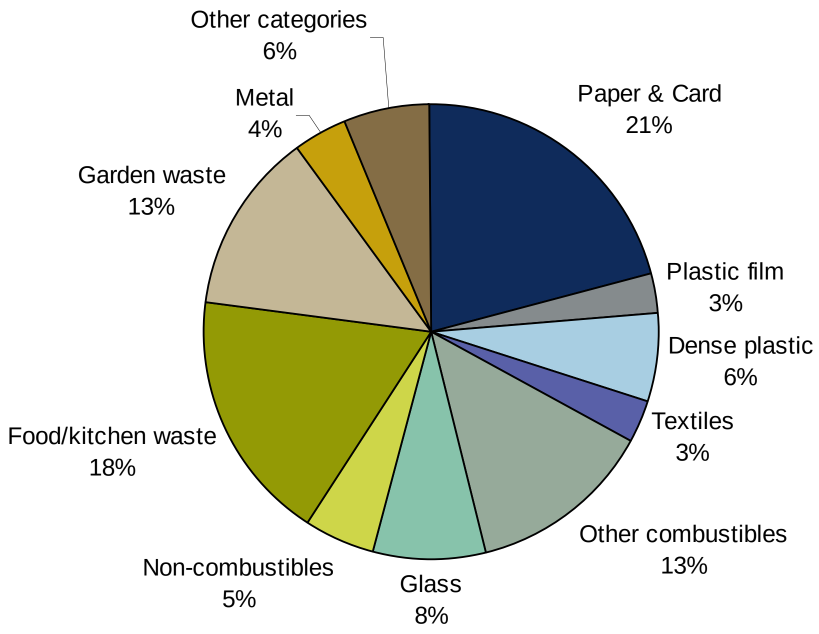



Figure E1: Overall composition (weight %) of MSW in Scotland

### The composition of residual waste

Residual waste is of particular interest as this is the material that is currently sent to landfill. Table E1 shows the composition of the main residual waste streams determined from this study. Specific findings include:

- Food/kitchen waste represents about one third (by weight) of the residual household collected (dustbin waste) stream.
- Residual waste arising at household waste recycling centre (HWRC) sites contains about 40% of the 'other combustibles' category. This category includes wood.
- The main components of trade waste collected by local authorities are paper & card and food/kitchen waste. There are differences in the composition of waste produced by different types of business; for example, the proportion of food/kitchen waste is highest in waste from cafes/restaurants and care homes, and the proportion of cardboard is highest in waste from retail premises.
- The main components of bulky household waste are furniture and white goods.
- The main components of waste from schools are paper & card and food/kitchen waste.

Table E1: Composition (percentage by weight) of residual waste in Scotland

| | Residual household collected waste | Residual waste arising at household waste recycling centres | Residual trade waste collected by local authorities |
|---|---|---|---|
| Paper & card | 15.9 | 9.6 | 39.8 |
| Plastic film | 4.5 | 2.2 | 7.7 |
| Dense plastic | 9.2 | 8.4 | 9.3 |
| Textiles | 4.3 | 6.4 | 1.3 |
| Other combustibles | 13.1 | 39.6 | 5.0 |
| Glass | 5.5 | 3.4 | 4.3 |
| Other non-combustibles | 3.3 | 11.9 | 0.9 |
| Food/kitchen waste | 31.5 | 3.8 | 20.9 |
| Garden waste | 2.6 | 4.6 | 1.8 |
| Other organics | 1.1 | 0.4 | 2.3 |
| Metal | 4.1 | 4.2 | 4.6 |
| Hazardous items | 0.9 | 1.0 | 0.1 |
| Electrical items | 1.5 | 4.1 | 0.5 |
| Fines | 2.6 | 0.6 | 1.5 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Current recycling**

Contamination of current recycling by non-targeted materials was low. The dry recyclables stream contained small amounts of a number of non-targeted materials such as wood, other (non-packaging) glass, food/kitchen waste and waste electronic and electrical equipment (WEEE). The green waste stream contained less than 1% by weight of food/kitchen waste. The average capture rates that were achieved by the kerbside schemes in Scotland ranged from 67% for newspapers and magazines to 19% for plastic bottles and are comparable to those determined in other studies.

The overall recycling rate achieved at the HWRC sites in Scotland in 2008/09 was 56%. Capture rates for potentially recyclable or compostable materials ranged from over 70% for garden waste, construction and demolition (C & D) waste, WEEE, and metal, to less than 20% for dense plastic and textiles. These are comparable to capture rates determined in other studies.

**Opportunities for further recycling**

One of the objectives of this study was to provide information on the occurrence of recyclable or compostable materials that are contained within municipal solid waste in Scotland. Table E2 shows that 76% of the overall MSW comprises materials classified as recyclable or compostable, which could potentially be separated for recycling or composting. There may also be carpet that is suitable for recycling within the “other combustibles” category, and approximately 2% by weight of overall MSW is furniture. Some of this furniture and also some of the waste electrical items may be suitable for re-use.

Table E2: Arisings of potentially recyclable or compostable material in MSW in Scotland (as % of overall MSW by weight)

| Category | Weight % |
|---|---|
| Newspapers & magazines | 9 |
| Recyclable paper | 4 |
| Cardboard boxes and containers | 4 |
| Dense plastic bottles | 3 |
| Other plastic packaging | 2 |
| Textiles and shoes | 3 |
| Wood | 3 |
| Packaging glass | 7 |
| C&D waste (rubble) | 4 |
| Metal | 3 |
| Food/kitchen waste | 18 |
| Garden waste | 13 |
| Other (electrical items, oil, batteries) | 3 |
| **Total** | **76** |

The 2009 draft Zero Waste Plan for Scotland sets a target to collect and either recycle or compost 70% of MSW by 2025. The findings from this study suggest approximately three quarters (76%) of MSW in Scotland is made up of potentially recyclable and compostable material. It is important to highlight that the 76% calculated from this study represents what is available for potential capture using recycling and composting collections. Actual capture rates (i.e. the amount of material collected as a proportion of the total available in the waste stream) will vary according to a wide range of technical and socio-economic factors beyond the scope of this work.

In order to highlight opportunities for further recycling and composting it is useful to consider the current availability and capture of recyclable/compostable materials in the different MSW streams. Figure E2 shows the occurrence of materials commonly targeted for recycling or composting. For each material type their occurrence is subdivided according to the four main types of residual waste (that which commonly goes to landfill) and that which is separated for recycling/composting. The key findings from Figure E2 include:

- 67% of newspapers & magazines are currently collected for recycling and 22% are found in residual household collected (dustbin) waste
- 23% of cardboard is collected separately for recycling and a further 45% is found in residual household collected waste
- 20% of plastic bottles are currently recycled and 60% are found in residual household collected waste
- 83% of food/kitchen waste is found in residual household collected waste and a further 9% is in collected trade waste
- 83% of garden waste is currently collected for composting
- 52% of wood is recycled or composted and 27% is found in residual household waste recycling centre (HWRC) waste
- 21% of cardboard arises in the collected trade waste stream.

Local authorities will need to target the residual household collected waste stream, the residual household waste recycling centre (HWRC) stream and the trade waste stream if they wish to maximise the amount of material collected for recycling and composting in the future.

For household waste it is useful to consider waste on a kg per household basis. The average weight of residual household collected waste from samples in this study was 10.2 kg per household per week. As food/kitchen waste represents about 32% by weight of this stream, the typical arisings of food/kitchen waste are estimated at 3.2 kg/household per week. The typical arisings for a number of other potentially recyclable materials that occur in residual household collected waste were:

- newspapers and magazines – 0.4 kg/household per week;
- other paper – 0.7 kg/household per week (although a proportion of this currently can not be recycled);
- cardboard – 0.5 kg/household per week;
- plastic bottles – 0.3 kg/household per week;
- packaging glass – 0.5 kg/household per week; and
- metal cans – 0.2 kg/household per week.

This suggests that there is the potential to capture up to an additional 5 kg/household per week of recyclable or compostable material (including food/kitchen waste) from households through kerbside collection schemes.

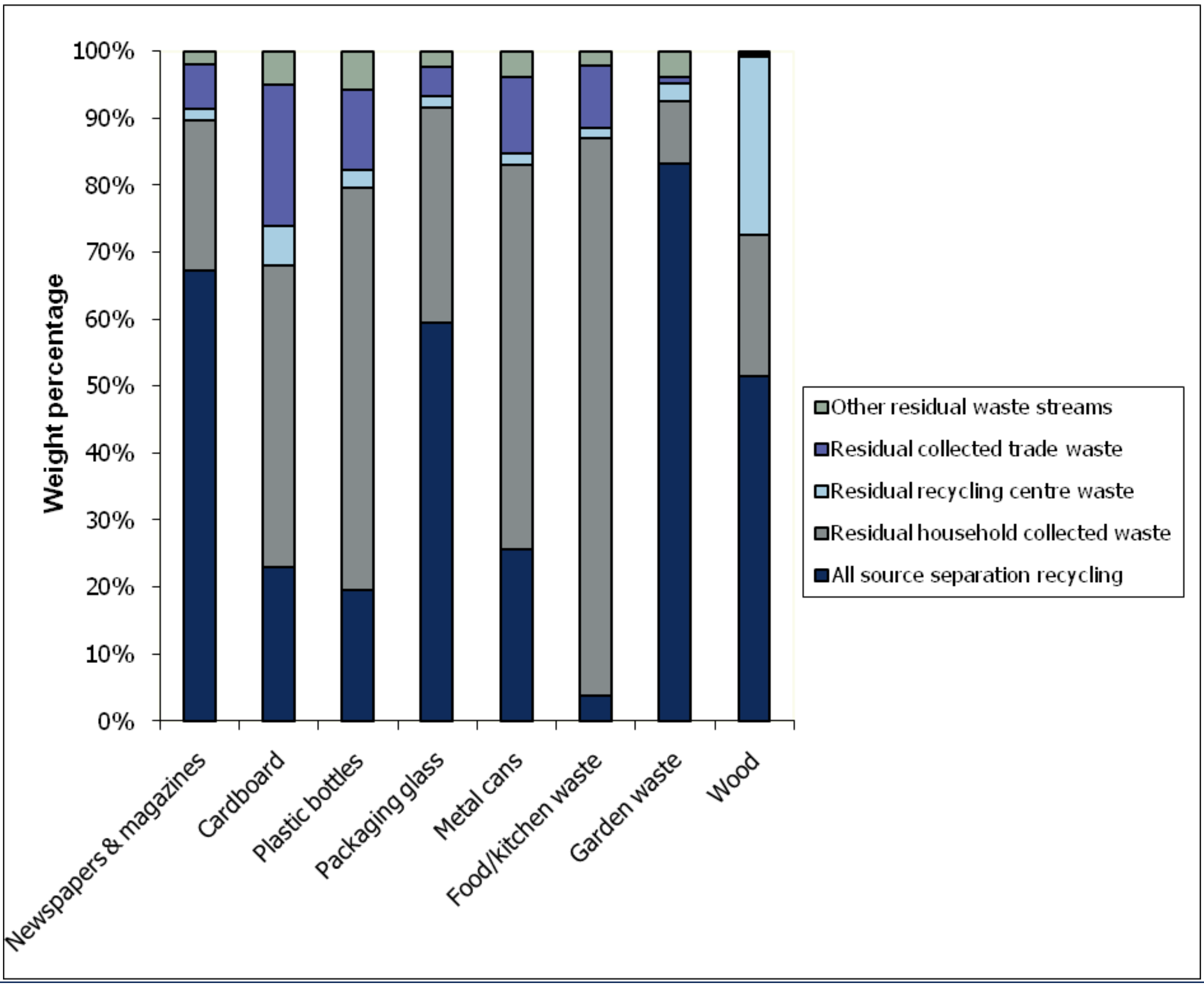



Figure E2: Distribution of the common recycled or compostable material types between MSW streams

# Contents



**List of Figures**



**List of Tables**

# Glossary

ACORN – A Classification of Residential Neighbourhoods
HHW – Household Hazardous Waste
HWRC – Household Waste Recycling Centre
MSW – Municipal Solid Waste
SEPA – Scottish Environment Protection Agency
WEEE – Waste Electrical & Electronic Equipment

# Acknowledgements

The authors would like to thank both the members of the Steering Group and the eight participating authorities (East Dunbartonshire, Edinburgh, Glasgow, Highland, Moray, Orkney Islands, Renfrewshire and South Ayrshire) for their help with completing the project.

## 1.0 Introduction

Before devolution in 1999, Scotland was almost wholly dependent on landfill to treat its waste. However, since then, Scotland has started on the journey towards treating waste arising from households and business as a resource:

- The recycling and composting rate for municipal waste[1] has increased from around 5% in 2000 to over 34% in 2008/09.
- The total amount of controlled waste sent to landfill has reduced from 10.9 million tonnes in 2000 to 7.4 million tonnes in 2007.
- Progress has been made on meeting European Union targets and Scotland has already achieved the 2009/10 target on reducing the amount of biodegradable municipal waste sent to landfill.

The Scottish government's Zero Waste plan consultation in 2009 sets out proposals for a challenging programme of change over the next 15 years which will continue to move Scotland away from an over-reliance on landfill and maximise the use of unavoidable waste. The plan includes the following targets for 2025:

- infrastructure to collect, recycle and compost 70% of municipal waste (around 2.4 million tonnes). This will include recycling centres, transfer stations, Material Recovery Facilities (MRFs, to process dry recyclates), composting facilities and anaerobic digestion facilities;
- treating no more than 25% of its municipal waste (no more than 850,000 tonnes) in energy from waste facilities;
- landfilling no more than 5% of its municipal waste (no more than 170,000 tonnes).

In developing the new waste plan, the Scottish Government has been looking in more detail at waste statistics in order to:

- ensure appropriate information is available to adequately assess the recycling, composting and treatment facilities required to meet the requirements set by the waste strategy;
- ensure that sufficient suitable facilities are provided to meet the requirements set by both the Landfill Directive and the new Waste Framework Directive; and
- develop more sustainable waste management practices.

However, knowledge about the composition of municipal waste in Scotland is limited. Some local authorities have commissioned or carried out their own analyses of some of the waste streams that make up municipal solid waste (mainly just the residual household collected waste stream) but these have used a variety of methods, and have been designed to suit local needs rather than producing data which could be used to create a national picture for Scotland. Consequently, the Scottish Government identified the need to commission a full-scale waste composition analysis.

A steering group, with representatives from Scottish Government, the Scottish Environmental Protection Agency (SEPA) and Zero Waste Scotland was set up to oversee the project. Also participating in the steering group were the local authorities selected to take part in the study and Waste Aware Scotland and Remade Scotland. The four objectives of this project were to:

- estimate the composition of Scottish municipal solid waste (MSW) as a whole;
- estimate, by physical analysis, the composition of the eight main waste streams that make up MSW;
- provide MSW data specific to each of the eight participating local authorities; and
- use a methodology that will be comparable with similar projects carried out in other parts of the United Kingdom.

The study was commissioned by Zero Waste Scotland on behalf of the Scottish Government, and a consortium of WastesWork and AEA was selected to deliver the study following Zero Waste Scotland's evaluation of competitive tender responses.

The work was managed by WastesWork, supported by AEA as the subcontractor. WastesWork developed the sampling strategy and conducted the analysis work, and AEA collated and reported the results. This report describes how the methodology for obtaining the data was developed, presents the results from the analyses of

---

[1] *Municipal waste is defined by the Scottish Government as all waste for which a local authority makes arrangements, with a few exceptions, mainly being industrial waste taken for disposal or treatment separately from any other waste (SEPA website). For this study we sampled waste from the list provided in Section 2 below.*

each stream which were conducted, and provides information on the overall composition of MSW in Scotland. The occurrence and capture of recyclable materials is then considered in order to highlight potential opportunities for further recycling and composting. Finally, it considers ways in which an ongoing programme of sampling might be designed and undertaken.

Eight local authorities participated in the study and were selected according to a sampling framework described in section 2.1. The study was designed to provide information on the overall composition of MSW in Scotland, and there was no intention to compare the performance of the eight authorities which participated in the project. This report presents average results for Scotland; more detailed information for each of the eight participating authorities can be found in separate reports supplied to each local authority.

## 2.0 Development of the approach

The main areas which needed to be considered in developing the methodology to conduct the study were:

- selection of the sampling areas;
- development of a category classification system; and
- development of methodologies for sampling each waste stream.

The streams which were sampled were all of the main municipal waste streams:

- collected household waste, including household waste from flats and tenement blocks;
- commingled materials for recycling/composting where data on the separate amounts does not exist;
- civic amenity (HWRC) waste (the mixed waste stream only);
- litter and street sweepings;
- bulky uplift waste;
- parks and gardens (if a mixed waste stream); and
- trade waste.

The project did not sample either gully emptyings or household clinical waste. SEPA has prepared guidance on analysing household waste (National Methodology for Household Waste Composition Analysis in Scotland), but Zero Waste Scotland had identified three exceptions to this guidance for this specific project:

- The selection of households was to be based on small areas such as street blocks rather than a random selection of households within an area as this is operationally much easier to achieve.
- ACORN (A Classification of Residential Neighbourhoods) was to be used to represent socio-demographic differences rather than council tax band; this will ensure there is comparability between the Scottish study and the studies in England and Wales on which any new estimate of biodegradability that may be produced is likely to be based.
- Sub-categories would be added to the high level categories to make the analysis more useful for policy and strategy purposes.

These exceptions were included in the development of the methodology for this study.

### 2.1 Selection of sampling areas

Prior to awarding the project, Zero Waste Scotland and the project Steering Group had already carried out some preliminary work on sample selection.  The principle factor for the design of the sampling frame was to ensure that the local authorities selected were representative of the types of waste and recycling collection systems used in Scotland at the time of the study. A sampling matrix was then developed that categorised local authorities according to the three factors below:

- waste collection method and collection frequency for both residual waste and recycling;
- urban/rural[2] location; and
- relative levels of multiple deprivation[3].

[2] *For the purposes of this project urban has been defined as a population density of 10 people per hectare or more while rural is less than 10. Whilst this does not consider the more complex SERU 8 classification commonly used in Scotland this approach was seen as a sensible compromise when designing the sample framework*

[3] *Each of Scotland's 32 local authorities were given a relative rank according to the overall level of multiple deprivation in each local authority area using Scottish Index of Multiple Deprivation (SMID) statistics. For the purposes of obtaining a workable*

Table 1 shows the eight local authorities which were selected to meet these requirements.

Table 1: Sampling strategy for the eight local authorities selected for this study

| Collection frequency | | SIMD 17-32 | SIMD 1-16 |
|---|---|---|---|
| **Residual waste** | **Recycling** | | |
| Weekly sack | Fortnightly | Orkney Islands | |
| Weekly wheeled bin | Weekly | East Dunbartonshire | |
| Weekly wheeled bin | Fortnightly | Edinburgh<br>Highland | Glasgow<br>Renfrewshire |
| Fortnightly wheeled bin | Weekly | Moray | |
| Fortnightly wheeled bin | Fortnightly | | South Ayrshire |

No authorities in Scotland provide weekly sack and weekly recycling, or fortnightly sack and weekly recycling collections. These collection systems were not included in the sampling matrix. Glasgow and Edinburgh were classified as urban authorities; the other six authorities were classified as rural authorities. Following development of the sampling frame all of the selected authorities agreed to participate in the project.

Table A1 in Appendix A shows the collection systems used in each of the selected authorities, together with the types of dry recyclables that are collected, and the number of household waste recycling centre (HWRC) sites.

Residual household waste is the largest single stream of municipal waste, and so it is important that it is analysed to the highest levels of accuracy. In order to gain a representative picture the selection of sample areas for residual household waste analysis is commonly based on the socio-economic characteristics of households. The ACORN system has become the standard method for profiling the socio-economic characteristics of households. The system was designed to reflect purchasing patterns and uses census data to determine which of five main categories (1 is the most affluent and 5 is the least affluent) each household is placed into. Purchasing patterns significantly influence waste composition, and thus as a tool, the profile very neatly differentiates between householder types in terms of their spending power, number and the age of the occupants. After input from the steering group it was decided to use the ACORN system to select the individual sample areas for household waste in this study.

Table 2 below shows the ACORN Category profile for Scotland. This is the broadest level of profiling, and shows that the dominant ACORN Category is ACORN 5 (hard pressed), with fairly equal concentrations of ACORN Categories 1 and 2 and lower proportions for ACORN 3 and 4.

Table 2: ACORN Category profile for Scotland

| ACORN Category profile | | No. of households | Data as % for Scotland |
|---|---|---|---|
| 1 | Wealthy Achievers | 480,378 | 20.6 |
| 2 | Urban Prosperity | 422,142 | 18.1 |
| 3 | Comfortably Off | 395,964 | 16.9 |
| 4 | Moderate Means | 189,366 | 8.1 |
| 5 | Hard-Pressed | 838,510 | 35.9 |
| | Unclassified | 10,500 | 0.4 |
| | **Total** | **2,336,860** | **100.0** |

The second level of ACORN profiling (see Table 3 below) provides a more detailed picture of which household groups need to be included in the sampling. To gain adequate cover of each ACORN category it is important to ensure that different age groups, families with or without children and the different ages of children. The selected sample areas used in the current study are highlighted in green in Table 3.

*sample frame for this study, local authorities with a score of 17 or more were simply classified as being "less deprived" and authorities with a score of 16 or less were classified as being "more deprived".*

Table 3: ACORN group profile for Scotland based on 2001 Census data, boxes shaded in green show household types sampled in this study

| ACORN Category | ACORN Group and description | | East. Dunbartonshire % of HH | Edinburgh % of HH | Glasgow % of HH | Highland % of HH | Moray % of HH | Orkney % of HH | Renfrewshire % of HH | South Ayrshire % of HH | Scotland No of HH | Scotland % of HH | Samples analysed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Wealthy Executives | 16.43 | 4.02 | 0.61 | 7.91 | 4.61 | 1.61 | 6.86 | 7.06 | 134033 | 5.74 | 2 |
| | B | Affluent Greys | 3.94 | 2.69 | 0.12 | 26.72 | 21.20 | 49.10 | 0.96 | 14.78 | 201714 | 8.63 | 3 |
| | C | Flourishing Families | 15.49 | 2.75 | 1.22 | 7.72 | 8.42 | 8.85 | 7.16 | 5.80 | 144631 | 6.19 | 2 |
| 2 | D | Prosperous Professionals | 5.97 | 8.11 | 2.00 | 1.04 | 1.11 | 0.64 | 1.74 | 3.62 | 70176 | 3.00 | 1 |
| | E | Educated Urbanites | 3.05 | 35.93 | 21.71 | 1.55 | 0.58 | 0.21 | 7.18 | 5.10 | 213622 | 9.14 | 2 |
| | F | Aspiring Singles | 2.66 | 9.89 | 6.93 | 3.39 | 5.70 | 6.29 | 5.78 | 4.42 | 138344 | 5.92 | 1 |
| 3 | G | Starting Out | 2.76 | 3.45 | 1.79 | 3.20 | 1.86 | 1.12 | 3.33 | 2.50 | 59688 | 2.55 | 0 |
| | H | Secure Families | 16.61 | 4.09 | 5.18 | 7.47 | 10.50 | 2.03 | 12.20 | 8.68 | 208383 | 8.92 | 2 |
| | I | Settled Suburbia | 1.87 | 0.82 | 0.34 | 6.06 | 7.03 | 7.08 | 1.47 | 4.05 | 55816 | 2.39 | 1 |
| | J | Prudent Pensioners | 4.41 | 2.00 | 1.04 | 4.30 | 4.87 | 4.13 | 2.01 | 3.88 | 72077 | 3.08 | 0 |
| 4 | K | Asian Communities | 0.00 | 0.01 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 645 | 0.03 | 0 |
| | L | Post-Industrial Families | 3.43 | 2.16 | 1.75 | 2.05 | 2.77 | 0.61 | 5.27 | 3.31 | 86659 | 3.71 | 1 |
| | M | Blue-Collar Roots | 5.06 | 2.01 | 2.42 | 3.91 | 3.97 | 1.45 | 7.70 | 8.41 | 102062 | 4.37 | 2 |
| 5 | N | Struggling Families | 10.28 | 5.54 | 8.40 | 17.36 | 20.16 | 12.17 | 10.35 | 14.14 | 377151 | 16.14 | 3 |
| | O | Burdened Singles | 5.58 | 7.37 | 16.73 | 5.68 | 5.22 | 4.47 | 14.38 | 8.64 | 245357 | 10.50 | 3 |
| | P | High-Rise Hardship | 2.12 | 8.00 | 24.25 | 1.53 | 1.25 | 0.24 | 13.16 | 5.20 | 201215 | 8.61 | 2 |
| | Q | Inner City Adversity | 0.00 | 0.55 | 4.37 | 0.00 | 0.00 | 0.00 | 0.12 | 0.00 | 14787 | 0.63 | 0 |
| Unclassified | | | 0.36 | 0.59 | 1.00 | 0.10 | 0.75 | 0.00 | 0.32 | 0.39 | 10500 | 0.45 | 0 |
| Total | | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 2336860 | 100.0 | 25 |

As can be seen from the shaded green boxes in Table 3, the majority of household groups in Scotland were covered by the sampling strategy in the current study. The most commonly occurring household types were sampled the most frequently, e.g. 5.N and 5.O. To provide each participating local authority with a usable level of data three household groups were sampled in each local authority area. The dominant ACORN group in each local authority was identified first. The other two sample areas were then selected to cover the more dominant groups in each local authority area. In some cases the need for a representative national picture meant that less commonly occurring household types for a given local authority area were sampled.

Household waste samples were taken from all types of properties including flats. The research objectives and associated sampling methodology in the current study was not designed to measure the impact of other types of housing or socio-economic classification (e.g number of persons, employment status, ethnicity).

For each ACORN group, one street containing more than 32 households was identified by the local authority. The housing types were checked using postcode information that was then verified with CACI (ACORN database developers). In total the residual waste from approximately 770 households was collected for each of the two sampling seasons.

## 2.2 Development of a waste category classification system

The category classification system was based on SEPA guidelines, but in order to develop the sub-category classification required for this study it was necessary to take account of both the level of detail required by the Scottish Government in reporting waste composition, and the cost implications of using a very detailed sub-classification system. The level of detail in the sub-category classifications needed to be sufficient to meet all the requirements for this programme. In addition, any sub-category classification also needed to take account of items in different waste streams. Following discussion with the Steering Group, the 59 category classification normally used by WastesWork was adopted for this study. This is shown in Table B1 in Appendix B.

This category listing enabled each of the following sub-classifications to be identified:

- **A general waste classification** – the 59 category classification is an expansion of an original 12-category classification which covered paper, plastic film, dense plastic, textiles, miscellaneous combustibles, miscellaneous non-combustibles, glass, organics, ferrous metal, non-ferrous metal, and –10 mm fines. This now also contains overall categories for both WEEE and Household Hazardous Waste (HHW).
- **Recyclables** – as the 59-category classification was developed from a classification system designed to assess source separation schemes, it includes categories for all of the main materials collected by local authorities for recycling.
- **Compostables** – the 59-category classification separately identifies the sources of organic material, such as kitchen waste and garden waste contained in household collected waste.
- **Biodegradables** – SEPA and the Scottish Government developed[4] a list of items in waste which are biodegradable as part of developing procedures for monitoring progress towards meeting the requirements of the Landfill Directive. All of these items are separately identified in the 59-category classification, and so an assessment of the biodegradability of each sample can be determined.
- **Combustibles** – the 59-category classification identifies all combustible materials.

Although a “junk mail” category could also have been included as this is a category which could be targeted in a waste minimisation scheme, experience gained during other waste analysis studies identified the difficulties in positively identifying “junk mail” items. For this reason, these items were included in the “other recyclable paper” category.

Although this detailed category list provides information on a wide range of items, a less comprehensive breakdown using 24 categories (for examples see Tables 5 and 20 in Chapters 4 and 5) was used for the purposes of discussing the results.

## 2.3 Development of methodology for sampling each waste stream.

The methodology used for sampling and subsequent analysis of each waste stream was based on the SEPA guidance[5] for household dustbin waste and the protocol for MSW streams developed for the analysis study conducted in Wales in 2002/03. This is described in more detail in Appendix C.

[4] *Scottish Statutory Instrument 2005 No. 157 - Landfill Allowance Scheme (Scotland) Regulations 2005, and Scottish Executive Guidance: March 2007*

[5] *National Methodology for Household Waste Composition Analysis in Scotland*

## 3.0 Practical work

The next chapter outlines the practical work that was conducted during the project. Practical work was conducted by WastesWork over two seasons in 2009; spring (April) and autumn (September). In each season, the fieldwork was carried out over a four-week period by four teams of three analysts. Each team spent two weeks in two participating local authorities; this enabled the fieldwork to cover both alternate weekly or fortnightly collection systems.

The typical amounts of waste which were analysed in each season in each of the eight authorities were:

- household collected waste (residual, dry recyclables and compostables) - 800 kg per sample area or a total of 2,400 kg per authority (3 areas analysed in each authority);
- residual HWRC waste – 2,500 kg;
- trade waste – 300 kg; and
- other waste streams – 200 kg.

The total amount of waste which was analysed was approximately 85 tonnes. As AEA were not involved in the operational procedures for acquiring or sorting samples of waste, they conducted an audit of a number of WastesWork's operations during the first season of the analysis work. This determined that:

- all four WastesWork teams were correctly following the protocols for both health and safety procedures and collection and analysis procedures agreed for this study;
- there was a good level of communication between the teams; and
- all four teams had received suitable training to be able to correctly answer the questions on how to classify specific items.

No areas for potential improvement for the hand-sorting and weighing of the collected samples by any of the four WastesWork teams were identified.

### 3.1 Household collected waste

The household waste samples were collected on the normal collection day for 32 households in each of the selected sample areas. The teams arrived in their sampling street approximately 30 minutes before the normal collection time. A simple household survey was carried out; this involved noting how full each residual waste/recycling container was, or the number of bags set out. All of the household waste set out for collection (either residual waste, recycling and green waste depending on the scheme in operation) was then transferred into bulk bags, and these were then loaded onto the back of a Luton van with tailgate.

Figure 1: Collection of residual household waste

Once back at the sort site the samples were unloaded and the different materials were weighed on electronic platform scales to determine the total weights collected. The bulk waste, recycling and compost samples were all hand-sorted separately. Samples for hand-sorting were placed on a screen with 10mm apertures to remove fines (particles less than 10mm in any one dimension irrespective of composition) and initially sorted into the major material categories (e.g. dense plastics, metals, mixed textiles). Sorting at this level of definition continued until each of the samples had been screened. All particles falling through the screen were removed, weighed separately and classified as fines. Secondary sorting was then undertaken. This involved the separation of materials into 59 specified sub-categories. Each sub-category was then weighed on electronic platform scales and the data recorded

Figure 2: Sorting of residual household collected waste

## 3.2 Residual recycling centre waste

Each of the eight participating local authorities identified a HWRC for inclusion in the sampling. These are shown in Table 4.

Table 4: Household Waste Recycling Centre site in each authority

| Authority | HWRC site |
|---|---|
| Highland | Alness |
| Orkney | Kirkwall |
| Edinburgh | Seafield |
| East Dunbartonshire | Maws Valley |
| Renfrewshire | Barhill Road |
| Moray | Forres |
| Glasgow | Dalsholm Road |
| South Ayrshire | Troon |

The sites in Table 4, above, were all surveyed on a single week day and a single weekend day. Sampling of individual visitors was conducted at the sites in Orkney, Renfrewshire, East Dunbartonshire, Glasgow and South Ayrshire, but space constraints at the sites identified by the other three authorities meant that the authority provided a bulk sample for analysis.

Where the survey was carried out on site, users planning to deposit waste into the residual waste skip were selected using the “next available visitor” approach. Further discussion of this methodology can be found in Appendix C. The supervisor selected the next visitor to the residual waste container when the analysis of the current sample had almost been completed. The typical number of samples which were analysed on any day was between 40 and 50.

Each of those selected users who intended to throw rubbish into the residual skips was asked if they would participate in the survey. If they agreed, the waste they were going to throw into the residual skips was taken from them for hand sorting; they were asked to continue with their recycling. If they did not want to take part in the survey then the next user was selected. Once the visitor had left the site the waste was hand-sorted using the same procedures as those for the kerbside collected waste. Bagged waste that contained food was not tipped out and sorted on-site, instead it was given its own sort category - ‘black sack waste’. Ten of these sacks were later hand-sorted at the sort site to show a more detailed breakdown of their content, including the potentially recyclable element.

Figure 3: Sorting of residual waste at a HWRC site

In areas where it was not possible to carry out the HWRC survey on site the local authority arranged to have a residual waste skip delivered from the HWRC site to the team at their sort site. The contents of the skip were then hand sorted as a bulk sample. For ease of operation the bulky items were hand sorted and weighed off first. Then all sacks were opened and those that did not contain food waste were hand-sorted and the weights added to the sort sheet., Finally all sacks that contained food were weighed and the figure added to the sort sheet. Ten of these sacks were then fully hand-sorted and these weights were recorded on a separate sheet.

## 3.3 Schools

Each of the eight participating local authorities was asked to identify three schools for inclusion in the survey. Where possible this was two primary schools and one secondary school. The head teachers were telephoned prior to sampling to ask if the school would participate in the survey and to gain information on what time to arrive and who to meet. The samples were collected on the normal waste collection day for the school. Each of the schools bins - residual waste and recycling were weighed, using a trolley jack with scales, and a note was made of the type of bin, size and the material the bin was made of. Health and safety operating reasons meant that it was not possible to empty bins over 660L manually, so a sample of waste (approximately 200 litres) was removed from each bin. The analysis was conducted using the same procedure as that for household collected waste.

## 3.4 Trade waste

The location of each business identified by each participating local authority was identified on a map and the day and time of normal collection was determined. As with the schools, many businesses use bins that are larger than 660 litres, which means they cannot be manually emptied. Instead the bins were weighed using trolley jack scales and a sample (approximately 200 litres) was then removed from each bin. The analysis was conducted using the same procedure as that for household collected waste.

## 3.5 Litter

All Scottish local authorities survey their own litter according to a seven-zone system. They also survey each other’s litter, and Keep Scotland Beautiful validates the quality of the data. Each local authority was asked to provide litter and sweeping samples according to the seven-zone system over the same two-week sampling period. These samples were hand-sorted using the same procedure as that for household collected waste. If samples were delivered from gully clearance, these were not hand-sorted; the composition was determined through visual inspection.

## 3.6 Bulky household waste

Two local authorities provided detailed records of their bulky household collections. This was deemed sufficient to derive an overall national picture for this waste stream. For each selected record, the typical weight listed in the FRN list[6] was allocated to each item. These were then added together to provide an overall composition for bulky household waste. Orkney also provided a sample of material (total weight about 0.5 tonnes) collected by their bulky household service. This was hand-sorted into major categories, such as furniture and WEEE items for comparison purposes.

## 3.7 Other waste streams

Local authorities were asked to supply samples of park and garden waste and beach cleansing waste. Where samples were provided, they were analysed using the same procedure as that for household collected waste.

[6] *Typical weights for items potentially suitable for reuse. Furniture Reuse Network (www.frn.org.uk), 2009.*

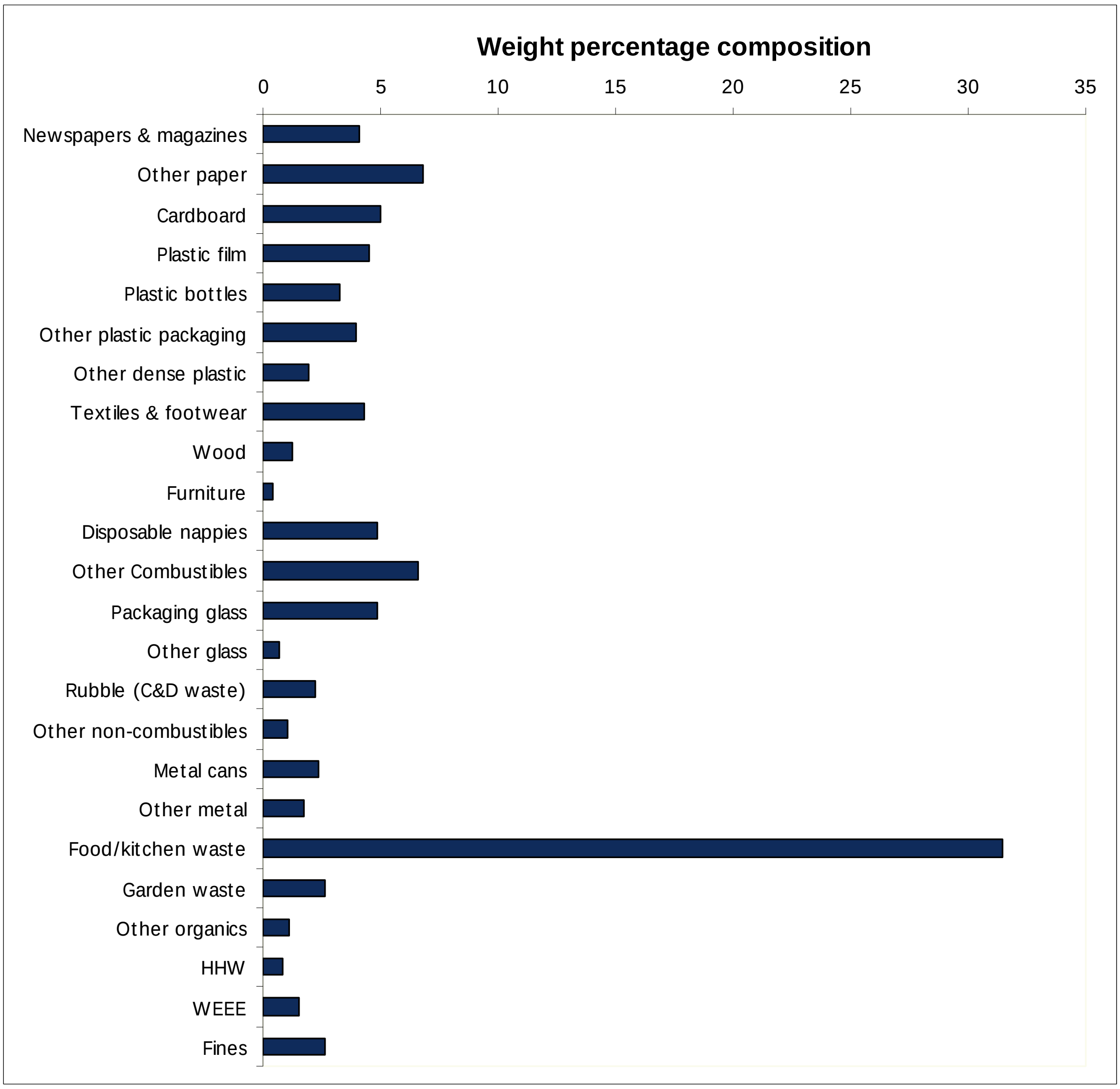
## 4.0 Composition of individual MSW streams

This chapter presents the results for the composition of each of the MSW waste streams which were analysed during the current study. The results for each of the eight local authorities which participated in the project are presented in separate reports supplied to local authorities. A more detailed category breakdown for each stream is presented in Appendix D. Chapter Five presents information on the overall composition of MSW in Scotland which is calculated by using a combination of compositional data from this study and WasteDataFlow. The compositional analysis results were compared with those from other studies, such as the analysis[7] of MSW in Wales conducted in 2002/03 in order to assess whether the data obtained was both sensible and robust.

### 4.1 Residual household collected waste

Figure 4 shows the average composition (% by weight) for residual household collected (dustbin) waste in Scotland. The largest category is food/kitchen waste, which represents almost one third (31.5%). The overall paper & card content was 15.9 percent.

Figure 4: Composition (Wt %) of residual household collected waste in Scotland




[7] *The Composition of Municipal Solid Waste in Wales. Report by AEA for the Welsh Assembly Government, December 2003.*

Table 5 compares the average results for Scotland with those determined during analyses conducted[8] in an English County during 2008. It also compares the findings with those from a review[9] of waste composition analyses[10] (most of the results are from English authorities) which has recently been published by Defra. This shows that the findings for Scotland are similar to those determined for other studies; the two main categories are the food/kitchen waste category, which represents about one third, by weight, of the residual household collected waste stream, and the overall paper & card content, which represents about 16-18% by weight of this waste stream.

Table 5: Composition (Wt %) of residual household collected waste

| | **Scotland 2009** | **Undisclosed English County 2008** | **Defra review March 2009** |
|---|---|---|---|
| Newspapers & magazines | 4.1 | 3.9 | 13 |
| Other paper | 6.8 | 7.3 | |
| Cardboard | 5.0 | 4.8 | 5 |
| Plastic film | 4.5 | 5.5 | 14 |
| Plastic bottles | 3.3 | 1.9 | |
| Other plastic packaging | 4.0 | 2.4 | |
| Other dense plastic | 2.0 | 2.6 | |
| Textiles & footwear | 4.3 | 2.9 | 4 |
| Wood | 1.2 | 0.7 | 1 |
| Furniture | 0.4 | 0.4 | - |
| Disposable nappies | 4.8 | 6.3 | 5 |
| Other Combustibles | 6.6 | 2.7 | 3 |
| Packaging glass | 4.8 | 5.2 | 5 |
| Other glass | 0.7 | 0.5 | |
| Rubble (C&D waste) | 2.2 | 1.1 | 2 |
| Other non-combustibles | 1.0 | 0.6 | |
| Metal cans | 2.4 | 1.7 | 4 |
| Other metal | 1.7 | 1.6 | |
| Food/kitchen waste | 31.5 | 34.4 | 32 |
| Garden waste | 2.6 | 2.6 | 6 |
| Other organics | 1.1 | 6.7 | 2 |
| HHW | 0.9 | 0.4 | 1 |
| WEEE | 1.5 | 1.1 | 1 |
| Fines | 2.6 | 2.6 | 2 |
| **Total** | **100.0** | **100.0** | **100** |

A comparison of the findings from this study and the previous studies mentioned above also show that the weight percentage of other types of recyclable materials are similar:

- Glass bottles – about 5%
- Metal cans – about 2%.

In the current study plastic bottles made up a slightly higher proportion (3.3%) of residual waste when compared to a previous study of an English County (1.3%), although individual local authority samples in the current study ranged from less than 2% to over 6%.

[8] *Unpublished report by WastesWork and AEA, 2009. Consisted of an average of 55 samples from 11 districts and the range of collection systems for residual waste and recycling is similar to that for Scotland as a whole*

[9] *Municipal waste composition – A review of municipal waste component analyses. Report by Resource Futures for Defra for project WR0119 (available at www.defra.gov.uk)*

[10] *The English County results were not included in the Defra study as the data used was collected before this study was conducted*

The residual household collected waste stream represents about 45% by weight[11] of overall arisings of MSW in Scotland. Variability in the composition of this stream could have a significant impact on the estimates of overall composition of MSW in Scotland. The 95% confidence intervals for the two main categories in the residual household collected waste stream were:

- Food/kitchen waste – 32% ± 2%
- Total paper & card – 15.9% ± 1%.

These confidence limits are considered to be relatively low and suggest an acceptable level of variation in estimates of MSW in Scotland from this study.

The average weight (kg per household per week) of waste in the residual household collected waste stream observed in this study was 10.2 kg per household per week. As food/kitchen waste (see Table 5) represents about 32% by weight of this stream, the typical arisings of food/kitchen waste in this waste stream are estimated at 3.2 kg/household per week.

The average weight (kg per household per week) of a number of other potentially recyclable materials that occurred in the residual household waste were as follows:

- Newspapers and magazines – 0.4 kg/household per week
- Other paper – 0.7 kg/household per week (some of this currently can not be recycled)
- Cardboard – 0.5 kg/household per week
- Plastic bottles – 0.3 kg/household per week
- Packaging glass – 0.5 kg/household per week
- Metal cans – 0.2 kg/household per week.

This suggests that there is the potential to capture up to an additional 5 kg/household per week of recyclable or compostable (including food/kitchen waste) material from households through kerbside collection schemes.

There are a number of factors which can influence waste generation including socio-economic profile of the households, urban or rural location and seasonal variation. The residual household collected waste arisings for each sample area are shown in Appendix E. The potential impact of household socio-economic circumstances and rural/urban comparison were used in the sampling design/strategy in order to try to obtain a more representative picture of national MSW composition. It is therefore inappropriate to draw conclusions on the effects of these variables in isolation from the findings of this study.

A simple comparison of the average spring and autumn results for household residual waste suggested there was no evidence of any significant seasonal variation in composition. A similar finding was determined for each of the other waste streams which were analysed during this survey. The survey conducted on MSW arisings in Wales in 2002/03, which covered all four seasons, also determined that there was no identifiable evidence of any seasonal variation in composition for all categories apart from garden waste.

[11] *2008/09 WasteDataFlow data for Scotland*

## 4.2 Kerbside collected recyclables

Table 6 shows the average composition for the kerbside collected dry recyclables stream and the kerbside collected green waste stream. Although not all of the participating local authorities collect the same dry recyclable materials (see Appendix A, Table A1), newspapers & magazines was the largest category (54% by weight) in the average dry recyclables stream. None of the authorities collected co-mingled garden and food/kitchen waste, and garden waste represented almost 99% of the materials collected through the green waste streams.

Table 6: Average composition (Wt %) of kerbside collected dry recyclables and green waste

| | Dry recyclables | Green waste |
|---|---|---|
| Newspapers & magazines | 54.6 | 0.0 |
| Other paper | 5.1 | 0.0 |
| Cardboard | 8.6 | 0.0 |
| Plastic film | 0.3 | 0.0 |
| Plastic bottles | 1.9 | 0.0 |
| Other plastic packaging | 0.7 | 0.0 |
| Other dense plastic | 0.1 | 0.0 |
| Textiles & footwear | 0.1 | 0.0 |
| Wood | 0.1 | 0.1 |
| Furniture | 0.0 | 0.0 |
| Disposable nappies | 0.0 | 0.0 |
| Other Combustibles | 0.0 | 0.4 |
| Packaging glass | 23.8 | 0.0 |
| Other glass | 0.2 | 0.0 |
| Rubble (C&D waste) | 0.0 | 0.1 |
| Other non-combustibles | 0.0 | 0.1 |
| Metal cans | 3.8 | 0.0 |
| Other metal | 0.1 | 0.0 |
| Food/kitchen waste | 0.1 | 0.6 |
| Garden waste | 0.0 | 98.7 |
| Other organics | 0.2 | 0.0 |
| HHW | 0.0 | 0.0 |
| WEEE | 0.2 | 0.0 |
| Fines | 0.0 | 0.0 |
| **Total** | **100.0** | **100.0** |

Table 6 shows that the dry recyclables stream contained small amounts of non-targeted materials such as wood, other non-packaging glass, food/kitchen waste and WEEE. The green waste stream contained less than 1% by weight of food/kitchen waste.

The monitored collection rates (kg/household/week) for both dry recyclables and green waste in each of the sample areas are shown in Appendix E. It may be desirable to make comparisons of collection rates between the different waste/recycling schemes and sample areas in Appendix E. However, it is important to highlight that the sampling framework developed for this study focused exclusively on obtaining a representative picture of overall MSW composition in Scotland. It is therefore inappropriate to make simple comparisons between the collection rates of the different sample areas used in this study.

The average capture rates[12] achieved by the kerbside schemes in Scotland for a number of potentially recyclable or compostable materials were:

- newspapers and magazines – 67%;
- other paper and card – 26%;
- plastic bottles – 19%;
- glass packaging – 44%;
- metal cans – 22%; and
- garden waste – 80%.

These findings are consistent with those from other studies of kerbside separation schemes conducted over the past 15 years which show that capture rates for newspapers & magazines and glass packaging are higher than those for either metal cans or plastic bottles. They are also comparable to the kerbside capture rates determined in the Defra review of MSW compositional analyses.

## 4.3 Household recycling centre waste

Figure 5 shows the average weight percentage composition for residual HWRC waste in Scotland. These have been determined after including the results from the 'mixed bagged waste' category used during the hand-sorting procedure for each sample which was analysed. The largest single category is other combustibles (16% by weight) which includes carpets. Wood and furniture each represented about 10% by weight, and garden waste represented about 5% by weight of this waste stream.

[12] *Calculated using WasteDataFlow information on the arisings and composition of recyclable or compostable material recovered at the kerbside, WasteDataFlow information on arisings of residual household collected waste, and the average composition of residual household collected waste in Scotland shown in Table 5.*

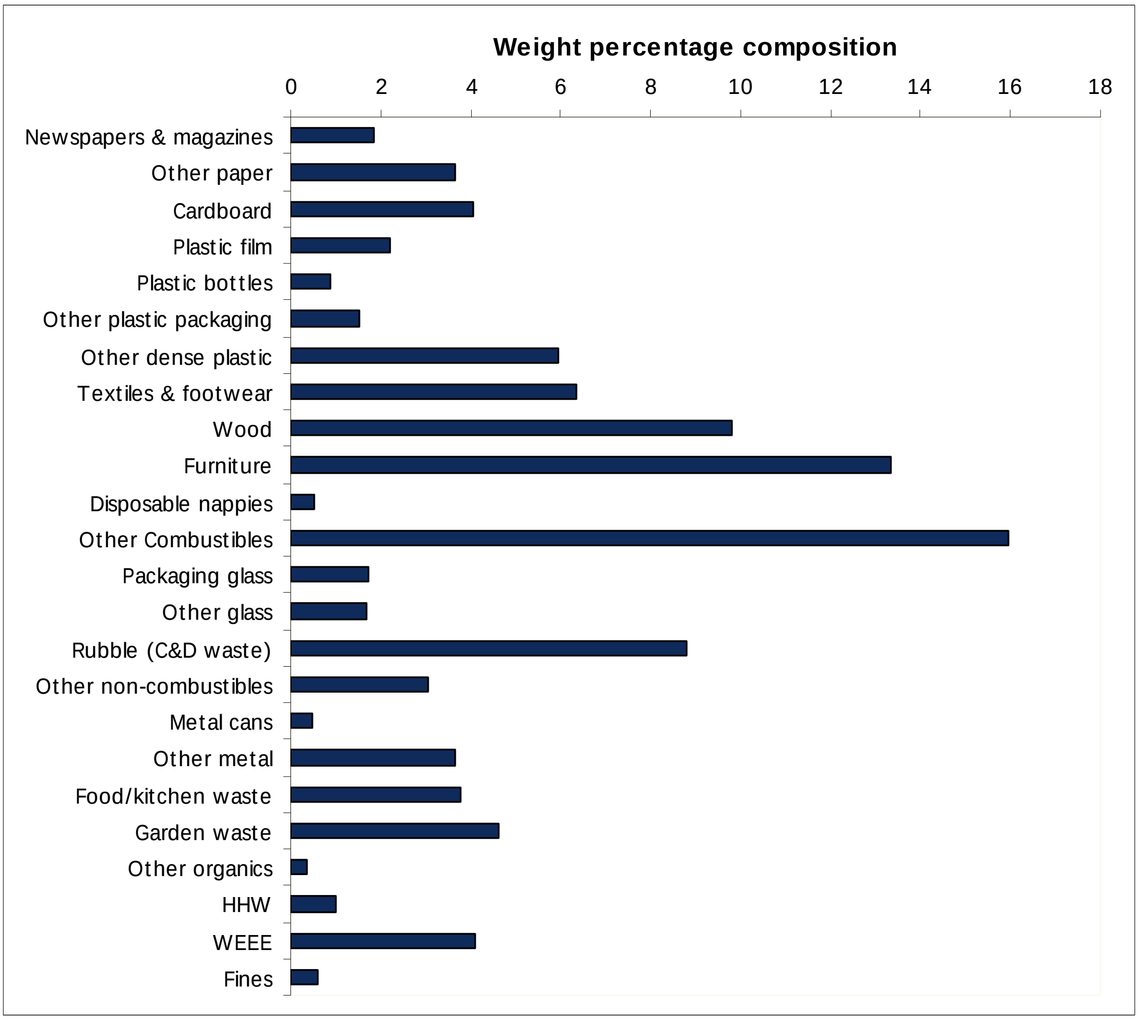



Figure 5: Composition (Wt %) of residual HWRC waste in Scotland

Table 7 compares the results for Scotland with those determined during analyses conducted in an English County during 2008 and from a review of waste composition analyses (mostly English authorities) which has recently been published by Defra. The analyses conducted on this stream in Wales in 2002/03 were on the waste brought to the site, and so can not be compared with these results.  All of the results show that the largest category is ‘other combustibles’ (furniture, carpets and other combustible materials), which represents between a quarter and a third by weight of this waste stream.

Table 7: Composition (Wt %) of residual HWRC waste

| | Scotland 2009 | Undisclosed English County 2008 | Defra review March 2009 |
|---|---|---|---|
| Paper | 6 | 8 | 5 |
| Cardboard | 4 | 3 | 3 |
| Plastic film | 2 | 3 | 11 |
| Dense plastic | 8 | 12 | |
| Textiles | 6 | 5 | 5 |
| Wood | 10 | 7 | 15 |
| Other combustibles | 30 | 33 | 27 |
| Glass | 3 | 4 | 3 |
| C&D waste | 9 | 5 | 15 |
| Other non-combustibles | 3 | 3 | |
| Garden waste | 5 | 6 | 10 |
| Other organics | 4 | 6 | |
| Metal | 4 | 2 | 2 |
| Household hazardous | 1 | 1 | 1 |
| WEEE | 4 | 1 | 2 |
| Fines | 1 | 1 | 1 |
| **Total** | **100** | **100** | **100** |

There were no identifiable differences between weekday and weekend arisings for either the weight or composition of residual HWRC waste in the current study. The MSW survey in Wales also determined that there was no consistent overall difference between weekdays and weekends in the mean weight per visitor of waste brought to the site.

Table 8 shows the average capture rates achieved by the HWRC sites in Scotland. The overall recycling rate achieved at the HWRC sites was 56%, and capture rates for potentially recyclable or compostable materials ranged from over 70% for garden waste, C&D waste, WEEE, and metal, to less than 20% for dense plastic and textiles. These capture rates are comparable to those determined for HWRC sites in the Defra 2009 review of MSW compositional analyses.

Table 8: Average capture rates (Wt %) achieved at HWRC sites in Scotland

| | Capture rate (Wt %) |
|---|---|
| Paper | 65 |
| Cardboard | 54 |
| Dense plastic | 13 |
| Textiles | 17 |
| Wood | 65 |
| Glass | 61 |
| C&D waste | 79 |
| Garden waste | 87 |
| Metal | 70 |
| WEEE | 71 |
| **Total** | **56** |

## 4.4 Commercial waste collected by local authorities

One of the aims of the current study was to capture the differences in the residual waste produced business which is collected by local authorities. Table 9 shows the number of residual waste samples taken for each of the 9 business categories used in this study. A total of 229 samples of residual waste were analysed for their composition. Sampling did not take account of whether a business recycled or not as the primary goal of this part of the study was to characterise what remains in the residual waste stream.

Table 9 Number of residual waste samples from commercial premises

| | Spring | Autumn | Total |
|---|---|---|---|
| Retail | 17 | 17 | 34 |
| Food (cafes and restaurants) | 16 | 16 | 32 |
| Care | 10 | 10 | 20 |
| Hair & Beauty | 13 | 11 | 24 |
| Health (doctor, dentist, vet) | 15 | 14 | 29 |
| Leisure | 15 | 11 | 26 |
| Offices | 11 | 12 | 23 |
| Manufacturing | 11 | 6 | 17 |
| Other businesses | 11 | 13 | 24 |
| **Total** | **119** | **110** | **229** |

Table 10 presents the average composition of residual waste for each business type, and shows, for example, that:

- Retail and office businesses produce a much higher percentage (up to 50%) of paper & card than businesses in the food (e.g. cafes and restaurants) and hair and beauty (e.g. hairdresser) sectors (typically 20%).
- The food/kitchen waste category represents over 45% by weight of waste produced by food and cafe businesses[13]. This is much higher than values produced by hair & beauty, health and manufacturing and other businesses (less than 15%).

Similar findings were determined for the study in Wales in 2002/03. This information can be used by local authorities to target their recycling collection schemes to the most appropriate businesses.

[13] *WRAP has also commissioned separate, UK wide research into the composition of waste from the hospitality sector (hotels, pubs and restaurants), which will compliment the findings for trade waste from the current study. This work is due to be published in 2010, please see [http://www.wrap.org.uk/](http://www.wrap.org.uk/) for more details*

Table 10: Composition (weight %) of residual trade waste produced by eight business categories

| | Retail | Food | Care | Hair & Beauty | Health | Leisure | Offices | Manufacturing | Other businesses |
|---|---|---|---|---|---|---|---|---|---|
| Newspapers & magazines | 9.4 | 1.4 | 3.4 | 16.3 | 8.0 | 3.3 | 11.3 | 2.4 | 8.7 |
| Other paper | 15.6 | 9.6 | 14.7 | 9.1 | 31.0 | 16.7 | 28.8 | 28.1 | 18.5 |
| Cardboard | 29.3 | 7.9 | 6.8 | 6.9 | 14.2 | 13.4 | 9.7 | 14.7 | 15.9 |
| Plastic film | 11.6 | 7.1 | 7.4 | 6.3 | 6.8 | 7.6 | 5.4 | 11.1 | 5.0 |
| Plastic bottles | 2.2 | 3.9 | 1.9 | 6.2 | 2.8 | 6.3 | 6.1 | 2.5 | 3.0 |
| Other plastic packaging | 3.1 | 4.3 | 3.5 | 6.5 | 4.9 | 4.7 | 4.1 | 6.6 | 2.7 |
| Other dense plastic | 2.4 | 0.2 | 0.5 | 0.3 | 0.7 | 1.4 | 0.7 | 0.9 | 1.4 |
| Textiles & footwear | 1.1 | 0.4 | 1.0 | 0.5 | 0.6 | 1.8 | 0.2 | 6.2 | 1.3 |
| Wood | 0.1 | 0.1 | 0.8 | 0.1 | 0.1 | 0.5 | 0.0 | 0.1 | 0.0 |
| Furniture | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Disposable nappies | 0.1 | 1.3 | 4.5 | 2.7 | 0.2 | 0.6 | 0.4 | 0.0 | 0.3 |
| Other Combustibles | 1.2 | 1.8 | 2.4 | 12.9 | 6.3 | 3.5 | 1.9 | 3.0 | 2.7 |
| Packaging glass | 1.1 | 6.1 | 3.2 | 4.1 | 0.9 | 8.6 | 2.1 | 0.6 | 8.1 |
| Other glass | 0.6 | 0.1 | 0.0 | 0.1 | 0.0 | 0.7 | 0.0 | 1.3 | 0.6 |
| Rubble (C&D waste) | 0.0 | 0.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.0 | 0.4 |
| Other non-combustibles | 0.1 | 0.0 | 0.2 | 0.0 | 1.6 | 0.9 | 0.2 | 1.1 | 1.1 |
| Metal cans | 1.3 | 4.0 | 2.2 | 3.4 | 1.4 | 3.7 | 2.0 | 1.8 | 4.5 |
| Other metal | 3.0 | 0.4 | 0.6 | 4.1 | 0.3 | 1.4 | 1.6 | 1.7 | 3.8 |
| Food/kitchen waste | 12.5 | 48.4 | 42.7 | 14.2 | 11.1 | 17.9 | 18.2 | 7.7 | 11.7 |
| Garden waste | 3.4 | 0.0 | 2.1 | 0.0 | 0.5 | 1.6 | 0.0 | 8.0 | 4.0 |
| Other organics | 0.8 | 1.2 | 1.1 | 5.1 | 2.4 | 2.7 | 3.6 | 0.8 | 3.4 |
| HHW | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.3 | 0.4 | 0.2 | 0.0 |
| WEEE | 0.1 | 0.0 | 0.0 | 0.0 | 0.8 | 0.2 | 2.2 | 0.0 | 1.4 |
| Fines | 1.0 | 1.7 | 0.8 | 1.0 | 2.3 | 2.1 | 1.1 | 1.2 | 1.5 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

Although the analyses enabled the typical composition of wastes produced by different types of businesses to be determined, the data needs to be grossed up in order to determine the overall composition of this waste stream. The method initially developed for grossing up the data was to:

- determine the typical composition of waste from each type of business– (number of samples for each business type shown in Table 9); and
- determine the number of each type of business in each local authority that has a trade waste collection, and use this information to calculate the overall composition of this waste stream.

However, it was not possible to obtain suitable data on the numbers of each types of business whose waste was collected by local authorities. Consequently the estimated composition of residual trade waste shown in Table 11 and Figure 6 are based on our sample alone. These show that:

- The food/kitchen and other paper categories each represent about a fifth of this waste stream.
- The other paper and card categories (newspapers & magazines and card) represent about a fifth of this waste stream.

There are also 13 categories, such as rubble, which each represent less than 2% by weight of this waste stream.

Table 11: Overall composition (Wt %) of collected trade waste

| | **Weight %** |
|---|---|
| Newspapers & magazines | 7.2 |
| Other paper | 18.8 |
| Cardboard | 13.8 |
| Plastic film | 7.7 |
| Plastic bottles | 3.5 |
| Other plastic packaging | 4.8 |
| Other dense plastic | 1.0 |
| Textiles & footwear | 1.3 |
| Wood | 0.2 |
| Furniture | 0.0 |
| Disposable nappies | 1.0 |
| Other Combustibles | 3.8 |
| Packaging glass | 3.9 |
| Other glass | 0.4 |
| Rubble (C&D waste) | 0.4 |
| Other non-combustibles | 0.5 |
| Metal cans | 2.7 |
| Other metal | 1.9 |
| Food/kitchen waste | 20.9 |
| Garden waste | 1.8 |
| Other organics | 2.3 |
| HHW | 0.1 |
| WEEE | 0.5 |
| Fines | 1.5 |
| **Total** | **100.0** |

Figure 6: Composition (Wt %) of collected trade waste

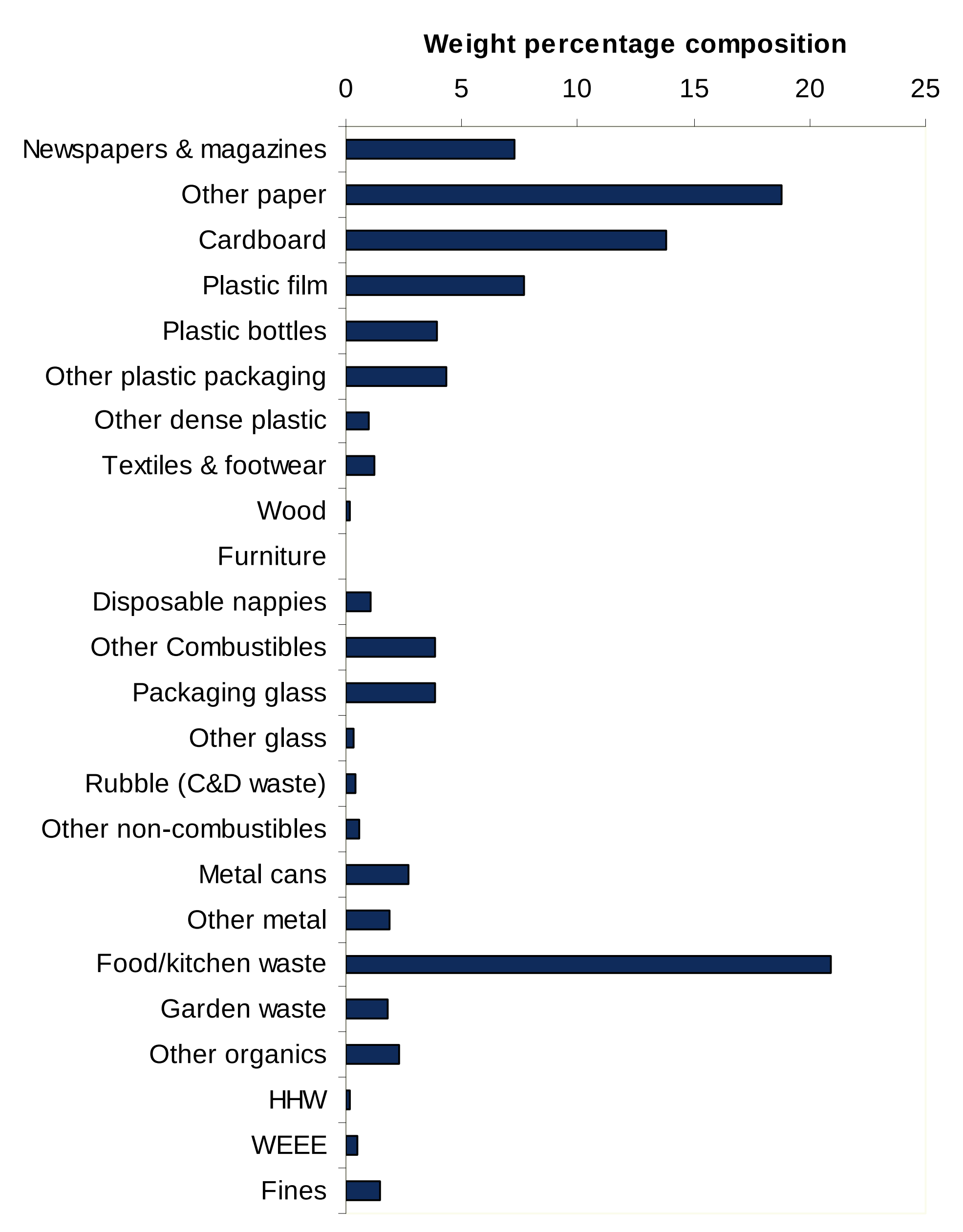



Table 12 compares the current results with those for the composition of collected trade waste determined during the study of composition of MSW in Wales in 2002/03 (Wales 2003), a study[14] conducted in a County in England during 2006, and an analysis of the mixed waste stream from commercial and industrial premises determined[15] in Wales in 2007 (Wales 2007).

[14] *Unpublished report by AEA, 2006*

[15] *Determination of the Biodegradability of Mixed Industrial and Commercial Waste Landfilled in Wales. Report by SLR for Environment Agency Wales, November 2007*

Table 12: Comparison of composition (Wt %) of trade waste stream

| | Scotland 2009 | Wales 2003 | Undisclosed English County 2006 | Wales 2007 |
|---|---|---|---|---|
| Paper and cardboard | 40 | 41 | 35 | 32 |
| Plastic film | 8 | 4 | 7 | 7 |
| Dense plastic | 9 | 6 | 6 | 8 |
| Textiles | 1 | 2 | 1 | 2 |
| Other combustibles | 5 | 6 | 10 | 16 |
| Glass | 4 | 4 | 3 | 4 |
| Other non-combustibles | 1 | 1 | 2 | 6 |
| Food/kitchen waste | 21 | 23 | 27 | 13 |
| Other organics | 3 | 4 | 3 | 2 |
| Metal | 5 | 5 | 4 | 4 |
| Household hazardous | <1 | 1 | 0 | 1 |
| WEEE | <1 | 1 | 1 | 1 |
| Fines | 2 | 1 | 2 | 4 |
| **Total** | **100** | **100** | **100** | **100** |

This shows that there is very little difference in the composition, particularly in terms of the two main categories (paper & card and food/kitchen waste) between the two surveys of trade waste collected by local authorities conducted in Wales and Scotland. However, the analyses of overall trade waste collected in an English County in 2006, and the analysis of the mixed waste stream conducted in 2007 both show that these have lower paper & card content. This is mainly due to the higher concentrations of other combustibles. However all four results show that the two main categories are paper &card and food/kitchen waste, which is a similar finding to that for the residual collected household waste stream.

## 4.5 Litter

Figure 7 shows the average composition of litter in Scotland. The weight percentage composition for 11 of the 24 categories (which include a number of categories that could be targeted for recycling) is over 5%, and the food/kitchen waste category has the highest weight percentage (14%).

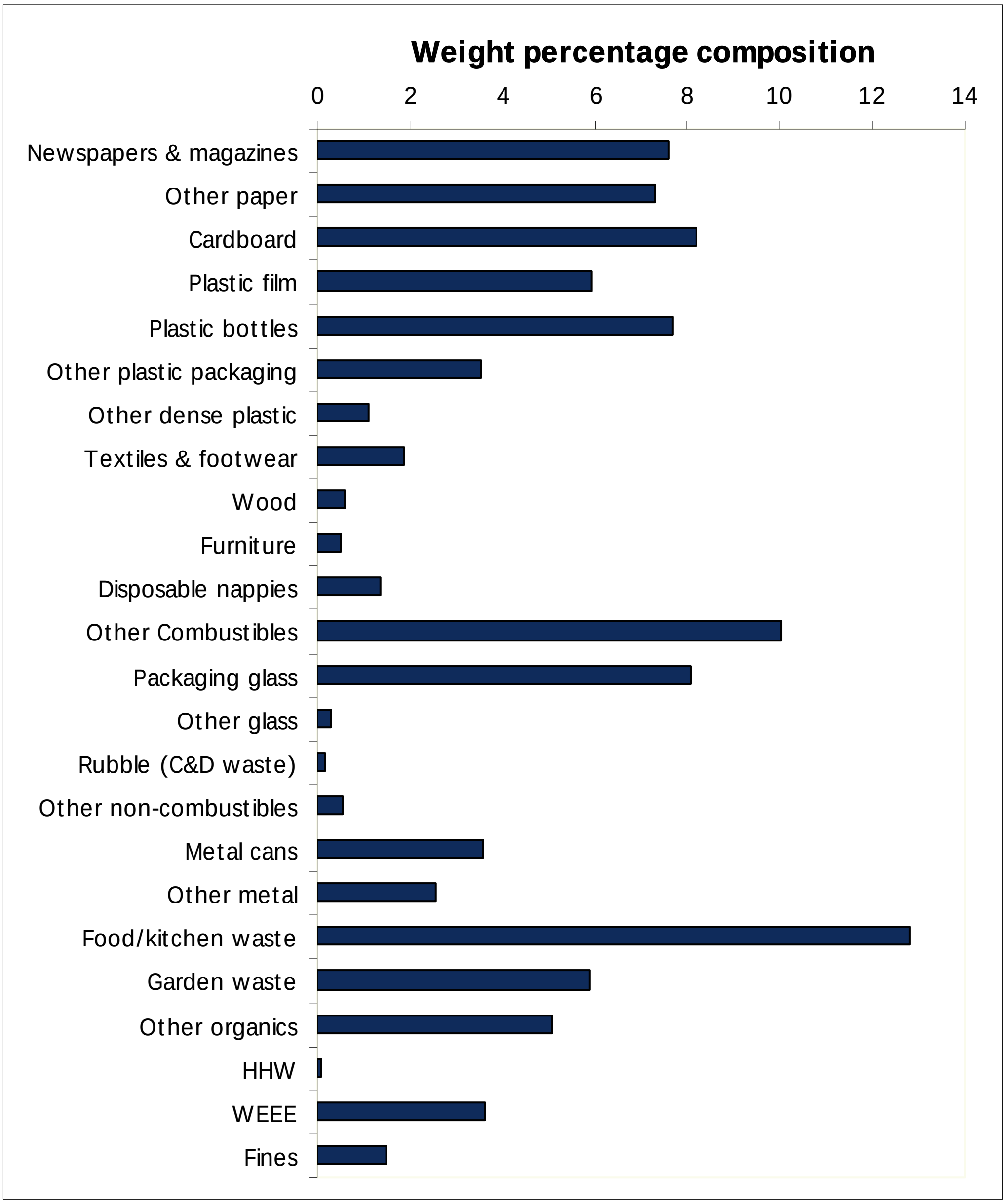



Figure 7: Composition (Wt %) of litter in Scotland

Table 13 compares the results for Scotland with those for analyses conducted in Wales in 2002/03, analyses conducted[16] in an English Unitary Authority in 2005, and analyses conducted[17] in an English County in 2002. The results show that whilst there is a variation in composition, litter typically contains up to 10% by weight of a number of common material types such as newspapers & magazines, glass bottles and metal cans, which could be targeted for recycling.

[16] *Unpublished report by AEA, 2005*

[17] *Unpublished report by AEA, 2002*

Table 13: Composition (Wt %) of litter

| | Scotland 2009 | Wales 2002/03 | Undisclosed English Authority 2005 | Undisclosed English County 2002 | Average |
|---|---|---|---|---|---|
| Newspapers & magazines | 7.6 | 9.7 | 6.8 | 10.2 | 8.6 |
| Other paper | 7.3 | 8.8 | 6.8 | 5.6 | 7.1 |
| Cardboard | 8.2 | 12.4 | 7.0 | 11.7 | 9.8 |
| Plastic film | 5.9 | 7.8 | 6.3 | 4.7 | 6.2 |
| Plastic bottles | 7.7 | 6.6 | 10.3 | 7.5 | 8.0 |
| Other plastic packaging | 3.6 | 3.4 | 2.1 | 3.4 | 3.1 |
| Other dense plastic | 1.1 | 2.5 | 1.8 | 1.8 | 1.8 |
| Textiles & footwear | 1.9 | 2.2 | 1.0 | 2.8 | 2.0 |
| Wood | 0.6 | 1.2 | 0.3 | 0.5 | 0.6 |
| Furniture | 0.5 | 0.0 | 0.0 | 0.0 | 0.1 |
| Disposable nappies | 1.4 | 1.1 | 1.1 | 0.6 | 1.0 |
| Other Combustibles | 10.0 | 1.5 | 3.8 | 3.7 | 4.8 |
| Packaging glass | 8.1 | 8.1 | 18.0 | 11.5 | 11.4 |
| Other glass | 0.3 | 0.3 | 0.5 | 1.2 | 0.6 |
| Rubble (C&D waste) | 0.2 | 0.3 | 1.2 | 0.3 | 0.5 |
| Other non-combustibles | 0.6 | 0.5 | 0.3 | 1.7 | 0.8 |
| Metal cans | 3.6 | 6.1 | 6.2 | 4.6 | 5.1 |
| Other metal | 2.6 | 1.8 | 1.1 | 1.2 | 1.7 |
| Food/kitchen waste | 12.8 | 15.0 | 19.7 | 8.7 | 14.1 |
| Garden waste | 5.9 | 2.2 | 3.1 | 0.6 | 2.9 |
| Other organics | 5.1 | 6.3 | 1.3 | 12.6 | 6.3 |
| HHW | 0.1 | 0.3 | 0.8 | 0.1 | 0.3 |
| WEEE | 3.6 | 0.2 | 0.0 | 1.0 | 1.2 |
| Fines | 1.5 | 1.7 | 0.7 | 3.9 | 1.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

## 4.6 Schools waste

Table 14 shows the average composition of waste from both primary and secondary schools in Scotland. The wastes have similar paper and card contents (30-35%) but the waste from primary schools contains a much higher percentage (35%) of food/kitchen waste than that from secondary schools (21%). This may be due to a higher percentage of primary school children making use of the school dinner service, but may also reflect the fact that children at secondary schools may well eat their lunch outside the school.

The analyses indicate that the main categories which could be targeted for recycling or composting are paper & card and food/kitchen waste.

Table 14: Composition (Wt %) of waste from schools

| | Primary schools | Secondary schools |
|---|---|---|
| Newspapers & magazines | 2.3 | 3.4 |
| Other paper | 19.1 | 23.3 |
| Cardboard | 10.6 | 9.0 |
| Plastic film | 5.8 | 7.9 |
| Plastic bottles | 4.5 | 5.8 |
| Other plastic packaging | 4.9 | 3.6 |
| Other dense plastic | 1.1 | 1.7 |
| Textiles & footwear | 0.8 | 0.6 |
| Wood | 0.3 | 1.2 |
| Furniture | 0.0 | 0.0 |
| Disposable nappies | 0.0 | 0.0 |
| Other Combustibles | 1.4 | 2.4 |
| Packaging glass | 0.8 | 0.7 |
| Other glass | 0.0 | 0.2 |
| Rubble (C&D waste) | 0.1 | 0.6 |
| Other non-combustibles | 0.2 | 0.3 |
| Metal cans | 0.9 | 2.7 |
| Other metal | 0.8 | 1.0 |
| Food/kitchen waste | 32.1 | 20.9 |
| Garden waste | 1.9 | 6.8 |
| Other organics | 7.9 | 4.7 |
| HHW | 0.1 | 0.5 |
| WEEE | 1.0 | 1.0 |
| Fines | 3.2 | 1.8 |
| **Total** | **100.0** | **100.0** |

There is no data on the amount of school waste which is collected as it is normally included within the tonnage reported for household waste collections. Consequently, the results from the sample of schools in the current study were not used in the calculation of overall MSW composition.

## 4.7 Bulky household waste

Figure 8 shows the composition of bulky household waste in 2008/09 based on the data provided by two participating local authorities. The two main categories, both of which represent over 40% by weight of the total arisings, are furniture and WEEE. Nearly all of the WEEE in the records provided is either white goods or televisions.

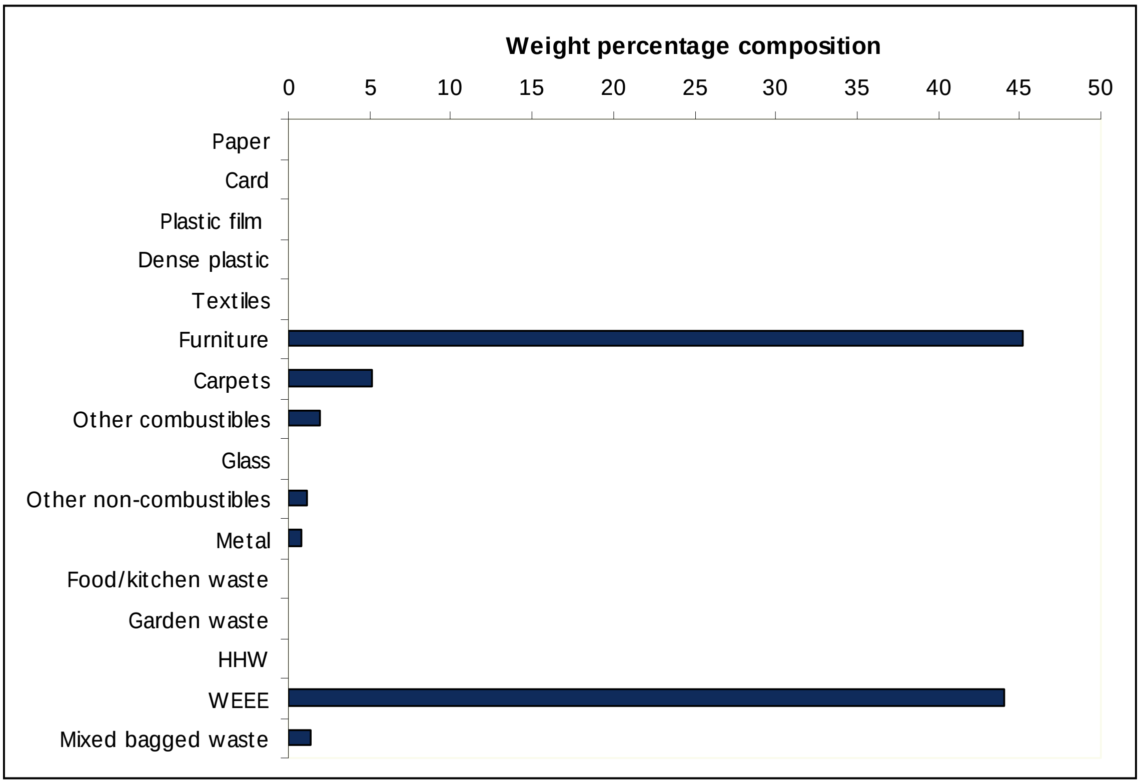



Figure 8: Composition (Wt %) of bulky household waste in Scotland

Table 15 compares the composition of bulky household waste in Scotland with those determined in other studies. All the results show that the two main categories are furniture and WEEE, which could be targeted for either re-use or recycling. A similar finding was determined for the smaller physical sample provided by Orkney. The total arisings of other recyclable categories, such as paper and food/kitchen waste, are less than 3% by weight of this stream.

Table 15: Composition (Wt %) of bulky household waste

| | Scotland 2009 | Wales 2002/03 | English County 2002 | English Unitary Authority 2005/06 |
|---|---|---|---|---|
| Paper | - | - | - | - |
| Card | - | <1 | <1 | - |
| Plastic film | - | - | - | - |
| Dense plastic | <1 | 1 | <1 | <1 |
| Textiles | <1 | <1 | <1 | <1 |
| Furniture | 45 | 37 | 41 | 49 |
| Carpets | 5 | 7 | 13 | 3 |
| Other combustibles | 2 | 14 | <1 | 1 |
| Glass | - | <1 | <1 | - |
| Other non-combustibles | 1 | 2 | <1 | - |
| Metal | 1 | 1 | <1 | 2 |
| Food/kitchen waste | - | - | - | - |
| Garden waste | - | <1 | - | - |
| HHW | - | <1 | - | <1 |
| WEEE | 44 | 35 | 44 | 43 |
| Mixed bagged waste | 1 | 1 | <1 | 1 |
| **Total** | **100** | **100** | **100** | **100** |

## 4.8 Other waste streams

Table 16 presents the results for the analysis of park & garden waste and beach cleansing waste. There is no data on the amount of these waste streams which are collected as it is normally included within WasteDataFlow returns as the tonnage for ‘other waste streams’ (although some authorities do report a grounds waste tonnage). Consequently, the results were not used in the calculation of MSW composition.

No analyses were conducted of the gully sweepings stream. Other analyses (such as that conducted in the study on MSW composition in Wales in 2002/03) indicate that this stream contains about 50% by weight of fine (-10 mm) material, over 45% by weight of organic material (mainly garden waste) and a small amount of packaging materials.

Table 16: Composition (Wt %) of other waste streams

| | Park & garden waste | Beach cleaning waste |
|---|---|---|
| Newspapers & magazines | 8.9 | 0.5 |
| Other paper | 6.1 | 1.2 |
| Cardboard | 7.3 | 1.0 |
| Plastic film | 4.3 | 8.2 |
| Plastic bottles | 7.3 | 4.7 |
| Other plastic packaging | 2.6 | 4.5 |
| Other dense plastic | 1.3 | 17.2 |
| Textiles & footwear | 2.1 | 6.2 |
| Wood | 0.1 | 2.8 |
| Furniture | 0.0 | 0.0 |
| Disposable nappies | 0.0 | 0.0 |
| Other Combustibles | 14.3 | 4.8 |
| Packaging glass | 18.7 | 5.9 |
| Other glass | 1.1 | 0.1 |
| Rubble (C&D waste) | 0.0 | 0.0 |
| Other non-combustibles | 1.7 | 6.4 |
| Metal cans | 3.1 | 2.7 |
| Other metal | 2.0 | 0.0 |
| Food/kitchen waste | 10.8 | 1.5 |
| Garden waste | 2.2 | 17.1 |
| Other organics | 2.7 | 7.1 |
| HHW | 0.0 | 0.0 |
| WEEE | 0.5 | 0.0 |
| Fines | 2.7 | 8.1 |
| **Total** | **100.0** | **100.0** |

## 5.0 Arisings and overall composition of municipal solid waste

The sampling methodology we developed for the compositional analyses is described in detail in Chapter 2. By sampling waste from a range of local authorities (geography, socio-economics, type and frequency of residual waste and recycling collection) and household types (ACORN framework) we assume the compositional findings are representative of Scotland as whole. The overall composition of MSW in Scotland can therefore be determined by applying the composition of each waste stream from this study (Chapter 4) with Wastedataflow returns on the tonnage arisings of each of these waste streams.

Table 17 shows the tonnage arisings of the waste streams that, between them, comprise the overall MSW stream. The tonnages in Table 17 are derived from the 2008/09 WasteDataFlow[18] information collated by SEPA using the following assumptions:

- Litter and Gully waste each represent 50% of the street cleansing waste category
- The tonnage for collected trade waste excludes any material classified as industrial waste (as SEPA do not classify this as municipal waste)
- The WasteDataFlow tonnages for the following two categories; 'Collected non-household waste: Construction and Demolition', and 'Collected non-household waste: Highways waste', are excluded as SEPA do not classify these waste streams as municipal waste.

Table 17: Tonnage arisings of MSW in Scotland in 2008/09

| | Weight (' 000 tonnes) | Wt % |
|---|---|---|
| Materials recycled or composted | 1,068 | 32.5 |
| Collected residual household waste | 1,534 | 46.7 |
| Residual HWRC waste | 245 | 7.5 |
| Residual trade waste | 259 | 7.9 |
| Litter | 31 | 1.0 |
| Gully wastes | 31 | 1.0 |
| Bulky waste | 66 | 2.0 |
| Other waste streams | 48 | 1.5 |
| **Total** | **3,283** | **100.0** |

Table 18 shows a list of the MSW streams included in the 'Other waste streams' category in Table 17 (which represents 1.5% of the overall MSW stream). The tonnages for each of these streams have been derived from WasteDataFlow information, and the overall composition of this stream has been determined using the assumed compositions for each waste stream shown in Table 18.

Table 18: Other waste streams

| Stream | Categories | Wt % |
|---|---|---|
| Separately collected asbestos | 100% non-combustible | <1 |
| Fly tipped waste | Similar to bulky household waste | 14 |
| Grounds waste | Park & garden waste | 13 |
| Beach cleansing waste | Beach cleansing waste | 1 |
| Other collected household waste | Similar to residual household waste | 48 |
| Other collected non-household waste | Similar to trade waste | 24 |
| **Total** | | **100** |

The overall composition (based on the 24-category list) of the recycling/composting stream was determined using WasteDataFlow information on reported tonnages of material collected through source separation schemes. The WasteDataFlow information includes figures for co-mingled collections from some authorities; this was converted to tonnages of newspaper & magazines, etc, using the average composition data (see
Table 6) for the kerbside collected dry recyclable stream.

*[18] There are minor differences between the overall figures for household residual waste and recycling/composting in Table 18 when compared to those published by SEPA. This is a result of minor differences in the way relatively rare components of the household waste stream are considered (e.g. the fraction that goes to mixed biological treatement). The focus of this study was to provide an overall estimate of the composition of the 8 main waste streams that make up MSW.*

Table 19 presents the composition of each of the waste streams that comprise MSW, together with the overall composition of MSW.

Table 19: Composition (Wt%) of municipal solid waste in Scotland in 2009

| | Material recycled or composted | Residual household collected waste | Residual HWRC waste | Collected trade waste | Litter | Gully waste | Bulky waste | Other MSW waste streams | Municipal solid waste |
|---|---|---|---|---|---|---|---|---|---|
| **Weight ('000 tonnes)** | 1,068 | 1,534 | 245 | 259 | 31 | 31 | 48 | 66 | 3,282 |
| **Wt %** | 32.5 | 46.7 | 7.5 | 7.9 | 0.9 | 0.9 | 1.5 | 2.0 | 100.0 |
| | | | | | | | | | |
| **Category** | | | | | | | | | |
| Newspapers & magazines | 17.8 | 4.1 | 1.9 | 7.2 | 7.6 | 0.3 | 0.0 | 6.4 | 8.6 |
| Other paper | 6.8 | 6.8 | 3.7 | 18.8 | 7.3 | 0.1 | 0.0 | 14.3 | 7.5 |
| Cardboard | 3.6 | 5.0 | 4.0 | 13.8 | 8.2 | 1.3 | 0.1 | 10.9 | 5.2 |
| Plastic film | 0.0 | 4.5 | 2.2 | 7.7 | 5.9 | 0.1 | 0.0 | 6.1 | 3.0 |
| Plastic bottles | 1.5 | 3.3 | 0.9 | 3.9 | 7.7 | 1.8 | 0.0 | 3.6 | 2.5 |
| Other plastic packaging | 0.0 | 4.0 | 1.5 | 4.4 | 3.6 | 0.3 | 0.0 | 3.7 | 2.4 |
| Other dense plastic | 0.0 | 2.0 | 6.0 | 1.0 | 1.1 | 0.2 | 0.3 | 1.1 | 1.5 |
| Textiles & footwear | 1.5 | 4.3 | 6.4 | 1.3 | 1.9 | 0.0 | 0.1 | 1.3 | 3.1 |
| Wood | 4.4 | 1.2 | 9.8 | 0.2 | 0.6 | 0.0 | 0.0 | 0.2 | 2.8 |
| Furniture | 0.5 | 0.4 | 13.3 | 0.0 | 0.5 | 0.0 | 43.5 | 5.9 | 2.3 |
| Disposable nappies | 0.0 | 4.8 | 0.5 | 1.0 | 1.4 | 0.0 | 0.0 | 0.7 | 2.4 |
| Other Combustibles | 0.0 | 6.6 | 15.9 | 3.8 | 10.0 | 0.0 | 11.8 | 6.3 | 5.0 |
| Packaging glass | 12.9 | 4.8 | 1.7 | 3.9 | 8.1 | 0.4 | 0.0 | 5.3 | 7.0 |
| Other glass | 0.0 | 0.7 | 1.7 | 0.4 | 0.3 | 0.0 | 0.1 | 0.4 | 0.5 |
| Rubble (C&D waste) | 8.4 | 2.2 | 8.8 | 0.4 | 0.2 | 0.0 | 0.4 | 0.4 | 4.5 |
| Other non-combustibles | 0.0 | 1.0 | 3.1 | 0.5 | 0.6 | 0.6 | 0.4 | 1.0 | 0.8 |
| Metal cans | 1.5 | 2.4 | 0.5 | 2.7 | 3.6 | 0.6 | 0.0 | 2.4 | 1.9 |
| Other metal | 2.4 | 1.7 | 3.7 | 1.9 | 2.6 | 0.0 | 1.7 | 1.9 | 2.1 |
| Food/kitchen waste | 2.1 | 31.5 | 3.8 | 20.9 | 12.8 | 0.3 | 0.0 | 16.4 | 17.7 |
| Garden waste | 33.6 | 2.6 | 4.6 | 1.8 | 5.9 | 43.0 | 0.1 | 1.8 | 13.1 |
| Other organics | 0.0 | 1.1 | 0.4 | 2.3 | 5.1 | 0.8 | 0.0 | 2.1 | 0.8 |
| HHW | 0.1 | 0.9 | 1.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.5 |
| WEEE | 2.8 | 1.5 | 4.1 | 0.5 | 3.6 | 0.0 | 41.3 | 6.1 | 2.9 |
| Fines | 0.0 | 2.6 | 0.6 | 1.5 | 1.5 | 50.0 | 0.0 | 1.5 | 1.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

Figure 9 shows the composition of MSW in Scotland.  The two largest categories (in weight percentage terms) are food/kitchen waste (18%) and garden waste (13%).  The total arisings of paper & card represent 21% by weight of MSW in Scotland.

Figure 9: Composition (Wt %) of municipal solid waste in Scotland

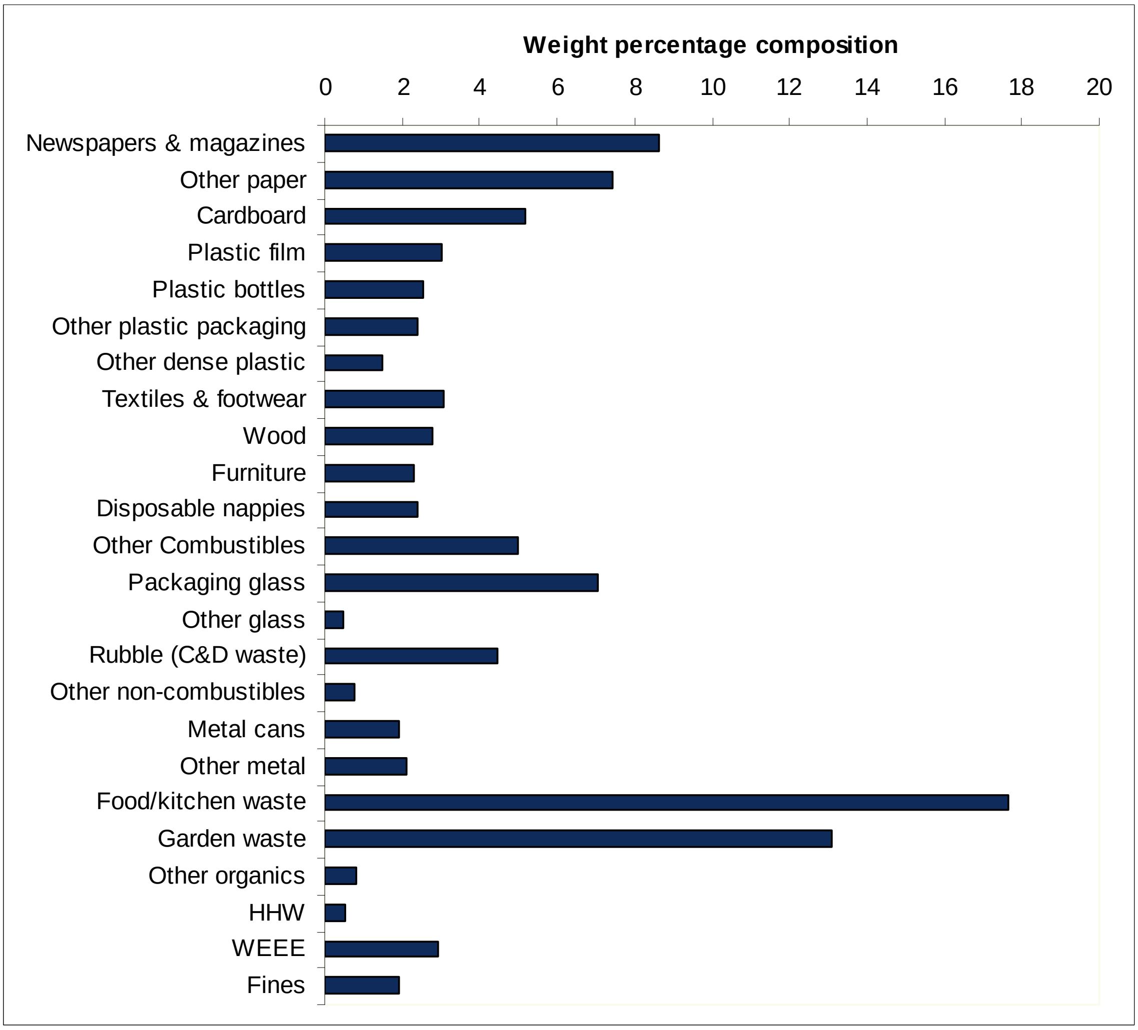



Table 20 compares the composition of MSW in Scotland with that determined in Wales in 2002/03 and the composition determined by the Defra review of compositional analyses (most of these were conducted in England).  The MSW compositions are similar. The overall biodegradable content of municipal solid waste in Scotland from this study is 62.9% (±1.5%). Further details on the calculation of biodegradable content and associated confidence intervals can be found in Appendix F.

Table 20: Composition of municipal solid waste

| | Scotland 2009 | Wales 2003 | Defra review March 2009 |
|---|---|---|---|
| Paper & card | 21.2 | 21.1 | 22 |
| Plastic film | 3.0 | 2.8 | |
| Dense plastic | 6.4 | 4.5 | 10 |
| Textiles | 3.1 | 2.2 | 3 |
| Other combustibles | 12.5 | 11.7 | 10 |
| Glass | 7.5 | 5.8 | 7 |
| Other non-combustibles | 5.3 | 8.0 | 5 |
| Food/kitchen waste | 17.7 | 15.7 | 18 |
| Garden waste | 13.1 | 12.7 | 14 |
| Other organics | 0.8 | 2.1 | 2 |
| Metal | 4.0 | 5.6 | 4 |
| HHW | 0.5 | 0.8 | 1 |
| WEEE | 2.9 | 2.0 | 2 |
| Fines | 1.9 | 5.0 | 2 |
| **Total** | **100.0** | **100.0** | **100** |

## 6.0 Opportunities for further recycling

Table 21 shows that 76% of the arisings[19] of MSW in Scotland are materials classified as recyclable or compostable that could potentially be separated for recycling. MSW in Scotland also contains about 2% by weight of furniture. Some of this, and also some of the WEEE may be suitable for reuse. There may also be potential for additional recycling of carpet.

Table 21: Potentially recyclable or compostable material in MSW in Scotland (% of overall MSW)

| Category | Weight % |
|---|---|
| Newspapers & magazines | 9 |
| Other paper | 4 |
| Cardboard boxes and containers | 4 |
| Dense plastic bottles | 3 |
| Other plastic packaging | 2 |
| Textiles and shoes | 3 |
| Wood | 3 |
| Packaging glass | 7 |
| C&D waste (rubble) | 4 |
| Metal | 3 |
| Food/kitchen waste | 18 |
| Garden waste | 13 |
| Other (WEEE items, oil, batteries) | 3 |
| **Total** | **76** |

The 2009 draft Zero Waste Plan for Scotland sets a target to collect and either recycle or compost 70% of MSW by 2025. The findings from this study suggest approximately three quarters (76%) of MSW in Scotland is made up of potentially recyclable and compostable material. It is important to highlight that the 76% calculated from this study represents what is available for potential capture using recycling and composting collections. Actual capture rates (i.e. the amount of material collected as a proportion of the total available in the waste stream) will vary according to a wide range of technical and socio-economic factors beyond the scope of this work.

In order to highlight opportunities for further recycling and composting it is useful to consider the current availability and capture of recyclable/compostable materials in the different MSW streams. Table 22 provides a breakdown by material types commonly targeted for recycling and their occurrence in the overall MSW stream. Comparisons can be used to highlight any further opportunities for additional capture and recycling of materials. The key findings from Table 22 include:

- 67% of newspapers & magazines are currently collected for recycling and 22% are found in residual household collected (dustbin) waste;
- 23% of cardboard is collected separately for recycling and a further 45% is found in residual household collected waste;
- 20% of plastic bottles are currently recycled and 60% are found in residual household collected waste;
- 83% of food/kitchen waste is found in residual household collected waste and a further 9% is in collected trade waste;
- 83% of garden waste is currently collected for composting;
- 52% of wood is recycled or composted and 27% is found in residual household waste recycling centre (HWRC) waste; and
- 21% of cardboard arises in the collected trade waste stream.

Local authorities will need to target the residual household-collected waste stream, the residual HWRC stream and the trade-waste stream if they wish to further maximise the amount of material collected for recycling and composting in the future.

[19] *The percentages of both "other paper" and "other plastic packaging" listed in Table 21 are lower than those shown in Table 19. This is because a proportion of these materials is likely to be unsuitable for recycling so a correction has been applied to account for this.*

Table 22: Distribution (Wt %) of recyclable and compostable materials between waste streams

| | Material recycled or composted | Residual household collected waste | Residual HWRC waste | Collected trade waste | Litter | Gully waste | Bulky waste | Other MSW waste streams | Municipal solid waste |
|---|---|---|---|---|---|---|---|---|---|
| Newspapers & magazines | 67 | 22 | 2 | 7 | 1 | - | - | 1 | **100** |
| Other paper | 30 | 43 | 4 | 20 | 1 | - | - | 3 | **100** |
| Cardboard | 23 | 45 | 6 | 21 | 2 | - | - | 3 | **100** |
| Plastic film | - | 69 | 6 | 20 | 2 | - | - | 3 | **100** |
| Plastic bottles | 20 | 60 | 3 | 12 | 3 | 1 | - | 2 | **100** |
| Other plastic packaging | - | 77 | 5 | 14 | 1 | - | - | 2 | **100** |
| Other dense plastic | - | 62 | 30 | 5 | 1 | - | - | 1 | **100** |
| Textiles & footwear | 15 | 65 | 15 | 3 | 1 | - | - | 1 | **100** |
| Wood | 52 | 21 | 27 | 1 | - | - | - | - | **100** |
| Furniture | 7 | 8 | 46 | - | - | - | 38 | 1 | **100** |
| Disposable nappies | - | 94 | 2 | 3 | 1 | - | - | - | **100** |
| Other Combustibles | - | 62 | 24 | 6 | 2 | - | 5 | 2 | **100** |
| Packaging glass | 60 | 32 | 2 | 4 | 1 | - | - | 1 | **100** |
| Other glass | - | 65 | 26 | 6 | 1 | - | - | 1 | **100** |
| Rubble (C&D waste) | 61 | 23 | 15 | 1 | - | - | - | - | **100** |
| Other non-combustibles | - | 61 | 29 | 5 | 1 | 1 | 1 | 2 | **100** |
| Metal cans | 26 | 57 | 2 | 11 | 2 | - | - | 2 | **100** |
| Other metal | 37 | 39 | 13 | 7 | 1 | - | 2 | 1 | **100** |
| Food/kitchen waste | 4 | 83 | 2 | 9 | 1 | - | - | 1 | **100** |
| Garden waste | 83 | 9 | 3 | 1 | 0 | 3 | - | - | **100** |
| Other organics | - | 64 | 3 | 22 | 6 | 1 | - | 4 | **100** |
| HHW | 8 | 75 | 14 | 1 | 0 | - | - | - | **100** |
| WEEE | 31 | 24 | 10 | 1 | 1 | - | 28 | 3 | **100** |
| Fines | - | 65 | 2 | 6 | 1 | 25 | - | 1 | **100** |

## 7.0 Further work

The study has enabled a considerable amount of data on the arisings and composition of MSW in Scotland to be obtained. Analyses in additional authorities could be conducted, or further sampling conducted in authorities in the sampling groups which represent a significant proportion of households in Scotland, particularly those operating alternate week collections for residual household waste. However, there is likely to be little impact on the findings presented on the current composition of overall MSW in Scotland because of the robust sampling framework employed in this study.

Increasing emphasis on waste minimisation initiatives, such as the household 'Love food, hate waste' campaign, might suggest a reduction in the arisings of potentially recyclable and compostable materials that the Scottish authorities would need to collect in order to meet future recycling targets. As it could be some years before the impacts of any waste minimisation campaign can be clearly identified, a further large-scale waste analysis programme could be conducted in about five years time to obtain updated information on the composition of MSW. This study could attempt to assess the impact of waste minimisation campaigns, determine whether changes in packaging have any impacts for meeting future recycling targets, and identify any further changes which will be required to meet longer-term recycling targets.

# Appendix A - Collection systems in the participating authorities

**Table A1: Collection systems for household waste and recycling in each area**

| | HWRC sites | Residual waste collection | Dry recycling collection | Compost collection |
|---|---|---|---|---|
| Highland | 21 sites | 240L w/b weekly | Blue box - paper, cans AWC with garden waste | Brown bin - garden only AWC with blue box |
| Orkney | 5 sites | Provided with sacks weekly | Fortnightly same day as waste - glass paper and card | Sacks collected Mar to Oct |
| Edinburgh | 4 sites | 240L w/b weekly or sacks in shared bins | Red box - card and cartons Blue box cans and glass bag for paper, bag for textiles red box and blue box AWC | 4 weekly in winter and fortnightly at all other times |
| East Dunbartonshire | 1 site | 240L w/b weekly | Blue box - paper/card, plastic bottles Black box - cans, aerosols and glass | March to October only |
| Renfrewshire | 6 sites | 240L w/b weekly | Fortnightly Blue and Green box textiles, cans, glass, paper and plastic bottles | Fortnightly March to November |
| Moray | 5 sites | 240L w/b fortnightly | Weekly blue and orange box collection: paper, card, glass, cans | w/b fortnightly |
| Glasgow | 2 sites | 240L w/b weekly or sacks in shared bins | Four weekly blue bin for paper, cans and plastic bottles | w/b fortnightly |
| South Ayrshire | 4 sites | w/b Fortnightly | Monthly blue bin (mixed recycling), fortnightly box collection for glass | w/b Monthly |

# Appendix B - Detailed category classification

### Table B1: Detailed category classification

| Primary Category | Secondary Category |
|---|---|
| Paper | Newspaper, magazines |
| | Other Recyclable Paper |
| | Office quality paper |
| | Non-recyclable Paper |
| Card | Liquid Cartons and tetrapaks |
| | Board Packaging |
| | Thin Card Packaging |
| | Other Card |
| Plastic Film | Carrier Bags |
| | Bin Bags |
| | Packaging Plastic Film |
| | Other Plastic Film |
| Dense Plastic | 1. PET drink bottles |
| | 1. Other PET packaging |
| | 2. HDPE drink bottles |
| | 2. Other HDPE |
| | 3. PVC |
| | 5. PP |
| | 6. PS |
| | 6. EPS |
| | Other dense plastic packaging |
| | Other dense plastic |
| Textiles | Reusable Textiles |
| | Non-reusable Textiles |
| | Shoes, belts and bags |
| Glass | Brown Glass Bottles and jars |
| | Green Glass Bottles and jars |
| | Clear Glass Bottles and jars |
| | Other Glass |
| Miscellaneous Combustibles | Treated wood |
| | Untreated wood (excluding garden waste) |
| | Reconstituted wood e.g. MDF |
| | Soft furniture |
| | Wooden furniture |
| | Kitchen units and work tops |
| | Disposable Nappies |
| | Other absorbent hygiene products |
| | Pet excrement and bedding |
| | Mattresses |
| | Carpet and Underlay |
| | Other Miscellaneous Combustibles |
| Miscellaneous Non-combustibles | Construction and Demolition Waste |
| | Plaster board |
| | Other Miscellaneous Non-combustible |
| Ferrous Metal | Ferrous food, beverage cans and aerosols |
| | Other ferrous metal |
| Non-Ferrous Metal | Non-ferrous food/beverage/cans/aerosols |
| | Foil |
| | Other non-ferrous metal |
| Organic Non-Catering (Garden) | Soft garden waste |
| | Woody and bulky garden waste |
| | Soil |
| Organic Catering (Kitchen) | Raw fruit and vegetable matter |
| | Raw meat and fish |
| | Cooked and prepared food |
| Liquids | Liquids |
| Fines (<10mm) | particles smaller than 10mm sq aperture |
| WEEE | list all |
| HHW | List all |
| | Total |

# Appendix C – Development of the methodology for sampling each waste stream

## Household dustbin waste

Household waste is complex in its composition because of diverse factors such as geographical location, season, social and economic conditions and methods and frequency of collection. It is practically impossible, as well as physically undesirable; to separate, measure and analyse all the solid waste arisings generated in a local authority. However, the accuracy of waste data has been significantly improved over time with the use of socio-economic profiling tools such as ACORN.

The sample collected for analysis must be sufficient to:

- ensure that the sample is representative of the population (waste stream) as a whole; and
- ensure that a specified precision is achieved.

It should be noted that the amount of sample needed to produce a required precision, reflecting abundance and particle size distribution in the waste stream, for a commonly found material (e.g. paper or glass) would be significantly smaller than that required for a less commonly found material (e.g. batteries). Thus the requirements of the project must be understood from the outset.

Data derived from the National Household Waste Analysis Programme[20] showed that, for a sample of household waste with a paper concentration of about 40% by weight, it was necessary to collect a sample weighing about 500kg (that arising from about 50 households per week, assuming a waste generation rate of 10kg per household). This would achieve a relative error of +/- 10%.

The introduction of kerbside recycling schemes has significantly reduced the weight of paper in household residual waste to approximately 20%. In addition, today the average household throws away, recycles or composts approximately 16kg per week. As such, a minimum of 32 households will provide a sample of about 500 kg. This is considered a more than sufficient weight to determine the concentrations of common items e.g. newspaper and magazines, card packaging, plastic bottles, glass bottles and jars, cans, food and garden waste with a reduced relative error.

## Residual Recycling Centre Waste

The two approaches for analysing waste at HWRC sites are either to analyse a representative sample of the total waste brought to the site (which will include any items that visitors planned to recycle), or to analyse a representative sample of the residual waste that visitors were planning to place in the 'landfill' container. The second approach was adopted for this study as the arisings of residual HWRC waste are reported by authorities through WasteDataFlow, and this information can then be used to determine the overall MSW composition.

The most suitable HWRC site in each of the eight authorities was identified through liaison with the relevant local authority officers. Although the main aim of the site selection process was to identify sites which would be used by the households which were sampled at the kerbside, the selection process also had to consider the operational procedures for sampling at each site. The analysis of waste brought to a HWRC is usually determined by selecting a number of visitors during a day, analysing each of the selected visitors waste, and then summing these analyses to produce an overall estimate of HWRC waste composition.

A variety of approaches can be taken to the sampling of waste at HWRC sites. On purely statistical grounds, the most effective method is stratified random sampling, in which the sampling is based on predetermined factors (this approach is used for opinion poll surveys). However, for this to be successful for sampling at a HWRC site, information is needed on expected visitor types and arrival patterns, and this will seldom be available beforehand at a sufficient level of detail. Stratified random sampling is also likely to impose appreciable operational difficulties

[20] *National household waste analysis project – report on composition and weight data. Department of the Environment report CWM 082/94, August 1994.*

- a drawback that applies equally to simple random sampling. In practice, therefore, three main options are available:

1 systematic sampling of visitors (also termed sampling every 'n-th' vehicle);
2 systematic sampling through time; and
3 sampling the next available vehicle after the present sample has been completed.

Option one is statistically the most attractive as it provides an unbiased estimate of mean weight per vehicle. Consequently, the protocol states that the best approach is to sample every n'th visitor. However, there are operational difficulties with this approach as the limited space at most HWRC sites can make it difficult both to direct a number of visitors to an area where their waste will be unloaded, and to store the waste until it can be analysed. In addition, poor weather may significantly reduce the expected number of visitors, particularly on a week day.

Option two largely reduces these operational problems, but it will introduce a potential bias. Furthermore, clustering problems can still arise as some vehicles may take substantially longer to sample and analyse than the allowed inter-sample time. Thus Option 3 is practically the most attractive, as by definition it avoids any necessity for holding vehicles in a queue or temporarily storing waste. It also makes the most efficient use of sampling effort, as there are no gaps waiting for the next scheduled vehicle or sampling time.

Although option three is the most operationally attractive option, it is more prone to bias, as it reduces the percentage of visitors which are sampled during busy periods. Thus it was necessary to consider whether the practical approach of sampling the next visitor after an analysis has been completed enables a representative sample of waste brought to a HWRC site over a day to be obtained. A simulation model developed as part of the development of the sampling protocol for Wales showed that whilst there is a risk of a modest degree of bias in adopting a sampling strategy based on sampling the "next available visitor", it enables the number of samples taken during the day to be maximised and will thus have an additional benefit in the form of improved precision. This is an important benefit as it outweighs the risk of a possible modest degree of bias. Consequently a sampling procedure based on "next available visitor" was chosen for this study.

## Commercial waste collected by local authorities

Commercial waste collected by local authorities ('trade waste') tends to arise from small premises, with the larger businesses tending to make use of the private sector. This waste stream represents up to 10% by weight of MSW in Scotland, and is becoming more important to local authorities because it counts as municipal waste under the Landfill Directive and therefore requires diversion away from landfill. Thus, there is clearly a need to collect information on this stream in order to both increase confidence in the overall composition of MSW in Scotland and to assess the opportunities for recovering recyclable or compostable materials from this stream.

Local authorities collect from a wide range of types of business. As one of the aims of the study was to obtain information on the wastes produced by different types of business, the businesses were grouped into nine principal business types:

- care services;
- food-related (e.g. restaurant, café);
- hairdressers and beauty salons;
- health care (doctor, dentist or vet);
- office-based;
- retail;
- manufacturing;
- clubs/leisure; and
- other businesses.

Following discussion with the Steering Group, 18 businesses in each authority were chosen by council officers for inclusion in the analysis - two for each business type. As analyses were being conducted in eight authorities in two seasons, this meant that 32 samples from each business type would be analysed during the study. Additional addresses for each business type were listed as fall-backs so that the total sample could be achieved for each authority.

## Bulky household waste

Records of bulky household collections are held by local authorities. As these cover all collections which are made over a year, they provide a better means for determining the composition of this waste stream than sampling one or two collections during the analysis periods.

Local authorities may well make over 5,000 collections (which may contain just one item or a number of items) per year. Although analysis of about 250 records in each authority would have enabled the frequencies of the main types of items in bulky household waste to be identified at an acceptable level of precision, a more extensive analysis provides more information on the arisings of rarer items. Consequently, a minimum sample size of 500 records over a one-year period was chosen for the analysis.

## Other waste streams

These were sampled using the protocol for Wales developed for the 2002/03 survey. For streams, such as schools waste, which were not in this protocol, the most appropriate methodology of those already presented was used.

# Appendix D - Composition of MSW waste streams

**Table D1: Composition (Wt %) of household collected waste**

| Primary Category | Secondary Category | Residual waste | Kerbside dry recyclables | Kerbside green waste |
|---|---|---|---|---|
| Paper | Newspaper, magazines | 4.13 | 54.60 | 0.00 |
| | Other Recyclable Paper | 2.24 | 3.99 | 0.00 |
| | Office quality paper | 0.31 | 0.75 | 0.00 |
| | Non-recyclable Paper | 4.28 | 0.34 | 0.00 |
| Card | Liquid Cartons and tetrapaks | 0.59 | 0.31 | 0.00 |
| | Board Packaging | 1.22 | 4.19 | 0.00 |
| | Thin Card Packaging | 2.91 | 3.81 | 0.00 |
| | Other Card | 0.25 | 0.31 | 0.00 |
| Plastic Film | Carrier Bags | 1.33 | 0.10 | 0.00 |
| | Bin Bags | 0.83 | 0.02 | 0.01 |
| | Packaging Plastic Film | 1.93 | 0.13 | 0.01 |
| | Other Plastic Film | 0.39 | 0.02 | 0.00 |
| Dense Plastic | 1. PET drink bottles | 1.22 | 1.05 | 0.00 |
| | 1. Other PET packaging | 0.81 | 0.23 | 0.00 |
| | 2. HDPE drink bottles | 0.67 | 0.70 | 0.00 |
| | 2. Other HDPE | 0.49 | 0.24 | 0.00 |
| | 3. PVC | 0.05 | 0.03 | 0.00 |
| | 5. PP | 1.32 | 0.14 | 0.01 |
| | 6. PS | 0.46 | 0.06 | 0.00 |
| | 6. EPS | 0.24 | 0.02 | 0.00 |
| | Other dense plastic packaging | 1.98 | 0.16 | 0.00 |
| | Other dense plastic | 1.96 | 0.13 | 0.00 |
| Textiles | Reusable Textiles | 1.75 | 0.04 | 0.00 |
| | Non-reusable Textiles | 1.56 | 0.03 | 0.00 |
| | Shoes, belts and bags | 0.97 | 0.01 | 0.00 |
| Glass | Brown Glass Bottles and jars | 0.64 | 2.39 | 0.00 |
| | Green Glass Bottles and jars | 1.21 | 8.62 | 0.00 |
| | Clear Glass Bottles and jars | 2.98 | 12.75 | 0.00 |
| | Other Glass | 0.68 | 0.20 | 0.00 |
| Miscellaneous Combustibles | Treated wood | 0.86 | 0.02 | 0.00 |
| | Untreated wood (excluding garden waste) | 0.10 | 0.01 | 0.05 |
| | Reconstituted wood e.g. MDF | 0.29 | 0.09 | 0.00 |
| | Soft furniture | 0.00 | 0.00 | 0.00 |
| | Wooden furniture | 0.01 | 0.00 | 0.00 |
| | Kitchen units and work tops | 0.39 | 0.00 | 0.00 |
| | Disposable Nappies | 4.84 | 0.00 | 0.00 |
| | Other absorbent hygiene products | 0.65 | 0.01 | 0.00 |
| | Pet excrement and bedding | 3.30 | 0.00 | 0.41 |
| | Mattresses | 0.01 | 0.00 | 0.00 |
| | Carpet and Underlay | 0.85 | 0.00 | 0.00 |
| | Other Miscellaneous Combustibles | 1.79 | 0.04 | 0.03 |
| Miscellaneous Non-combustibles | Construction and Demolition Waste | 2.03 | 0.00 | 0.07 |
| | Plaster board | 0.20 | 0.00 | 0.00 |
| | Other Miscellaneous Non-combustible | 1.02 | 0.03 | 0.09 |
| Ferrous Metal | Ferrous food, beverage cans and aerosols | 1.72 | 2.65 | 0.00 |
| | Other ferrous metal | 1.17 | 0.02 | 0.00 |
| Non-Ferrous Metal | Non-ferrous food/beverage/cans/aerosols | 0.63 | 1.16 | 0.00 |
| | Foil | 0.43 | 0.03 | 0.00 |
| | Other non-ferrous metal | 0.15 | 0.00 | 0.00 |
| Organic Non-Catering (Garden) | Soft garden waste | 1.58 | 0.01 | 76.60 |
| | Woody and bulky garden waste | 0.23 | 0.00 | 11.30 |
| | Soil | 0.80 | 0.00 | 10.83 |
| Organic Catering (Kitchen) | Raw fruit and vegetable matter | 14.24 | 0.03 | 0.55 |
| | Raw meat and fish | 0.93 | 0.00 | 0.00 |
| | Cooked and prepared food | 16.29 | 0.12 | 0.00 |
| Liquids | Liquids | 1.11 | 0.18 | 0.00 |
| Fines (<10mm) | particles smaller than 10mm sq aperture | 2.64 | 0.02 | 0.00 |
| WEEE | WEEE | 1.50 | 0.19 | 0.00 |
| HHW | HHW | 0.86 | 0.02 | 0.00 |
| | **Total** | **100.00** | **100.00** | **100.00** |

## Table D2: Composition of residual waste from HWRC sites

| Primary Category | Secondary Category | |
|---|---|---|
| Paper | Newspapers & magazines | 1.86 |
| | Books | 0.83 |
| | Other recyclable paper | 1.06 |
| | Non-recyclable Paper | 1.77 |
| Card | Liquid Cartons and tetrapaks | 0.17 |
| | Board Packaging | 2.92 |
| | Thin Card Packaging | 0.71 |
| | Other Card | 0.24 |
| Plastic Film | Carrier Bags | 0.43 |
| | Bin Bags | 0.71 |
| | Packaging Plastic Film | 0.53 |
| | Other Plastic Film | 0.56 |
| Dense Plastic | PET bottles | 0.29 |
| | Other PET Packaging | 0.13 |
| | HDPE bottles | 0.16 |
| | Other HDPE | 0.31 |
| | PVC | 0.01 |
| | PP | 0.44 |
| | PS | 0.17 |
| | EPS | 0.30 |
| | Other dense plastic packaging | 0.61 |
| | Other dense plastic | 5.96 |
| Textiles | Reusable Textiles | 2.76 |
| | Non-reusable Textiles | 1.81 |
| | Shoes, belts and bags | 1.78 |
| Glass | Brown Glass Bottles | 0.59 |
| | Green Glass Bottles and jars | 0.58 |
| | Clear Glass Bottles and jars | 0.54 |
| | Other Glass | 1.70 |
| Miscellaneous Combustibles | Treated wood | 2.92 |
| | Untreated wood (excluding garden waste) | 0.90 |
| | Reconstituted wood | 6.00 |
| | Soft furniture | 1.40 |
| | Wooden furniture | 8.14 |
| | Kitchen units and work tops | 3.79 |
| | Disposable Nappies | 0.51 |
| | Other absorbent hygiene products | 0.11 |
| | Pet excrement and bedding | 0.76 |
| | Mattresses | 4.07 |
| | Carpet and Underlay | 9.46 |
| | Other Miscellaneous Combustibles | 1.54 |
| Miscellaneous Non-combustibles | Construction and Demolition Waste | 6.19 |
| | Plaster board | 2.59 |
| | Other Miscellaneous Non-combustible | 3.07 |
| Ferrous Metal | Ferrous Food and Beverage Cans | 0.30 |
| | Other Ferrous Metal | 3.18 |
| Non-Ferrous Metal | Non-ferrous Food and Beverage Cans | 0.17 |
| | Foil | 0.09 |
| | Other Non-Ferrous Metal | 0.41 |
| Organic Non-Catering (Garden) | Soft Garden Waste | 1.58 |
| | Bulky garden waste | 0.53 |
| | Soil | 2.49 |
| Organic Catering (Kitchen) | Raw fruit and vegetable matter | 1.65 |
| | Raw meat and fish | 0.17 |
| | Cooked and prepared food | 1.95 |
| Liquids | Liquids | 0.38 |
| Fines (<10mm) | Fines (<10mm) | 0.60 |
| WEEE | Large household appliances | 1.38 |
| | Small household appliances | 0.91 |
| | IT and telecommunications equipment | 0.35 |
| | Consumer equipment | 0.42 |
| | Lighting equipment | 0.29 |
| | Electrical and electronic tools | 0.32 |
| | Toys, leisure and sport equipment | 0.27 |
| | Monitoring and control instruments | 0.13 |
| Hazardous, Clinical and Batteries | Paint & paint related products | 0.85 |
| | Engine Oil | 0.05 |
| | Batteries | 0.07 |
| | Healthcare waste | 0.00 |
| | Pesticides and other chemicals for the garden | 0.00 |
| | Other | 0.04 |
| **Total** | | **100.00** |

## Table D3: Composition (Wt %) of other MSW streams

| Primary Category | Secondary Category | Litter | Primary Schools | Secondary Schools | Parks & Gardens |
|---|---|---|---|---|---|
| Paper | Newspaper, magazines | 7.59 | 2.30 | 3.42 | 8.91 |
| | Other Recyclable Paper | 3.41 | 4.64 | 5.29 | 2.19 |
| | Office quality paper | 0.08 | 2.51 | 6.63 | 0.00 |
| | Non-recyclable Paper | 3.82 | 11.94 | 11.34 | 3.95 |
| Card | Liquid Cartons and tetrapaks | 0.98 | 3.38 | 1.27 | 1.46 |
| | Board Packaging | 1.74 | 5.12 | 5.20 | 0.92 |
| | Thin Card Packaging | 3.96 | 1.95 | 1.79 | 3.94 |
| | Other Card | 1.52 | 0.16 | 0.73 | 0.94 |
| Plastic Film | Carrier Bags | 1.67 | 0.37 | 0.53 | 1.37 |
| | Bin Bags | 2.07 | 2.64 | 3.48 | 2.18 |
| | Packaging Plastic Film | 1.85 | 2.16 | 2.39 | 0.51 |
| | Other Plastic Film | 0.35 | 0.62 | 1.50 | 0.26 |
| Dense Plastic | 1. PET drink bottles | 5.83 | 1.97 | 3.74 | 5.56 |
| | 1. Other PET packaging | 0.49 | 0.74 | 0.38 | 0.36 |
| | 2. HDPE drink bottles | 0.42 | 0.33 | 0.41 | 0.31 |
| | 2. Other HDPE | 0.24 | 0.38 | 0.33 | 0.02 |
| | 3. PVC | 0.00 | 0.91 | 0.51 | 0.00 |
| | 5. PP | 1.41 | 1.29 | 1.13 | 1.41 |
| | 6. PS | 0.48 | 1.76 | 1.01 | 1.15 |
| | 6. EPS | 0.72 | 0.25 | 0.74 | 0.17 |
| | Other dense plastic packaging | 1.62 | 1.78 | 1.17 | 0.89 |
| | Other dense plastic | 1.13 | 1.14 | 1.69 | 1.33 |
| Textiles | Reusable Textiles | 0.10 | 0.07 | 0.23 | 0.82 |
| | Non-reusable Textiles | 0.65 | 0.61 | 0.17 | 0.53 |
| | Shoes, belts and bags | 1.14 | 0.17 | 0.15 | 0.72 |
| Glass | Brown Glass Bottles and jars | 0.81 | 0.04 | 0.00 | 2.53 |
| | Green Glass Bottles and jars | 2.89 | 0.06 | 0.12 | 5.97 |
| | Clear Glass Bottles and jars | 4.39 | 0.70 | 0.58 | 10.25 |
| | Other Glass | 0.28 | 0.02 | 0.18 | 1.07 |
| Miscellaneous Combustibles | Treated wood | 0.28 | 0.19 | 0.43 | 0.07 |
| | Untreated wood | 0.18 | 0.10 | 0.76 | 0.00 |
| | Reconstituted wood e.g. MDF | 0.13 | 0.00 | 0.05 | 0.01 |
| | Soft furniture | 0.00 | 0.00 | 0.00 | 0.00 |
| | Wooden furniture | 0.00 | 0.00 | 0.00 | 0.00 |
| | Kitchen units and work tops | 0.52 | 0.00 | 0.00 | 0.00 |
| | Disposable Nappies | 1.36 | 0.01 | 0.00 | 0.00 |
| | Other absorbent hygiene products | 0.72 | 0.03 | 0.03 | 0.01 |
| | Pet excrement and bedding | 8.69 | 0.07 | 0.15 | 13.69 |
| | Mattresses | 0.00 | 0.00 | 0.00 | 0.00 |
| | Carpet and Underlay | 0.09 | 0.02 | 0.00 | 0.00 |
| | Other Miscellaneous Combustibles | 0.52 | 1.31 | 2.22 | 0.64 |
| Miscellaneous Non-combustibles | Construction and Demolition Waste | 0.03 | 0.12 | 0.63 | 0.00 |
| | Plaster board | 0.15 | 0.01 | 0.00 | 0.00 |
| | Other Miscellaneous Non-combustible | 0.57 | 0.18 | 0.35 | 1.74 |
| Ferrous Metal | Ferrous food, beverage cans and aerosols | 1.21 | 0.79 | 1.70 | 0.99 |
| | Other ferrous metal | 0.56 | 0.42 | 0.49 | 1.98 |
| Non-Ferrous Metal | Non-ferrous food/beverage/cans/aerosols | 2.35 | 0.12 | 0.97 | 2.14 |
| | Foil | 0.38 | 0.32 | 0.38 | 0.01 |
| | Other non-ferrous metal | 1.63 | 0.07 | 0.10 | 0.00 |
| Organic Non-Catering (Garden) | Soft garden waste | 1.28 | 0.61 | 1.51 | 0.15 |
| | Woody and bulky garden waste | 0.47 | 0.34 | 2.51 | 0.07 |
| | Soil | 4.14 | 0.94 | 2.79 | 1.99 |
| Organic Catering (Kitchen) | Raw fruit and vegetable matter | 4.31 | 14.14 | 10.35 | 0.69 |
| | Raw meat and fish | 0.82 | 1.28 | 0.32 | 4.94 |
| | Cooked and prepared food | 7.69 | 16.71 | 10.17 | 5.21 |
| Liquids | Liquids | 5.07 | 7.87 | 4.75 | 2.70 |
| Fines (<10mm) | particles smaller than 10mm sq aperture | 1.49 | 3.21 | 1.82 | 2.69 |
| WEEE | WEEE | 3.65 | 1.03 | 0.96 | 0.52 |
| HHW | HHW | 0.08 | 0.09 | 0.47 | 0.03 |
| **Total** | | **100.00** | **100.00** | **100.00** | **100.00** |

# Appendix E – Weight of household waste in sample areas

## Table E1: Monitored weight arisings (kg/household per week) in each sample area

| | | | Spring | | | | Autumn | | | | Average | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LA | collections | ACORN | waste | dry recycling | compost | total | waste | dry recycling | compost | total | waste | dry recycling | compost | total |
| **East Dunbartonshire** | waste = weekly | 1.C.9 | 9.34 | 4.35 | 4.42 | 18.11 | 6.74 | 4.36 | 6.19 | 17.29 | 8.04 | 4.36 | 5.31 | 17.70 |
| | recycling = weekly | 3.H.28 | 10.89 | 4.18 | 4.54 | 19.61 | 10.86 | 4.71 | 1.23 | 16.80 | 10.88 | 4.45 | 2.89 | 18.21 |
| | compost = fortnightly | 4.M.41 | 10.41 | 4.00 | 4.37 | 18.78 | 12.53 | 2.85 | 2.16 | 17.54 | 11.47 | 3.43 | 3.27 | 18.16 |
| **Edinburgh** | waste = weekly | 2.D.13 | 12.00 | 1.48 | 4.56 | 18.04 | 13.22 | 4.10 | 6.70 | 24.02 | 12.61 | 2.79 | 5.63 | 21.03 |
| | recycling = AWC red/blue b | 2.E.19 | 8.94 | 1.34 | 2.85 | 13.13 | 13.14 | 1.17 | 3.76 | 18.07 | 11.04 | 1.26 | 3.31 | 15.60 |
| | compost = fortnightly | 5.P.53 | 8.20 | 0.63 | | 8.83 | 3.28 | 0.35 | | 3.63 | 5.74 | 0.49 | | 6.23 |
| **Glasgow** | waste = weekly | 2.E.17 | 10.32 | | | 10.32 | 6.76 | 2.56 | | 9.32 | 8.54 | 1.28 | | 9.82 |
| | recycling = weekly | 5.O.50 | 3.75 | | | 3.75 | 4.36 | | | 4.36 | 4.06 | | | 4.06 |
| | | 5.P.54 | 8.50 | | | 8.50 | 13.44 | | | 13.44 | 10.97 | | | 10.97 |
| **Highlands** | waste = weekly | 1.B.8 | 14.01 | 1.10 | 5.92 | 21.03 | 11.25 | 2.10 | 9.13 | 22.48 | 12.63 | 1.60 | 7.53 | 21.76 |
| | recycling = fortnightly | 3.H.26 | 15.08 | 1.69 | 11.87 | 28.64 | 9.60 | 1.58 | 12.32 | 23.50 | 12.34 | 1.64 | 12.10 | 26.07 |
| | compost = fortnightly | 5.N.45 | 16.39 | 1.18 | 4.80 | 22.37 | 11.64 | 1.90 | 4.84 | 18.38 | 14.02 | 1.54 | 4.82 | 20.38 |
| **Moray** | waste = AWC | 1.A.3 | 7.66 | 2.88 | 4.85 | 15.39 | 5.91 | 1.88 | 4.41 | 12.20 | 6.79 | 2.38 | 4.63 | 13.79 |
| | recycling = weekly | 4.L.40 | 7.33 | 4.00 | 5.29 | 16.62 | 6.04 | 3.38 | 2.90 | 12.32 | 6.69 | 3.69 | 4.10 | 14.47 |
| | compost = AWC | 5.N.46 | 10.28 | 3.57 | 0.91 | 14.76 | 7.65 | 2.35 | 2.80 | 12.80 | 8.97 | 2.96 | 1.86 | 13.78 |
| **Orkney** | waste = weekly | 1.B.6 | 16.68 | | | 16.68 | 7.80 | | | 7.80 | 12.24 | | | 12.24 |
| | recycling = fortnightly | 3.I.34 | 6.38 | 1.81 | 0.41 | 8.60 | 6.52 | 1.49 | 0.95 | 8.96 | 6.45 | 1.65 | 0.68 | 8.78 |
| | compost = four weekly | 5.N.46 | 12.19 | 1.56 | 4.31 | 18.06 | 11.98 | 0.53 | 3.67 | 16.18 | 12.09 | 1.05 | 3.99 | 17.12 |
| **Renfrewshire** | waste = weekly | 1.C.10 | 14.65 | | | 14.65 | 10.62 | | | 10.62 | 12.64 | | | 12.64 |
| | recycling = fortnightly | 2.F.22 | 12.85 | | | 12.85 | 9.87 | | 3.63 | 13.50 | 11.36 | | 1.82 | 13.18 |
| | compost = fortnightly | 5.O.52 | 13.79 | | | 13.79 | 9.08 | | 3.61 | 12.69 | 11.44 | | 1.81 | 13.24 |
| **South Ayrshire** | waste = fortnightly | 1.A.2 | 10.00 | 4.44 | 5.14 | 19.58 | 10.40 | 5.66 | 5.34 | 21.40 | 10.20 | 5.05 | 5.24 | 20.49 |
| | recycling = mixed 4 weekly | 1.B.6 | 12.45 | 0.10 | 1.68 | 14.23 | 14.44 | 5.23 | 5.43 | 25.10 | 13.45 | 2.67 | 3.56 | 19.67 |
| | recycling = glass fortnightly | 4.M.43 | 9.47 | 3.64 | 2.61 | 15.72 | 9.83 | 4.13 | 8.51 | 22.47 | 9.65 | 3.89 | 5.56 | 19.10 |
| | compost = 4 weekly | 5.N.47 | 10.66 | 2.37 | 0.69 | 13.72 | 11.54 | 5.93 | 2.59 | 20.06 | 11.10 | 4.15 | 1.64 | 16.89 |

# Appendix F – Determination of biodegradable content of MSW

The biodegradable content of MSW in Scotland from this study is calculated as 62.9%. This was calculated using data on the composition of the MSW stream and the assumed biodegradable content of each of the categories of MSW (see Table F1 below). The assumed biodegradable content (expressed as % of each material type) was taken from Scottish landfill allowance regulations (2005) and associated guidance produced in 2007. For a small number of the waste types listed in Table F1 the assumed biodegradable content is not specified in Scottish regulations and guidance. In this case we used the assumed biodegradable content from Environment Agency guidance. The five waste categories where this applies are marked with * in table F1 below. For those waste categories specified in the Scottish guidance the assumed biodegradable content (%) is the same as in the Environment Agency guidance.

**Table F1: Biodegradable content of MSW in Scotland**

| | Composition (Wt %) of MSW in Scotland | Assumed biodegradable content (Wt %) | Biodegradable content (Wt %) |
|---|---|---|---|
| Newspapers & magazines | 8.6 | 100 | 8.6 |
| Other paper | 7.5 | 100 | 7.5 |
| Cardboard | 5.2 | 100 | 5.2 |
| Plastic film | 3.0 | 0 | 0.0 |
| Plastic bottles | 2.5 | 0 | 0.0 |
| Other plastic packaging | 2.4 | 0 | 0.0 |
| Other dense plastic | 1.5 | 0 | 0.0 |
| Textiles & footwear | 3.1 | 50 | 1.5 |
| Wood | 2.8 | 100 | 2.8 |
| Furniture | 2.3 | 50 | 1.2 |
| Disposable nappies* | 2.4 | 50 | 1.2 |
| Other Combustibles* | 5.0 | 50 | 2.5 |
| Packaging glass | 7.0 | 0 | 0.0 |
| Other glass | 0.5 | 0 | 0.0 |
| Rubble (C&D waste) | 4.5 | 0 | 0.0 |
| Other non-combustibles* | 0.8 | 0 | 0.0 |
| Metal cans | 1.9 | 0 | 0.0 |
| Other metal | 2.1 | 0 | 0.0 |
| Food/kitchen waste | 17.7 | 100 | 17.7 |
| Garden waste | 13.1 | 100 | 13.1 |
| Other organics | 0.8 | 100 | 0.8 |
| HHW* | 0.5 | 0 | 0.0 |
| WEEE | 2.9 | 0 | 0.0 |
| Fines* | 1.9 | 50 | 1.0 |
| **Total** | **100.0** | | **62.9** |

To calculate 95% confidence intervals for the estimate of biodegradable content in Table F1 the variability in composition of residual waste streams was used. The biodegradable content was then determined using the assumed biodegradable contents for each category shown in Table F1. This showed that the 95% confidence interval for the biodegradable content of MSW in Scotland was ±1.5 percentage points, which means that there is a 95% probability that the biodegradable content of MSW in Scotland is between 61.4% and 64.4%.

As composition data was taken from a non-random sample frame (e.g ACORN household categories) this variation only represents sampling error. It is recognised that the use of the highly stratified design in this study may have introduced additional non-sampling bias which cannot be accounted for. WasteDataFlow records were not used directly to calculate confidence intervals as the figures reported are absolute values.

Zero Waste Scotland
Unit 1b, Hillside House
Laurelhill Business Park
Stirling
FK7 9JQ
Tel: 01786 468890

www.zerowastescotland.org.uk

# Borders Council

# Household (Town) Waste Analysis

# June 2009

# Borders Council – Waste Analysis Spring 2008

**Borders Council – Household (Town) Waste Analysis June 2009**

## 1. Introduction

Albion Environmental Ltd was requested to carry out a Waste Analysis by Borders Council. The waste composition analysis was to be carried out over 150 households in the Hawick and Kelso areas.

The analysis was undertaken at the Council Depot situated in Hawick where waste was uplifted from differing council tax banded areas in and around the towns of Hawick and Kelso. The primary purpose was to provide details of the quantity of each material type going to the residual (green) bin collection system operated by Borders Council. The second purpose was to try and identify the quantity of waste which should be in the recycling bins.

## 2. Household Waste Composition Analysis

Methodology

Detailed risk and method statements are included in Appendix 2. In summary the aim was to collect a number of bins from a known area and split the waste into the following fractions:

1. Newspapers and magazines
2. Other recyclable paper
3. Card and Card Packaging
4. Non-recyclable paper
5. Plastic film
6. Dense Plastics Total (including PET and HDPE)
7. Textiles
8. Glass
9. Organic Kitchen (catering) Waste Only.
10. Organic Garden Waste Only
11. Other Putrescibles
12. Ferrous Metal
13. Non-ferrous metal
14. Electrical / electronic equipment
15. Potentially Hazardous
16. Other Combustibles
17. Other Non-combustible
18. Fines

The weight and volume of each of these waste types was then recorded. Work was completed from 16$^{th}$ to 17$^{th}$ June 2009 by Albion Environmental Ltd.

The work has been completed to try and ensure that the data is as representative as possible of the complete Borders Council area. Current guidance from the 'National Methodology for Household Waste Composition Analysis in Scotland' suggests that a sample size of 150 houses provides a statically sound analysis for the Borders Council area.

In order to further improve the statistical accuracy of the analysis the 150 bin sample was weighted to represent the council tax bandings for the whole of the Borders Council area. The amount of households selected from each Tax Banding were calculated using 'National Methodology for Household Waste Composition Analysis in Scotland' and also Report 3 - Council Tax by Assessor/Local Authority/Council Tax Band from the General Statistics page of the Scottish Assessors Association website.

The breakdown of the households is shown below:

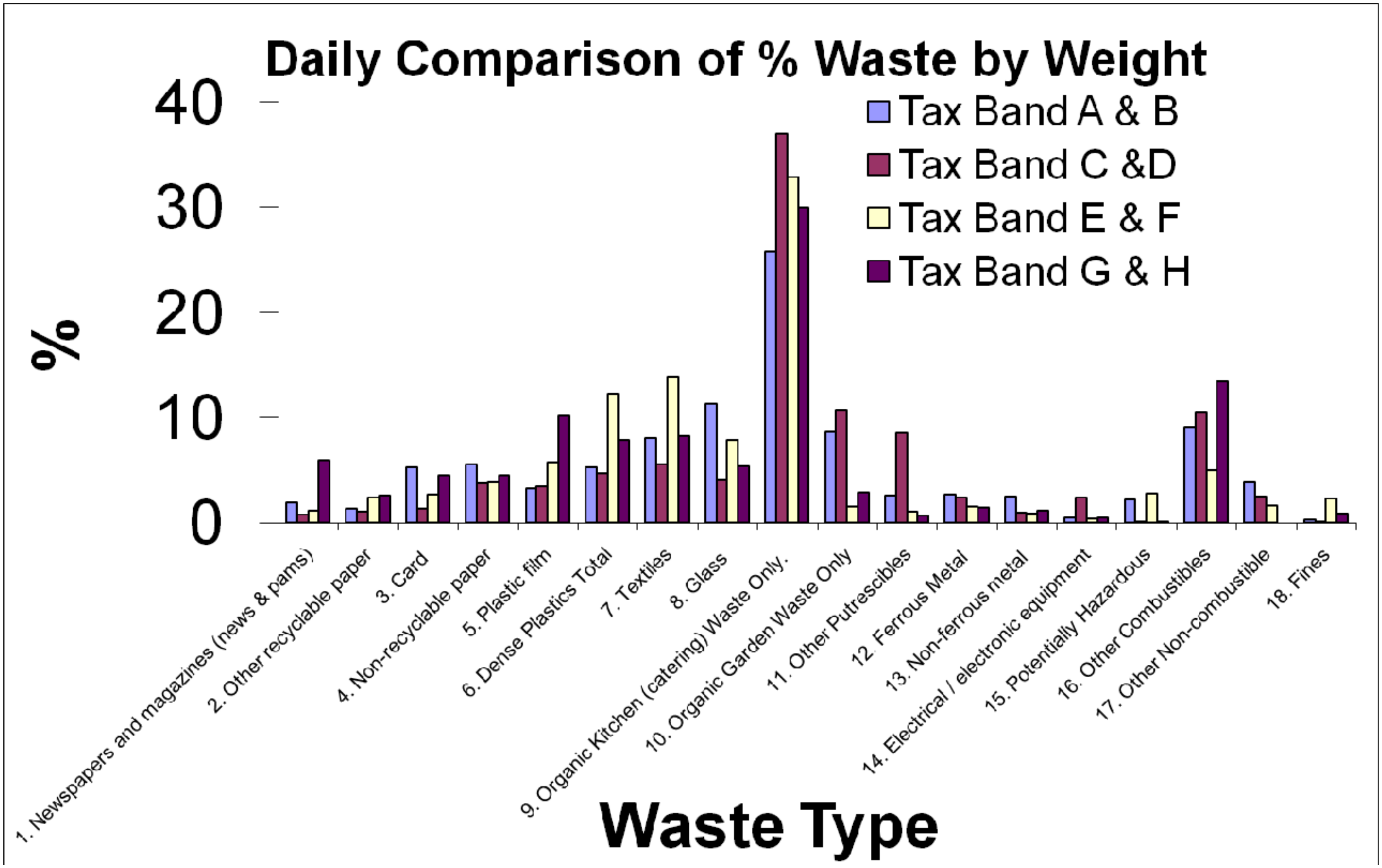
| Council Tax Bands | No of Household Bins |
|---|---|
| A & B | 79 |
| C & D | 33 |
| E & F | 27 |
| G & H | 11 |
| **Total** | **150** |

## 3. Analysis Data

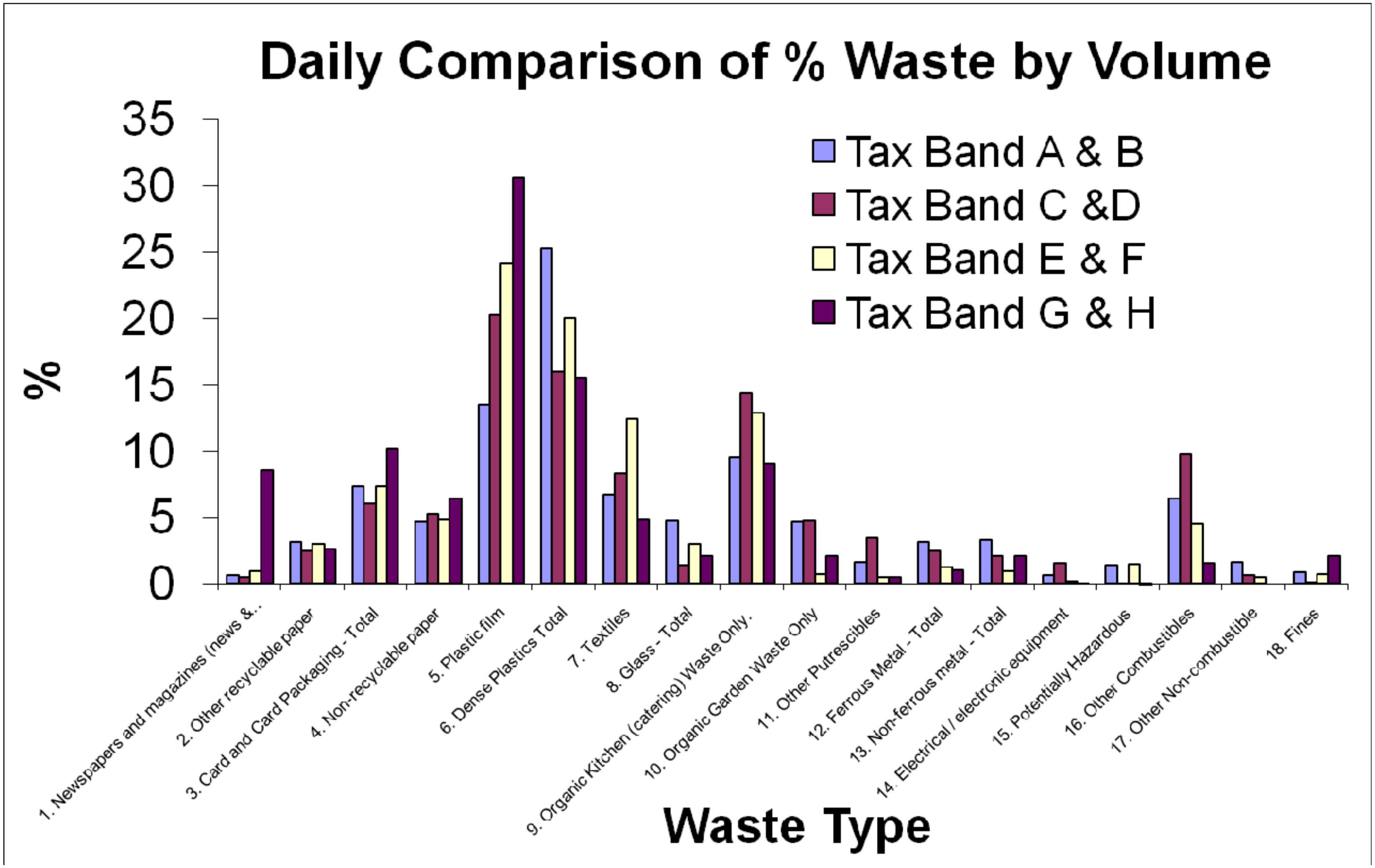
The raw data recorded on each day is included within Appendix 5.

The following charts show the percentages of each waste type present. The first chart shows percentage waste versus weight and the second chart percentage waste versus volume. Both charts show data from a complete week, which in this case is a 150-bin sample.

As both graphs show a lot of detail, for clarity the key for both graphs is shown below.



Daily Comparison of % Waste by Weight
Tax Band A & B
Tax Band C &D
Tax Band E & F
Tax Band G & H
%
40
30
20
10
0
1. Newspapers and magazines (news & pams)
2. Other recyclable paper
3. Card
4. Non-recyclable paper
5. Plastic film
6. Dense Plastics Total
7. Textiles
8. Glass
9. Organic Kitchen (catering) Waste Only.
10. Organic Garden Waste Only
11. Other Putrescibles
12. Ferrous Metal
13. Non-ferrous metal
14. Electrical / electronic equipment
15. Potentially Hazardous
16. Other Combustibles
17. Other Non-combustible
18. Fines
Waste Type



Daily Comparison of % Waste by Volume
%
35
30
25
20
15
10
5
0
Tax Band A & B
Tax Band C &D
Tax Band E & F
Tax Band G & H
1. Newspapers and magazines (news &...
2. Other recyclable paper
3. Card and Card Packaging - Total
4. Non-recyclable paper
5. Plastic film
6. Dense Plastics Total
7. Textiles
8. Glass - Total
9. Organic Kitchen (catering) Waste Only.
10. Organic Garden Waste Only
11. Other Putrescibles
12. Ferrous Metal - Total
13. Non-ferrous metal - Total
14. Electrical / electronic equipment
15. Potentially Hazardous
16. Other Combustibles
17. Other Non-combustible
18. Fines
Waste Type

It is clear from the first chart, that the largest portion of waste by weight is organic kitchen waste at an average of 30.18%. The next largest is other combustibles (av. 9.08%), followed by glass (av. 8.52%), then textiles (av. 8.31%), garden waste (av. 7.73%), dense plastics (6.37%) then non-recyclable paper (4.73%).

From the second chart it is clear that the percentages are quite different when waste types are related to volume. For example organic kitchen waste only makes up on average 11.32% by volume compared to 30.18% by weight. The largest categories by volume are dense plastics (21.28%) then plastic film (18.41%) followed by organic kitchen waste, textiles (7.97%), card (7.27%) and other combustibles (6.56%). Glass makes up 3.44% of the waste by volume.

The category other combustibles was mostly made up of disposable nappies and wood. The category textiles generally consisted of clothing with the occasional small carpet or pillow. Only PET and HDPE bottles were placed in their respective categories (6.1 and 6.2) with any other PET or HDPE product placed in the unallocated reference category (6.6).

## 4. Housing Types

As previously discussed the waste was received from the Borders area. A range of housing types was selected by Council Tax Band to try and get as large a cross section of the community as possible. In summary they are as follows:

Tuesday 16th June 2009
Council Tax Bands A & B - (79 Bins)
Hawick Town – Tuesday Collection

Wednesday 17th June 2009
Council Tax Bands C & D - (33 Bins)
Kelso Town – Wednesday Collection

Wednesday 17th June 2009
Council Tax Bands E & F - (27 Bins)
Kelso Town – Wednesday Collection

Tuesday 16th June 2009
Council Tax Bands G & H - (11 Bins)
Hawick Town – Tuesday Collection

Samples were chosen as detailed above to represent the ratio of council tax bands in Borders Council area as a whole.

## 5. Analysis of Data by Housing Type

It is difficult to note specific trends between tax bands but it is worth noting the following:

- Tax bands G & H produced the largest % weight of newspapers/magazines and recyclable paper while tax bands C & D produced the lowest.
- Also tax bands A & B threw away the largest % weight of card with tax bands C & D the least.
- Tax bands G & H discarded the most % weight of PET and HDPE and E & F discarded the least.
- Tax bands E & F disposed of the greatest amount of textiles (mainly clothes) and tax bands A & B the least.
- Tax bands A & B bins the highest % weight of glass and C & D the lowest.
- Tax bands C & D disposes the most % weight of organic kitchen waste and A & B the least.
- Tax bands C & D disposes the most % weight of organic garden waste and E & F the least.
- C & D the highest amount of WEEE and E & F the least.

## 6. Analysis of Residual Waste Bins

An analysis of residual waste has being carried out to try and identify the participation in the multi bin collection system. This analysis can also be used to provide valuable information for future development of the system.

Borders Council currently has developed and rolled out a three bin system which operates as follows:

Recycling Bags collected weekly and contains recyclate including cans, paper, cardboard, plastic bottles and also clear plastic film.

The Green Lid bin is collected weekly for 31 weeks of the year from the beginning of April till the end of October and contains all garden waste.

Finally the residual waste (grey lid bin) is collected weekly and contains all remaining wastes.

Average data for weight and volume for each bin is listed in the table 1 below. All wastes were collected from the grey lid bins only in each area.

Based on the weights and volumes of bins used for this study the average weight per bin was 13.96 kg and the average volume was 151.34 litres.

If we assume that all blue bin waste and brown bin waste is placed in the correct bin over a month the quantities in each bin would be as follows-

The residual (grey lid) bin would average 9.88kg in weight and 104.54 litres in volume

The recycling bag would average an additional 1.81kg and 24.8 litres approximately. The waste categories ferrous and non-ferrous metals used in the waste composition analysis included all metals but were predominately drinks and aerosol cans.
It is also worth noting that glass averaged 1.19 kg and 5.2 litres per bin. It is obvious that some households are still not making full use of the bottle banks available around the towns.

The green waste (green lid) bin would average an additional 1.08 kg by weight and 5.8 litres by volume.

**Table 1 – Average Weights and Volume for Three-Bin System.**

| Waste Type | Average Weight per bin | Average Volume per bin | Average weight of waste | | | Average volume of waste | | |
|---|---|---|---|---|---|---|---|---|
| | | | Residual Bin Total (Waste) | Recyclate Bin Total (Recyclate) | Green Waste Bin Total (Compost) | Residual Bin Total (Waste) | Recyclate Bin Total (Recyclate) | Green Waste Bin Total (Compost) |
| **1. Newspapers and magazines (news & pams)** | **0.24** | **2.07** | | **0.24** | | | **2.07** | |
| **2. Other recyclable paper** | **0.21** | **4.47** | | **0.21** | | | **4.47** | |
| **3. Card** | **0.53** | **11.00** | | **0.53** | | | | |
| **4. Non-recyclable paper** | **0.66** | **7.60** | **0.66** | | | **7.60** | | |
| **5. Plastic film** | **0.57** | **27.87** | **0.57** | | | **27.87** | | |
| **6. Dense Plastic** | **0.89** | **32.20** | | | | | | |
| *6.1 PET Bottles* | *0.08* | *3.87* | | *0.08* | | | *3.87* | |
| *6.2 HDPE* | *0.17* | *6.73* | | *0.17* | | | *6.73* | |
| *6.6 Unallocated Reference* | *0.63* | *21.60* | *0.63* | | | *21.60* | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **7. Textiles** | **1.16** | **12.07** | **1.16** | | | **12.07** | | |
| **8. Glass** | **1.19** | **5.20** | | | | | | |
| **9. Organic Kitchen (catering) Waste Only.** | **4.21** | **17.13** | **4.21** | | | **17.13** | | |
| **10. Organic Garden Waste Only** | **1.08** | **5.80** | | | **1.08** | | | **5.80** |
| **11. Other Putrescibles** | **0.53** | **2.77** | **0.53** | | | **2.77** | | |
| **12. Ferrous Metal** | **0.33** | **3.80** | | **0.33** | | | **3.80** | |
| **13. Non-ferrous Metal** | **0.24** | **3.87** | | **0.24** | | | **3.87** | |
| **14. Electrical / electronic equipment** | **0.14** | **1.21** | **0.14** | | | **1.21** | | |
| **15. Potentially Hazardous** | **0.22** | **1.50** | **0.22** | | | **1.50** | | |
| **16. Other Combustibles** | **1.27** | **9.93** | **1.27** | | | **9.93** | | |
| **17. Other Non-combustible** | **0.40** | **1.67** | **0.40** | | | **1.67** | | |
| **18. Fines** | **0.08** | **1.20** | **0.08** | | | **1.20** | | |
| **Total** | **13.96** | **151.34** | **9.88** | **1.81** | **1.08** | **104.54** | **24.80** | **5.80** |

## 7. Future Potential for Three Bin System

The residual waste analysis indicates that there is potential to increase recycling rates above existing levels. The data above would suggest that Borders Council can still expect to achieve an increased recycling rate of 16.4 % for the recycling bags and 3.8% for the green waste bins by volume (12.9% and 7.7% by weight respectively) giving a total of 20.2% by volume (20.7% by weight). Glass recycling could also be increased by 23.7% by volume and 29.2 % by weight.

The increase in volume of waste needing to be placed in the recycling bag may be a barrier to achieving this high rate depending on fullness of bags at present and should be kept under review. Borders should consider completing further work to identify the barriers to recycling certain waste streams by the public.

## 8. BMW Content

The Scottish Executive has asked local councils to identify average BMW (Biodegradable Municipal Waste) figures for household waste.

Based on this months data an approximate BMW total can be arrived at by taking weight of the categories at the following percentages. Paper, cardboard, organic kitchen and garden waste, other putrescibles, combustibles and fines at 100% and textiles at 50%. Percentage of BMW is therefore 67.28%.

## 9. Anomalies with Analysis

Using the method as described for completing the waste analysis there are a number of anomalies within the system. To ensure these anomalies are not significant they are dealt with in a consistent manner. They are as follows-

- Small percentage of tins still contained some food residues and they are placed in metal category. Result - Metal weights will be slightly increased.
- Small percentage of plastic bottles still contained some liquid/food residues and they are placed in plastic category. Result - Plastic weights will be slightly increased.
- Plastic film and packaging were sometimes contaminated with food waste and they are placed in plastics categories. Result - plastic film and dense plastic weights will be slightly increased.
- Plastic film removed from waste was placed in 190 litre bins and compressed by hand in the bins. Depending on the amount of plastic film from tax band to tax band, some bins would contain more plastic film (more compressed) than others, therefore total volume would remain fairly level but weights would vary.
- Large volumes of cat litter and other pet bedding may yield unrepresentative results for the sampled area (other putrescibles).

Due to the nature of the material being handled there is no easy answer to remove these anomalies. For example a container holding liquid residues may be hazardous, but analysis team would have no method of identification or method to identify the risks. If drinks bottle contained what looked like named liquid e.g. Irn-Bru then liquid would be poured into kitchen waste category and empty bottle placed in PET category. If, however, liquid in drinks bottle did not resemble that of the packaging e.g. oil, then item would be placed into potentially hazardous category.

Due to the nature in which the waste was delivered to the analysis site i.e. bin lorry, much of the waste was compressed. As a result certain food packaging, etc. burst open and consequently contaminated other categories with food residues which in turn affected the their respective weights.

## 10. Seasonal Variations with Analysis

Normal practice with waste analysis is to carry out four waste analysis studies per year to take into account seasonal variations. The main seasonal variation between winter and summer waste analysis is the expected increase in garden waste and also non-recyclable paper in the form of used tissue paper. All other wastes would be expected to show little variation.

## Appendix 1

Waste Categories

| PRIMARY MATERIAL CATEGORY | MATERIALS INCLUDED (Examples) |
|---|---|
| 1. Newspapers and magazines | Newspapers, Exchange & Mart, glossy magazines, telephone directories, yellow pages, catalogues, travel brochures. |
| 2. Other recyclable paper | Unused wall paper, paper bags, paper packaging, mail in an envelope, diaries, envelopes, posters, books, travel tickets, non-glossy pamphlets.<br><br>Office Quality Paper: Letters, writing paper, computer paper, loose leaf paper, photocopies |
| 3. Card | **Boxes and packets for**: cereal, washing powder, eggs, tissues, powdered milks, washing soda, biscuits, ice cream, fabric conditioner. Corrugated card, greetings cards, postcards, beer mats, files.<br>**Drinks Cartons**: fruit juice, milk cartons. |
| 4. Non-recyclable paper | Wall paper removed from walls, photos, facial and toilet tissues, kitchen paper. |
| 5. Plastic film | Films such as garment and produce bags, refuse sacks, packaging films, bubble wrap, |
| 6. Dense Plastic | **6.1 PET [Type1]:** Fizzy / still drink and alcohol bottles<br><br>**6.2 HDPE** Packaging household and industrial chemicals (e.g. detergents, bleaches) bottles, snack and food bottles, milk and non-carbonated drinks bottles<br><br>**6.6 Unallocated References:** There are many polymers other than the six most common. Including<br><br>**6.3 PVC** Pipes & fittings, shampoo & vegetable oil bottles, credit cards, synthetic leather products.<br><br>**6.4 PP :** Large moulded products such as battery casings, bottle tops, ketchup & pancake bottles, yoghurt & margarine containers, crisp bags, drinking straws, medicine containers. |

| PRIMARY MATERIAL CATEGORY | MATERIALS INCLUDED (Examples) |
|---|---|
| 6. Dense Plastic (cont.) | 6.5 **PS** Yoghurt pots, fast food trays, disposable cutlery, video cases, vending cups, seed trays, coat hangers, low cost brittle toys. Expanded polystyrene is also used for egg boxes food trays, hot drink cups, protective packaging for fragile items and insulation. |
| 7. Textiles | Clothing, shoes and other household items made form man-made or natural fibres. |
| 8. Glass | **Brown glass:** bottles and packaging.<br>**Green glass:** bottles and packaging.<br>**Clear glass:** bottles and packaging.<br>**Other coloured glass:** bottles and packaging<br>**Non-packaging glass:** mirrors, reinforced glass, non-fluorescent light bulbs etc. |
| 9. Organic Kitchen (catering) Waste Only. | Vegetable peelings & trimmings, fruit, including cooked vegetables etc. (excluded at source).<br><br>Kitchen waste that contains or is potentially contaminated with meat / meat products etc. |
| 10. Organic Garden Waste Only | Grass cuttings, weeds, flowers, prunings, tree branches, hedge trimmings etc. |
| 11. Other Putrescibles | Pet excrement, bones (non-catering), dead animals etc. |
| 12. Ferrous Metal (magnetic) | **Cans** for beer, cola, pet food, food, perfume, hairspray etc.<br>**Other ferrous material:** Keys, cutlery, bike locks, ring pulls, paper clips, safety pins, tools, car parts, oil filters, biscuit tins, radiators, metal shelving units etc. |
| 13. Non-ferrous metal (not magnetic) | **Food and beverage cans:** beer / cola, aerosols, ring pulls etc.<br>**Foil:** aluminium foil, milk bottle tops, yoghurt tops etc.<br>**Other non-ferrous metal:** copper pipe, stainless steel sink unit, saucepans, bike parts etc. |
| 14. Electrical / electronic equipment | **Large Household Appliances**: refrigerators, freezers, washing machines, clothes dryers, dish washing machines, electric stoves, microwaves, electric heating appliances, electric radiators, electric fans, air conditioner appliances etc.<br>**Small Household Appliances**: vacuum cleaners, carpet sweepers , appliances for sewing, knitting, weaving and processing for textiles, irons, toasters, fryers, grinders, coffee machines electric knives, hair dryers, toothbrushes, shavers, massage and other body care appliances, clocks, watches etc.<br>**IT and Telecommunications Equipment**: mainframes, printers, personal computers, laptops and accessories (CPU, mouse, screen and keyboard included), copying equipment, electrical and electronic typewriters, calculators, fax machines, |

| **PRIMARY MATERIAL CATEGORY** | **MATERIALS INCLUDED (Examples)** |
|---|---|
| 14. Electrical / electronic equipment (cont) | telex, telephones (including cordless & cellular), answering machines etc.<br>**Consumer Equipment**: radio and television sets, video cameras, video recorders, Hi-fi systems, audio amplifiers, musical instruments (electric, e.g. keyboards) etc.<br>**Lighting Equipment**: straight & compact fluorescent lamps, other lighting or equipment for the purpose of shedding or controlling light with the exception of filament bulbs etc.<br>**Electrical & Electronic Tools**: drills, saws, equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making holes, punching, folding, bending; tools for riveting, nailing, screwing or removing rivets, nails, screws or similar uses; tools for welding, soldering or similar uses, tools for mowing & other gardening activities etc.<br>**Toys, Leisure & Sports Equipment**: electric trains, car racing sets, hand-held video games & consoles; video games, computers for biking, running, rowing etc. sports related electronic equipment etc.<br>**Monitoring & Control Instruments**: smoke detectors, thermostats etc. |
| 15. Potentially Hazardous | **Paint cans**: with or without paint contained<br>**Oil**: engine/lubricating oil contained within a bottle or a can<br>**Batteries**: lead-acid batteries (including car batteries, other lead-acid batteries), other batteries (including household batteries, household rechargeable batteries) etc.<br>**Healthcare waste**: syringes / sharps, medicinal products, potentially infected healthcare waste etc.<br>Pesticides: items containing pesticides, liquid or solid etc.<br>**Other**: Asbestos, fluorescent light bulbs, other household hazardous waste, identifiable hazardous items that do not fall readily into the above categories. |
| 16. Other Combustibles | Wooden boxes, pallets, cork packaging, wood from DIY, wood fencing, carpet, kitchen units and work-tops, all other furniture, combustible flooring, combustible tiles, disposable nappies, other sanitary products, sweepings, combustible items that do not fall easily into any of the above categories. |
| 17. Other Non-combustible | DIY rubble (bricks etc), sand, gravel, non-combustible tiles, ceramic toilets, ceramic wash basins, crockery, stones, flowerpots, cinder, soil etc. and other non-combustible items that do not easily fall into any of the above categories. |
| 18. Fines | <10mm fines. i.e. material less that 10mm in particle size, not hand-sorted but classified as fines irrespective of composition. In general the material will be an ‘organic rich’ fraction. |

## Appendix 2

Waste Analysis Procedures

**Operating Procedures – Conducting A Household Waste Analysis**

**PURPOSE**

To minimise the risks posed by the practice of manually sorting waste to allow the conduct of a waste analysis. This document outlines the requirements and responsibilities needed to conduct household waste analysis operations safely.

**RESPONSIBILITY**

It is the responsibility of Albion Environmental Ltd's director to ensure that the requirements of this document are adhered to.

**TRAINING**

The director is responsible for training nominated staff on the aspects of this procedure as it relates to their job.
All relevant staff must be inducted on these procedures and the contents of Risk Assessment (ALB/ENV/RA/001) & associated needle stick procedures.

**PROCEDURE**

**1.0 Preparation**

1.1 The analysis should be conducted on firm level ground with adequate ventilation & lighting.

1.2 The analysis area should be segregated from all other activities and access to the area controlled.

1.3 The area must be clear of all personnel as waste is deposited.

**2.0 Manual Sorting of the Waste.**

2.1 PPE to include safety boots, overalls and gloves are to be worn at all times.

2.2 Suitable RPE should be provided and worn as required.

2.3 To avoid repetitive bending & lifting, litter picking sticks should be used to pick out individual items of waste.

2.4 Waste/Bin bags should be lifted carefully onto a sorting table of about waist height prior to opening & sorting.

2.5 Bags should be opened using a knife.

2.6 Sorting tables should be located as near to the sorting bins as possible to minimise the

manual handling of the waste.
2.7 Welfare facilities must be available and all staff must wash their hands prior to eating, drinking or smoking.

**3.0 Needle stick injuries**

3.1 Identified or suspected needles and syringes must be isolated and dealt with in accordance with the associated needle stick procedures.

3.2 A competent first aider with knowledge of needle stick injuries is to be present on site at all times.

**4.0 Weighing the Waste**

4.1 Caution must be used when transferring the sorting bins onto the scales and where necessary team lifting should be employed.

4.2 All staff must be trained in safe manual handling techniques and where required a separate manual handling assessment conducted.

**Supporting Documents**

**AF023** - Inspecting/Auditing Household Waste

**AF024** – COSHH - Bleach Solutions (Active Chlorine >10%)

**Punctured and needled Guidance** - Needle stick injuries and discarded needles

# Risk assessment form



| | | |
|---|---|---|
| **Site/operation:** Council | **Task assessed:** Inspecting/Auditing Household Waste | **Scoring system**<br>**Severity** ("S") scored between 1 - 5 dependant on severity<br>**Likelihood** ("LI") scored between 1 - 5 dependant on likelihood<br>**Risk factor** = severity x likelihood. Scored between 1 – 25 where: 15 – 25 = high ("H"), 7 – 14 = medium ("M"), 1 – 6 = low ("L")<br>**Overall risk rating =** if all risk factors identified are low overall risk rating is "low". If any risk ratings identified are medium and/or high overall risk rating is "high/medium" |
| **Assessor/s:** Gary Ross | **Date of assessment:** 29/3/08 | |
| **Overall risk rating (high/medium/low):** LOW | | |
| **Supervisor's/manager's signature:** | **Date review due:** 29/3/10<br>(high/medium overall risk rating review due in 2 years, low overall risk rating review due in 3 years | **Severity ("S")**<br>1. = No Injury<br>2. = Minor Injury (no time lost)<br>3. = Time Lost up to 3 days<br>4. = Time Lost above 3 days<br>5. = Sever Injury/Death<br>**Likelihood ("L")**<br>1. = Rare<br>2. = Unlikely<br>3. = Probable<br>4. = Very Likely<br>5. = Certainty |

| Hazard | Risk | Persons potentially affected | Current controls | "S" | "L" | Risk factor "L" | Risk factor "M" | Risk factor "H" | Additional control/s required | Who will carry out action | Time action complete by |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement of vehicles and other workshop activities | Person being struck by vehicles/machinery | Inspection team | Audit area segregated from all other workshop activities<br>Site inductions/awareness<br>Hi-Viz clothing | 4 | 1 | 5 | | | None | | |
| Discharge of wastes into audit area by RCV/Cage vehicle | Person being struck by vehicle | Inspection team | Audit area segregated from all other workshop activities<br>Site inductions/awareness<br>Area clear of all personnel prior to vehicle discharging load | 4 | 1 | 5 | | | None | | |
| | Person being struck or buried by waste being discharged | | Audit area segregated from all other workshop activities<br>Site inductions/awareness<br>Area clear of all personnel prior to vehicle discharging load | 4 | 1 | 5 | | | None | | |

**Comments:**

This risk assessment should be read in conjunction with Albion Environmental Ltd's method statement (conducting a waste audit) and the attached needle stick injury procedure.

Nominated qualified first aider is Craig Chandler

**PPE requirements for task above normal:**
Safety footwear, gloves, hi-viz clothing and overalls

**Weather and light conditions during assessment:**
Desktop Assessment

**Time of day assessment carried out at:**
14:30 HOURS

# Risk assessment form

**AF023 (Cont) Page 2**

| | | |
|---|---|---|
| **Site/operation:** Council | **Task assessed:** Inspecting/Auditing Household Waste | **Scoring system**<br>**Severity** ("S") scored between 1 - 5 dependant on severity<br>**Likelihood** ("LI") scored between 1 - 5 dependant on likelihood<br>**Risk factor** = severity x likelihood. Scored between 1 – 25 where: 15 – 25 = high ("H"), 7 – 14 = medium ("M"), 1 – 6 = low ("L")<br>**Overall risk rating =** if all risk factors identified are low overall risk rating is "low". If any risk ratings identified are medium and/or high overall risk rating is "high/medium" |
| **Assessor/s:** Gary Ross | **Date of assessment:** 29/3/08 | |
| **Overall risk rating (high/medium/low):** LOW | | |
| **Supervisor's/manager's signature:** | **Date review due:** 29/3/10<br>(high/medium overall risk rating review due in 2 years, low overall risk rating review due in 3 years | **Severity ("S")**<br>5. = No Injury<br>2. = Minor Injury (no time lost)<br>3. = Time Lost up to 3 days<br>4. = Time Lost above 3 days<br>5. = Sever Injury/Death<br>**Likelihood ("L")**<br>5. = Rare<br>2. = Unlikely<br>3. = Probable<br>4. = Very Likely<br>5. = Certainty |

| Hazard | Risk | Persons potentially affected | Current controls | "S" | "L" | Risk factor "L" | Risk factor "M" | Risk factor "H" | Additional control/s required | Who will carry out action | Time action complete by |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Discharge of wastes into audit area by RCV/Cage vehicle | Inhalation of dust caused by waste being deposited | Inspection team | Audit area segregated from all other workshop<br>Area clear of all personnel prior to vehicle discharging load | 3 | 1 | 3 | | | None | | |
| Contact with waste | Needlestick injuries | Inspection team | Visual inspection prior to sorting<br>Use of litter picking stick<br>Sharps box<br>Needlestick procedure<br>Trained first aider<br>PPE (gloves) | 3 | 2 | 6 | | | None | | |
| | Contamination & infection | Inspection team | Good standards of hygiene<br>PPE (gloves & overalls)<br>Use of litter picking stick | 3 | 2 | 6 | | | None | | |
| Sorting waste | Manual handling injuries | Inspection team | Use of litter picking stick<br>Manual handling training | 3 | 2 | 6 | | | None | | |
| | Slips, trips and falls | Inspection team | Correct safety footwear<br>Adequate lighting | 3 | 2 | 6 | | | None | | |

| | |
|---|---|
| **Comments:** | **PPE requirements for task above normal:**<br>Safety footwear, gloves, hi-viz clothing and overalls |
| | **Weather and light conditions during assessment:**<br>Desktop Assessment |
| | **Time of day assessment carried out at:**<br>14:30 HOURS |

**SUBSTANCE HEALTH & SAFETY INFORMATION SHEET**

**BLEACH SOLUTIONS (ACTIVE CHLORINE >10%)**

**DOMESTOS: THICKENED BLEACH**

## COMPOSITION INFORMATION

Based on an aqueous solution of sodium hypochlorite. Active chlorine content <10%

## HAZARD CLASSIFICATION

R36/36/38 - Irritating to eyes, respiratory system and skin.
R31 - Contact with acids liberates toxic gas

& ACID

**Irritant** → **Toxic Gas**

## OCCUPATIONAL EXPOSURE LIMITS

Chlorine – OES – 0.5 ppm/1.5 mg/$m^3$ 8 hr TWA and 1ppm/2.9 mg/$m^3$ 15 min TWA

## HAZARD SUMMARY

Liquid irritating to eyes and skin, the latter especially from repeated or prolonged contact. Vapour or mist irritating to eyes, respiratory system and skin. Toxic gas (chlorine) released on contact with acids.

## ADVERSE EXPOSURE SYMPTOMS

Irritation to eyes, respiratory system and skin.

## SAFE WORKING GUIDANCE

1. Avoid eye contact – if likely wear safety glasses
2. Avoid repeated or prolonged skin contact – if likely wear suitable protective clothing. This to include plastic gloves, overalls etc.
3. Control exposures to as low a level as possible by good working methods, ventilation or RPE as appropriate.
4. Where RPE used, unless otherwise identified, a general purpose nuisance mask should prove adequate.
5. Good standards of personal hygiene and skin care required.
6. Always wash hands thoroughly after use/handling and before eating, drinking or smoking.
7. Remove and wash contaminated clothing.
8. Handling and use by trained personnel only.
9. Protective clothing and respiratory protection to be used/worn as appropriate.
10. AVOID ANY CONTACT WITH ACIDIC MATERIALS !!

## FIRST AID

1.Eye Contact – Wash out with water or eye wash solution. Seek medical attention
2.Skin Contact – Wash with soap/water. If irritation developes seek medical attention.
3.Inhalation – If affected by 'fume', remove to fesh air. Seek medical attention.
4.Wash face/mouth with water. Seek medical attention

## FLAMMABILITY

Non flammable

## STORAGE

Store in containers in a cool, dry area away from incompatible substances especially acidic materials. Protect from damage.

## SPILLAGE

Only small amounts kept. For small spillages absorb on sand or vemiculite. Shovel/sweep up and place in container for disposal. Alternatively dilute with copious amounts of water and run to waste.

## DISPOSAL

Either run very small amounts to waste as above or contain in suitable container for collection and disposal by Waste Management Company.

# Punctured and needled

## Needle stick injuries and discarded needles

Needle stick and similar injuries, while very rare, are worrying and can be potentially serious. The most obvious of this type of injury are those sustained from discarded hypodermic syringes. However, other causes, such as surgical blades, glass contaminated with blood following a first aid incident etc, are also possible sources of infection. The below advice is centred around hypodermic syringe (needle stick) injuries, but the same principles apply to the above other possibilities.

### Needle stick injuries

The risks from needle stick injuries are various and range from Hepatitis B and Human Immunodeficiency Virus (HIV) to Hepatitis C (all of these diseases are called 'blood borne' viruses because they are carried in the blood or other body fluids). However, the actual risk is small. Taking Hepatitis B as an example:

**1.** First you have to receive a needle stick injury - this is still rare
**2.** Second the person who previously used the syringe must have Hepatitis B
**3.** Third the Hepatitis virus needs to be 'alive'
**4.** You need to actually contract Hepatitis – most who are exposed do not develop the disease

Overall, then, the risk of contracting Hepatitis B as a worker in the waste management industry is very low (the risk will vary dependant on factors such as the level of drug use in the area the waste was collected from). However, the possible outcome of contracting Hepatitis B is severe if it is not treated immediately. Prompt action is therefore essential:

### What to do if you suffer a needle stick injury

First, do not panic - the risk is low. However, you must follow the below procedure.

- Encourage the wound to bleed by gently squeezing it
- **DO NOT** suck the wound
- Wash the affected area with soap and water
- **DO NOT** scrub the wound
- Dry and apply a waterproof dressing
- Inform your manger and stress that you have suffered a needle stick injury
- Seek **IMMEDIATE** professional advice by going to the accident and emergency unit at your local hospital - again stress that you have suffered a needle stick injury – the hospital will assess the risk of you contracting hepatitis or another blood borne virus and take appropriate action
- Once you have received any required treatment, make sure you fill in an incident report form when back at work
- **ALWAYS** follow good hygiene at work - the risk will be lower

### What to do after needle stick, or if you find a needle

If a syringe has been found, for example on a MRF picking line, or after a needle stick injury has occurred and the syringe is still 'in-situ' it will need to be disposed of safely. Those sites which are at risk, such as MRFs, should ensure that they have the right equipment to deal with needles.

### Disposing of syringes and/or needles

The below procedure **MUST** be followed if a needle or complete hypodermic syringe is found.

- Before attempting to dispose of the syringe all work should stop and the area where the syringe is isolated

- All sites where there is a risk of discarded syringes being found should carry, or have access to, a 'sharps kit'
- Before attempting to lift the needle make sure you are wearing the gloves supplied in the sharps kit
- Spray the needle and surrounding area with the disinfectant found in the kit
- Follow the instructions on the sharps kit and, using the forceps provided, carefully
- Place the needle into the sharps container
- **NEVER** lift a discarded needle with your hands - **ALWAYS** use forceps
- Make sure the sharps container is disposed of properly
- Ensure that you dispose of the gloves properly and wash your hands afterwards

## Inoculations

Some of the diseases which can be contracted from needle stick injuries can be inoculated against, in particular Hepatitis B. If you are at a significant risk of suffering a needle stick injury you are advised to be inoculated against Hepatitis B. This is a three injection course.

However, inoculation is not the answer to everything. The Hepatitis B inoculation takes three to six months to be effective and in the interim no immunity may exist. In addition, around five percent of people do not react to inoculation against Hepatitis B and never achieve immunity. The primary control measure must be to prevent needle stick injuries from occurring in the first place. While the below list is not exhaustive, the physical controls against needle stick injuries include:

- Always wash down heavy plant, HGV etc before maintaining or repairing them – needles from wastes can 'hide' and you may not see them before it is too late
- All employees who may be at risk should be inducted in the risks and instructed to keep alert for needles and similar sharps
- Never handle needles without the proper precautions (as given above)
- If needles can be traced to specific collections routes or customers, managers must ensure that such are followed-up
- Always report any needles you may see to your manager

**Needle stick injuries are rare, but pose serious risks**
**The risk of contracting a disease such as Hepatitis B**
**is small, but the outcome can be serious**
**Always follow the above advice**

## Appendix 3;
## SBHA Data

**a. SBHA supplied estate data**
**b. Ditto, heat load estimates added**
**c. Heating system replacement profile analysis**

| No. | Street | Town | Postcode | PTYPE | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|
| 15 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 17 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 19 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 21 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 23 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 25 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 29 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 31 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Mid Terrace |
| 33 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 35 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 39 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 43 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Other | 13 | Flat |
| 45 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 47 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 51 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 53 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 57 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 61 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 63 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 65 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 67 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 69 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 71 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 73 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 75 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 12 | End Terrace |
| 77 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 79 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | End Terrace |
| 80 | Hawthorn Road | Galashiels | TD1 2LQ | Cottage - 4 Apt | Gas CH | 2 | End Terrace |
| 81 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 82 | Hawthorn Road | Galashiels | TD1 2LQ | Cottage - 4 Apt | Electric Storage | 3 | End Terrace |
| 83 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 3 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 13 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 11 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | -2 | Flat |
| 7 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 5 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 3 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 1 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 21 | Broom Drive | Galashiels | TD1 2LU | Cottage - 5 Apt | Electric Storage | 12 | Mid Terrace |
| 13 | Broom Drive | Galashiels | TD1 2LU | Cottage - 5 Apt | Gas CH | 3 | End Terrace |
| 12 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | Electric Storage | -2 | Flat |
| 11 | Broom Drive | Galashiels | TD1 2LU | Cottage - 5 Apt | Gas CH | 12 | Mid Terrace |
| 8 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | Electric Storage | -2 | Flat |
| 6 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 4 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | Electric Storage | -2 | Flat |
| 2 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | Electric Storage | -2 | Flat |
| 29 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | Electric Storage | -2 | Mid Terrace |
| 24 | Aster Court | Galashiels | TD1 2LN | Cottage - 4 Apt | Electric Storage | 8 | Mid Terrace |
| 17 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | Electric Storage | -2 | End Terrace |
| 16 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | Electric Storage | 8 | Mid Terrace |
| 12 | Aster Court | Galashiels | TD1 2LN | Cottage - 4 Apt | Electric Storage | -2 | End Terrace |
| 11 | Aster Court | Galashiels | TD1 2LN | Cottage - 4 Apt | Electric Storage | 8 | Mid Terrace |
| 6 | Aster Court | Galashiels | TD1 2LN | Cottage - 4 Apt | Electric Storage | -2 | End Terrace |
| 5 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | Electric Storage | 8 | Mid Terrace |
| 4 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | Electric Storage | -2 | Mid Terrace |
| 3 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | Electric Storage | 8 | Mid Terrace |
| 1 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | Electric Storage | 12 | End Terrace |
| 85 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 87 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 89 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | -2 | Flat |
| 91 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 93 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 95 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 96 | Hawthorn Road | Galashiels | TD1 2LQ | Cottage - 3 Apt | Electric Storage | 3 | Mid Terrace |
| 97 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 99 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 101 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 105 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | End Terrace |
| 107 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 109 | Hawthorn Road | Galashiels | TD1 2LR | Homeless Flat - 2 Apt | Electric Storage | 12 | Flat |
| 113 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 12 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 115 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 117 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 121 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 123 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 125 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 127 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 15 | Heather Court | Galashiels | TD1 2LS | Cottage - 3 Apt | Electric Storage | -2 | End Terrace |
| 1 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 2 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | Electric Storage | 3 | Flat |
| 3 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | Gas CH | 8 | Flat |
| 4 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 5 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 6 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 7 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 8 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 11 | Kenilworth Avenue | Galashiels | TD1 2DG | Cottage - 4 Apt | Electric Storage | 12 | Semi-Detached |
| 16 | Kenilworth Avenue | Galashiels | TD1 2DG | Cottage - 4 Apt | Gas CH | 12 | End Terrace |
| 23 | Kenilworth Avenue | Galashiels | TD1 2DG | Flat - 3 Apt | Gas CH | 12 | Flat |
| 25 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 8 | Flat |
| 27 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 29 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 31 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 8 | Flat |
| 33 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 35 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 8 | Flat |
| 37 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 39 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 8 | Flat |
| 41 | Kenilworth Avenue | Galashiels | TD1 2DD | Cottage - 3 Apt | Gas CH | 8 | Flat |
| 43 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 45 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 47 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 49 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 8 | Flat |
| 51 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 53 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 55 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 56 | Kenilworth Avenue | Galashiels | TD1 2DD | Cottage - 3 Apt | Electric Storage | 12 | End Terrace |
| 57 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 58 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | Gas CH | 12 | Flat |
| 59 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 60 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 61 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 62 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 3 Apt | Gas CH | 12 | Mid Terrace + pass |
| 63 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 65 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 66 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 67 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 8 | Flat |
| 68 | Kenilworth Avenue | Galashiels | TD1 2DB | Four/Block - 2 Apt | Electric Storage | 3 | Flat |
| 69 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 71 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 72 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 3 Apt | Gas CH | 12 | Mid Terrace |
| 73 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 74 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 4 Apt | Gas CH | 12 | Mid Terrace + pass |
| 77 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 79 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Room Heaters Only | 12 | Flat |
| 81 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 82 | Kenilworth Avenue | Galashiels | TD1 2DD | Cottage - 3 Apt | Gas CH | 12 | Mid Terrace + pass |
| 83 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 85 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 87 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 91 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | Gas CH | 12 | Flat |
| 92 | Kenilworth Avenue | Galashiels | TD1 2DB | Four/Block - 2 Apt | Electric Storage | 12 | Flat |
| 94 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | Gas CH | 12 | Flat |
| 95 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 96 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 97 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 98 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 99 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 100 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 4 Apt | Electric Storage | 12 | Mid Terrace + pass |
| 101 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Electric Storage | 12 | Flat |
| 103 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 105 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 106 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 4 Apt | Gas CH | 8 | Mid Terrace + pass |
| 107 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 4 Apt | Gas CH | 8 | Maisonette |
| 108 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 110 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | Gas CH | 12 | End Terrace |
| 111 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 113 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 115 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | Gas CH | 12 | Flat |
| 117 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 119 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | Gas CH | 12 | End Terrace |
| 121 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Electric Storage | 12 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 123 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 125 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 127 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 129 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 4 Apt | Electric Storage | 12 | Flat |
| 131 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 133 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 135 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 3 Apt | Gas CH | 12 | Flat |
| 1 | Langlee Avenue | Galashiels | TD1 2DZ | Cottage - 4 Apt | Solid Fuel CH | 12 | Mid Terrace |
| 3 | Langlee Avenue | Galashiels | TD1 2DZ | Cottage - 4 Apt | Electric Storage | 12 | Mid Terrace |
| 3 | Langlee Drive | Galashiels | TD1 2DY | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 5 | Langlee Drive | Galashiels | TD1 2DY | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 7 | Langlee Drive | Galashiels | TD1 2DY | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 9 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | Gas CH | 3 | Flat |
| 11 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 13 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 21 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | Gas CH | 12 | Flat |
| 23 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 27 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 29 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 33 | Langlee Drive | Galashiels | TD1 2DY | Cottage - 4 Apt | Gas CH | 12 | Semi-Detached |
| 41 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Gas CH | 13 | Flat |
| 43 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 47 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 49 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Gas CH | 12 | Flat |
| 51 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 55 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Gas CH | 12 | Flat |
| 59 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Gas CH | 12 | Flat |
| 63 | Langlee Drive | Galashiels | TD1 2EA | Homeless Flat - 3 Apt | Gas CH | 12 | Flat |
| 65 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Gas CH | 12 | Flat |
| 67 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 69 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 71 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 73 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 75 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Gas CH | 13 | Flat |
| 77 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 79 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 83 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | Electric Storage | 13 | Flat |
| 2 | Langlee Road | Galashiels | TD1 2DH | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 3 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | Gas CH | 8 | Flat |
| 6 | Langlee Road | Galashiels | TD1 2DH | Four/Block - 3 Apt | Gas CH | 8 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 8 | Langlee Road | Galashiels | TD1 2DH | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 9 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 10 | Langlee Road | Galashiels | TD1 2DH | Cottage - 4 Apt | Electric Storage | 8 | Semi-Detached |
| 12 | Langlee Road | Galashiels | TD1 2DH | Cottage - 4 Apt | Gas CH | 8 | Semi-Detached |
| 13 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 14 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 15 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 16 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 17 | Langlee Road | Galashiels | TD1 2DQ | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 18 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 19 | Langlee Road | Galashiels | TD1 2DQ | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 20 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 8 | Flat |
| 21 | Langlee Road | Galashiels | TD1 2DQ | Four/Block - 3 Apt | Electric Storage | 8 | Flat |
| 22 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 23 | Langlee Road | Galashiels | TD1 2DQ | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 24 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 26 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 36 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 38 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Mid Terrace + pass |
| 40 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 44 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Gas CH | 12 | Flat |
| 46 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 48 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 1 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | 12 | End Terrace |
| 2 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | -2 | Mid Terrace |
| 7 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 4 Apt | Electric Storage | 12 | End Terrace |
| 8 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | -2 | End Terrace |
| 9 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | -2 | Mid Terrace |
| 11 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | -2 | Mid Terrace |
| 12 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | -2 | End Terrace |
| 13 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | 12 | Mid Terrace |
| 18 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | -2 | End Terrace |
| 23 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | -2 | Mid Terrace |
| 24 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | Electric Storage | -2 | End Terrace |
| 26 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 4 Apt | Electric Storage | 12 | Mid Terrace |
| 29 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 4 Apt | Electric Storage | 12 | End Terrace |
| 33 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | Gas CH | 12 | Flat |
| 34 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | Gas CH | 8 | Flat |
| 35 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | Gas CH | 3 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 36 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | Gas CH | 3 | Flat |
| 37 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | Other | 13 | Flat |
| 38 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | Gas CH | 8 | Flat |
| 6 | Marmion Road | Galashiels | TD1 2DE | Flat - 3 Apt | Gas CH | 8 | Flat |
| 1 | Primrose Bank | Galashiels | TD1 2LL | Cottage - 3 Apt | Electric Storage | -2 | End Terrace |
| 2 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | Gas CH | 3 | Flat |
| 4 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | Gas CH | 8 | Flat |
| 6 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 8 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | Gas CH | 8 | Flat |
| 10 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | Gas CH | 12 | Flat |
| 12 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | Gas CH | 8 | Flat |
| 13 | Primrose Bank | Galashiels | TD1 2LL | Cottage - 3 Apt | Electric Storage | 12 | End Terrace |
| 14 | Primrose Bank | Galashiels | TD1 2LJ | Cottage - 3 Apt | Electric Storage | 8 | End Terrace |
| 17 | Primrose Bank | Galashiels | TD1 2LL | Cottage - 3 Apt | Electric Storage | 8 | Mid Terrace |
| 18 | Primrose Bank | Galashiels | TD1 2LJ | Cottage - 3 Apt | Electric Storage | -2 | Mid Terrace |
| 33 | Primrose Bank | Galashiels | TD1 2LL | Cottage - 4 Apt | Electric Storage | 12 | Mid Terrace |
| 39 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | Gas CH | -2 | Flat |
| 40 | Primrose Bank | Galashiels | TD1 2LJ | Cottage - 5 Apt | Electric Storage | -2 | Mid Terrace + pass |
| 41 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 43 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | Gas CH | 12 | Flat |
| 45 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | Gas CH | 8 | Flat |
| 47 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 48 | Primrose Bank | Galashiels | TD1 2LJ | Cottage - 3 Apt | Electric Storage | -2 | End Terrace |
| 49 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 1 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 2 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 3 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 4 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 5 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 6 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 7 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 8 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 9 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 10 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 11 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 12 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 13 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 14 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 15 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 16 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | -2 | Mid Terrace |
| 18 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 19 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 20 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 21 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 22 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 23 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 24 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | Electric Storage | 3 | Maisonette |
| 1 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 2 | Talisman Avenue | Galashiels | TD1 2DL | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 3 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 4 | Talisman Avenue | Galashiels | TD1 2DL | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 5 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 6 | Talisman Avenue | Galashiels | TD1 2DN | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 7 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 8 | Talisman Avenue | Galashiels | TD1 2DL | Four/Block - 3 Apt | Gas CH | 8 | Flat |
| 9 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 11 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 12 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 13 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 15 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 4 Apt | Gas CH | 12 | Maisonette |
| 17 | Talisman Avenue | Galashiels | TD1 2DN | Homeless Maisonette - 3 Apt | Gas CH | 12 | Semi-Detached |
| 19 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Semi-Detached |
| 21 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 22 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 23 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Flat |
| 24 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Gas CH | 12 | Flat |
| 25 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 27 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 8 | Maisonette |
| 29 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 33 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 34 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Gas CH | 12 | Flat |
| 35 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 36 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Gas CH | 8 | Flat |
| 38 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | Electric Storage | 12 | Mid Terrace + pass |
| 40 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | Gas CH | 12 | Mid Terrace |
| 41 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 44 | Talisman Avenue | Galashiels | TD1 2DN | Cottage - 4 Apt | Electric Storage | 12 | Mid Terrace + pass |
| 45 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 47 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 4 Apt | Gas CH | 12 | Maisonette |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 48 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | Electric Storage | 12 | Mid Terrace + pass |
| 49 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 50 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Electric Storage | 3 | Flat |
| 51 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 53 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 54 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 55 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 56 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Gas CH | 12 | Flat |
| 57 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 59 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 61 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 62 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 3 Apt | Electric Storage | 12 | Mid Terrace |
| 63 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 4 Apt | Electric Storage | 12 | Maisonette |
| 64 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | Gas CH | 8 | Mid Terrace + pass |
| 65 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 2 Apt | Gas CH | 12 | Flat |
| 66 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | Gas CH | 12 | Mid Terrace |
| 67 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 3 | Maisonette |
| 69 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 70 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Gas CH | 12 | Flat |
| 71 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 3 | Maisonette |
| 72 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 73 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 75 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 76 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 3 Apt | Gas CH | 12 | Mid Terrace |
| 77 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Flat |
| 79 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 4 Apt | Gas CH | 12 | Maisonette |
| 81 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 82 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | Electric Storage | 3 | Flat |
| 83 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 85 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 3 Apt | Gas CH | 8 | Flat |
| 86 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | Gas CH | 8 | Flat |
| 88 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | Gas CH | 12 | Flat |
| 90 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | Gas CH | 8 | Flat |
| 92 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | Gas CH | 8 | Flat |
| 1 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 2 | Winston Place | Galashiels | TD1 2EL | Cottage - 3 Apt | Gas CH | 13 | End Terrace |
| 3 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 5 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 6 | Winston Place | Galashiels | TD1 2EL | Cottage - 3 Apt | Gas CH | 13 | Mid Terrace |
| 7 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 11 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 13 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 15 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Electric Storage | 12 | Flat |
| 17 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Gas CH | 13 | Maisonette |
| 19 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 21 | Winston Place | Galashiels | TD1 2EL | Maisonette - 4 Apt | Gas CH | 12 | Flat |
| 23 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 25 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 27 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 29 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 31 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 33 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 35 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 37 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 39 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 41 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 43 | Winston Place | Galashiels | TD1 2EL | Maisonette - 4 Apt | Gas CH | 12 | Maisonette |
| 4 | Winston Road | Galashiels | TD1 2EH | Flat - 3 Apt | Gas CH | 8 | Flat |
| 8 | Winston Road | Galashiels | TD1 2EH | Flat - 3 Apt | Gas CH | 12 | Flat |
| 10 | Winston Road | Galashiels | TD1 2EH | Flat - 3 Apt | Gas CH | 12 | Flat |
| 14 | Winston Road | Galashiels | TD1 2EJ | Cottage - 3 Apt | Gas CH | 13 | End Terrace |
| 20 | Winston Road | Galashiels | TD1 2EJ | Cottage - 4 Apt | Gas CH | 13 | Mid Terrace |
| 22 | Winston Road | Galashiels | TD1 2EJ | Cottage - 3 Apt | Electric Storage | 12 | Flat |
| 24 | Winston Road | Galashiels | TD1 2EJ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 26 | Winston Road | Galashiels | TD1 2EJ | Flat - 2 Apt | Gas CH | 13 | Flat |
| 28 | Winston Road | Galashiels | TD1 2EJ | Flat - 2 Apt | Gas CH | 12 | Flat |
| 30 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 32 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 34 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 36 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 38 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 40 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 42 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 44 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 4 Apt | Gas CH | 12 | Maisonette |
| 24 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 2 Apt | Gas CH | 8 | Flat |
| 26 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 2 Apt | Electric Storage | 8 | Flat |
| 28 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 2 Apt | Gas CH | 8 | Flat |
| 30 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 2 Apt | Electric Storage | 12 | Flat |
| 51 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Gas CH | 8 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 53 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Gas CH | 12 | Flat |
| 55 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Gas CH | 12 | Flat |
| 56 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 57 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Gas CH | 12 | Flat |
| 58 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 3 Apt | Electric Storage | 12 | Flat |
| 59 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 60 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 12 | Flat |
| 61 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Gas CH | 8 | Flat |
| 62 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 63 | Woodstock Avenue | Galashiels | TD1 2EQ | Four/Block - 3 Apt | Gas CH | 8 | Flat |
| 66 | Woodstock Avenue | Galashiels | TD1 2EG | Four/Block - 2 Apt | Gas CH | 12 | Flat |
| 67 | Woodstock Avenue | Galashiels | TD1 2EQ | Four/Block - 3 Apt | Gas CH | 8 | Flat |
| 69 | Woodstock Avenue | Galashiels | TD1 2EQ | Four/Block - 3 Apt | Gas CH | 12 | Flat |
| 70 | Woodstock Avenue | Galashiels | TD1 2EG | Four/Block - 2 Apt | Electric Storage | 12 | Flat |
| 71 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 72 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 8 | Flat |
| 73 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 74 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Electric Storage | 13 | Flat |
| 75 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 77 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 78 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 12 | Flat |
| 79 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 80 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 81 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 82 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 83 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 8 | Flat |
| 85 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Gas CH | 8 | End Terrace |
| 86 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 87 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Gas CH | 8 | Flat |
| 88 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Gas CH | 12 | Flat |
| 89 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 12 | Flat |
| 90 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 91 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 12 | Flat |
| 92 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 93 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 12 | Flat |
| 94 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 95 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 12 | Flat |
| 97 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 8 | Flat |
| 98 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 12 | Flat |
| 99 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 12 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 100 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 8 | Flat |
| 102 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 12 | Flat |
| 103 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Gas CH | 12 | Flat |
| 104 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 105 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 13 | Flat |
| 106 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 107 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 8 | Flat |
| 108 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 109 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 110 | Woodstock Avenue | Galashiels | TD1 2EG | Homeless Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 111 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 113 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 8 | Flat |
| 114 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Flat |
| 115 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 8 | Flat |
| 117 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 118 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 4 Apt | Electric Storage | 12 | Maisonette |
| 119 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 120 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 121 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 122 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 8 | Flat |
| 123 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | -2 | Flat |
| 124 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 12 | Maisonette |
| 125 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 12 | Flat |
| 126 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Gas CH | 12 | Maisonette |
| 127 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 128 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 129 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 131 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 132 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 134 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 135 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | Electric Storage | 12 | Flat |
| 136 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Electric Storage | 12 | Maisonette |
| 137 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Gas CH | 12 | Flat |
| 138 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | Gas CH | 8 | Maisonette |
| 139 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 140 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 4 Apt | Gas CH | 12 | Maisonette |
| 141 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 8 | Flat |
| 142 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 8 | Flat |
| 143 | Woodstock Avenue | Galashiels | TD1 0EQ | Flat - 2 Apt | Gas CH | 12 | Flat |
| 144 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Electric Storage | 12 | Flat |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 145 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 146 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 8 | Flat |
| 147 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | Electric Storage | 12 | Flat |
| 148 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 8 | Flat |
| 150 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | Gas CH | 8 | Flat |
| 151 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 3 Apt | Gas CH | 8 | Semi-Detached |
| 155 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 3 Apt | Gas CH | 8 | End Terrace |
| 157 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 4 Apt | Electric Storage | -2 | Mid Terrace + pass |
| 158 | Woodstock Avenue | Galashiels | TD1 2EG | Cottage - 3 Apt | Electric Storage | 12 | End Terrace |
| 162 | Woodstock Avenue | Galashiels | TD1 2EG | Cottage - 3 Apt | Gas CH | 12 | End Terrace |
| 163 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 3 Apt | Gas CH | 8 | End Terrace |
| 164 | Woodstock Avenue | Galashiels | TD1 2EG | Cottage - 4 Apt | Other | 13 | Mid Terrace |
| 171 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 3 Apt | Gas CH | 12 | End Terrace |
| 178 | Woodstock Avenue | Galashiels | TD1 2EG | Cottage - 3 Apt | Gas CH | 8 | End Terrace |

**Langlee Property Listing as at 14 Aug 12**

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 2 | 17 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 3 | 19 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 4 | 21 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 5 | 23 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 6 | 25 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 7 | 29 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 8 | 31 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Mid Terrace |
| 9 | 33 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 10 | 35 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 11 | 39 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 12 | 43 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Other | 13 | Flat |
| 13 | 45 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 14 | 47 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 15 | 51 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 16 | 53 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 17 | 57 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 18 | 61 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 19 | 63 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 20 | 65 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 21 | 67 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 22 | 69 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 23 | 71 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 24 | 73 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 25 | 75 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | End Terrace |
| 26 | 77 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 27 | 79 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | End Terrace |
| 28 | 80 | Hawthorn Road | Galashiels | TD1 2LQ | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 2 | End Terrace |
| 29 | 81 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 30 | 82 | Hawthorn Road | Galashiels | TD1 2LQ | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | End Terrace |
| 31 | 83 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 32 | 9 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 33 | 13 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 34 | 11 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | -2 | Flat |
| 35 | 7 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 36 | 5 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 37 | 3 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 38 | 1 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 39 | 21 | Broom Drive | Galashiels | TD1 2LU | Cottage - 5 Apt | 8,000 | 3.65 | Electric Storage | 12 | Mid Terrace |
| 40 | 13 | Broom Drive | Galashiels | TD1 2LU | Cottage - 5 Apt | 8,000 | 3.65 | Gas CH | 3 | End Terrace |
| 41 | 12 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | -2 | Flat |
| 42 | 11 | Broom Drive | Galashiels | TD1 2LU | Cottage - 5 Apt | 8,000 | 3.65 | Gas CH | 12 | Mid Terrace |
| 43 | 8 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | -2 | Flat |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 44 | 6 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 45 | 4 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | -2 | Flat |
| 46 | 2 | Broom Drive | Galashiels | TD1 2LU | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | -2 | Flat |
| 47 | 29 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | Mid Terrace |
| 48 | 24 | Aster Court | Galashiels | TD1 2LN | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 8 | Mid Terrace |
| 49 | 17 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | End Terrace |
| 50 | 16 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 8 | Mid Terrace |
| 51 | 12 | Aster Court | Galashiels | TD1 2LN | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | -2 | End Terrace |
| 52 | 11 | Aster Court | Galashiels | TD1 2LN | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 8 | Mid Terrace |
| 53 | 6 | Aster Court | Galashiels | TD1 2LN | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | -2 | End Terrace |
| 54 | 5 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 8 | Mid Terrace |
| 55 | 4 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | Mid Terrace |
| 56 | 3 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 8 | Mid Terrace |
| 57 | 1 | Aster Court | Galashiels | TD1 2LN | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | End Terrace |
| 58 | 85 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 59 | 87 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 60 | 89 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | -2 | Flat |
| 61 | 91 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 62 | 93 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 63 | 95 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 64 | 96 | Hawthorn Road | Galashiels | TD1 2LQ | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 3 | Mid Terrace |
| 65 | 97 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 66 | 99 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 67 | 101 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 68 | 105 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | End Terrace |
| 69 | 107 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 70 | 109 | Hawthorn Road | Galashiels | TD1 2LR | Homeless Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 71 | 113 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 72 | 115 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 73 | 117 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 74 | 121 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 75 | 123 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 76 | 125 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 77 | 127 | Hawthorn Road | Galashiels | TD1 2LR | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 78 | 15 | Heather Court | Galashiels | TD1 2LS | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | End Terrace |
| 79 | 1 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 80 | 2 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 81 | 3 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 82 | 4 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 83 | 5 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 84 | 6 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 85 | 7 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 86 | 8 | Kenilworth Avenue | Galashiels | TD1 2DG | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 87 | 11 | Kenilworth Avenue | Galashiels | TD1 2DG | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Semi-Detached |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 88 | 16 | Kenilworth Avenue | Galashiels | TD1 2DG | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | End Terrace |
| 89 | 23 | Kenilworth Avenue | Galashiels | TD1 2DG | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 90 | 25 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 91 | 27 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 92 | 29 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 93 | 31 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 94 | 33 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 95 | 35 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 96 | 37 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 97 | 39 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 98 | 41 | Kenilworth Avenue | Galashiels | TD1 2DD | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Flat |
| 99 | 43 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 100 | 45 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 101 | 47 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 102 | 49 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 103 | 51 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 104 | 53 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 105 | 55 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 106 | 56 | Kenilworth Avenue | Galashiels | TD1 2DD | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | End Terrace |
| 107 | 57 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 108 | 58 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 109 | 59 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 110 | 60 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 111 | 61 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 112 | 62 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Mid Terrace + pass |
| 113 | 63 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 114 | 65 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 115 | 66 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 116 | 67 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 117 | 68 | Kenilworth Avenue | Galashiels | TD1 2DB | Four/Block - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 118 | 69 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 119 | 71 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 120 | 72 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Mid Terrace |
| 121 | 73 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 122 | 74 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Mid Terrace + pass |
| 123 | 77 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 124 | 79 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Room Heaters Only | 12 | Flat |
| 125 | 81 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 126 | 82 | Kenilworth Avenue | Galashiels | TD1 2DD | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Mid Terrace + pass |
| 127 | 83 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 128 | 85 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 129 | 87 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 130 | 91 | Kenilworth Avenue | Galashiels | TD1 2DD | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 131 | 92 | Kenilworth Avenue | Galashiels | TD1 2DB | Four/Block - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 132 | 94 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 133 | 95 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 134 | 96 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 135 | 97 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 136 | 98 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 137 | 99 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 138 | 100 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Mid Terrace + pass |
| 139 | 101 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Flat |
| 140 | 103 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 141 | 105 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 142 | 106 | Kenilworth Avenue | Galashiels | TD1 2DB | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 8 | Mid Terrace + pass |
| 143 | 107 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 4 Apt | 7,500 | 3.42 | Gas CH | 8 | Maisonette |
| 144 | 108 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 145 | 110 | Kenilworth Avenue | Galashiels | TD1 2DB | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | End Terrace |
| 146 | 111 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 147 | 113 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 148 | 115 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 149 | 117 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 150 | 119 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | End Terrace |
| 151 | 121 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Flat |
| 152 | 123 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 153 | 125 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 154 | 127 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 155 | 129 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Flat |
| 156 | 131 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 157 | 133 | Kenilworth Avenue | Galashiels | TD1 2DW | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 158 | 135 | Kenilworth Avenue | Galashiels | TD1 2DW | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 159 | 1 | Langlee Avenue | Galashiels | TD1 2DZ | Cottage - 4 Apt | 7,500 | 3.42 | Solid Fuel CH | 12 | Mid Terrace |
| 160 | 3 | Langlee Avenue | Galashiels | TD1 2DZ | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Mid Terrace |
| 161 | 3 | Langlee Drive | Galashiels | TD1 2DY | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 162 | 5 | Langlee Drive | Galashiels | TD1 2DY | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 163 | 7 | Langlee Drive | Galashiels | TD1 2DY | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 164 | 9 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 3 | Flat |
| 165 | 11 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 166 | 13 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 167 | 21 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 168 | 23 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 169 | 27 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 170 | 29 | Langlee Drive | Galashiels | TD1 2DY | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 171 | 33 | Langlee Drive | Galashiels | TD1 2DY | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Semi-Detached |
| 172 | 41 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 13 | Flat |
| 173 | 43 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 174 | 47 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 175 | 49 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 176 | 51 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 177 | 55 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 178 | 59 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 179 | 63 | Langlee Drive | Galashiels | TD1 2EA | Homeless Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 180 | 65 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 181 | 67 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 182 | 69 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 183 | 71 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 184 | 73 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 185 | 75 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 13 | Flat |
| 186 | 77 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 187 | 79 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 188 | 83 | Langlee Drive | Galashiels | TD1 2EA | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 13 | Flat |
| 189 | 2 | Langlee Road | Galashiels | TD1 2DH | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 190 | 3 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 191 | 6 | Langlee Road | Galashiels | TD1 2DH | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 192 | 7 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 193 | 8 | Langlee Road | Galashiels | TD1 2DH | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 194 | 9 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 195 | 10 | Langlee Road | Galashiels | TD1 2DH | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 8 | Semi-Detached |
| 196 | 12 | Langlee Road | Galashiels | TD1 2DH | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 8 | Semi-Detached |
| 197 | 13 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 198 | 14 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 199 | 15 | Langlee Road | Galashiels | TD1 2DJ | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 200 | 16 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 201 | 17 | Langlee Road | Galashiels | TD1 2DQ | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 202 | 18 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 203 | 19 | Langlee Road | Galashiels | TD1 2DQ | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 204 | 20 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 205 | 21 | Langlee Road | Galashiels | TD1 2DQ | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 8 | Flat |
| 206 | 22 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 207 | 23 | Langlee Road | Galashiels | TD1 2DQ | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 208 | 24 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 209 | 26 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 210 | 36 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 211 | 38 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Mid Terrace + pass |
| 212 | 40 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 213 | 44 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 214 | 46 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 215 | 48 | Langlee Road | Galashiels | TD1 2DH | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 216 | 1 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | End Terrace |
| 217 | 2 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | Mid Terrace |
| 218 | 7 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | End Terrace |
| 219 | 8 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | End Terrace |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 220 | 9 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | Mid Terrace |
| 221 | 11 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | Mid Terrace |
| 222 | 12 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | End Terrace |
| 223 | 13 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Mid Terrace |
| 224 | 18 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | End Terrace |
| 225 | 23 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | Mid Terrace |
| 226 | 24 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | End Terrace |
| 227 | 26 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Mid Terrace |
| 228 | 29 | Marigold Drive | Galashiels | TD1 2LW | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | End Terrace |
| 229 | 33 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 230 | 34 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 231 | 35 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 3 | Flat |
| 232 | 36 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 3 | Flat |
| 233 | 37 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | 5,500 | 2.51 | Other | 13 | Flat |
| 234 | 38 | Marigold Drive | Galashiels | TD1 2LW | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 235 | 6 | Marmion Road | Galashiels | TD1 2DE | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 236 | 1 | Primrose Bank | Galashiels | TD1 2LL | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | End Terrace |
| 237 | 2 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 3 | Flat |
| 238 | 4 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 239 | 6 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 240 | 8 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 241 | 10 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 241 | 85 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 242 | 12 | Primrose Bank | Galashiels | TD1 2LJ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 243 | 13 | Primrose Bank | Galashiels | TD1 2LL | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | End Terrace |
| 244 | 14 | Primrose Bank | Galashiels | TD1 2LJ | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 8 | End Terrace |
| 245 | 17 | Primrose Bank | Galashiels | TD1 2LL | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 8 | Mid Terrace |
| 246 | 18 | Primrose Bank | Galashiels | TD1 2LJ | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | Mid Terrace |
| 247 | 33 | Primrose Bank | Galashiels | TD1 2LL | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Mid Terrace |
| 248 | 39 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | -2 | Flat |
| 249 | 40 | Primrose Bank | Galashiels | TD1 2LJ | Cottage - 5 Apt | 8,000 | 3.65 | Electric Storage | -2 | Mid Terrace + pass |
| 250 | 41 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 251 | 43 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 252 | 45 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 253 | 47 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 254 | 48 | Primrose Bank | Galashiels | TD1 2LJ | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | -2 | End Terrace |
| 255 | 49 | Primrose Bank | Galashiels | TD1 2LL | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 256 | 1 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 257 | 2 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 258 | 3 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 259 | 4 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 260 | 5 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 261 | 6 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 262 | 7 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 263 | 8 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 264 | 9 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 265 | 10 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 266 | 11 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 267 | 12 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 268 | 13 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 269 | 14 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 270 | 15 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 271 | 16 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 272 | 17 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | -2 | Mid Terrace |
| 273 | 18 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 274 | 19 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 275 | 20 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 276 | 21 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 277 | 22 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 278 | 23 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 279 | 24 | Rose Court | Galashiels | TD1 2LH | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 3 | Maisonette |
| 280 | 1 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 281 | 2 | Talisman Avenue | Galashiels | TD1 2DL | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 282 | 3 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 283 | 4 | Talisman Avenue | Galashiels | TD1 2DL | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 284 | 5 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 285 | 6 | Talisman Avenue | Galashiels | TD1 2DN | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 286 | 7 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 287 | 8 | Talisman Avenue | Galashiels | TD1 2DL | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 288 | 9 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 290 | 12 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 291 | 13 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 292 | 15 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Maisonette |
| 293 | 17 | Talisman Avenue | Galashiels | TD1 2DN | Homeless Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Semi-Detached |
| 294 | 19 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Semi-Detached |
| 295 | 21 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 296 | 22 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 297 | 23 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Flat |
| 298 | 24 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 299 | 11 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 299 | 25 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 300 | 27 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 8 | Maisonette |
| 301 | 29 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 302 | 33 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 303 | 34 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 304 | 35 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 305 | 36 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 306 | 38 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Mid Terrace + pass |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 307 | 40 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Mid Terrace |
| 308 | 41 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 309 | 44 | Talisman Avenue | Galashiels | TD1 2DN | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Mid Terrace + pass |
| 310 | 45 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 311 | 47 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Maisonette |
| 312 | 48 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Mid Terrace + pass |
| 313 | 49 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 314 | 50 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 3 | Flat |
| 315 | 51 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 316 | 53 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 317 | 54 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 318 | 55 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 319 | 56 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 320 | 57 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 321 | 59 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 322 | 61 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 323 | 62 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Mid Terrace |
| 324 | 63 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 4 Apt | 6,000 | 2.74 | Electric Storage | 12 | Maisonette |
| 325 | 64 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 8 | Mid Terrace + pass |
| 326 | 65 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 327 | 66 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Mid Terrace |
| 328 | 67 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 3 | Maisonette |
| 329 | 69 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 330 | 70 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 331 | 71 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 3 | Maisonette |
| 332 | 72 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 333 | 73 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 334 | 75 | Talisman Avenue | Galashiels | TD1 2DN | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 335 | 76 | Talisman Avenue | Galashiels | TD1 2DL | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Mid Terrace |
| 336 | 77 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Flat |
| 337 | 79 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Maisonette |
| 338 | 81 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 339 | 82 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 3 | Flat |
| 340 | 83 | Talisman Avenue | Galashiels | TD1 2DN | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 342 | 86 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 343 | 88 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 344 | 90 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 345 | 92 | Talisman Avenue | Galashiels | TD1 2DL | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 346 | 1 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 347 | 2 | Winston Place | Galashiels | TD1 2EL | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 13 | End Terrace |
| 348 | 3 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 349 | 5 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 350 | 6 | Winston Place | Galashiels | TD1 2EL | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 13 | Mid Terrace |
| 351 | 7 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 352 | 9 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 353 | 11 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 354 | 13 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 355 | 15 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Flat |
| 356 | 17 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 13 | Maisonette |
| 357 | 19 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 358 | 21 | Winston Place | Galashiels | TD1 2EL | Maisonette - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Flat |
| 359 | 23 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 360 | 25 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 361 | 27 | Winston Place | Galashiels | TD1 2EL | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 362 | 29 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 363 | 31 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 364 | 33 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 365 | 35 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 366 | 37 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 367 | 39 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 368 | 41 | Winston Place | Galashiels | TD1 2EL | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 369 | 43 | Winston Place | Galashiels | TD1 2EL | Maisonette - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Maisonette |
| 370 | 4 | Winston Road | Galashiels | TD1 2EH | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 371 | 8 | Winston Road | Galashiels | TD1 2EH | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 372 | 10 | Winston Road | Galashiels | TD1 2EH | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 373 | 14 | Winston Road | Galashiels | TD1 2EJ | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 13 | End Terrace |
| 374 | 20 | Winston Road | Galashiels | TD1 2EJ | Cottage - 4 Apt | 7,500 | 3.42 | Gas CH | 13 | Mid Terrace |
| 375 | 22 | Winston Road | Galashiels | TD1 2EJ | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Flat |
| 376 | 24 | Winston Road | Galashiels | TD1 2EJ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 377 | 26 | Winston Road | Galashiels | TD1 2EJ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 13 | Flat |
| 378 | 28 | Winston Road | Galashiels | TD1 2EJ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 379 | 30 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 380 | 32 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 381 | 34 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 382 | 36 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 383 | 38 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 384 | 40 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 385 | 42 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 386 | 44 | Winston Road | Galashiels | TD1 2EJ | Maisonette - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Maisonette |
| 387 | 24 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 388 | 26 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 389 | 28 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 390 | 30 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 391 | 51 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 392 | 53 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 393 | 55 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 394 | 56 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 395 | 57 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 396 | 58 | Woodstock Avenue | Galashiels | TD1 2ED | Four/Block - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 397 | 59 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 398 | 60 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 399 | 61 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 400 | 62 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 401 | 63 | Woodstock Avenue | Galashiels | TD1 2EQ | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 402 | 66 | Woodstock Avenue | Galashiels | TD1 2EG | Four/Block - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 403 | 67 | Woodstock Avenue | Galashiels | TD1 2EQ | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 404 | 69 | Woodstock Avenue | Galashiels | TD1 2EQ | Four/Block - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 405 | 70 | Woodstock Avenue | Galashiels | TD1 2EG | Four/Block - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 406 | 71 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 407 | 72 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 408 | 73 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 409 | 74 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 13 | Flat |
| 410 | 75 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 411 | 77 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 412 | 78 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 413 | 79 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 414 | 80 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 415 | 81 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 416 | 82 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 417 | 83 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 418 | 85 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | End Terrace |
| 419 | 86 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 420 | 87 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 8 | Flat |
| 421 | 88 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Flat |
| 422 | 89 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 423 | 90 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 424 | 91 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 425 | 92 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 426 | 93 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 427 | 94 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 428 | 95 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 429 | 97 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 430 | 98 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 431 | 99 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 432 | 100 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 433 | 102 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 434 | 103 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Gas CH | 12 | Flat |
| 435 | 104 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 436 | 105 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 13 | Flat |
| 437 | 106 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 438 | 107 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 439 | 108 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 440 | 109 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 441 | 110 | Woodstock Avenue | Galashiels | TD1 2EG | Homeless Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 442 | 111 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 443 | 113 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 444 | 114 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Flat |
| 445 | 115 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 446 | 117 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 447 | 118 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 4 Apt | 7,500 | 3.42 | Electric Storage | 12 | Maisonette |
| 448 | 119 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 449 | 120 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 450 | 121 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 451 | 122 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 452 | 123 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | -2 | Flat |
| 453 | 124 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Maisonette |
| 454 | 125 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 455 | 126 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | Maisonette |
| 456 | 127 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 457 | 128 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 458 | 129 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 459 | 131 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 460 | 132 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 461 | 134 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 462 | 135 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 3 Apt | 5,500 | 2.51 | Electric Storage | 12 | Flat |
| 463 | 136 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | Maisonette |
| 464 | 137 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 465 | 138 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Maisonette |
| 466 | 139 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 467 | 140 | Woodstock Avenue | Galashiels | TD1 2EG | Maisonette - 4 Apt | 7,500 | 3.42 | Gas CH | 12 | Maisonette |
| 468 | 141 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 8 | Flat |
| 469 | 142 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 470 | 143 | Woodstock Avenue | Galashiels | TD1 0EQ | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 12 | Flat |
| 471 | 144 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 472 | 145 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 473 | 146 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 474 | 147 | Woodstock Avenue | Galashiels | TD1 2EQ | Flat - 2 Apt | 5,000 | 2.28 | Electric Storage | 12 | Flat |
| 475 | 148 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 476 | 150 | Woodstock Avenue | Galashiels | TD1 2EG | Flat - 2 Apt | 5,000 | 2.28 | Gas CH | 8 | Flat |
| 477 | 151 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | Semi-Detached |
| 478 | 155 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | End Terrace |
| 479 | 157 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 4 Apt | 7,500 | 3.42 | Electric Storage | -2 | Mid Terrace + pass |
| 480 | 158 | Woodstock Avenue | Galashiels | TD1 2EG | Cottage - 3 Apt | 7,000 | 3.20 | Electric Storage | 12 | End Terrace |
| 481 | 162 | Woodstock Avenue | Galashiels | TD1 2EG | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | End Terrace |
| 482 | 163 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | End Terrace |
| 483 | 164 | Woodstock Avenue | Galashiels | TD1 2EG | Cottage - 4 Apt | 7,500 | 3.42 | Other | 13 | Mid Terrace |

| P No. | No. | Street | Town | Postcode | PTYPE | Estimated heat demand KWhr/A | Estimated maximum heat demand KW | MAIN HEATING TYPE | MAIN HEATING BOILER REM LIFE | BUILT FORM |
|---|---|---|---|---|---|---|---|---|---|---|
| 484 | 171 | Woodstock Avenue | Galashiels | TD1 2EQ | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 12 | End Terrace |
| 485 | 178 | Woodstock Avenue | Galashiels | TD1 2EG | Cottage - 3 Apt | 7,000 | 3.20 | Gas CH | 8 | End Terrace |
| | | | | | **TOTAL** | **2,928** | **1.34** | **MWhr/A** | | |

**Approx RHI/annum based on 1p/KWhr for large commercial biomass (>1000 KWth)** **£29,280**

ENERGETIC
PROJECT MANAGEMENT

# New Earth Solutions

# Easter Langlee Advanced Thermal Treatment EfW Project

# Heat Mapping Study

## SBHA Housing Properties- Langlee

## Analysis of heating types and "useful life left" against Overall heat load for mapping

(based on data supplied by SBHA Technical managers on 14th August 2012 (assumed from 1 April 2012)

| | | |
|---|---|---|
| Total No. of properties: | 485 | |
| No. with gas CH system; | 199 | (41%) |
| No. with electric storage heating; | 281 | ( 58%) |
| No. of "other systems: | 5 | ( 1%) |

Systems "life left";

| | Overdue | 1-3 yrs | 4-6yrs | 7-9yrs | 10-yrs+ |
|---|---|---|---|---|---|
| Gas central heating ; | 1 (n/a) | 7 (3.5%) | 0 ( 0%) | 62 (31.3%) | 129 ( 64.8%) |
| Electric storage; | 30 (10.7%) | 44 (15.7%) | 0 (0%) | 38 (13.5%) | 169 (6.0%) |
| O/A life left average; | 31 ( 6.4%) | 51 (10.5%) | 0 (0%) | 100 (20.6%) | 298 (61.4%) |

For planning/ connection puposes- assume plant/system operational late 2015, all remaining life reduced by 3.5 years, figures become:

| | Overdue | 1-3 yrs | 4-6yrs | 7-9yrs - | 10-yrs+ |
|---|---|---|---|---|---|
| Gas central heating ; | 8 ( 3.5%) | 0 ( 0%) | 62 (31.3%) | 129 ( 64.8%) | 0 |
| Electric storage; | 74 (26.4%) | 0 (0%) | 38 (13.5%) | 169 (60.0%) | 0 |
| O/A life left average; | 82 ( 16.9%) | 0 (0%) | 100 (20.6%) | 298 (61.4%) | 0 |

MOFFAT HOUSE, AYTON
BERWICKSHIRE TD14 5QJ

**T** 018907 81463 / 018907 60156
**M** 07885 648854
**WWW**.ENERGETICPM.COM
**E** scott.robertson@energeticpm.com

**Appendix 4;**
**Scottish Borders College**

**a. Boiler replacement study report (the Carbon Trust/ EMS consultants, September 2012**
**b. Scottish Borders College supplied AMR gas usage readings**

**RESTRICTED – COMMERCIAL**

# Detailed Survey Report

## Assessment Of Energy Saving Opportunities For
## Scottish Borders Campus


| | | | |
|---|---|---|---|
| Prepared for | Robert Hewitt<br>Facilities Manager | Prepared by | Emma Hutchinson |
| | Borders College<br>Scottish Borders Campus<br>Nether Road<br>Galasheils<br>TD1 3HE | | Energy Management Solutions Ltd<br>4 Melville Crescent<br>Edinburgh<br>EH3 7JA |
| Tel<br>Email | 01896 662550<br>rhewit@borderscollege.ac.uk | Tel<br>Email | 0131 466 0516<br>e.hutchinson@ems.org.uk |
| Account manager | Brendan Reid | Tel<br>Email | 01355 581814<br>brendan.reid@carbontrust.co.uk |


| | |
|---|---|
| Product ID | P-0144526 |
| PO Reference | PO037939 |
| Country | Scotland |
| Date | 12/09/2012 |
| Version | 1.0 |

# CONTENTS

# EXECUTIVE SUMMARY

This report presents the results of a detailed survey report of Scottish Borders Campus carried out by Energy Management Solutions Ltd. This survey and report are provided by the Carbon Trust. The Carbon Trust receives funding from the Scottish Government and the Welsh Government.

The agreed scope of work was to investigate the feasibility of installing a biomass boiler to supply the campus including carrying out a period of heat metering.

It is recommended that a 500kW biomass boiler should be installed at the main building of the campus. There were a number of options available for the location of the biomass boiler, thermal stores and importantly, fuel store. Due to the space constraints which are present for constructing a fuel store, the recommended fuel type is pellets due to the practicality which comes with the silo approach to fuel storage.

The ideal approach to the location of the biomass system is to use the existing steam boiler room as the new boiler room, running a series of pipes to the existing main boiler room through the roof space between the two rooms. The steam boiler is an outdated, underused and excessively large machine making the room in which it is located an ideal location for a biomass boiler. If the conclusion made in pre-planning is that using the steam boiler room is not a practical option (the steam boiler is currently used in dye processing on campus) then the boiler and controls can be housed in an external containerized solution located just outside the steam boiler room.

Scottish Borders Campus currently pay a low price for natural gas which results with the economic analysis of the biomass project providing good, but not exceptional paybacks (which are found when biomass replaces more expensive oil or LPG boilers). However the client must note that separating themselves from a carbon intensive heating method will insulate them from any future gas price increases as well as any potential future legislation which could be put in place on carbon intensive fuels. In addition to this, to if any eligible installation is fitted, the renewable heat incentive can be claimed for the site which could represent as much as £60,000 per year income.

There are a number of wood fuel (both pelleted and chipped) suppliers within close proximity to Scottish Borders Campus with the capability of supplying biomass fuel to Scottish Borders Campus. A local pellet supplier has been contacted and has confirmed they are capable of delivering pellets (via a blower truck) to the site.

| **Recommendation/s** | **Estimated Annual Savings** | | | **Estimated Cost** | **Payback Period** |
|---|---|---|---|---|---|
| | **(£)** | **kWh** | **$CO_2$ (tonne)** | **(£)** | **(years)** |
| Install a 500 kW biomass boiler | £28,941 | - | 218 | £222,434 | 7.7 |

* The estimated annual savings include any applicable RHI payments

**Estimated Energy Savings**

This could save Scottish Borders Campus 1,490,210 kWh in natural gas costs with a combination of savings from the natural gas costs and revenue from the renewable heat incentive scheme resulting in a total saving of £28,811 per annum.  This equates to a 13% saving of energy costs.

**Estimated Carbon Savings**

Carbon emissions from the campus could be reduced by 218 tonnes per year, which represents 42% of heating emissions and 16.6% of total emissions.

**IMPORTANT NOTICE**
All costs and savings stated in this report are based on the data available at the time of the visit. For further liability information, see the Important Notice section.

# 1. INTRODUCTION & BACKGROUND

## 1.1. General

This consultation was carried out on June 6th 2012 by Emma Hutchinson of Energy Management Solutions Ltd. Our main site contact was Robert Hewitt, Facilities Manager.

## 1.2. Organisation Background

The Scottish Borders Campus is a mixed-use college campus, with both further and higher education activities and on-site student accommodation. Heriot-Watt University operates the High Mill building, and several areas of the main campus buildings (including research labs, offices and teaching spaces). Scottish Borders Campus operates the majority of the interconnected main campus buildings, and the adjacent Technical Training Centre. Some spaces (such as the library, unions and other shared services) are shared (in terms of usage and energy costs) between Borders College and HWU, with the Scottish Borders Campus facilities management team taking responsibility for operation and maintenance of building services.

## 1.3. Energy Consumption Overview

The campus consumes approximately 4.27 million kWh of energy per annum (based on 2011 figures), costing a total of £230,000. This comprises:

| **Utility** | **Energy Consumption** | | **Cost** | | **Carbon Emissions** | |
|---|---|---|---|---|---|---|
| | **kWh/year** | **%** | **£/year** | **%** | **$tCO_2$/year** | **%** |
| Electricity | 1,474,257 | 35% | £132,683 | 58% | 803 | 60 |
| Gas | 2,798,253 | 65% | £97,938 | 42% | 518 | 40 |
| **Total Energy** | **4,272,510** | | **£230,621** | | **1312** | |

The unit costs for electricity and gas used in calculating savings are 9 and 3.5 p/kWh respectively. The gas cost includes CCL and an element of standing charge but does not include VAT.

## 1.4. Objectives

The objective of this report was to investigate the technical feasibility of installing a biomass boiler at Scottish Borders Campus, explore the business case and detail the legislative and administrative aspects of the project.

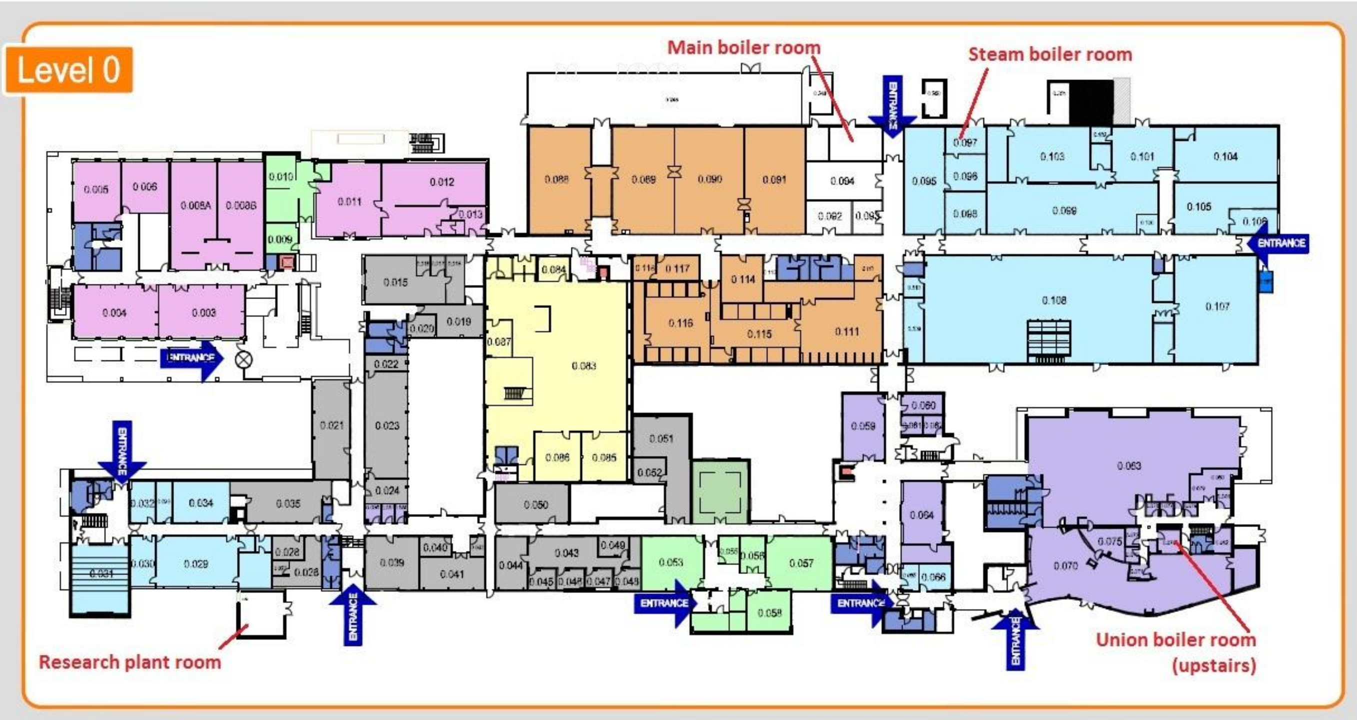
# 2. EXISTING SYSTEM

The Border's College campus has 6 boiler rooms in total (4 in the main building including the steam boiler) and one in the High Mill building. There is a variety of power ratings for the various boilers which are listed in the table below:

| ***Boiler Location*** | ***Equipment*** | ***Rated Input (kW)*** | ***Rated Output (kW)*** |
|---|---|---|---|
| Main Boiler Room | 2 x MHS 923 UltraMax gas boilers | 966 | 906 |
| | 2 x Andrews R300 Direct fired gas water heaters | 147 | 139 |
| Lab Block Boiler Room | 3 x MHS UltraMax gas boilers | 112.4 | 109.8 |
| Old Union Boiler Room | 2 x Hamworthy gas boilers | unknown | 70 |
| High Mill Boiler Room | 4 x Hamworthy gas boilers with Permanent Pilot Light | unknown | Estimated 100 |
| Steam Boiler Room | 1 x Steam boiler for dye plant | n/a | 1,050lbs/hr steam production |
| Technical Training Centre Plant Room | Qty 2 x ACV Heatmaster Gas Boiler | 69.9 | 63.5 |

The High Mill Building and Technical Training Centre are separate from the main building (see map in appendix A), they have their own heating and hot water circuits. Although biomass was initially considered for both of these buildings (as part of a large district heating scenario) the capital cost involved with excavating trenches for connecting pipework would make the project much less appealing. In addition to this there are drainage and telecommunication issues, as well as potential disruption to other on-site deliveries which make the DH system unfeasible.

The main building is heated by 3 boiler rooms and hot water is provided by direct fired gas water heaters. The heating circuit for the border's campus main building is quite complicated due to the 3 main boiler rooms and their positions throughout the building.



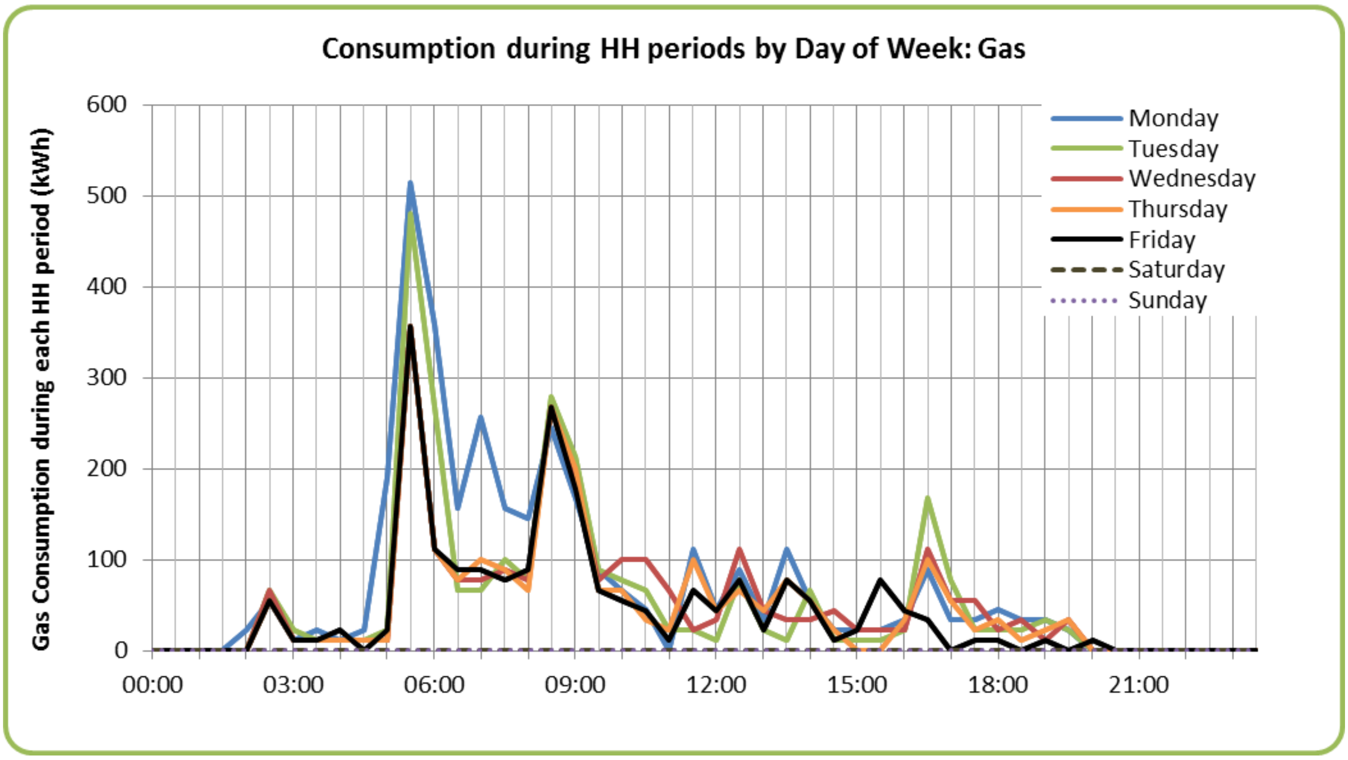
The main boiler room provides the majority of the heat loads across the main building (with the exception of the union and research laboratory areas of the building). There are two CT (constant temperature) circuits and two VT (variable temperature) circuits which are fed from the UltraMax gas boilers providing heating loads across a large proportion of the building; the district hot water loads are provided by the Andrews direct fire gas boilers. In the southern corner of the building, where the research plant room is located, separate heating (a CT and a VT circuit) and domestic hot water circuits are provided by the 3 UltraMax gas boilers.

The Union boiler room has one VT phase which leaves the boiler and supplies the domestic hot water needs of the union area of the main building (North East corner of the building) as well as approximately 10 radiators. When Border's College was renovated in 2009 the boiler and heating circuit were not renovated for this are of the building, and so this area of the main building has a separate heating circuit to the main building.

One of the major considerations for Scottish Borders Campus is in the effectiveness and practicality of merging the main boiler circuitry with both the union boiler room circuitry and the research lab area of the main building. There are pipes from the main boiler room which deliberately terminate in the close proximity of the union boiler room. It is understood that when the renovations were undertaken these pipes were put in place so that the two heating circuits could be combined, which would remove the need for the union boiler room altogether.

The research laboratory area of the main campus building has separate heating and hot water circuits; however there is no easily available connection point to incorporate the two heating circuits. It is therefore recommended that Scottish Borders Campus evaluate the available capacity on their existing heating circuit from a certified HVAC engineer to establish whether or not these two heating circuits could be connected. It is in the interest of Scottish Borders Campus to do this as it will reduce their gas consumption across the campus. If the capacity in the existing pipes is not adequate for connecting the two heating circuits then an additional leg may be required to be installed from the biomass boiler through the main building connecting to the lab research boiler room. This will place an additional cost on the project as a whole but will reduce the college's carbon footprint by reducing gas use.

Scottish Borders Campus had an AMR gas meter installed on the campus in June/July 2012. The meter accurately measures the gas supply to the entire campus. Included within the diagram below are the gas supply to the high mill building, technical training centre as well as gas supplies which are used in the direct fire gas water heaters, the gas used in the kitchens and laboratory areas of the campus. The diagram shows the overall gas use for a week in July 2012 (ideally it would be a snapshot of a winter week but as the meter has only been installed in summer 2012 this was not possible).




AMR data is exceptionally good at assessing where energy has been miss-used. For example on the gas AMR data below it was immediately recognized that the optimizer on the BMS was performing as expected (with the heating coming on at 5.30am). In addition to this there is a spike at 2.30am from the laboratory part of the main building which is thought to be due to faulty controls causing an optimizer to attempt to reach a temperature that it is not possible to reach causing it to switch on earlier and earlier.

The initial spike at 5.30am is from one of the boilers in the main boiler room switching on; the other significant spike from 8am is high mill and the technical training centre boilers turning on. As this data is compiled from a summer month there is no real established heat load throughout the campus, rather the boilers cycling on and off as and when they are required. During a typical design day in winter we can establish that there would be a much more constant load profile (from continual space heating) across the hours in the day. This is will not be represented in the peak load however, it will of course be larger during the winter months, however we would not see a doubling of peak load where we may see at least a doubling of daily consumption.

# 3. RECOMMENDED SYSTEM

## 3.1. System Sizing

In order to correctly size the biomass boiler, the separate buildings of the border's college must be adequately considered with respect to gas consumption. Because the individual buildings of the Border's College are not sub-metered, it is an inexact process which separates the gas consumption for each building. The table below shows each building of the campus as both Total Floor Area (TFA) and then the % that this building takes up as part of the total floor area.

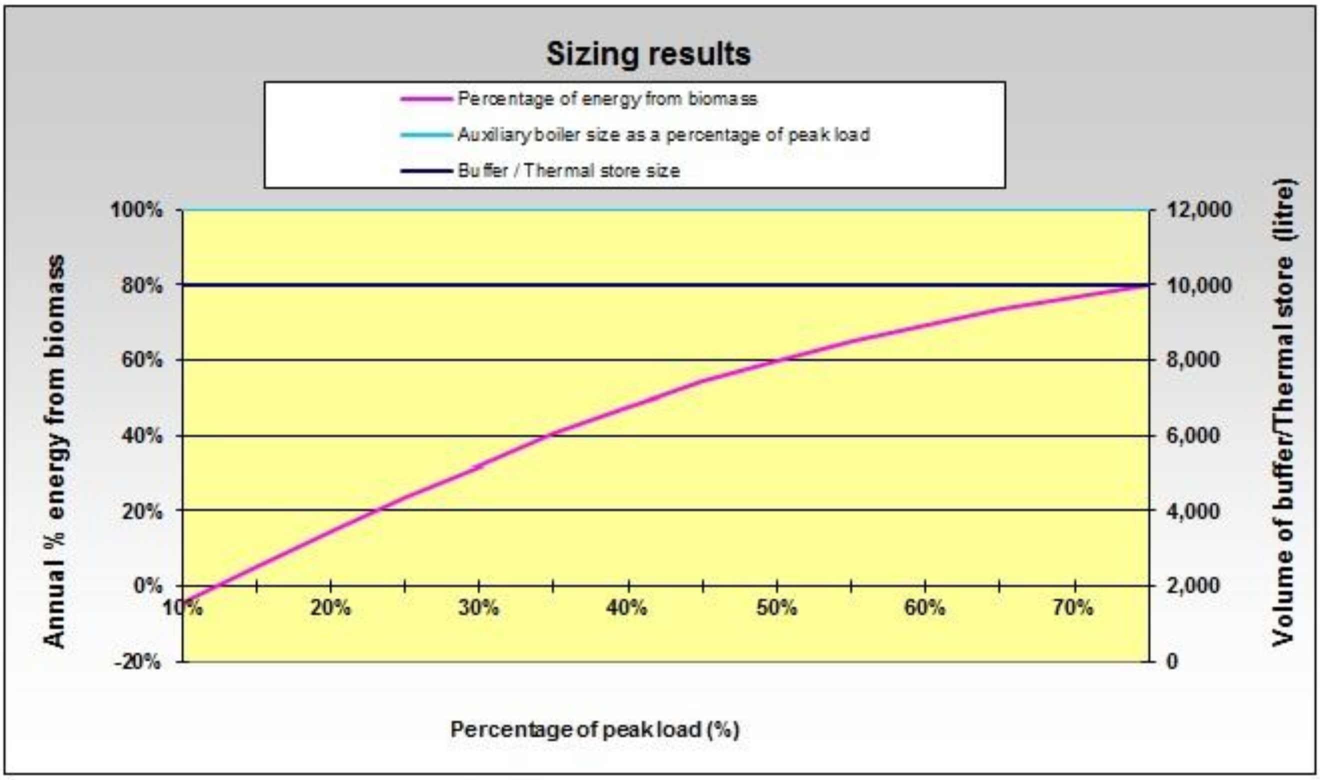
| Location | TFA ($m^2$) | % of Site TFA |
|---|---|---|
| Main Campus Buildings | 14,603 | 70% |
| Technical Training Centre | 2,188 | 10% |
| High Mill | 4,068 | 20% |
| **Total** | **20,859** | **100%** |

With regard to energy consumption per $m^2$ of floor space area, it has been estimated that the main campus buildings and the technical training centre use approximately the same amount of energy per $m^2$ whereas the High Mill is likely to use up to double this as it is a poorly insulated and draughty building. As discussed in the previous section, neither the High Mill Building or Technical Training Centre will be considered as part of a biomass district heating system, due to the technical issues involved in dredging pipework from the main campus out to these external buildings.

Three scenarios were built up from old gas meter readings and heating degree days in order to size the boiler correctly. These were for an exceptionally cold week during December 2010, an average cold week in winter and a week in March. Using these and heating per square meter, a daily design heating load (for a winter's day) was calculated as 7,800kWh for the main building.

To estimate the gas supply which was delivered to the main campus building separated from the total annual supply we can use the floor areas and energy use per floor area. This leads to the main campus building using approximately 58% of the entire gas consumption. Therefore, of the 2,798,253 kWh consumed in a year the consumption of the main campus building can be estimated at 1,640,000 kWh / year.

Analysis using both the HH gas data and the Carbon Trust biomass design tool has resulted in a biomass boiler size of 500kW along with a thermal store of 10,000 litres capacity. It can be seen that during a summer month the biomass boiler, along with the thermal store will easily meet the load and can be modulated to run at part load to meet the entire demand. During winter months when the demand is much higher the biomass boiler will be operating much more efficiently with higher constant loads on the system.

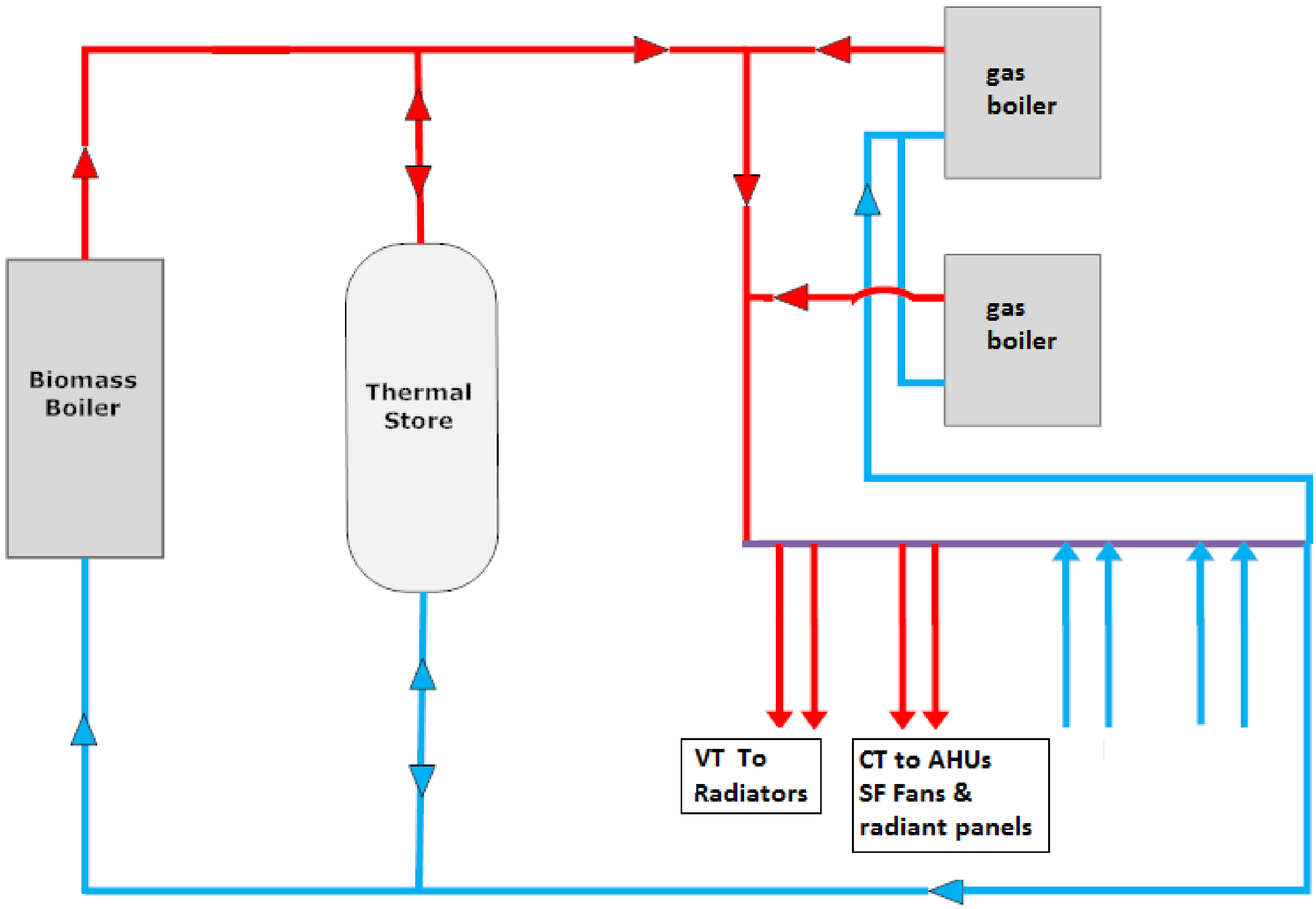



If the biomass boiler was sized to meet its peak winter demand it would operate at below optimum efficiency for much of the year. A 500kW boiler allows the boiler to operate at optimum efficiency with one of the existing gas boilers providing back up and peaking during the winter months. It is estimated that a 500kW biomass boiler will provide 77.7% of the heat demand of the main campus building.

Domestic hot water in the main building is currently supplied by Andrew's water heaters. It has been assumed that these are isolated and the biomass boiler is used to supply this load as well. An option would be to shut down the biomass boiler completely during hot summer holiday periods (if they occur) and utilize one of the Andrew's water heaters to supply the DHW load during this time.

## 3.2. System Connections

As it is planned to keep one of the existing boilers to provide the peak load and provide a backup in case of any biomass supply or maintenance issues, the biomass boiler will need to integrate with the existing flow and return to the boilers. A possible connection scheme is shown below. Although peaking and back-up are required, the current capacity in the main boiler room (2 x 906kW → 1818kW) is excessive and only one boiler would be required for back-up. The schematic below has both boilers in place, however one of these gas fired boilers could be removed from the boiler house and this would free space for the accumulator tank. There is also a market for 2nd hand gas fired boilers if Scottish Borders Campus were to remove one of their existing boilers they could recuperate some of the biomass boiler by selling one of the surplus boilers. Alternatively it could be used to replace the aging boilers in High Mill.




The actual connection scheme will be determined during the detailed design process. This scheme allows the biomass system to be isolated in the case of planned or unplanned shutdowns. If Scottish Borders Campus decide to connect the research lab area of the main building to the biomass boiler then an additional flow and return leg to and from this area of the main building may need to be incorporated.

## 3.3. Fuel Supply

There are three options for fuel supply for biomass boilers:

| Fuel | Quality | Typical Cost | Availability |
|---|---|---|---|
| Logs | Varied moisture and log sized. Can be stored in store partially open to the weather | £55/tonne @ 25% moisture (1.2 p/kWh) | Widely available |
| Woodchip | Dependent on supplier, can be of consistent quality. Should be stored in a watertight building with ventilation | £100/tonne @ 30% moisture (2.9 p/kWh) | Increasing number of suppliers such as sawmills and local tree surgeons |
| Pellets | Normally consistent quality. Must be stored in a completely dry building | £200/tonne (4.9 p/kWh) | Few manufacturing plants and suppliers |

Each fuel has benefits and disadvantages. These are discussed below:

**Price**
The price differential reflects the amount of processing required to get the fuel to a state so that it can be burnt. Logs require seasoning, preferably partially under cover and then cutting to size. Wood chip is generated from chipping seasoned logs or from chipping virgin timber and then drying it to the required moisture level. Wood pellets are made from wood chip or sawdust that is pulverized and then pushed through a steel die at high pressure requiring a high level of energy input.

**Boiler Availability**
In all but residential and small commercial properties, log boilers can be ruled out due to the manual loading requirement. Wood chips can be used in boilers as small as 20kW but in general, they are more economic in boilers with a capacity greater than 50kW. Wood pellets can be used in any size of boiler.

**Operational Issues**
Logs require most effort in that the boiler will need to be regularly loaded with logs. Some automation is possible, but it is limited. Wood chip can be automatically loaded into a boiler from a store with an auger, swept arm or walking floor. These mechanisms can occasionally block and require regular cleaning. Pellets are the easiest to handle and can be mechanically transferred from the store with an auger or swept arm or can be piped in to the boiler.

**Deliveries**
With all fuels, the larger the delivery size, the cheaper it is likely to be. Logs are usually delivered by trailer load, ranging from a pickup to an articulated lorry. Wood chip can be delivered in a variety of formats including:

- Bags.
- Trucks with grab: the grab can be used to transfer chip into an above ground store with a roof opening. These can have a wide range of sizes with the limitation being the time taken to transfer the chip by grab.
- Tipper trucks: these tip the chip into below ground stores or onto a flat clean surface for onward transfer into the store. Typically these have a capacity of `0 – 30m$^3$ but they may have a capacity of up to 70m$^3$.
- Hook bins: trailers that can be "plugged in" to the biomass system so that they act as the fuel store themselves. These trailers normally have an integral walking floor. These normally have a capacity of 20 – 40m$^3$.
- Blower trucks: these blow the chip along a flexible pipe into the store, usually for a distance of up to 8m.
- Trucks with walking floors: these tend to be larger vehicles with capacity of up to 110m$^3$.
- High lift trailers: These can elevate the trailer to allow the chip to be tipped in to an above ground store through a roof opening. These generally have a capacity of no more than 23m$^3$.

Pellet delivery methods are similar to those used with chip. The most common delivery methods are tipper trucks and blower trailers.

Care should be taken when selecting a fuel supplier. Even if they have high quality fuel and good handling procedures in their production or main distribution facility, it is possible for the fuel to be contaminated during the distribution process.

It is therefore important to understand the entire fuel supply chain and to ensure that liability is correctly allocated in case of contamination.

**Recommended Fuel for Border's College**
The main factors influencing fuel choice at Scottish Borders Campus are listed in the following table with a rating for each factor for each fuel type. The ratings are from 1 (worst) to 3 (best).

| | Log | Wood Chip | Pellet | Notes |
|---|---|---|---|---|
| Local availability | 2 | 3 | 3 | There are local chip, pellet and log suppliers but no major depots in the surrounding area. |
| Boiler size required | 0 | 3 | 3 | No log boilers have been identified at the size required. Multiple smaller boilers would therefore be required making them uneconomic. |
| Space availability and on site logistics | 1 | 2 | 3 | There is a reasonable amount of space available for storage; however, the additional on-site vehicle movements required for logs may disturb students. Because of the infrastructure of the area, an above ground fuel store would be the most economical option (silo for pellets or hook bins for chip). |
| Operational constraints | 1 | 3 | 3 | There is an estates department but filling a log boiler of the required size would require additional personnel. There is a maintenance team with skills that could be adapted to the regular maintenance require for a wood chip or pellet boiler. |
| Cost | 3 | 2 | 1 | As per table above. |
| Delivery flexibility | 3 | 3 | 3 | Access to the site is good. |
| **Total** | **10** | **16** | **16** | |

Using the rating system above, both wood chip and pellets come out as the best wood fuel option at Scottish Borders Campus. Due to the nature of the Border's College campus, it would require some considerable civil work to construct an underground bunker for woodchips (or indeed for a pellet store). Because of this an over ground fuel store will be the most cost effective. This limits the availability of woodchips, as specialized scissor lifting trucks are required for the delivery of wood chips, or even rarer are woodchip blower deliveries.

Hook bins offer a good solution for integrating wood chip with the border's college biomass system, however there is a lack of availability of hook bin deliveries in this area.

Due to the aforementioned reasons, a pellet boiler with a silo container is considered to be the best option for the Border's College biomass project.

## 3.4. Boiler Location and Access

There are several options for siting the biomass boiler at the Border's College:

- In the main boiler room (this would require the removal of one or both of the existing gas boilers – depending on the requirements for back-up generation) under this scenario, the thermal store which would be required for the biomass system could be sited in the steam boiler room.

- In the steam boiler room – the steam boiler is used for the dye plant but is not utilized regularly. It is extremely old and is likely to have a very low efficiency level and would therefore benefit from being replaced with a modern smaller replacement. The steam boiler room is of ample size to fit a biomass boiler and thermal store. There is also space outside where a silo fuel store could be located as show in the picture below.


- Containerized boiler option – a custom built moveable boiler option which houses the boiler and controls. This is an excellent siting option if the first two options cannot be used. There are several locations on the western facing side of the main campus building where a containerized boiler could be located. However, directly outside the main boiler room (which would be the ideal location to minimize any additional pipework which would be required) is a large disabled access entrance. In addition to this there is a small chemical store (as shown in the image above) which is located externally between the steam boiler room and main boiler room. During the site visit it was indicated that if required this chemical store could be re-sited if this boiler room location was chosen. This adds a further consideration for the siting of the boiler.

In addition to the siting of the boiler, some consideration must be taken for the sizing of the thermal store which will accompany the biomass boiler. The thermal store has a large cross sectional area as well as sufficient height. It is recommended that the thermal store could be located in the steam boiler room (with or without removing the steam boiler depending on the biomass boiler location) or with the containerized boiler room located externally if a containerized solution is decided upon.


The image above shows one possible delivery route onsite, however access from the tweed road would also be a possible option. The on-campus road network is sufficiently wide to accommodate delivery lorries and there is good space to maneuver the lorry for any of the desired biomass boiler locations (they are all in close to proximity to one another).

The number of deliveries to the site will be dependent on the size of the fuel store which is onsite. The quote received from Econergy specified a $54m^3$ fuel store. At this size, it is estimated that the system will require approximately 15 deliveries in the summer months and 20 deliveries in the winter months giving a total of 35 deliveries per year.  Each delivery lorry holds approx. 15 tonnes of wood pellets to approx. 45,000 kWh of delivered heat.

This is a large fuel store and Border's College may want to re-evaluate what size of store they require as this size of fuel store would be a fairly tall unit and may not be as aesthetically pleasing as a smaller fuel store.

## 3.5. O&M Requirements O&M Requirements

### 3.5.1. Daily Operation

It is important to consider the daily tasks required to support reliable and efficient operation of a biomass heat system.

There are a number of technological features, available for biomass systems, which can reduce the range and complexity (and hence time requirements) for daily operational support. These tasks include:

- Visual Inspection
- Cleaning (of combustion chamber & heat exchanger surfaces)

- Emptying of Ash disposal bin

The aforementioned technological features can be specific to types of biomass system, but generally include:

- Automatic ignition (avoids manually re-lighting of boiler)
- Automatic de-ashing avoids manually raking out ash – ash is mechanically conveyed to a ash disposal bin for easy disposal
- Automated heat exchanger cleaning

Advanced biomass boilers are highly automated and only require checks once a day to ensure the plant is running correctly and fuel is still available.

### 3.5.2. Maintenance

Biomass systems require more user input for operation and maintenance than gas or oil-fired alternatives. Other than quick daily checks and occasional ash bucket emptying, a biomass boiler will normally require a shutdown, clean and detailed check every four to six weeks. This involves cleaning all heat transfer surfaces, removing all ash from the boiler, checking for cracks or blockages, clearing out any flue gas filters or cyclones and air inlets and checking the chip feed mechanism. These tasks should be able to be performed by existing estates or maintenance staff.

As with daily operation, certain technological options and operational practices may minimize the maintenance time required. In addition to those already mentioned, such practices and technologies include:

- Ensure that the fuel is of consistent size and moisture content to limit blockages
- Avoid short-cycling (i.e. short bursts of boiler operation followed by a switch off) using controls and thermal stores
- Conduct and record regular checks and maintenance and ensure that any issues found by the checks are referred the maintenance organization

The following table, taken from Section 3.4.1 of Carbon Trust publication CTG012, details an example maintenance regime for a biomass boiler.

| Frequency | Task |
|---|---|
| **Daily** | • Visual Inspection<br>• Clean and components where necessary |
| **Weekly** | • Check gear motors for leaks<br>• Check ash level and empty if necessary |
| **Monthly** | • Scrape combustion chamber and remove bed ash<br>• Check conveyor grate |
| **3-Monthly** | • Wipe flue gas sensor<br>• Clean Lambda probe<br>• Check grate |
| **6-Monthly** | • Check and clean flue gas return (where applicable)<br>• Inspect operational drives<br>• Check motors<br>• Clean heat exchanger<br>• Clean combustion chamber |
| **Annual** | • Clean under-pressure controller<br>• Check seals<br>• Check combustion air blower fan and induced draught fan<br>• Check and clean secondary air ducts |

- Grease bearings
- Brush flue

The annual tasks will normally be undertaken by a maintenance contractor. Depending on the maintenance contract, other 3 and 6 monthly tasks may also be performed by the contractor.

Where the boiler is supplied under an ESCO arrangement (see below) the majority of maintenance tasks may be carried out by the maintenance provider.

### 3.5.3. Ash Disposal

Ash primarily consists of the non-combustible, mineral constituents of the fuel as oxides or salts. It falls into two components, those, primarily larger, particles that fall through the grate during combustion and are collected as bottom ash. The very fine particles that are carried in the flue gases are known as fly ash.

The ash should be of good enough quality to be utilised as fertiliser or recycled by utilising it as a component of cement.

As mentioned in Section 3.5.1, automatic de-ashing systems avoid manual raking out of the combustion chamber. In this scale of boiler these are likely to take the form of an auger or augers that remove the ash into one or two small ash bins.

## 3.6. Health and Safety

The three main areas where health and safety issues can occur are fuel handling, fuel storage and combustion. Some of the potential risks and possible mitigation options are shown below. The actual risks will be dependent on the final design of the boiler, store and delivery mechanism. A full health and safety review should take place as part of the detailed design process. Safe systems of work should be developed for all identified risks.

### 3.6.1. Fuel Handling

| Risk | Mitigation |
|---|---|
| Vehicle movements. | Consideration should be given to timing the deliveries at times when few staff or students are likely to be walking through the campus. |
| Unloading | This will depend on the vehicle used and the store type. Normal H&S practices and training should be implemented. Particular care is required when the store is filled by lifting a flap in the roof of the store. Where this is the case, an automated flap removes some of the risk; however, care will be needed in windy conditions when additional restraints may be required. |
| Fuel storage of any kind is considered a confined space and can present fire or asphyxiation hazards. | A method statement for entering and working in the confined space will always be required and a 'permit to work' authorization is advisable. It should be ensured that the store design incorporates the correct size and number of exit routes for the level of risk. |
| Mechanical augers/conveyors pose hazards from unintentional human contact with their moving parts. | A safe method of work should be put in place and any person cleaning or maintaining the boiler should receive appropriate training. |

### 3.6.2. Fuel Storage and Handling

| Risk | Mitigation |
|---|---|
| Explosion & Fire: These can start for a number of reasons including:<br>• Burn-back from the boiler<br>• Ignition from self heating<br>• Ignition from a hot source such as an electrical component | The risk of fire in a pellet store is higher than in a wood chip store. A fire alarm that detects high temperatures should be used. |
| Formation of 'dead' pockets that may collapse | The fill system should load the bunker uniformly to its maximum level and the bunker extraction system should transfer the fuel in a controlled fashion, minimising 'dead' pockets. This is a particular danger for wood chip stores, and does not affect pellets in the same manner as they have the ability to 'flow'. |
| Issues related to the Control of Substances Hazardous to Health Regulations (COSSH), e.g. toxic spores or carbon monoxide (CO) poisoning | It should be ensured that the store is well ventilated, that a CO detector is used and that any one accessing the store receives the correct training. |
| Opening store access doors when level of pellet is above the level of the opening | There should be a method of determining the level of fuel in the store. This could be in the form of a Perspex panel, level probes or ultrasonic level detectors. |

### 3.6.3. Boiler and Combustion

| Risks | Mitigation |
|---|---|
| Fire: Biomass boilers differ from fossil fuel boilers in that they cannot be quickly extinguished. Biomass boilers have large thermal inertia caused by fuel burning on the grate and potentially also residual heat stored in the refractory. This presents a risk of excess temperature or pressure if the boiler must be shut down suddenly (e.g. if there is a power failure which would stop fuel feed motors and draft fans from operating). The problem tends to be greater with wood chip boilers that are physically much larger than pellet boilers with similar outputs and hence have a larger thermal inertia. | This risk can be reduced by including a buffer vessel, an emergency heat dump or cooling loops in the design. |
| Fire: The likelihood of hazardous situations in the fire side is much higher than on the wet side. The combustion of biomass fuel involves gasification and the production of potentially explosive gas mixtures on a large static fire bed of considerable depth and area, while oil or gas combustion employs essentially a transient flame. Due to the different combustion process, biomass boilers cannot be fitted with the same levels of interlocks as gas or oil plant. Occasionally, un-combusted, explosive gas mixtures can build up within a biomass boiler's combustion chamber and flue, which are subsequently ignited and an explosion of some form can occur. There is anecdotal evidence of a | Correct operating procedures minimise this hazard but its presence cannot be eliminated. |

| | |
|---|---|
| significant number of these having occurred in the UK, in some cases resulting in blown out boiler house windows and doors or even blown-open boiler hatches. | |
| Fire: Flues can present an explosion risk due to the potential build-up of explosive gases as mentioned above. Fires from tar build up can also occur. | The fitting of explosion relief for the flue can partially mitigate this risk. The flue should be regularly cleaned. |
| CO2: The risk of CO poisoning is always present with a biomass system as the flue gases generally contain higher concentrations than gas oil. | A CO monitor should be installed in the same room as all solid fuel appliances. Sound design, good installation practice and maintenance should minimise the risks of CO poisoning. |

## 3.7. Technical RHI Requirements

In order to qualify for the RHI there are some basic requirements:

### 3.7.1. Boiler

The boiler must have solid biomass as the primary fuel and there is a range of documentary evidence required to prove this. For a wood pellet boiler this should not be an issue due to the feed mechanisms.

In addition, the plant must use liquid or steam as the heat delivery mechanism. The heat must be used to heat a space, water or a process. The recommended solutions in this report all use low temperature hot water to heat the campus and the domestic hot water so will qualify.

### 3.7.2. Metering

The July 2012 RHI proposed update has provided some flexibility with regard to metering arrangements for future renewable heat installations. The original RHI document required installers of eligible renewable heating equipment to meter where appropriate, in order to exclude heat which has not been used for an eligible purpose (for example, two meters would be required for two separate buildings to ensure Ofgem do not pay the participant for heat which is lost between the buildings).

Depending on where the biomass boiler is physically located (within the main campus building or as an external containerized solution) the biomass installation will either be considered to be a 'simple' or 'complex' installation. The new consultation proposals for the RHI aim to reduce any 'unduly burdensome' metering requirements for eligible heat installations.

Considering the containerized solution, where originally the RHI would require three heat meters (one within the boiler house and two within the main campus building, one before the back up boiler and one after the back up boiler) to ensure payments were not being made for ineligible purposes (i.e. the transfer of heat between buildings and for heat provided by the ineligible fuel source).

In addition to this, where both eligible and ineligible heat sources are connected (in this case, a biomass boiler providing the heating loads and a gas fired boiler used as back-up or as a peaking plant) in a heating system then several heat meters would be required, one to measure the eligible heat generated by the biomass boiler, and one to measure the heat delivered by the gas-fired boiler (so that payments are not being made on ineligible heat uses).

The new proposals to the RHI should minimize the meters required to one, as shown in the diagram below. The RHI proposals are under consultation until September 14$^{th}$ after which more detailed and finalized decisions will be made on the future of metering under the RHI.

Example 2: A backup fossil fuel boiler.

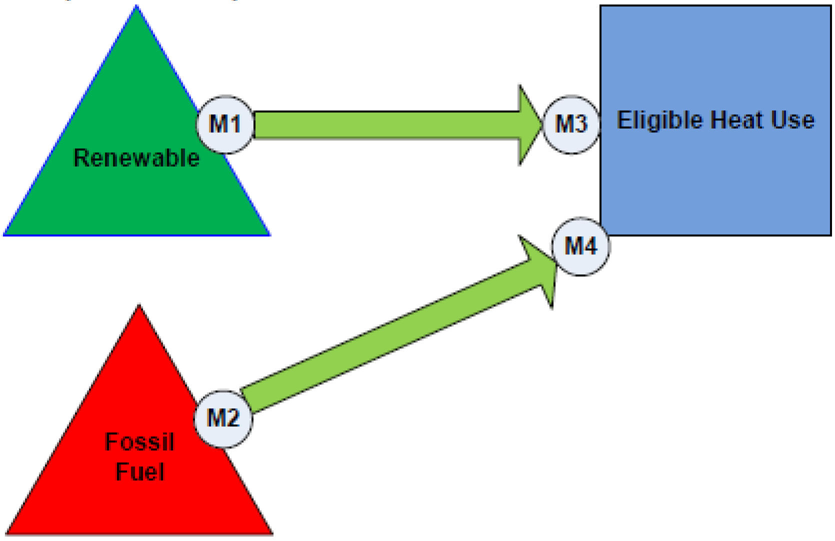



*Figure 3 Current Metering Requirement: Currently the regulations require each ineligible fuel source to be metered, even when the payment calculation does not require that measurement.*

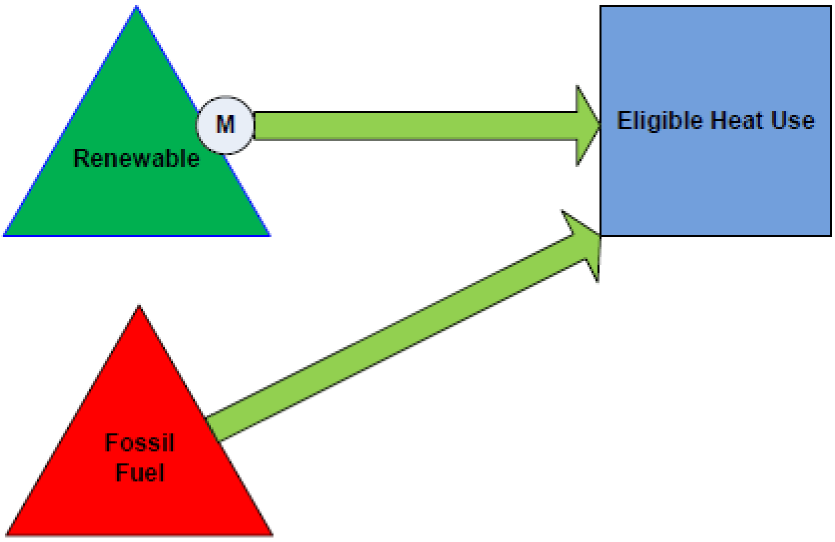



*Figure 4: Metering requirement under new proposals. Only the renewable heat generated would need to be metered.*

The metering configuration will need to be confirmed once the system design is finalized. Once the meters are installed, a metering report will be required from a suitably qualified expert.

The meters must also meet the following criteria:

- comply with the relevant requirements set out in Annex I to the 2004 Measuring Instruments Directive (MID)69 (2004/22/EC)
- comply with the specific requirements listed in Annex MI-004 of the MID
- fall within accuracy Class 2 as defined in Annex MI-00470

It should be noted that this section is based on the proposed RHI amendments which are currently subject to consultation and the situation may therefore change.

# 4. BUSINESS CASE

## 4.1. Capital Costs

Indicative quotes have been provided by Econergy. They have experience of installing similarly sized boilers and can provide a simple boiler installation or a more turnkey solution depending on the boiler options decided upon. They also provided quotes for a containerized biomass solution.

Econergy proposed installing a 500kW Fröhling Turbomat pellet boiler with an external silo fuel store.

The indicative costs were as follows:

| Item | Cost |
|---|---|
| Boiler & ancillary systems | £70,000 |
| Fuel extraction & transfer | £4,837 |
| Fuel Store | £10,738 |
| Flue and chimney system | £15,008 |
| Wiring and controls | £6,851 |
| Remodeled pipework | £10,000 |
| Design/ project management | £12,000 |
| Mechanical services | £58,000 |
| Offload and installation | £5,000 |
| Contingency | £30,000 |
| **Total** | **£222,434** |

The costs associated with a containerized solution adds a considerable additional cost to the project Also if it is decided that the biomass boiler is to be connected to the research laboratory part of the campus main building this will add approximately 140-160m of additional pipework depending on the route through the campus the pipes are laid.

## 4.2. Operating Costs

The operating costs can be divided into three categories: fuel, maintenance and operation of the boiler and the administrative costs associated with it.

### 4.2.1. Fuel

Lauderdale renewables have provided a price of £200/ tonne delivery of wood pellets. They are located about 7miles form the site and so provide the best option for wood pellet delivery to the site. Wood pellets can be blown in to an external silo at a rate of approximately 1 tonne every 5 minutes. Wood pellet delivery is relatively quiet when compared with woodchip blowing or tipper delivery. In addition to this, the location indicated for the biomass boiler is at an area of the campus with a variety of workshops where the level of noise associated with pellet deliveries is unlikely to cause any unrest, if the delivery was during normal working hours.

As a supplier throughout Scotland, Pentland biomass also indicated that they could supply wood pellets to the site for the same price as Lauderdale Renewables.

To supply the estimated peak load during winter for a 14 day period is estimated to require a 32 tonne silo.  Once more AMR data is available it will be possible to refine the size of the silo.

### 4.2.2. Operation and maintenance

Daily operational checks will be required. These are minor and it should be possible to include them in the normal daily maintenance schedule without recruiting extra team members. The periodic cleaning requirements will require a couple of hours every four to six weeks of an estates or maintenance team member. It has been assumed that it is possible to achieve this with existing personnel and that no additional personnel are required.

The maintenance will require an annual visit by a maintenance provider and the flue will also require sweeping. This is likely to cost £800 – £1,200 per year.

### 4.2.3. Administration costs

Administrative costs will also need consideration. In order to claim the RHI, meter readings must be regularly submitted and annual compliance declarations submitted.

Additional costs may also be incurred for insurance and rates. Typically, insurance costs are 1% of capital costs per annum. The rateable value of the property may also be affected.

## 4.3. RHI Income

The renewable heat incentive scheme has different levels of tariff for different sizes and types of heat producing renewable energy technologies. The tariffs are structured so that heat demand equivalent to the first 1,314 hours of operation at peak load is payable at a higher tariff (Tier 1) and the remainder receives a lower tariff (Tier 2). Biomass installations are eligible for the following tariffs in p/kWh:

| Technology | Tier 1 Tariff | Tier 2 Tariff |
|---|---|---|
| Small biomass (less than 200kW) | 8.3 | 2.1 |
| Medium biomass (200kW – 1 MW) | 5.1 | 2.1 |
| Large biomass (greater than 1MW) | 1.0 | 1.0 |

These tariffs will be paid for a twenty year period and are indexed to inflation (RPI).

## 4.4. Financing Options

Almost all of the historically available funding support for renewable energy projects are no longer available. The grants that were previously available have been superseded by the RHI. There are still low interest loans available from the Energy Saving Trust for SME businesses, however these are not open to Further Education facilities. However, Salix finance have agreed funding with the Scottish Government to support energy saving loans for Scotland's universities and colleges. More information can be found at http://www.salixfinance.co.uk/scotland-universities-and-colleges

Another option would be to use an energy services company (ESCO). They install and pay for the boiler, supply the fuel, maintain the boiler and charge a fee per kWh of energy supplied. Scottish Borders Campus indicated during the site visit that they did not intend on utilizing an ESCO financing option as the majority of the capital cost is available for the installation.

An ESCO has the advantage that almost all of the operational risk is carried by the ESCO provider. In addition, no upfront capital expenditure is required. This is offset by the decreased annual savings compared to an outright purchase option.

Scottish Borders Campus indicated during the site visit that they did not intend using an ESCO structure.

## 4.5. Economics

The following table summarises the economics without an ESCO:

| Parameter | Value |
|---|---|
| Boiler size | 500kW |
| Heat required | 1,640,000 kWh |
| Current gas consumption | 1,819,411 kWh |
| Gas price | 3.5p/kWh |
| gas costs displaced by biomass | 1,490,210 kWh |
| Wood pellet price | £200 / tonne |
| Wood pellet cost | £73,020 |
| **Savings on fuel costs** | **-£20,863** |
| RHI Payments | |
| Tier 1 revenue at 8.3 p/kWh | £33,507 |
| Tier 2 revenue at 2.1 p/kWh | £17,497 |
| **Total Payment** | **£51,004** |
| **Total savings (RHI + fuel savings)** | **£28,941** |
| Capital Costs | £222,000 |
| Operating Costs | £1,200 |
| **Simple payback** | **7.7 years** |

## 4.6. Risks

The risks to achieving these savings are as follows:

| Risk | Impact | Likelihood | Mitigation |
|---|---|---|---|
| The tariffs payable under the RHI are reduced | High | Medium | None |
| Delivery vehicles cannot access the site | High | Low | Suppliers should be invited to confirm that their delivery vehicles can easily access the site. |
| Natural gas prices fall | Low (because Scottish Borders Campus already pay a low price) | Low | None |
| Failure to achieve planning permission | High | Low | Investigate planning permission with the local council early in the process |
| Interruption to fuel supply | High | Medium | Revert to using gas boiler |
| Boiler breakdown | High | Low | Revert to using gas boiler |

# 5. LEGISLATIVE/ADMINISTRATIVE

## 5.1. Planning

It is recommended that Border's College contact the Scottish Borders Council to discuss the likelihood of planning permission being required for the Border's College. In many cases planning is required for the flues of biomass boilers as they can be of substantial height.

## 5.2. Local Air Quality Management

Because of the size of the recommended boiler to be installed, Scottish Borders Campus should contact the Environmental Health Officer at the Scottish Borders Council, David Brown, prior at the pre-planning stage of this project. The Scottish Borders have not declared any Air Quality Management Areas; however the quicker Scottish Borders Campus contact the council regarding this issue, planning permission and any related issues the better.

Due to the size of the project and its location, the local authority may require flue gas dispersion modeling to take place to ensure that the flue is correctly sized.

## 5.3. RHI Application

To apply for the RHI an account first needs to be created in the Ofgem RHI system.  This requires a bank statement to confirm identity.

Accreditation then needs to be applied for.  This requires provision of evidence of:

- Consent from Border's College for the application to be submitted
- The installation date and the installer (typical evidence: receipts, invoices)
- The commissioning certificate
- The commissioning report
- A photograph of the installation clearly showing the serial number of the equipment
- That the property is not a single domestic dwelling (e.g. business rates bill)
- Certification that the meters meet the required specification
- A schematic showing the eligible and ineligible heat losses, pipework connections, building boundaries and names, the positions of the meters
- A metering report
- Details of how the heat is used
- Evidence that the boiler has biomass as its primary fuel source
- Details of the gas boilers
- Information on any ESCO arrangements
- Costs associated with the installation

At one stage, over 95% of RHI applications were being rejected due to incomplete paperwork.  Care should be taken to ensure that all the require information is supplied in a clear format.

# 6. RECOMMENDATIONS



It is recommended that a 500kW pellet boiler should be installed in the existing steam boiler room as shown in section 3.4 above. If a decision is reached which indicates this is not a viable option then a containerized solution should be installed outside this location, however this adds a substantial cost to the project as well as adding further considerations regarding the replacement of the chemical store located outside this location. A pellet silo should be used for the fuel store located outside the steam boiler room and Scottish Borders Campus should consider the aesthetic impact of the silo when deciding on the capacity of the fuel store.

| **Recommendations** | **Estimated Annual Savings** | | | **Estimated Cost** | **Payback Period** |
|---|---|---|---|---|---|
| | **(£)** | **kWh** | **CO2 (tonne)** | **(£)** | **(years)** |
| Install 500kW pellet biomass boiler | £28,941 | - | 218 | £222,434 | 7.7 |

**Implementation:**

Before finalising the boiler and thermal store size, it would be beneficial to analyse further AMR data as it becomes available.

The following details should be confirmed prior to commencing detailed negotiations with a supplier:
- The supplier's delivery vehicles can negotiate the road to the chosen site
- The cost variation for different volumes of deliveries should be confirmed

These should allow the store size to be confirmed and the location finalised.

There is extensive support available on the Carbon Trust website including guidance documents and templates for wood fuel supply and ESCO arrangements.

# 7. FOLLOW UP SUPPORT

As part of the survey delivery process you will receive a supplement containing additional generic information. This is intended to complement your survey report and provide further information to enable you to implement the opportunities identified.

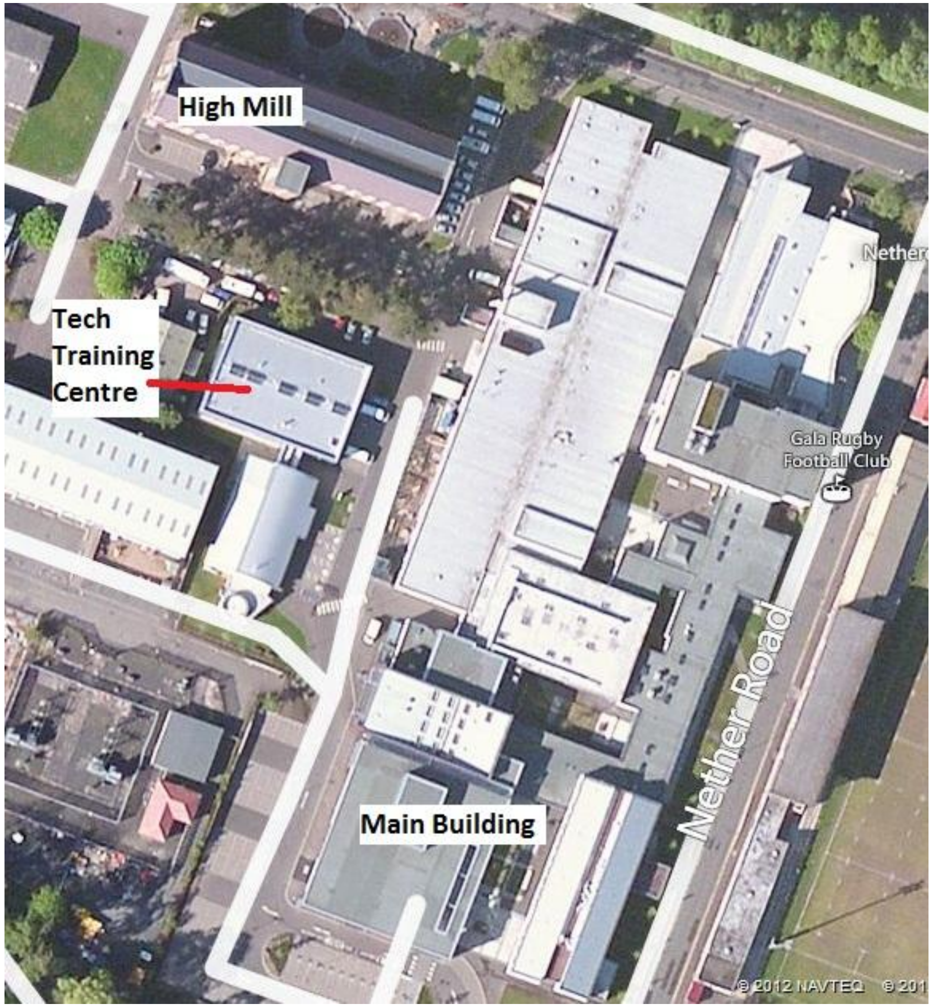
The supplement is divided into four sections;

- Preparation for your Survey
- The survey Process
- Implementation: advice and support
- Implementation: financial Support

Please contact your account manager if you do not receive your site survey supplement.

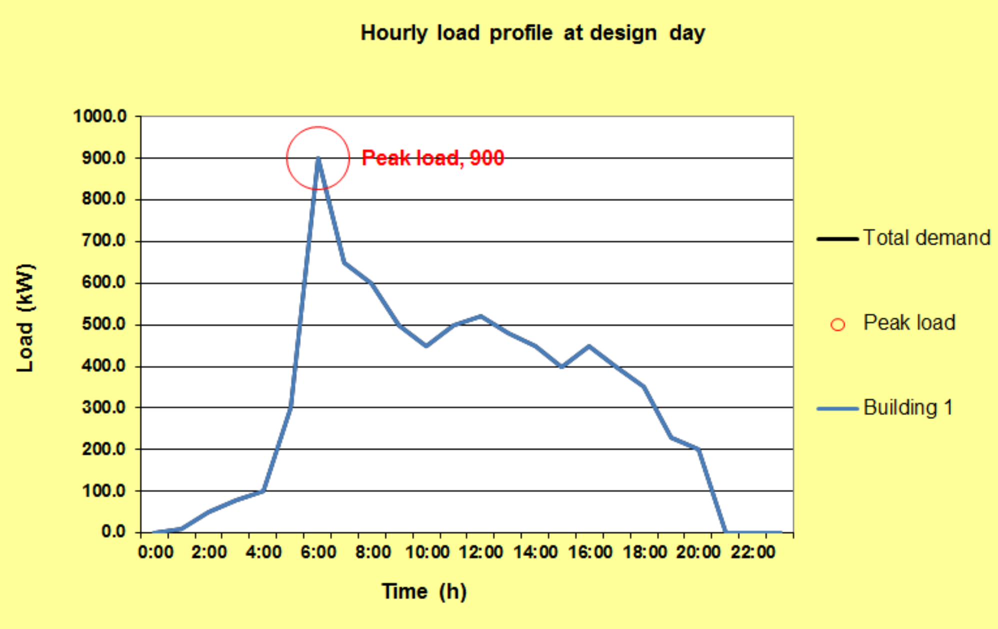
# APPENDICES

## Appendix 1 Supporting Information and Survey Findings

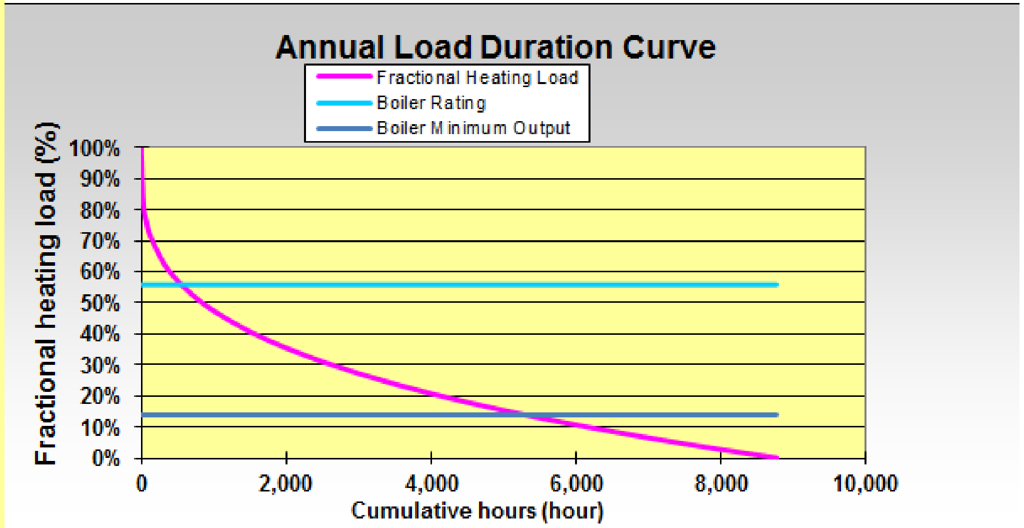



Scottish Borders Campus Layout showing the main building, technical training centre and high mill buildings

## Output from Carbon Trust Biomass Tool




Estimated winter design day profile




Load Duration Curve

| EntityType | EntityNam | Consumpt | EnergyConsumption |
|---|---|---|---|
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | 3/7/2012 | 1316.293 |
| SITE | Scottish Bo | 4/7/2012 | 2406.454 |
| SITE | Scottish Bo | 5/7/2012 | 1685.627 |
| SITE | Scottish Bo | 6/7/2012 | 1463.833 |
| SITE | Scottish Bo | 7/7/2012 | 11.089 |
| SITE | Scottish Bo | 8/7/2012 | 621.021 |
| SITE | Scottish Bo | 9/7/2012 | 3825.93 |
| SITE | Scottish Bo | ######## | 3615.226 |
| SITE | Scottish Bo | ######## | 3379.876 |
| SITE | Scottish Bo | ######## | 3482.15 |
| SITE | Scottish Bo | ######## | 1940.689 |
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | ######## | 1206.871 |
| SITE | Scottish Bo | ######## | 3061.878 |
| SITE | Scottish Bo | ######## | 2290.821 |
| SITE | Scottish Bo | ######## | 2418.763 |
| SITE | Scottish Bo | ######## | 2307.3 |
| SITE | Scottish Bo | ######## | 1549.346 |
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | ######## | 811.615 |
| SITE | Scottish Bo | ######## | 2307.3 |
| SITE | Scottish Bo | ######## | 1749.981 |
| SITE | Scottish Bo | ######## | 1515.907 |
| SITE | Scottish Bo | ######## | 1899.705 |
| SITE | Scottish Bo | ######## | 1423.106 |
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | ######## | 635.343 |
| SITE | Scottish Bo | ######## | 2423.727 |
| SITE | Scottish Bo | ######## | 1951.779 |
| SITE | Scottish Bo | 1/8/2012 | 1778.882 |
| SITE | Scottish Bo | 2/8/2012 | 1701.056 |
| SITE | Scottish Bo | 3/8/2012 | 1194.619 |
| SITE | Scottish Bo | 4/8/2012 | 0 |
| SITE | Scottish Bo | 5/8/2012 | 673.009 |
| SITE | Scottish Bo | 6/8/2012 | 2277.945 |
| SITE | Scottish Bo | 7/8/2012 | 1771.735 |
| SITE | Scottish Bo | 8/8/2012 | 1859.771 |
| SITE | Scottish Bo | 9/8/2012 | 1875.597 |
| SITE | Scottish Bo | ######## | 1415.589 |
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | ######## | 455.838 |
| SITE | Scottish Bo | ######## | 1945.653 |
| SITE | Scottish Bo | ######## | 1003.174 |
| SITE | Scottish Bo | ######## | 1460.175 |
| SITE | Scottish Bo | ######## | 1280.387 |
| SITE | Scottish Bo | ######## | 1667.702 |
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | ######## | 0 |

| | | | |
|---|---|---|---|
| SITE | Scottish Bo | ######## | 1273.807 |
| SITE | Scottish Bo | ######## | 1160.074 |
| SITE | Scottish Bo | ######## | 1717.364 |
| SITE | Scottish Bo | ######## | 1482.213 |
| SITE | Scottish Bo | ######## | 1592.258 |
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | ######## | 3158.253 |
| SITE | Scottish Bo | ######## | 2679.385 |
| SITE | Scottish Bo | ######## | 3186.53 |
| SITE | Scottish Bo | ######## | 3479.286 |
| SITE | Scottish Bo | ######## | 2998.885 |
| SITE | Scottish Bo | 1/9/2012 | 0 |
| SITE | Scottish Bo | 2/9/2012 | 633.727 |
| SITE | Scottish Bo | 3/9/2012 | 2700.089 |
| SITE | Scottish Bo | 4/9/2012 | 3127.651 |
| SITE | Scottish Bo | 5/9/2012 | 2861.81 |
| SITE | Scottish Bo | 6/9/2012 | 2636.756 |
| SITE | Scottish Bo | 7/9/2012 | 1765.382 |
| SITE | Scottish Bo | 8/9/2012 | 0 |
| SITE | Scottish Bo | 9/9/2012 | 567.246 |
| SITE | Scottish Bo | ######## | 3876.556 |
| SITE | Scottish Bo | ######## | 4559.292 |
| SITE | Scottish Bo | ######## | 4709.556 |
| SITE | Scottish Bo | ######## | 4396.465 |
| SITE | Scottish Bo | ######## | 3543.838 |
| SITE | Scottish Bo | ######## | 23.087 |
| SITE | Scottish Bo | ######## | 1004.28 |
| SITE | Scottish Bo | ######## | 5136.834 |
| SITE | Scottish Bo | ######## | 5760.181 |
| SITE | Scottish Bo | ######## | 5265.173 |
| SITE | Scottish Bo | ######## | 5359.279 |
| SITE | Scottish Bo | ######## | 4431.265 |
| SITE | Scottish Bo | ######## | 34.545 |
| SITE | Scottish Bo | ######## | 1731.517 |
| SITE | Scottish Bo | ######## | 8748.288 |
| SITE | Scottish Bo | ######## | 8352.123 |
| SITE | Scottish Bo | ######## | 6809.301 |
| SITE | Scottish Bo | ######## | 5718.885 |
| SITE | Scottish Bo | ######## | 4281.569 |
| SITE | Scottish Bo | ######## | 1041.463 |
| SITE | Scottish Bo | ######## | 3012.84 |
| SITE | Scottish Bo | ######## | 6114.51 |
| SITE | Scottish Bo | ######## | 6966.683 |
| SITE | Scottish Bo | ######## | 6903.577 |
| SITE | Scottish Bo | ######## | 6174.638 |
| SITE | Scottish Bo | ######## | 5307.461 |
| SITE | Scottish Bo | ######## | 853.591 |
| SITE | Scottish Bo | ######## | 3792.831 |
| SITE | Scottish Bo | ######## | 8054.887 |

| | | | |
|---|---|---|---|
| SITE | Scottish Bo | ######## | 8438.969 |
| SITE | Scottish Bo | ######## | 7226.709 |
| SITE | Scottish Bo | ######## | 5879.982 |
| SITE | Scottish Bo | ######## | 6187.515 |
| SITE | Scottish Bo | ######## | 4341.187 |
| SITE | Scottish Bo | ######## | 2959.377 |
| SITE | Scottish Bo | ######## | 9902.973 |
| SITE | Scottish Bo | ######## | 10016.42 |
| SITE | Scottish Bo | ######## | 10809.01 |
| SITE | Scottish Bo | ######## | 8467.728 |
| SITE | Scottish Bo | ######## | 6614.083 |
| SITE | Scottish Bo | ######## | 3576.03 |
| SITE | Scottish Bo | ######## | 2991.369 |
| SITE | Scottish Bo | ######## | 10148.08 |
| SITE | Scottish Bo | ######## | 7649.987 |
| SITE | Scottish Bo | ######## | 7555.342 |
| SITE | Scottish Bo | ######## | 8095.814 |
| SITE | Scottish Bo | ######## | 9766.181 |
| SITE | Scottish Bo | ######## | 3972.108 |
| SITE | Scottish Bo | ######## | 3747.677 |
| SITE | Scottish Bo | ######## | 9751.008 |
| SITE | Scottish Bo | ######## | 10239.63 |
| SITE | Scottish Bo | ######## | 10967.83 |
| SITE | Scottish Bo | ######## | 10568.81 |
| SITE | Scottish Bo | ######## | 10262.04 |
| SITE | Scottish Bo | ######## | 3544.491 |
| SITE | Scottish Bo | ######## | 6235.418 |
| SITE | Scottish Bo | ######## | 12719.8 |
| SITE | Scottish Bo | ######## | 10768.93 |
| SITE | Scottish Bo | ######## | 10186.94 |
| SITE | Scottish Bo | ######## | 9546.743 |
| SITE | Scottish Bo | ######## | 8468.523 |
| SITE | Scottish Bo | ######## | 3051.413 |
| SITE | Scottish Bo | ######## | 4920.544 |
| SITE | Scottish Bo | ######## | 11875.17 |
| SITE | Scottish Bo | ######## | 8579.022 |
| SITE | Scottish Bo | ######## | 8253.451 |
| SITE | Scottish Bo | ######## | 8211.872 |
| SITE | Scottish Bo | ######## | 8269.306 |
| SITE | Scottish Bo | ######## | 2830.329 |
| SITE | Scottish Bo | ######## | 4684.087 |
| SITE | Scottish Bo | ######## | 11447.02 |
| SITE | Scottish Bo | ######## | 9673.976 |
| SITE | Scottish Bo | ######## | 9894.918 |
| SITE | Scottish Bo | ######## | 9647.826 |
| SITE | Scottish Bo | ######## | 9435.733 |
| SITE | Scottish Bo | ######## | 2623.539 |
| SITE | Scottish Bo | ######## | 6224.102 |
| SITE | Scottish Bo | ######## | 12710.5 |
| SITE | Scottish Bo | ######## | 12419.59 |

| | | | |
|---|---|---|---|
| SITE | Scottish Bo | ######## | 13264.07 |
| SITE | Scottish Bo | ######## | 13634.17 |
| SITE | Scottish Bo | ######## | 12049.23 |
| SITE | Scottish Bo | ######## | 5038.162 |
| SITE | Scottish Bo | ######## | 9420.304 |
| SITE | Scottish Bo | ######## | 14828.88 |
| SITE | Scottish Bo | ######## | 14884.75 |
| SITE | Scottish Bo | ######## | 15016.47 |
| SITE | Scottish Bo | ######## | 14412.58 |
| SITE | Scottish Bo | ######## | 10336.52 |
| SITE | Scottish Bo | ######## | 5582.037 |
| SITE | Scottish Bo | ######## | 6615.331 |
| SITE | Scottish Bo | ######## | 14510.14 |
| SITE | Scottish Bo | ######## | 17076.67 |
| SITE | Scottish Bo | ######## | 15024.58 |
| SITE | Scottish Bo | ######## | 14859.23 |
| SITE | Scottish Bo | ######## | 10609.34 |
| SITE | Scottish Bo | ######## | 4971.283 |
| SITE | Scottish Bo | ######## | 6012.009 |
| SITE | Scottish Bo | ######## | 14496.81 |
| SITE | Scottish Bo | ######## | 13533.34 |
| SITE | Scottish Bo | ######## | 12883.57 |
| SITE | Scottish Bo | ######## | 12593.93 |
| SITE | Scottish Bo | ######## | 6208.531 |
| SITE | Scottish Bo | ######## | 0 |
| SITE | Scottish Bo | ######## | 1108.965 |
| SITE | Scottish Bo | ######## | 6264.263 |
| SITE | Scottish Bo | ######## | 6525.479 |
| SITE | Scottish Bo | ######## | 6161.705 |
| SITE | Scottish Bo | ######## | 7401.534 |
| SITE | Scottish Bo | ######## | 2738.605 |
| SITE | Scottish Bo | ######## | 3785.003 |
| SITE | Scottish Bo | ######## | 3740.077 |
| SITE | Scottish Bo | ######## | 7752.545 |
| SITE | Scottish Bo | 1/1/2013 | 5366.285 |
| SITE | Scottish Bo | 2/1/2013 | 2950.074 |
| SITE | Scottish Bo | 3/1/2013 | 9798.146 |
| SITE | Scottish Bo | 4/1/2013 | 6072.08 |
| SITE | Scottish Bo | 5/1/2013 | 11.174 |
| SITE | Scottish Bo | 6/1/2013 | 2632.729 |
| SITE | Scottish Bo | 7/1/2013 | 12401.83 |
| SITE | Scottish Bo | 8/1/2013 | 11130.04 |
| SITE | Scottish Bo | 9/1/2013 | 11748.28 |
| SITE | Scottish Bo | ######## | 11577.03 |
| SITE | Scottish Bo | ######## | 8311.282 |
| SITE | Scottish Bo | ######## | 1055.757 |
| SITE | Scottish Bo | ######## | 7577.862 |
| SITE | Scottish Bo | ######## | 14885.49 |
| SITE | Scottish Bo | ######## | 15863.59 |
| SITE | Scottish Bo | ######## | 17011.3 |

| | | | |
|---|---|---|---|
| SITE | Scottish Bo | ######## | 15054.7 |
| SITE | Scottish Bo | ######## | 10346.56 |
| SITE | Scottish Bo | ######## | 3662.194 |
| SITE | Scottish Bo | ######## | 8802.062 |
| SITE | Scottish Bo | ######## | 16790.47 |
| SITE | Scottish Bo | ######## | 15358.4 |
| SITE | Scottish Bo | ######## | 16098.86 |
| SITE | Scottish Bo | ######## | 14840.05 |
| SITE | Scottish Bo | ######## | 10800.84 |
| SITE | Scottish Bo | ######## | 590.758 |
| SITE | Scottish Bo | ######## | 8694.173 |
| SITE | Scottish Bo | ######## | 14768.95 |
| SITE | Scottish Bo | ######## | 12595.4 |
| SITE | Scottish Bo | ######## | 14300.8 |
| SITE | Scottish Bo | ######## | 13409.69 |
| SITE | Scottish Bo | 1/2/2013 | 8559.849 |
| SITE | Scottish Bo | 2/2/2013 | 949.853 |
| SITE | Scottish Bo | 3/2/2013 | 3024.836 |
| SITE | Scottish Bo | 4/2/2013 | 16035.75 |
| SITE | Scottish Bo | 5/2/2013 | 15778.73 |
| SITE | Scottish Bo | 6/2/2013 | 15045.76 |
| SITE | Scottish Bo | 7/2/2013 | 14013.12 |
| SITE | Scottish Bo | 8/2/2013 | 8839.245 |
| SITE | Scottish Bo | 9/2/2013 | 22.406 |

## Appendix 5;
## Heriot-Watt University

**a. H-WU supplied residences gas consumption data**
**b. Assessment of heat loads and annual profile**

Inbox Drafts Junk Sent Trash - - - - - - - - - Virtual INBOX Open FolderInbox New Message Folders Search Fetch Mail Mail Dynamic Mail Mobile Mail Filters Calendar Notes Tasks Address Book Options Help

Inbox: Heriot Watt University Galashiels Residences Utilities (1 of 854)

Mark as: Mark as: Unseen Flagged For Followup Not Flagged Answered Unanswered Draft Not Draft Move Copy Target Folder This message to - - - - - - - - - New Folder - - - - - - - - - Inbox Drafts Junk Sent Trash - - Task Lists - - scott.robertson@energeticpm.com's Task List Back to Inbox

Delete Reply

To Sender

To All

Forward

Entire Message

Body Text Only

Body Text with Attachments

Redirect View Thread Blacklist Whitelist Message Source Save as Print Headers

Show All Headers

Date: Fri, 1 Feb 2013 12:49:30 -0000 [06:49:30 CST]

From: Jack, David A <D.A.Jack@hw.ac.uk>

To: scott.robertson@energeticpm.com

Cc: Kerr, Peter G <P.G.Kerr@hw.ac.uk>, Monaghan, John A <J.A.Monaghan@hw.ac.uk>

Subject: Heriot Watt University Galashiels Residences Utilities

Hi Scott

A very interesting project.

To get things moving here is a list of our most recent gas data for the above site. Please bear in mind that these residences are not yet fully occupied and indeed the last unit was only handed over in December 2012.

| 2010 | kWh |
|---|---|
| August | 49833 |
| September | 84937 |
| October | 113142 |
| November | 138992 |

| | |
|---|---|
| December | 170991 |
| January 2011 | 161944 |
| February | 153677 |
| March | 160170 |
| April | 149265 |
| May | 105009 |
| June | 39277 |
| July | 43309 |

| 2011 | kWh |
|---|---|
| August | 56025 |
| September | 81031 |
| October | 103992 |

| | |
|---|---|
| November | 118731 |
| December | 148297 |
| January 2012 | 123094 |
| February | 168456 |
| March | 133391 |
| April - August | 81397 |

New Residences...

| | |
|---|---|
| September 2012 | 75942kWh Only 19 days. |
| October 2012 | 142,445kWh |
| November2012 | 118,591 kWh |
| December 2012 | 195,364 kWh |

New Boilers:- 2x 140kw and 4 x 95kw Hamworthy Boilers (PV140C and PV95C)

Best wishes

David.

David A Jack

Environment and Energy Manager

Estate and Buildings Services

Heriot Watt University

Estates Office

Riccarton

Edinburgh

EH14 4AS

Tel. 0131 451 4086

Fax. 0131 451 3932

Mob. 0791 750 4437

E-mail. D.A.Jack@hw.ac.uk <mailto:D.A.Jack@hw.ac.uk>

Visit our Energy and Environment pages at

http://www.hw.ac.uk/estate/environment-energy.htm

<http://www.hw.ac.uk/estate/environment-energy.htm>

-----

Heriot-Watt University is a Scottish charity

registered under charity number SC000278.

Delete Reply

To Sender

To All

Forward

Entire Message

Body Text Only

Body Text with Attachments

Redirect View Thread Blacklist Whitelist Message Source Save as Print Headers

Show All Headers

Mark as: Mark as: Unseen Flagged For Followup Not Flagged Answered Unanswered Draft Not Draft Move Copy Target Folder This message to - - - - - - - - - New Folder - - - - - - - - - Inbox Drafts Junk Sent Trash - - Task Lists - - scott.robertson@energeticpm.com's Task List Back to Inbox

# New Earth Solutions

## Easter Langlee Advanced Thermal Treatment EfW Project

## Heat Mapping Study

### Heriot Watt University Residences- Netherdale – Analysis of Annual Heat Demand

| Gas Consumption (KWHr) | | | | | | Average |
|---|---|---|---|---|---|---|
| Aug10 | 48,933 | Aug11 | 56,025 | | | 52,479 |
| Sep 10 | 84,937 | Sep 11 | 81,031 | Sep 12 | 75,942 | 80,637 |
| Oct 10 | 113,142 | Oct 11 | 103,992 | Oct 12 | 142,445 | 119,860 |
| Nov 10 | 138,992 | Nov 11 | 118,731 | Nov 12 | 118,591 | 125,438 |
| Dec 10 | 170,991 | Dec 11 | 148,297 | Dec 12 | 195,364 | 171,551 |
| Jan 11 | 161,944 | Jan 11 | 123,094 | | | 142,519 |
| Feb 11 | 153,677 | Feb 11 | 168,456 | | | 161,067 |
| Mar 11 | 160,170 | Mar 11 | 133,391 | | | 146,781 |
| Apr 11 | 149,265 | Apr-Jul 11 | 81,397 | | | 149,265 |
| May11 | 105,009 | | | | | 105,009 |
| Jun 11 | 29,277 | | | | | 29,277 |
| Jul 11 | 43,309 | | | | | 43,309 |

New residences boilers; Hamworthy boilers, 4 x 95KW (model PV95C), 2 x 140KW (model PV140C)
Rated output total = 660KW, efficiency = 87%

| Heat Requirement (gas consumed x eff %) and % of annual load | | | |
|---|---|---|---|
| Heat demand (KWHr) | | % of annual load | Remarks |
| Aug | 45,657 | 3.9% | |
| Sep | 70,154 | 6.1% | |
| Oct | 104,278 | 9.0% | |
| Nov | 109,131 | 9.5% | |
| Dec | 149,249 | 12.9% | |
| Jan | 123,992 | 10.7% | |
| Feb | 140,128 | 12.1% | |
| Mar | 127,699 | 11.0% | |
| Apr | 129,860 | 11.2% | |
| May | 91,358 | 7.9% | |
| Jun | 25,471 | 2.2% | Note; summer figures based on 1 years demand and future business to change |
| Jul | 37,679 | 3.3% | |
| Annual total | 1,154,657 | | |

MOFFAT HOUSE, AYTON
BERWICKSHIRE TD14 5QJ

**T** 018907 81463 / 018907 60156
**M** 07885 648854
**WWW**.ENERGETICPM.COM
**E** scott.robertson@energeticpm.com

**Appendix 6;**
**Scottish Borders Council**

**a. SBC supplied estate data**
**b. ditto, heat load estimates added**

| UPRN | NAME | ASSETTYPE | USE | ADDRESS | ADDRESS_1 | ADDRESS_12 | POSTCODE | DISTRICT | DEPARTMENT | TYPE | OPERATIONA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TW008/01 | Joint Ability Store | Miscellaneous | Store | | Tweedbank Industrial Estate | Tweedbank | TD1 3RS | E&L | SW | Building | Operational - Other Land and Buildings |
| TW001/01 | Tweedbank Primary School | Schools | Primary School | | Tweedbank Drive | Tweedbank | TD1 3RR | E&L | E&LL | Building | Operational - Other Land and Buildings |
| TW005/01 | Eildon Mill | Corporate Office | Training Centre | | Tweedbank Industrial Estate | Tweedbank | TD1 3RP | E&L | PED | Building | Operational - Other Land and Buildings |
| GL027/01 | St Peters Primary School | Schools | Primary School | | Parsonage Road | Galashiels | TD1 3DS | E&L | E&LL | Building | Operational - Other Land and Buildings |
| GL004/01 | St Peters Offices No 6/8 | Corporate Office | Office (SBC) | 6/8 | Abbotsford Road | Galashiels | TD1 3DS | E&L | RES | Building | Operational - Other Land and Buildings |
| GL015/01 | Galashiels Academy | Schools | Secondary School | | Elm Row | Galashiels | TD1 3HU | E&L | E&LL | Building | Operational - Other Land and Buildings |
| GL028/01 | Waverley Residential Home for the Elderly | Elderly Persons Home | Residential Home for the Eld | | Scott Park | Galashiels | TD1 3JG | E&L | SW | Building | Operational - Other Land and Buildings |
| GL036/01 | Old Gala House | Cultural Facility | Museum | | Scott Crescent | Galashiels | TD1 3JS | E&L | E&LL | Building | Operational - Other Land and Buildings |
| GL036/02 | Old Gala House Community Centre | Cultural Facility | Community Centre | | Scott Crescent | Galashiels | TD1 3JS | E&L | E&LL | Building | Operational - Other Land and Buildings |
| GL034/01 | Galashiels Local Office | Corporate Office | Office (SBC) | | Paton Street | Galashiels | TD1 3AS | E&L | RES | Building | Operational - Other Land and Buildings |
| GL023/02 | Oakwood Day Centre | Day Centre | Day Centre | | Oakwood Park | Galashiels | TD1 1DH | E&L | SW | Building | Operational - Other Land and Buildings |
| GL016/01 | Galashiels Library | Cultural Facility | Library | | Lawyers Brae | Galashiels | TD1 3JQ | E&L | E&LL | Building | Operational - Other Land and Buildings |

| UPRN | NAME | ASSETTYPE | USE | ADDRESS | ADDRESS_1 | ADDRESS_12 | POSTCODE | DISTRICT | DEPARTMENT | TYPE | OPERATIONA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GL049/01 | Volunteer Hall | Cultural Facility | Hall | | Gala Park | Galashiels | TD1 3JX | E&L | E&LL | Building | Operational - Other Land and Buildings |
| GL013/01 | Focus Ability Centre | Day Centre | Day Centre | | Livingston Place | Galashiels | TD1 1DQ | E&L | SW | Building | Operational - Other Land and Buildings |
| GL014/01 | Galapark Office | Corporate Office | Office (SBC) | 12 | Gala Park | Galashiels | TD1 1EU | E&L | RES | Building | Operational - Other Land and Buildings |
| GL026/01 | St. Margarets R C Primary School | Schools | Primary School | | Livingston Place | Galashiels | TD1 1DQ | E&L | E&LL | Building | Operational - Other Land and Buildings |
| GL013/02 | Focus Youth Centre | Cultural Facility | Youth Centre | | Livingston Place | Galashiels | TD1 1DQ | E&L | E&LL | Building | Operational - Other Land and Buildings |
| GL011/01 | Burgh Primary School | Schools | Primary School | | Galapark Road | Galashiels | TD1 1EZ | E&L | E&LL | Building | Operational - Other Land and Buildings |
| GL023/01 | Galashiels Resource Centre - Park Villa | Day Centre | Day Centre | 69 | Gala Park | Galashiels | TD1 1EZ | E&L | SW | Building | Operational - Other Land and Buildings |
| GL018/01 | Glendinning Terrace Primary School | Schools | Primary School | | Glendinning Terrace | Galashiels | TD1 2JW | E&L | E&LL | Building | Operational - Other Land and Buildings |
| | **TOTALS at 1-2 mile** | | | | | | | | | | |

| UPRN | NAME | TENURE | PORTFOLIOS | TITLE | SITENAME | EASTING | NORTHING |
|---|---|---|---|---|---|---|---|
| TW008/01 | Joint Ability Store | L/P | SW | SBC | Joint Ability Store | 352424 | 634557 |
| TW001/01 | Tweedbank Primary School | F/P | ED | BRC | Schools | 351718 | 634743 |
| TW005/01 | Eildon Mill | F/P | PL | BRC | Tweedbank Industrial Estate & Eildon Mill | 352419 | 634810 |
| GL027/01 | St Peters Primary School | F/P | ED | BRC | St Peters Schools & Car Park | 349615 | 635512 |
| GL004/01 | St Peters Offices No 6/8 | F/P | PR | BRC | 4-6 St Peters Offices | 349533 | 635622 |
| GL015/01 | Galashiels Academy | F/P | ED | BRC | Galashiels Academy & Stables House | 348962 | 635683 |
| GL028/01 | Waverley Residential Home for the Elderly | F/P | SW | BRC | Waverley RHE | 349092 | 635790 |
| GL036/01 | Old Gala House | F/P | LR | E&LDC | Old Gala House | 349157 | 635885 |
| GL036/02 | Old Gala House Community Centre | F/P | LR | E&LDC | Old Gala House | 349157 | 635885 |
| GL034/01 | Galashiels Local Office | F/T | PR | E&LDC | Local Office | 349345 | 635902 |
| GL023/02 | Oakwood Day Centre | L/P | SW | SBC | Park Villa & Oakview Day Centre | 348996 | 635920 |
| GL016/01 | Galashiels Library | F/P | LR | BRC | Library | 349244 | 635946 |

| UPRN | NAME | TENURE | PORTFOLIOS | TITLE | SITENAME | EASTING | NORTHING |
|---|---|---|---|---|---|---|---|
| GL049/01 | Volunteer Hall | F/P | LR | E&LDC | Volunteer Hall | 349216 | 636007 |
| GL013/01 | Focus Ability Centre | F/P | SW | BRC | Focus Ability & Youth Centre | 348933 | 636008 |
| GL014/01 | Galapark Office | F/T | PR | BRC | Galapark Offices | 349166 | 636014 |
| GL026/01 | St. Margarets R C Primary School | F/P | ED | BRC | St. Margarets Primary School | 348865 | 636020 |
| GL013/02 | Focus Youth Centre | F/P | ED | BRC | Focus Ability & Youth Centre | 348932 | 636030 |
| GL011/01 | Burgh Primary School | F/P | ED | BRC | Burgh Schools | 349055 | 636175 |
| GL023/01 | Galashiels Resource Centre - Park Villa | F/P | SW | BRC | Park Villa & Oakview Day Centre | 348966 | 636200 |
| GL018/01 | Glendinning Terrace Primary School | F/P | ED | BRC | Glendinning Schools | 348959 | 636869 |
| | **TOTALS at 1-2 mile** | | | | | | |

| UPRN | NAME | ELECTRICITY OFF PEAK USAGE | | | | | HEAT DEMAND FOR ELECTICALLY SUPPLIED PROPERTY KWhrs assuming 90% efficiency of heating | | | | | Average annual heat demand over 5 years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | | | | | | 2007-2012 |
| TW008/01 | Joint Ability Store | | | | | | | | | | | |
| TW001/01 | Tweedbank Primary School | | | | | | | | | | | |
| TW005/01 | Eildon Mill | | | | | | | | | | | |
| GL027/01 | St Peters Primary School | | | | | | | | | | | |
| GL004/01 | St Peters Offices No 6/8 | 90503 | 95252 | 91469 | 73829 | 87884 | 81453 | 85727 | 82322 | 66446 | 79096 | 79009 |
| GL015/01 | Galashiels Academy | | | | | | | | | | | |
| GL028/01 | Waverley Residential Home for the Elderly | | | | | | | | | | | |
| GL036/01 | Old Gala House | | | | | | | | | | | |
| GL036/02 | Old Gala House Community Centre | 35229 | 36042 | 51021 | 36349 | 49163 | 31706 | 32438 | 45919 | 32714 | 44247 | 37405 |
| GL034/01 | Galashiels Local Office | | | | | | | | | | | |
| GL023/02 | Oakwood Day Centre | | | | | | | | | | | |
| GL016/01 | Galashiels Library | | | | | | | | | | | |

| UPRN | NAME | **ELECTRICITY OFF PEAK USAGE** | | | | | **HEAT DEMAND FOR ELECTICALLY SUPPLIED PROPERTY KWhrs assuming 90% efficiency of heating** | | | | | **Average annual heat demand over 5 years** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | | | | | | 2007-2012 |
| GL049/01 | Volunteer Hall | | | | | | | | | | | |
| GL013/01 | Focus Ability Centre | | | | | | | | | | | |
| GL014/01 | Galapark Office | | | | | | | | | | | |
| GL026/01 | St. Margarets R C Primary School | 102576 | 106900 | 105800 | 106432 | 89011 | 92318 | 96210 | 95220 | 95789 | 80110 | 91929 |
| GL013/02 | Focus Youth Centre | | | | | | | | | | | |
| GL011/01 | Burgh Primary School | | | | | | | | | | | |
| GL023/01 | Galashiels Resource Centre - Park Villa | | | | | | | | | | | |
| GL018/01 | Glendinning Terrace Primary School | | | | | | | | | | | |
| | **TOTALS at 1-2 mile** | | | | | | | | | | | **208343** |

| UPRN | NAME | GAS USAGE KWhrs | | | | | HEAT DEMAND FOR GAS SUPPLIED PROPERTY KWhrs assuming 70% efficiency of boilers | | | | | Average annual heat demand over 5 years KWhrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-2012 |
| TW008/01 | Joint Ability Store | 122896 | 131109 | 91716 | 126510 | 143378 | 86027 | 91776 | 64201 | 88557 | 100365 | 86185 |
| TW001/01 | Tweedbank Primary School | 454 | 2130 | 606 | 255270 | 161325 | 317.8 | 1491 | 424.2 | 178689 | 112928 | 58770 |
| TW005/01 | Eildon Mill | | | | 77834 | 84453 | | | | 111191 | 120647 | 115919 |
| GL027/01 | St Peters Primary School | | | | | | | | | | | |
| GL004/01 | St Peters Offices No 6/8 | | | | | | | | | | | |
| GL015/01 | Galashiels Academy | 115449 | 381927 | 447175 | 156984 | 99989 | 80814 | 267349 | 313023 | 109889 | 69992 | |
| GL028/01 | Waverley Residential Home for the Elderly | 664934 | 651806 | 685111 | 629098 | 566374 | 465454 | 456264 | 479578 | 440369 | 396462 | 447625 |
| GL036/01 | Old Gala House | | | | | | | | | | | |
| GL036/02 | Old Gala House Community Centre | | | | | | | | | | | |
| GL034/01 | Galashiels Local Office | 164298 | 155144 | 181026 | 196026 | 152257 | 115009 | 108601 | 126718 | 137218 | 106580 | 118825 |
| GL023/02 | Oakwood Day Centre | | | | | | | | | | | |
| GL016/01 | Galashiels Library | | | | | | | | | | | |

| UPRN | NAME | GAS USAGE KWhrs | | | | | HEAT DEMAND FOR GAS SUPPLIED PROPERTY KWhrs assuming 70% efficiency of boilers | | | | | Average annual heat demand over 5 years KWhrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-2012 |
| GL049/01 | Volunteer Hall | 1934 | 1576 | 233 | 1021 | 741 | 1353.8 | 1103.2 | 163.1 | 714.7 | 518.7 | 771 |
| GL013/01 | Focus Ability Centre | | | | | | | | | | | |
| GL014/01 | Galapark Office | | | | | | | | | | | |
| GL026/01 | St. Margarets R C Primary School | | | | | | | | | | | |
| GL013/02 | Focus Youth Centre | | | | | | | | | | | |
| GL011/01 | Burgh Primary School | | | | | | | | | | | |
| GL023/01 | Galashiels Resource Centre - Park Villa | 44541 | 36299 | 46341 | 55284 | 47632 | 31179 | 25409 | 32439 | 38699 | 33342 | 32214 |
| GL018/01 | Glendinning Terrace Primary School | 78479 | 87164 | 908702 | 109668 | 89159 | 54935 | 61015 | 636091 | 76768 | 62411 | 178244 |
| | **TOTALS at 1-2 mile** | | | | | | | | | | | **1038553** |

| UPRN | NAME | OIL USAGE | | | | | EST HEAT DEMAND FOR OIL SUPPLIED PROPERTY KWhrs assuming 65% efficiency of boilers | | | | | Average annual heat demand over 5 years KWhrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-2012 |
| TW008/01 | Joint Ability Store | | | | | | | | | | | |
| TW001/01 | Tweedbank Primary School | | | | | | | | | | | |
| TW005/01 | Eildon Mill | | | | | | | | | | | |
| GL027/01 | St Peters Primary School | 244644 | 292961 | 211189 | 241024 | 204411 | 159019 | 190425 | 137273 | 156666 | 132867 | 155250 |
| GL004/01 | St Peters Offices No 6/8 | | | | | | | | | | | |
| GL015/01 | Galashiels Academy | 321900 | 315655 | 341094 | 381980 | 277750 | 209235 | 205176 | 221711 | 248287 | 180538 | 212989 |
| GL028/01 | Waverley Residential Home for the Elderly | | | | | | | | | | | |
| GL036/01 | Old Gala House | | | | | | | | | | | |
| GL036/02 | Old Gala House Community Centre | | | | | | | | | | | |
| GL034/01 | Galashiels Local Office | 171680 | 138696 | 192966 | 187665 | 191470 | 111592 | 90152 | 125428 | 121982 | 124456 | 114722 |
| GL023/02 | Oakwood Day Centre | | | | | | | | | | | |
| GL016/01 | Galashiels Library | 148074 | 150799 | 162228 | 165747 | 148347 | 96248.1 | 98019 | 105448 | 107736 | 96425.6 | 100775 |

| UPRN | NAME | OIL USAGE | | | | | EST HEAT DEMAND FOR OIL SUPPLIED PROPERTY KWhrs assuming 65% efficiency of boilers | | | | | Average annual heat demand over 5 years KWhrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-2012 |
| GL049/01 | Volunteer Hall | | | | | | | | | | | |
| GL013/01 | Focus Ability Centre | 114275 | 141958 | 121005 | 153125 | 134612 | 74278.8 | 92273 | 78653 | 99531 | 87497.8 | 86447 |
| GL014/01 | Galapark Office | | | | | | | | | | | |
| GL026/01 | St. Margarets R C Primary School | | | | | | | | | | | |
| GL013/02 | Focus Youth Centre | 114275 | 141958 | 121005 | 153125 | 134612 | 74278.8 | 92273 | 78653 | 99531 | 87497.8 | 86447 |
| GL011/01 | Burgh Primary School | 313455 | 287564 | 267358 | 315311 | 354511 | 203746 | 186917 | 173783 | 204952 | 230432 | 199966 |
| GL023/01 | Galashiels Resource Centre - Park Villa | | | | | | | | | | | |
| GL018/01 | Glendinning Terrace Primary School | | | | | | | | | | | |
| | **TOTALS at 1-2 mile** | | | | | | | | | | | **956596** |

**TOTAL at 1-2 mile** **MWhrs/A** **2,203**

**TOTAL 1 mile and 1-2** **MWhrs/A** **2,567**

**Approx RHI/annum based on 1p/KWhr for large commercial biomass (>1000 KWth)** **£25,669**

**Maximum heating load assuming 3 x average** **MWhrs** **0.879**

| UPRN | NAME | ASSETTYPE | USE |
|---|---|---|---|
| GL009/10 | Langlee Community Centre | Cultural Facility | Community Centre |
| GL009/11 | Langlee Centre | Cultural Facility | Centre |
| GL021/01 | Langlee Primary School | Schools | Primary School |
| GL021/02 | Langlee Nursery School | Schools | Nursery School |
| GL044/01 | Waste Recycling Centre | Waste Disposal | Waste Recycling Centre |
| GL044/02 | Landfill Site | Waste Disposal | Refuse Site |
| GL044/03 | Easter Langlee Waste Transfer Unit | Waste Disposal | Community Recycling Centre |
| GL053/01 | Glenview Childrens Home | Residential Home | Residential Home |
| TW002/01 | Tweedbank Community Centre | Cultural Facility | Community Centre |

| ADDRESS | ADDRESS_1 | ADDRESS_12 | POSTCODE | DISTRICT | DEPARTMENT |
|---|---|---|---|---|---|
| | Marigold Drive | Galashiels | TD1 2LP | E&L | E&LL |
| | Marigold Drive | Galashiels | TD1 2LP | E&L | RES |
| | Langlee Drive | Galashiels | TD1 2EB | E&L | E&LL |
| | Langlee Drive | Galashiels | TD1 2EB | E&L | E&LL |
| | Easter Langlee | Galashiels | TD1 2NX | E&L | TS |
| | Easter Langlee | Galashiels | TD1 2NU | E&L | TS |
| | Easter Langlee | Galashiels | TD1 2NX | E&L | TS |
| | Marigold Drive | Galashiels | TD1 2LP | E&L | SW |
| | Essenside Drive | Tweedbank | TD1 3RT | E&L | E&LL |

| TYPE | OPERATIONA |
|---|---|
| Building | Operational - Other Land and Buildings |
| Building | Operational - Other Land and Buildings |
| Building | Operational - Other Land and Buildings |
| Building | Operational - Other Land and Buildings |
| Land | Operational - Other Land and Buildings |
| Land | Operational - Other Land and Buildings |
| Building | Operational - Other Land and Buildings |
| Building | Operational - Other Land and Buildings |
| Building | Operational - Other Land and Buildings |

| SITENAME | EASTING | NORTHING | ELCETRICITY OFF PEAK USAGE | | | | |
|---|---|---|---|---|---|---|---|
| | | | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
| Langlee Units, Community Centre & Centre | 351393 | 635686 | | | | | |
| Langlee Units, Community Centre & Centre | 351422 | 635697 | | | | | |
| Langlee Schools | 350542 | 635626 | 14207 | 17110 | 15889 | 16720 | 19781 |
| Langlee Schools | 350542 | 635626 | | | | | |
| Easter Langlee Refuse Sites | 352096 | 636206 | | | | | |
| Easter Langlee Refuse Sites | 351830 | 636496 | | | | | |
| Easter Langlee Refuse Sites | 352016 | 636206 | | | | | |
| Glenview Childrens Home, Wheatlands House & 2 | 351421 | 635596 | | | | | |
| Community Centre | 351603 | 635007 | | | | | |

| GAS USAGE | | | | | OIL USAGE | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | 377224 | 282542 | 346506 | 328093 | 223566 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| 119017 | 116304 | 38776 | 69089 | 47532 | | | | | |
| 103711 | 207332 | 81300 | 158430 | 100125 | | | | | |

## Appendix 7;

## Industry – SBC Timber Kiln Drying study brief

# 2nd DRAFT
# SCOTTISH BORDERS COUNCIL
# ENVIRONMENT AND INFRASTRUCTURE
# 'BRIEF FOR THE ESTABLISHMENT OF A KILN DRYING FACILITY AT EASTER LANGLEE DEPOT
# CONSULTANT'S BRIEF

## 1 Introduction

1.1 This brief is to prepare a feasibility assessment and outline business plan for the development of a kiln drying facility for wood and timber products at Easter Langlee Depot, Galashiels.

1.2 Tenders are invited from appropriately qualified consultants to undertake the works outlined below.

## 2 Background

2.1 Studies undertaken as part of the implementation of the Scottish Borders Woodland Strategy have identified the lack of kiln drying facilities as a key constraint on growth of the timber processing sector in Scottish Borders. A report prepared by Buccleuch Woodlands in March 2011 concluded:

*The main added value manufacturers in the region use either imported or home grown kiln dried spruce, with no locally produced material sourced.*

*Within the Borders region there are only two timber drying kilns, one at Willy Dobbie, Abbey St Bathurns with an annual capacity around 700m³ and a small dehumidifying kiln at Real Wood Studios near Ancrum producing less than 40m³ a year. Otherwise there is no significant kilning capacity within the region.*

*The existing large sawmills with kilns but out with the region have no spare capacity for third party drying.*

The report went on to state:

*In addition, it should be noted that the production of kiln dried timber is a prerequisite for all but one of any future added value timber products. This is because before any timber can be machined accurately, moulded, glued or given a coating it must be dried. However, kiln dried timber could be regarded as a new product in its own right with a large potential market to existing end users in the Borders.*

2.2 Easter Langlee landfill site is owned and operated by Scottish Borders Council. See plans below:

INSERT PLAN

2.3 As part of its waste management strategy Scottish Borders Council is constructing a waste digestor plant based on a pyrolysis process. The digestor plant is being constructed by 'New Earth Solutions' and is due to operate from June 2015. The digestor plant will produce 3MW of heat as a bi-product and which is potentially available for operating a kiln drying facility

2.4 It is considered that an opportunity may exist to provide a kiln drying facility available to the Borders timber processing sector based on the heat produced from the new digestor plant and located on ground immediately adjoining it to the south. It is anticipated that the demand for such a facility will increase over time as potential markets for the manufacturing sector will need to develop.

2.5 There is a ready market for dry timber biomass for fuel use and this is expected to provide the main source of demand at least initially. In addition, there are also potential markets in the timber palette industry where heat treatment to ISPM 15 standard is a necessity for pest control for the shipment of palettes between countries. There are therefore 3 separate types of drying operation which the facility could service in order to maximise potential demand i.e.:

- Fuel wood sector via both dried logs and chips
- Manufacturing sector providing timber principally for building
- Palette industry processing timber palettes to comply with ISPM15

2.6 The only UK based supplier of timber drying kilns is:
Kiln Services Ltd, Rowan House, Burnham Business park, Burnham on Crouch, Essex CM0 8TE; Tel no: 01621 785 935; email: kilnservices@btconnect.com . The contact is Mr John Commons.

2.7 Initial discussions with Kiln Services Ltd have indicated that a multi use kiln could be developed with a potential capacity of 70-80 cu m and using approximately 500kW of heat and would produce a batch of dried product every 2-3 days.

## 3 Purpose and Limiting Factors

3.1 The purpose of this study is to determine the feasibility of installing a kiln drying facility at Easter Langlee and to establish what would be the costs and benefits both in terms of capital outlay and ongoing running costs. The study will provide the information base for a decision on whether or not to proceed and will inform the design parameters for such a development, should the recommendation prove favourable.

## 4 Methodology

4.1 There are two key tasks:

Task 1 – Feasibility - The first task is to determine the technical parameters and site and other constraints that would influence the design of a commercial kiln drying facility at Easter Langlee. This will provide an estimate of expected capacity and operating requirements based on the available site and heat source, together with a cost estimate for constructing the plant and any expected site works. This element of the work should also identify any planning or other issues that would affect delivery.

Task 2 – Business Plan - The second task is to develop an outline business plan based on the findings of Task 1 and prepare a scheme of operation with costs that would inform a potential operator of the facility.

## 5 Project Outputs

5.1 The following outputs are expected;

Task 1

- A technical assessment of what type of kiln drying facility could be built based on the waste heat outputs from the planned pyrolysis process and the space available at the Council Recycling Centre at Easter Langlee.
- An assessment of any relevant planning considerations associated with the creation of a kiln drying facility e.g. in terms of likely access and vehicle movements, potential neighbour nuisance issues (noise) etc.
- Using the above, prepare an outline specification for a kiln drying facility at Easter Langlee Depot together with estimated costs.

Task 2

- Propose the outline of an operating model, probably based on a leasing or franchise operation, which could manage and operate the facility as a going concern. (The Council would not undertake this work itself.)
- Provide an outline of likely running costs / overheads and the estimated charges and rates of use that would be required to run a viable business
- Quantify the potential carbon savings that could be achieved by operating the facility.

## 6 Client Information and Reporting

6.1 The client will be Scottish Borders Council, Environment and Infrastructure Department, Council Headquarters, Newtown St Boswells, TD6 0SA, telephone: 01835 824000.

6.2 The client representative will be Jim Knight, Planning and Economic Development, Scottish Borders Council, telephone 01835 825148, email jknight@scotborders.gov.uk

### Project responsibility and reporting

6.3 The tenderer will take responsibility for delivery of the agreed project outputs and will undertake to report progress regularly to the client.

6.4 Unless agreed otherwise, reporting shall be verbally, at least once per month, and in writing, once per 3 months. A presentation to the client group will be required at completion to explain the contents of the Management Plan.

6.5 The timing of reports shall be specified in an agreed programme of works.

### Timescale

6.6 The project period is from inception until end March 2013.

### Budget, Payment and References

6.7 It is envisaged that costs of this project shall not exceed £5,000.

6.8 Payment may be in stages related to completion of agreed work stages

## 7 Insurance and Indemnity

7.1 The appointed consultant shall indemnify and keep indemnified the Council from and against all liability which they incur to any third party by reason of anything done or omitted to be done in connection with the Contract in the duration of the Contract or otherwise arising as a consequence of any breach of the Provider's obligations herein contained, excepting from this provision any loss incurred by the Provider directly due to the wilful negligence or wilful default of the Council.

7.2 The appointed consultant shall effect or procure to be effected and maintained (promptly paying all premiums) with insurers in the UK insurance market of substance and repute approved in advance by the Council such policies of insurance as may be required by law including but not limited to:-

public liability
professional negligence
employer's liability
insurance against Directors and Officer's liability.

And all such other insurance's as may be necessary and or prudent for the full performance of this Contract.

7.3 The appointed consultant shall ensure that Public Liability Insurance of at least £5,000,000 and Employers liability insurance of £10,000,000 is effected and maintained for each and every event in any one insurance year unlimited with Insurers in the UK market of substance and repute.

7.4 The appointed consultant shall ensure that information in connection with the above insurance policies is provided to the Council. If the consultant determines that any of such insurances (save for mandatory insurances) are not available, they will immediately notify the Council. The consultant shall ensure that insurance policies are retained and made available annually to the Council.

7.5 In the event of the appointed consultant having motor vehicles which are used in the provision of the Service they shall maintain adequate vehicle and passenger insurance cover in respect of such vehicles and shall on request provide evidence to the Council that such cover has been effected and due premiums have been paid.

7.6 Where Staff or Volunteers use vehicles not owned or leased by the appointed consultant to transport Service Users, the consultant must ensure that such Staff and Volunteers have appropriate insurance, a valid MOT Certificate and an appropriate driving licence at all times.

## 8 Tender Content and Evaluation

### Tender process

### Criteria for evaluating tenders

**Appendix 8;**
**Contracts**

**a. Draft Heat Supply Agreement**
**b. CHPA Heat Customer Charter**

**HEAT SUPPLY AGREEMENT**

between

**[ ]**

and

**[ ]**

Anytown Solicitors LLP,
Scottish Borders
Scotland

**INDEX**

**AGREEMENT**

between:

**A** **[ ]** (the **"Supplier"**)

**B** **[ ]** (**"Customer"**)

WHEREAS

1 The Customer and Supplier have agreed that the Supplier will provide heat and hot water and related heating services to the Facilities on the terms agreed herein;

**IT IS AGREED AS FOLLOWS**

**1 Definitions and interpretation**

1.1 In this Agreement (unless the context otherwise requires) the following words and expressions shall have the following meanings:

1.1.1 "**Agreement**" means this agreement between the Supplier and the Customer including the Schedule;

1.1.2 "**Agreement Date**" means the last date of execution of this Agreement;

1.1.3 **"Change of Law"** means the coming into effect after the date of this Agreement of:

(a) legislation other than any legislation which on the date of this Agreement has been published.

(i) in a draft Bill as part of a Government Department Consultation Paper;

(ii) in a Bill;

(iii) in a draft statutory instrument; or

(iv) as a proposal in the Official Journal of the European Union;

(b) any applicable guidance or code of practice or directions.

1.1.4 **"Confidential Information"** means any information, however conveyed or presented, that relates to the business, affairs, operations, customers, processes, budgets, pricing policies, product information, strategies, developments, trade secrets, know-how, personnel and suppliers of the disclosing party, together with all information derived by the receiving party from any such information and any other information clearly designated by a party as being confidential to it (whether or not it is marked "confidential"), or which ought reasonably be considered to be confidential;

1.1.5 "**Contractor**" means any contractor (or sub-contractor of any tier) of the Supplier engaged to carry out any of the Installation Works or test, commission, maintain, repair or replace any of the Equipment;

1.1.6 **“Distribution Network”** means the network of pipes, wires, meters, interface units and other ancillary plant and equipment that distributes heat from the Supplier’s Energy Centre and shall include the Energy Centre,

1.1.7 **“Energy Centre”** means the plant and equipment used to produce energy

1.1.8 "**Equipment**" means the plant and equipment installed by the Supplier at the Facilities as detailed in Part 1 of the Schedule, including any replacements for such plant and equipment;

1.1.9 "**Existing Equipment"** means the [gas or other fuel] fuelled heating equipment at the Facilities used by the Customer as at the date of this Agreement, including any replacements for such equipment;

1.1.10 "**Existing Heat Meter**" means heat metering equipment, conforming to relevant industry standards, installed at the Facilities for the purpose of measuring the Customer's usage of the energy in the form of heat at the Facilities supplied from the Existing Equipment;

1.1.11 "**Facilities**" means the facilities of the Customer listed in Part 1 of the Schedule and Facility shall be construed accordingly;

1.1.12 "**Force Majeure**" has the meaning given to it in Clause 18**;**

1.1.13 **["Fuel Index"** means]

1.1.14 "**Good Industry Practice**" means the exercise of that degree of skill and care which would reasonably and ordinarily be expected to be exercised by a person engaged in the same type of undertaking under the same or similar circumstances and conditions as the Party subject to the good industry practice obligation;

1.1.15 "**Heat Commencement Date**" means the first date on which a Heat Supply is made from the Equipment to the Facilities;

1.1.16 "**Heat Interface Unit**" (or "HIU") means a heat exchanging link between the Heat Supply and the Customer's internal heat distribution systems at the Facilities;

1.1.17 "**Heat Meter**" means heat metering equipment, conforming to relevant industry standards, installed at the Facilities by the Supplier for the purpose of measuring the Customer's usage of the Heat Supply at the Facilities from the Equipment.

1.1.18 "**Heat Supply**" means the supply of energy in the form of [ circulatory hot water ] from the Equipment to the Facilities;

1.1.19 "**Information Regulations**" means the Freedom of Information (Scotland) Act 2002 and the Environmental Information Regulations (Scotland) 2004 each as amended, replaced, consolidated or re-enacted and shall include any orders, consents, regulations, legally binding codes of practice or subordinate legislation (within the meaning of section 21(1) of the Interpretation Act 1978) made thereunder;

1.1.20 "**Installation Works**" means the works relating to the Equipment at the Facilities and as detailed in Part 1 of the Schedule;

1.1.21 "**kWh**" means kilowatts per hour;

1.1.22 "**Maximum Heat Load**" means a demand for heat at the Facilities as set out in the Technical Annex;

1.1.23 "**Metering Equipment**" means the Heat Meter and the Existing Heat Meter;

1.1.24 "**Party**" means each person for the time being and from time to time party to this Agreement and any successor(s) in title to, or permitted assignee(s) of, such person;

1.1.25 "**Performance Standards**" means the standards for the Facilities set out in the Technical Annex;

1.1.26 "**Planned Outage**" has the meaning given to it in Clause 11.1;

1.1.27 "**Point of Supply**" means the valved connection forming the termination point of the Equipment, as described in the specification for the Installation Works for the Facilities;

1.1.28 "**Project Programme**" has the meaning given to it in Clause 3;

1.1.29 "**RPI**" means the Retail Prices Index published in Table 38 (excluding mortgage interest payments) of the Consumer Prices Indices published by the Office of National Statistics;

1.1.30 "**Schedule**" means the Schedule annexed and signed as relative to this Agreement in [ ] Parts, which forms part of this Agreement;

1.1.31 "**Supply Failure**" means any failure of the Supplier during the Supply Period to supply the Customer 100% of its demand for heat at the Facilities by way of the Heat Supply, other than:

1.1.31.1 as a result of an event or circumstances of Force Majeure;

1.1.31.2 as a result of a Planned Outage permitted in accordance with Clause 11.1; or

1.1.31.3 demand for heat in excess of the Maximum Heat Load

1.1.31.4 as a result of any act, error, omission, breach of contract, negligence or breach of statutory duty of the Customer or the Customer's employees, agents or contractors or any third party.

1.1.32 "**Supply Period**" means the period commencing from the later of the Heat Commencement Date or [ ] until [ ];

1.1.33 **"Target Installation Date"** has the meaning given to it in Schedule Part 1 as shall be adjusted to account for any period of Force Majeure (as hereinafter defined) or delay arising from the acts or omission of the Customer and/or its employees, agents or contractors;

1.1.34 "**Technical Annex**" means Part 2 of the Schedule;

1.1.35 "**Working Day**" means any day other than Saturday or Sunday on which the banks are generally open for business in Edinburgh;

**1.1.36** **"Works Contract"** means the Contract between the Supplier and the Contractor for completion of the Energy Centre, the Distribution Network and the Equipment.

1.2 In this Agreement:

1.2.1 words importing the singular also include the plural and vice versa where the context requires;

1.2.2 the word "including" means "including without limitation";

1.2.3 a reference to a person includes individuals, firms, partnerships and bodies corporate of any kind;

1.2.4 clause headings shall not be deemed to be part of this Agreement nor shall they be taken into consideration in its interpretation or construction;

1.2.5 unless the context otherwise requires all references to Clauses, Parts of the Schedule and paragraph numbers are references, respectively, to the numbered clauses of this Agreement, the numbered parts of the Schedule and the numbered paragraphs within Parts of the Schedule;

1.2.6 in the case of any ambiguity, inconsistency or conflict between any of the provisions of this Agreement, the provisions of the Agreement (excluding the Schedules) shall take precedence over the provisions of the Schedule;

1.3 [References in this Agreement to amounts expressed to be "Indexed" are references to such amounts multiplied by $RPI^B$ / $RPI^A$ where $RPI^A$ is the value of RPI as at the Agreement Date and $RPI^B$ is the value of RPI most recently published prior to the relevant calculation date.

1.4 If RPI or Fuel Index (or any substitute index) ceases to be published or in the event of a fundamental change to the way in which the Fuel Index or RPI is calculated, the Parties shall agree on a substitute index (or adjustments to the relevant index) in each case with the intention of putting the Parties in no better or worse a position than they would have been in had the relevant index not ceased to be published or the relevant fundamental change not been made. **Drafting Note**: to consider reference to RPI and or Fuel Index as an objective basis for the energy charge element of the charging provisions (see also Schedule Part 3) ]

**2 Term**

2.1 [ ANY CONDITIONS PRECEDENT ]

2.2 Subject to earlier termination in accordance with its terms, this Agreement shall enter into effect on the Agreement Date and shall continue in full force and effect until the end of the Supply Period.

2.3 The Supplier shall have no obligations to undertake the Heat Supply prior to the Supply Period but if the Customer takes Heat Supply prior to the commencement of the Supply Period, the Customer shall pay the Supplier for this Heat Supply in accordance with clause 9 for all Heat Supply taken at a Point of Supply.

2.4 Notwithstanding, that the Supply Period has ended, if the Customer continues to take the Heat Supply the Customer shall pay the Supplier for all Heat Supply in accordance with clause 9 for all Heat Supply taken at a Point of Supply.

## 3 Project Programme

3.1 As at the Agreement Date, the projected dates for the various key activities necessary for the implementation of the scheme contemplated by this Agreement are set out in Part 4 of the Schedule (the "**Project Programme**").

3.2 Subject always to the Customer complying with Clause 14.1 and 14.2 and the conditions of the Second Minute of Amendment, the Supplier shall procure the completion of the Installation Works by the Target Installation Date and in accordance with the Project Programme.

## 4 Consents

4.1 [ The Customer shall secure all necessary planning permissions and consents for the construction of the Installation Works. ]

## 5 Installation Works

5.1 The Supplier shall procure the completion of the Installation Works for the Facilities in accordance with Good Industry Practice.

5.2 The Supplier will provide to the Customer copies of all necessary test certificates required to be issued by third parties confirming that the Installation Works have been successfully completed, tested and commissioned.

5.3 The Customer shall have the right to conduct its own inspections and tests in relation to the Installation Works, at such time and in accordance with such procedure as the Supplier, acting reasonably, has approved in advance.

## 6 Heating Interface Unit

6.1 As part of the Installation Works, the Supplier shall procure that Heat Interface Units (HIU) are installed and commissioned at the Facilities in accordance with Good Industry Practice and in accordance with the Project Programme.

6.2 The Supplier will provide to the Customer copies of test certificates issued by third parties which confirm that each HIU has been successfully installed and commissioned.

6.3 The Customer shall have the right to conduct its own inspections and tests in relation to each HIU, at such time and in accordance with such procedure as the Supplier, acting reasonably, has approved in advance.

6.4 The Supplier shall operate and maintain each HIU in accordance with Good Industry Practice.

## 7 Supply Period

7.1 During the Supply Period, the Customer shall:

7.1.1 allow the connection of the Facilities to the Distribution Network at the Points of Supply and the Customer warrants that the Facilities are capable of taking the Heat Supply;

7.1.2 not interfere with, remove or move, modify or change in any way the Equipment without the prior approval of the Supplier in writing

7.1.3 protect the Equipment and the Distribution Network from damage, and indemnify the Supplier in respect of any damage caused to the Equipment and the Distribution Network by the Customer's negligent act or omission;

7.1.4 Subject to any related rights under this Agreement, not allow any person other than the Supplier or its authorised representatives to adjust, maintain, repair, replace, move, remove, alter or interfere with the Equipment (save in the event of an immediate risk to health or safety to the extent that such acts may mitigate the effects of such an event);

7.1.5 operate its systems connected to the Equipment in such a way that the Performance Standards are capable of being met and in accordance with such instructions and recommendations relating to the care safety and use of the Equipment as may from time to time be advised by the Supplier;

7.1.6 perform or provide at the Customer’s expense all services, repairs and adjustments to all equipment on the Customer’s side of the Point of Supply and Heat meter and shall at all times ensure that the a proper interface is maintained between such equipment and the Equipment on the Supplier’s side of the Point of Supply; and

7.1.7 advise the Supplier of any operating problems with its systems within the Facilities which may adversely affect the safe and efficient working of the Equipment.

7.1.8 maintain the Premises in good repair and condition, and preserve and protect the Premises so that Equipment will not become damaged.

7.1.9 [ at no expense to the Supplier procure from, and pay for, uninterrupted gas or other fuel or other fuel, electricity and water required to install, commission and operate the Equipment so as to enable the Supplier to comply with its obligations under this Agreement for the duration of the Supply Period.

7.2 During the Supply Period in relation to each of the Facilities, the Supplier shall:

7.2.1 make the Heat Supply available to the Customer at the Point of Supply to the extent required by the Customer up to the Maximum Heat Load;

7.2.2 operate the Equipment in accordance with Good Industry Practice;

7.2.3 measure the Customer's usage of the Heat Supply using the Heat Meter;

7.2.4 take readings from the Heat Meter on a monthly basis.

**8 Metering**

8.1 Prior to the start of the Supply Period the Supplier shall procure that the Metering Equipment is tested and, if reasonably required re-calibrated by a suitably qualified third party.

8.2 Unless the accuracy of any of the readings taken from the Metering Equipment are disputed in good faith by a Party, the Metering Equipment shall be deemed to be accurate for all purposes and the charges shall be calculated based on properly taken readings from the Metering Equipment.

8.3 If the accuracy of any of the Metering Equipment is disputed in good faith by a Party, then it shall send a notice to that effect to the other Party.

8.4 If it is necessary to remove any part of the Metering Equipment in order to enable recalibration, the Parties will procure that suitable arrangements are made in order to provide alternative metering of the relevant supply, or a protocol for estimating readings.

**9 Payment**

9.1 The Customer shall pay the Supplier for the Heat Supply in accordance with Part 3 of the Schedule.

9.2 Neither Party shall be entitled to retain or set off any amount owed to it by the other Party against any amount due to that Party under this Agreement or any other agreement.

**10 Supply and Maximum heat loads**

10.1 The Supplier shall be under no obligation to make the Heat Supply to the Facilities in excess of the Maximum Heat Load nor to provide the Maximum Heat Load if the Supplier meets the Customer's actual requirements for Heat Supply.

10.2 The Customer shall take the Heat Supply in priority to acquiring heat from any other source of supply, and the Customer agrees and undertakes with the Supplier that the Facilities shall be configured by the Customer so that the Heat Supply shall have priority over any other such supply of heat.

10.3 Subject to the Customer complying with Clause 10.2, the Customer may (but shall not be obliged to) operate the Existing Equipment in order to fulfil its heat needs to the extent they exceed the Maximum Heat Load.

**11 Temporary Discontinuation of Heat Supply**

11.1 Without prejudice to any other provisions of this agreement the Heat Supply may be discontinued or reduced by the Supplier:

11.1.1 to enable the Supplier at any time to inspect, test, alter, maintain, repair, renew, replace or add to all or any part of the Equipment or Distribution Network (a "**Planned Outage**") provided that:

11.1.1.1 [each Planned Outage is notified to the Customer in writing no less than [5] days in advance of the commencement of the Planned Outage; and

11.1.1.2 the aggregate of all Planned Outages at the Facilities during the Supply Period do not exceed [XX] hours in total **Drafting Note:** to consider an acceptable notification period and aggregate Planned Outages threshold]; or

11.1.2 in an emergency to prevent danger to life, health or property (including the Equipment and the Distribution Network); or

11.1.3 if it is necessary to do so due to an event of Force Majeure pursuant to clause 18; or

11.1.4 if obliged to do so by any law applicable in Scotland and shall include common law, statute, statutory instrument, proclamation, by-law, directive, decision, regulation, rule, order, notice, code of practice, code of conduct, rule of court, instrument, or delegated or subordinate legislation

11.2 The Supplier shall include in any notice of a Planned Outage particulars of the work to be carried out during the Planned Outage and an estimate of its duration.

11.3 The Supplier shall use its reasonable endeavours to minimise the length and number of any Planned Outages and to see that Planned Outages occur [during the months of [July and August] and/or] [during daily periods of low heat demand].

## 12 Heat Supply Failures

12.1 If the Customer becomes aware of a Supply Failure it shall notify the Supplier by telephone and by email without delay and no later than 24 hours after becoming aware of the Supply Failure.

12.2 In the event of any Supply Failure:

12.2.1 the Supplier shall use its reasonable endeavours to remedy the failure as soon as is reasonably practicable and to restore the Heat Supply;

12.2.2 the Supplier shall keep the Customer updated as to the reasons for the failure and the projected time and date on which the failure will be remedied;

12.2.3 the Supplier shall notify the Customer as soon as the failure has been remedied;

12.2.4 the Customer shall operate the Existing Equipment to fulfil its heat needs; and

12.2.5 the Customer shall have no right to terminate this Agreement other than as set out in Clause 17 notwithstanding whether the Existing Equipment is capable of fulfilling its heat needs or not.

12.3 The Customer shall use the Existing Equipment to fulfil its heat needs during the period of a Supply Failure and shall measure its usage of such heat using the Existing Heat Meter, taking readings from that meter on a daily basis. At the end of the Supply Failure the Customer shall make available to the Supplier full details of such meter readings.

## 13 Maintenance

13.1 Subject to clause 13.2, the Supplier shall be responsible for the maintenance, repair and any necessary replacement of the Equipment throughout the Supply Period.

13.2 The Customer shall pay to the Supplier on demand (and shall indemnify the Supplier against) all costs and expenses incurred by the Supplier, including any related to investigation of the cause of any defect or malfunction, where the need for repair or maintenance or the provision of spare or replacement components is cause by any of the following circumstances:

13.2.2 works undertaken at the Facilities by the Customer or the Customer’s employees, agents or contractors or any third party;

13.2.3 any error or omission relating to the operation of the Equipment by the Customer or failure to follow the advice or instructions of the Supplier or any other party authorised by the Supplier;

13.2.4 Any modification, adjustment or repair made to the Equipment or the Distribution Network made by the Customer or the Customer's employees, agents or contractors or by a third party without the written consent of the Supplier

13.2.5 Any act or omission of the Customer or the Customer's employees, agents or contractors or any third party (other than a third party which is an employee, agent or contractor of the supplier).

13.3 The Supplier shall secure any necessary consents for the use of any replacement Equipment installed.

13.4 The Customer shall be responsible for the maintenance, repair and any necessary replacement of the Existing Equipment throughout the Supply Period.

13.5 The Supplier will discharge its maintenance obligations in accordance with Good Industry Practice.

13.6 If, in the reasonable opinion of the Customer the Supplier is failing to discharge its maintenance obligations such that there is an adverse impact on the Equipment, Existing Equipment and/or operations, and/or the Supplier's ability to deliver the Heat Supply at the Facilities in accordance with this Agreement or the risk of such an adverse impact:

13.6.1 the Customer will be entitled to carry out an inspection of the relevant Equipment and or Existing Equipment to identify any necessary maintenance, repair or replacement activities which are required to eliminate or mitigate any adverse impact or risk of adverse impact, and will notify the Supplier in writing of those activities;

13.6.2 the Supplier will carry out such activities, at its cost; and

13.6.3 if the Supplier has failed to complete such activities within a reasonable period having regard to the nature of such activities and in any event within [15] days of the date of notice from the Customer pursuant to Clause 13.6.1, the Customer may procure the necessary maintenance, and the costs of procuring such maintenance shall be recoverable from the Supplier by the Customer.

**14 Access to the Facilities**

14.1 The Customer shall allow the Supplier and the Contractors access to the Facilities (with or without vehicles and equipment) for all reasonable purposes relating to this Agreement, including the installation, testing, maintenance, repair and replacement of the Equipment and taking readings from Metering Equipment. Other than in the case of emergency and the

Installation Works (as set out in the Project Programme), the Supplier shall give the Customer at least 24 hours notice of each requirement for access.

14.2 The Customer hereby agrees to permit the Supplier to have access to the areas of ground [shown outlined in red] in Part 1 of the Schedule for all purposes connected to this Agreement.

14.3 The Supplier will comply with any reasonable conditions of access which the Customer may impose relating to safety, security or to avoid damage to the Facilities.

14.4 The Supplier shall fully and effectively indemnify the Customer, the Customer's personnel and any members of the public visiting the Facilities, and keep each of the foregoing fully and effectively indemnified, from and against any and all loss, damage, injury to such persons or their property, fines and penalties imposed on them, and any and all claims by, or liability to, any third party, for loss, damage or injury to such persons or their property, and any damage caused to any part of the Facilities which arises out of the act or omission of the Supplier its officers, agents and Contractors at the Facilities, in each case other than anything arising our of a Supply Failure (which shall be dealt with pursuant to Clause 12.2).

14.5 The Customer shall fully and effectively indemnify the Supplier, the Supplier's personnel and any members of the public visiting the Facilities and the areas surrounding the Facilites, and keep each of the foregoing fully and effectively indemnified, from and against any and all loss, damage, injury to such persons or their property, fines and penalties imposed on them, and any and all claims by, or liability to, any third party, for loss, damage or injury to such persons or their property, and any damage caused to any part of the Distribution Network or the Supplier's property which arises out of the act or omission of the Customer its officers, agents and contractors.

**15 Title and risk**

15.1 Save as provided for in Clause 15.3 or as otherwise agreed between the Customer and Supplier, the Equipment shall be and shall remain the property of the Supplier during the Supply Period. The Customer shall have no right of lien over the Equipment. The Supplier's title to the Equipment shall be earmarked by a conspicuous mark recording the fact that it is the property of the Supplier.

15.2 The Customer warrants to the Supplier that it has absolute title to the Premises or that the Customer has a lease for a term of years greater than the Supply Period and that the landlord has consented to the Customer entering into this Agreement. The Customer shall notify the Supplier prior to entering into or creating any sale, transfer, lease, licence or other disposition of the whole or any part of the Premises.

15.3 Where by operation of law any Equipment becomes the property of the Customer, the Customer hereby grants (or shall procure the grant) of such rights of use and of access to such Equipment as are necessary to enable the Supplier to perform its obligations under this Agreement.

15.4 The Existing Equipment shall be and shall remain the property of the Customer.

15.5 Title to and risk in the Heat Supply shall pass to the Customer at the Point of Supply.

15.6 Title to and risk in the return water shall pass to the Supplier at the Point of Supply.

15.7 The Customer shall not be permitted to re-sell, re-distribute or re-deliver any Heat Supply purchased from the Supplier.

15.8 The Supplier is liable only for the Equipment and its interface with the Customer's plant and equipment at the Premises. The Supplier shall not be responsible for the adequacy, safety or other characteristics of the Customer's plant and equipment on the Premises.

**16 Assignation and Sub-contracting**

16.1 Neither party may assign or otherwise transfer this Agreement in whole or in part without the prior written consent of the other, which shall not be unreasonably withheld.

16.2 Each Party shall be responsible for the acts, omissions, default or neglect of any of its sub-contractors, as if they were the acts, omissions, default or neglect of the Party itself. The Supplier may sub-contract its duties without the consent of the Customer but will provide a list of sub-contractors and their roles in response to any reasonable request from the Customer.

**17 Termination**

17.1 Either Party may terminate this Agreement forthwith on written notice if:

17.1.1 the other party (the "**Affected Party**") goes into liquidation either voluntary or compulsory (save for the purposes of reconstruction or amalgamation); or

17.1.2 any receiver, administrator, administrative receiver or other encumbrancer is appointed in respect of the whole or any part of the Affected Party's assets; or

17.1.3 the Affected Party makes or offers to make any arrangement or composition for the benefit of creditors generally; or

17.1.4 the Affected Party ceases trading or is unable to pay its debts within the meaning of section 123 of the Insolvency Act 1986; or

17.1.5 the Affected Party suffers any event analogous to the events set out above in any jurisdiction in which it is incorporated or resident.

17.2 Either Party may terminate this Agreement forthwith on written notice if the other Party (the "**Defaulting Party**"):

17.2.1 has failed to comply with or discharge any material obligation incumbent upon it in terms of this Agreement and (if remediable) fails within [30] days of written notice to remedy the same or to provide a plan for such remediation acceptable to the other party (in its sole discretion);

17.2.2 fails to implement any plan for such remediation accepted pursuant to Clause 17.2.1.

17.3 The Supplier may terminate this Agreement on 10 days notice if for any reason the Works Contract is terminated.

**18 Force Majeure**

18.1 In this Clause "**Force Majeure**" means any event or circumstance beyond the reasonable control of the Party affected including (without limitation) acts of God or nature, fire, explosion, flood, acts of terrorism, war, rebellion, riot, acts of Government, sabotage or official strike or other labour dispute or disturbance, a Contractor suffers any event detailed in clauses 18.1; provided that it shall not include events or circumstances which delay or prevent the ability of a Party to make any payments when due under this Agreement

18.2 Subject to Clause 18.3, if either Party is by reason of Force Majeure rendered unable wholly or in part to carry out its obligations under this Agreement, then upon notice in writing of such Force Majeure from the Party affected to the other Party as soon as possible after the occurrence of the cause relied on the Party affected shall be released from its obligations and suspended from the exercise of its rights under this Agreement to the extent to which they are affected by the circumstances of Force Majeure and for the period during which those circumstances exist. This Agreement shall remain in effect but save as otherwise provided in this Agreement the obligations of the affected Party which are affected by Force Majeure shall be suspended without liability.

18.3 Notwithstanding Clause 18.2, a Party affected by the circumstances of Force Majeure shall use all reasonable endeavours to mitigate the effects of such circumstances.

18.4 If circumstances of Force Majeure exist for a continuous and uninterrupted period of [3] month which render a Party wholly or substantially unable to carry out its obligations under this

Agreement then either Party shall be entitled to terminate the Agreement on giving [10] Working Days' written notice to the other Party. Such termination shall be without prejudice to the rights and obligations of the Parties up to the date of termination and no further payment shall be due to or by either Party after the date of termination.

18.5 Neither Party shall be liable for any breach of this Agreement caused by Force Majeure and neither party shall be liable to the other in respect of losses to the extent that such losses are attributable to an event of Force Majeure.

**19 Consequences of Termination**

19.1 The termination or expiry of this Agreement:

19.1.1 shall not prejudice or affect any right of action or remedy which shall have accrued or shall thereafter accrue to either Party; and

19.1.2 shall not affect the continued operation of those Clauses or paragraphs which, having regard to their terms, are intended to apply on or to survive termination or expiry.

**20 Limitation of Liability**

20.1 Subject to Clause 20.2., and save as otherwise expressly provided for in this Agreement, neither Party shall be liable to the other in connection with this Agreement or the provision of the Heat Supply for any direct or indirect loss of profits, loss of business, loss of contract, additional costs of working or production of heating or for any indirect or consequential loss or damage whatsoever.

20.2 Clause 20.2 shall in no way affect any liability of a Party for any death or personal injury caused by that Party's negligence.

**21 Audit**

21.1 The Supplier must provide such information to the Customer as is reasonably required by the Customer from time to time in relation to the Supplier's performance of this Agreement, for the purposes of audit only.

21.2 The Supplier shall at all times during the term of this Agreement keep accurate accounts and records showing all dealings relating to this Agreement and shall retain its accounts and records in relation to this Agreement for at least [six (6)] years after the end of this Agreement.

21.3 The Supplier shall allow the Customer and any auditors of or other advisers to the Customer to access any of the Supplier's premises, personnel and relevant records as may be reasonably required in order to:

21.3.1 fulfil any legally enforceable request by any regulatory body; or

21.3.2 undertake verifications of the accuracy of the payments made or claimed by the Supplier under this Agreement; or

21.3.3 undertake verification that all obligations of the Supplier are being performed in accordance with this Agreement.

21.4 The Customer shall use its reasonable endeavours to ensure that the conduct of each audit does not unreasonably disrupt the Supplier and that, where possible, individual audits are co-ordinated with each other to minimise any disruption.

21.5 The Supplier shall provide the Customer (and its auditors and other advisers) with all reasonable co-operation, access and assistance in relation to each audit.

21.6 The Customer shall provide at least three (3) Working Days' notice of its intention to conduct an audit unless such audit is conducted in respect of a suspected fraud, in which event no notice shall be required.

21.7 The Parties shall bear their own costs and expenses incurred in respect of compliance with their obligations under this Clause 21, unless the audit identifies a material default by the Supplier in complying with its obligations under this Agreement, in which case the Supplier shall reimburse the Customer for all its reasonable costs incurred in the course of the audit.

21.8 If an audit identifies that:

21.8.1 the Supplier has failed to perform its obligations under this Agreement then, without prejudice to the other rights and remedies of the Customer, the Supplier shall take the necessary steps to comply with its obligations within the time scale specified by the Customer at no additional cost to the Customer; and/or

21.8.2 the Supplier has overcharged the Customer for the Heat Supply, the Supplier shall pay to the Customer the amount of the overcharge (to the extent that the same has already been paid by the Customer) within five (5) Working Days from the date of receipt of an invoice for such amount.

21.9 The Customer may increase the extent to which it monitors the conduct of the Supplier if the Supplier fails to fulfil its other obligations under this Agreement. The Customer shall give the Supplier prior notification of its intention to increase the level of its monitoring. The Supplier shall bear its own costs in complying with the Customer in relation to any monitoring which is conducted by the Customer pursuant to this Clause 21.

21.10 If the Customer and/or its advisors give the Supplier notice of any queries or questions in relation to any audit then the Supplier must provide an appropriate response as soon as practicable and no later than [twenty (20)] Working Days after the queries or questions are sent to the Supplier.

**22** [ **Insurance**

22.1 Without limitation to any other obligation or liability under this Agreement, both Parties shall effect and maintain throughout the term of this Agreement appropriate insurance cover (such as public liability insurance, employer's liability and product liability) with a reputable insurance company that is adequate to enable the Party to comply with any applicable laws and to meet any valid claims which may be brought pursuant to this Agreement. Both Parties confirm that as at the Agreement Date its current insurance cover is as follows, and that at least this level of cover shall be maintained by the Party throughout the term of the Agreement:-

22.1.1 public liability Insurance – [5] million pounds sterling for any one claim and/or a series of related claims;

22.1.2 employer's liability insurance – [10] million pounds sterling for any one claim and/or a series of related claims; . **Drafting note:** to consider insurance amounts]

22.2 Neither Party shall take or fail to take any reasonable action, or (insofar as it is reasonably within its power) permit anything to occur in relation to it, which would entitle any insurer to refuse to pay any claim under any of the insurance policies maintained in accordance with this Clause 22.

22.3 If requested by the other Party, the insured Party must at any time during the term of this Agreement, produce copies of the insurance policy or policies referred to in this Clause 23, receipts for premiums or certificates of currency to evidence such insurances. If either Party fails to effect or keep in force any of the insurances required by this clause 22, the other Party may effect and keep in force such insurances and pay any premiums as they fall due and any amounts paid by the other Party shall be refunded by the insured Party to the other Party upon demand, failing which any outstanding amounts shall be recoverable as a debt due by the insured Party to the other Party. ]

22.4 In the event that either party fails to comply with the terms of this Clause 22, for any reason, and fails to remedy that breach within a reasonable period, then that party shall have committed a material breach of this Agreement.

**23 PR**

23.1 The Supplier will require the prior approval of the Customer, not to be unreasonably withheld, for any promotional publications and reporting activities in relation to heat supply contemplated by this Agreement.

23.2 Subject to the terms of Clause 23.1 and Clause 28, both Parties shall be free to refer to the project contemplated by this Agreement in its promotional, publication and reporting activities but neither Party will reveal any information which is confidential to the other Party in so doing. Information which is confidential to the Supplier includes the price and payment details, but this shall not prevent publication of approximate energy savings.

**24 VAT**

24.1 All sums payable under this Agreement unless otherwise stated are exclusive of VAT and other duties or taxes and any VAT or other duties or taxes payable in respect of such sums shall be payable in addition to such sums.

**25 Entire Agreement and Variations**

25.1 As at the Agreement Date, the Agreement constitutes the entire agreement between the Parties in connection with its subject matter and supersedes all prior representations, communications, negotiations and understandings concerning the subject matter of the Agreement.

25.2 Each Party acknowledges and agrees that it has not entered into this Agreement on the basis of any representation or warranty made by the other, other than as incorporated in this Agreement.

25.3 No amendment, modification or substitution of this Agreement shall be effective unless executed in writing by both Parties.

25.4 In the event of a Change in Law occurring after commencement of this Agreement which requires the Supplier to increase any or all of its liabilities hereunder or cause the Supplier to incur a cost or costs whether in respect of capital expenditure as loss or revenue, such costs or losses shall be fully recoverable by the Supplier from the Customer and shall be payable by the Customer within 30 days of the Supplier issuing the Customer with an invoice in respect of the same.

**26 Notices**

26.1 Unless otherwise stated in this Agreement, all notices to be given under this Agreement shall be in writing and shall be given or sent by hand, or first class post or recorded delivery to the addresses detailed at the start of this Agreement (or any alternative address in the United Kingdom notified by that Party in accordance with this Clause):

26.2 Notice shall be deemed received, if sent by first class post, 48 hours after posting.

26.3 If a notice is sent by facsimile transmission during business hours on a Working Day, then it shall have been deemed to have been received immediately or if not sent during such hours, on commencement of the next following Working Day.

26.4 If a notice is delivered by hand, a signature on behalf of the receiving Party shall be sufficient evidence of delivery.

26.5 Where this Agreement requires information to be provided by telephone or in electronic form, the Parties shall use the contact numbers and email addresses notified from time to time for that purpose.

**27 Disputes**

27.1 Any dispute arising out of or in connection with this Agreement (Dispute) shall, save where otherwise specified in this Agreement, be resolved in accordance with this Clause 27 (Dispute Resolution Procedure).

27.2 Where a Dispute exists, either Party may serve upon the other notice (a “Dispute Notice”) briefly describing the Dispute and requesting that action be taken to resolve the Dispute. Upon service of the Dispute Notice, the Parties shall, in good faith, attempt to resolve the Dispute.

27.3 If the Dispute is not resolved within 10 Working Days of the service of the Dispute Notice, either Party may serve on the other a request (an “**Escalation Request**”) that a senior executive officer of the Customer and the managing director of the Supplier meet to resolve the Dispute.

27.4 The persons referred to in Clause 27.3 shall meet and attempt to resolve the Dispute in good faith within 5 Working Days of the service of an Escalation Request. If they fail to resolve the Dispute within 10 Working Days from the date of meeting (or the meeting fails to take place within the period), an Expert shall be appointed in respect of the Dispute pursuant to Clause 27.5.

27.5 If the procedure set out in Clauses 27.1 to 27.4 fails to resolve the Dispute an expert agreed to by the Parties shall be appointed. If the Parties fail to agree on the identity of an expert willing to accept the appointment, the Parties shall appoint an Expert nominated by the Institute of Mechanical Engineers. The expert agreed upon or appointed is referred to in this Agreement as the "Expert".

27.6 Each Dispute Party shall bear the fees and expenses of the Expert in equal proportions, unless the Expert determines to the contrary.

27.7 Each Party shall submit to the Expert a written statement which is as concise as possible on the matters in dispute together with all the documents on which it wishes to rely (copied to the other Party) within five Working Days of the appointment of the Expert.

27.8 The decision of the Expert shall be final and shall be binding upon the Parties except in the case of fraud or manifest error on the part of the Expert in which case either Party may commence court proceedings for the resolution of the Dispute.

27.9 Nothing in this Clause 27 shall prevent any Party applying for interim interdict or interim specific implement at any time.

27.10 The Parties shall continue to comply with, observe and perform all their obligations under this Agreement regardless of the nature of the Dispute and notwithstanding the referral of the Dispute to the Dispute Resolution Procedure.

**28 Confidentiality**

28.1 Except to the extent set out in this Clause 28, or where disclosure is expressly permitted elsewhere in this Agreement, each Party shall:

28.1.1 treat the other Party's Confidential Information as confidential; and

28.1.2 not disclose the other party's Confidential Information to any other person without the owner's prior written consent.

28.2 Clause 29.1 shall not apply to the extent that:

28.2.1 such information was in the possession of the Party making the disclosure, without obligation of confidentiality, prior to its disclosure; or

28.2.2 such information was obtained from a third party without obligation of confidentiality; or

28.2.3 such information was already in the public domain at the time of disclosure otherwise than through a breach of this Agreement; or

28.2.4 such information was independently developed without access to the other Party's Confidential Information or

28.2.5 Such information is reasonably required by the Party's personnel, professional advisors (including legal, financial, commercial or technical advisors), insurers and/or funders (including prospective funders) and, so far as possible, the Party ensures that such personnel, advisors and funders are aware of and act in accordance with these confidentiality obligations.

28.3 The Supplier shall not, and shall procure that the Supplier's personnel do not, use any of the Customer's Confidential Information received otherwise than for the purposes of this Agreement.

28.4 The Supplier undertakes (except as may be required by law or permitted by Clause 28.3 above) not to:

28.4.1 disclose or permit disclosure of any details of this agreement to the news media or any third party other than its Sub-Contractors; or

28.4.2 disclose that the Customer is a customer or client of the Supplier; or

28.4.3 use the Customer's name or brand in any promotion or marketing or announcement without the prior written consent of the Customer.

28.5 Nothing in this Clause 28 shall prevent either Party from using any techniques, ideas or know-how gained during the performance of this Agreement in the course of its normal business to the extent that this use does not result in a disclosure of the other Party's Confidential Information or an infringement of intellectual property rights.

**29 Freedom of Information**

29.1 The Supplier acknowledges that the Customer is subject to the requirements of the Information Regulations and:

29.1.1 accepts that the Customer shall have absolute discretion in determining whether or not to disclose information relating to this Agreement pursuant to the Information Regulations;

29.1.2 will provide the Customer, within [5] Working Days of a request, with a copy of any information in its possession that the Customer reasonably considers that it is required to disclose pursuant to the Information Regulations; and

29.1.3 will assist and co-operate with the Customer to enable the Regulated Party to comply with the Information Regulations in relation to this Agreement and its subject matter.

**30 Costs and Expenses**

30.1 Each Party shall pay its own costs and expense incurred in connection with the preparation, entering into or enforcement of this Agreement.

## 31 Severability and Waiver

31.1 If any provision of this Agreement is held by any court or other competent authority to be void or unenforceable in full or in part, all other provisions of this Agreement and the remainder of that provision shall remain in full force and effect.

31.2 Any delay on the part of either Party in enforcing any term or condition, right or remedy in respect of this Agreement shall not be deemed to be a waiver of any right or remedy whatever of that Party.

## 32 No Partnership or Agency

32.1 Nothing in this Agreement shall constitute a partnership between the Supplier and the Customer, nor constitute one Party as the agent of the Customer.

## 33 Governing Law

33.1 This Agreement shall be governed by and construed in accordance with the law of Scotland and subject to the Parties submit to the exclusive jurisdiction of the courts of Scotland.

This document is executed as follows:-

**For [ ]**

| | |
|---|---|
| signature of director | signature of director/witness |
| full name of above (print) | full name of above (print) |
| | date of signing |
| | place of signing |

**For [ ]**

| | |
|---|---|
| | signature of Proper Officer |
| | full name of above (print) |
| | date of signing |
| | place of signing |

[Customer Seal]

**This is the Schedule in [ ] Parts referred to in the foregoing agreement between [ ] and [ ]**

## PART 1 OF THE SCHEDULE

Project Information [To be updated to reflect technical aspects as agreed]



[Facilities]

[Equipment – Plant/equipment]

[Existing Plant]

[Existing Plant Meter]

[HIU specification and locations]

[[Installation Works]

[Point of Supply]

[Term]

[Key Dates

**[**Other Information?]

**[PART 2 OF THE SCHEDULE – TECHNICAL ANNEX – TO BE CONSIDERED]**

| | | | | | |
|---|---|---|---|---|---|
| | [[Initial] Energy Price]<br><br>[unit price of each kWH] | Maximum Heat Load | Energy Floor price | [Minimum Heat Load] | Perfo Stan Minir and Maxi temp |
| [Facilities] | #### | [##### in any period of 60 minutes]<br><br>#### in Supply Period<br><br>[[TBC] as at Agreement Date] | [[TBC] as at Agreement Date] | p[######] kWh] | #### |

## PART 3 OF THE SCHEDULE

## CHARGING ARRANGEMENTS [SUBJECT TO FURTHER REVIEW]

### 1 The charge for heat

1.1 The Customer shall pay the Supplier for the Heat Supply to the Facilities, based on consumption, monthly in arrears, on a calendar month basis.

1.2 Unless the Heat Commencement Date falls on the first day of a calendar month, the first payment shall be for a period longer than one month, being the period from the Heat Commencement Date to the end of the calendar month which follows the month in which the Heat Commencement Date occurred. References to "month" shall be construed accordingly so as to refer to that longer period.

1.3 Each monthly charge will be based on the readings in kWh taken by the Supplier from the Metering Equipment at the Facilities.

1.4 The monthly charge for the Facilities will be the product of:

1.4.1 the kWh of Heat Supply consumed by the Customer in the relevant month at the Facilities; and

1.4.2 the Energy Price applicable at that time for the Facilities, calculated in accordance with paragraph 2 of this Part of the Schedule.

1.5 The monthly charge shall be adjusted pursuant to paragraphs [3] and [4] of this Part of the Schedule.

### 2 [The Energy Price

**[Drafting note:** To consider, with relevant technical advice, whether a fixed energy price or one which reflects changes in gas or other fuel or other fuel prices should be sought. To discuss the application of a minimum monthly payment ]

### 3 Payment

3.1 The Supplier will invoice the Customer on a monthly basis. [The invoice shall be sent in both paper and electronic form.

3.2 Payment will be made by the Customer within [14] days of the date of each invoice.

3.3 Deductions from the monthly charge made pursuant to paragraph 3 may reduce the monthly charge to or beyond zero, and if there is a net amount due from the Supplier to the Customer in relation to any month, the Customer will provide the Supplier with an appropriate invoice and payment shall be due from the Supplier to the Customer within [14] days.

3.4 If any amount subject to an invoice is in genuine dispute the amount not in dispute must be paid and upon settlement of the disputed sum an appropriate adjustment will be made accordingly.

3.5 If any amount remains outstanding beyond the due date for payment by either Party:

3.5.1 interest shall be due on the outstanding amount from the due date until the date of payment at the rate of [4]% above the base rate from time to time of the [The Royal Bank of Scotland plc];

3.5.2 the Party to whom payment is due may charge the other Party in a subsequent invoice for the reasonably and properly incurred costs in recovering or trying to recover any overdue amounts; and

3.5.3 Any interest accruing under this Clause shall be compounded with the overdue amount on the last day of each month, and immediately payable on demand.

4.6 Each party shall be responsible for any tax levied on it

**PART 4 OF THE SCHEDULE**

Project Programme

# Domestic Customer Charter for Consumers Connected to Communal or District Heating Networks

## Introduction

Heat networks have become an increasingly common part of low carbon energy strategies for new build development and refurbishments. In coming years, as tighter limits are placed on emissions from new homes[1], the use of heat networks is expected to expand even more quickly.

DECC estimates that up to 8 million homes could be connected to district heating networks, rather than generating space and water heating using their own boiler. While this should reduce emissions and help to keep heat affordable, it raises a number of new issues for developers and customers of heat networks.

Heating networks are not subject to any particular regulation and there are no standards of service for heat providers. This means that there are no consumer protection measures in place other than general fair trading standards as imposed by the OFT. In addition, although there are many examples of good practice, there is no standard practice in managing domestic customers on heat networks.

To help address this lack of consumer protection, Fontenergy has carried out a consultation exercise with key stakeholders in order to put together a Customer Charter for Heat, based on similar measures within the electricity markets and best practice in the industry. The charter applies to the relationship between customers and the services provider[2] and is intended to:

- be applicable to customers on the great majority of heat schemes
- lay out the basic requirements for service and customer protection
- help services provider understand requirements from the outset

On the other hand, this charter does <u>not</u>:

- seek to apply to all possible schemes
- preclude developers, communities, or RSLs from requiring additional services from their service provider
- serve as a substitute for communication or contract negotiation with services providers

## How to use this document

The heat charter provides a series of service standards for the following areas:

- Vulnerable Customers;
- Maintenance;
- Pricing, Debt, Disconnection & Prepayment meters;

[1] In particular, upcoming regulations include the requirement for new homes by private developers to achieve a 44% reduction in emissions relative to Part L 2006 from 2013 and to achieve "zero carbon" standard from 2016. To obtain grant funding, social housing will required to achieve these standards sooner, in 2011 and 2015 respectively.
[2] The role of "services provider" encompasses both generation and supply of heat and might comprise more than one party. One example of this is where communal boilers are owned by one party while billing services and customer care are provided by another.

- Quality of service & complaint handling; and
- Tenant responsibilities

It provides definitions of the key terms used within the charter, such as vulnerable customer. It also provides some guidance on the application of the service standards set out in the heat charter. The definitions and guidelines are there to support parties wishing to adopt the heat charter, but are for guidance only and do not constitute mandatory elements to the heat charter.


## Acknowledgements

This charter was developed in collaboration with input from several Registered Social Landlords and other stakeholders. We are grateful for their feedback and assistance in putting this guidance together.

| Name | Company |
|---|---|
| Paul Jones | A2Dominion |
| Jake Lock | Affinity Sutton |
| Will Sullivan | Calfordseaden |
| Lena McManus | Catalyst Housing Group |
| Alistair Jones | Circle Anglia |
| Chris Baker | Davies Arnold Cooper LLP |
| Gowan Turnbull | Homes for Haringey |
| Gordon Calloway | Hyde Housing Group |
| Zia Mirza | Hyde Housing Group |
| Robin Feeley | London & Quadrant Group |
| Seb Junemann | Metropolitan Housing Trust |
| Sinead Gilhooly | Network Housing Group |
| Paul Haines | Network Housing Group |
| Derek Watters | Places for People |
| Chris Johnson | Poplar HARCA |
| Guy Hannell | Rydon |
| Jeff Henton | Rydon |
| Malcolm Pollard | Rydon |
| Gillian Draper | Southern Housing Group |
| Kate Lines | Southern Housing Group |


## Feedback

To contact us regarding this document, please contact:


Isabelle McKenzie
Head of New Business
Fontenergy
Unit 3 Cedar Court
1 Royal Oak Yard
London
SE1 3GA
020 7138 3210
isabelle.mckenzie@fontenergy.com


## Disclaimer

This heat charter has been prepared in good faith and with the assistance of a number of key stakeholders. Neither Fontenergy nor any of the contributing parties accept any liability for parties using this charter. This charter does not supersede any other service standard requirements imposed by regulatory authorities and there is no obligation on any organisation to follow the guidance herein.

# Customer Heat Charter

## Introduction

The purpose of this charter is to clarify and improve standards of service to domestic customers connected to communal and district heating systems.

It is a commitment to provide high levels of customer service and in particular to take into account the diverse needs of those customers.

## Vulnerable Customers

Heat service providers using this charter will:

- Keep a vulnerable customer register recognising customers who (a) have a health issue which makes them more vulnerable than the average consumer with regard to heating and/or hot water requirements or (b) customers who might have difficulty communicating with the service provider and require additional contact methods.
- Inform all occupants that the vulnerable customer register exists
- Allow customers to request inclusion on the register provided they meet the vulnerability criteria and make efforts to gather information about vulnerable customers
- Provide a variety of contact options to ensure that vulnerable customers who have communication requirements have appropriate provision to contact the service provider
- Allow vulnerable customers to nominate a third party to manage their billing/payment and all contact with the provider
- Not disconnect a customer who is vulnerable to heat loss for health reasons during the winter months

## Maintenance

Heat service providers using this charter will

- Offer occupants the option to select a password for any appointments with the provider. This password will be used to ensure that the agent who arrives at the property is indeed a representative of the service provider.
- Offer a guaranteed appointment system for maintenance visits (i.e. morning or afternoon appointments)
- Provide an enhanced response time for heating failures for customers who are vulnerable to a loss of heat and/or hot water and a seasonally adjusted response time for all other residents
- Provide all residents with an information pack on how to use their heating system and read their meter and bill or use their prepayment meter. Where necessary, the provider will make provision to give individual advice to customers on the use of the heating controls and system.
- Provide a disaster recovery plan to mitigate against a loss of services, which will take into account the requirements of vulnerable customers on the scheme and will include a communication plan to liaise with affected parties

## Pricing, debt, disconnection and prepayment meters

Heat service providers using this charter will:

- Provide a clear pricing policy to all occupants which will explain how tariffs are calculated and when they will be revised
- Provide fixed and variable direct debit credit payment options
- Provide a clear debt & disconnection policy to all occupants
- Allow customers to pay back debt in instalments
- Provide a clear prepayment policy to all occupants

- Be transparent in implications of prepayment on pricing
- Provide a clear policy for what happens if a customer believes their meter to be faulty

## Quality of service and complaint handling

Heat service providers using this charter will:

- Keep a record of number of telephone calls, waiting times and calls terminated by customer prior to connection;
- Keep a record of loss of heating/hot water service covering number of customers affected, number of incidents and duration of incident
- Provide a variety of options to communicate with customers taking into account language, and physical capability (e.g. multilingual phone contact, telephone, email, letter)
- Allow authorised third parties to manage customer accounts on behalf of vulnerable occupants
- Provide a clear complaint handling policy to all occupants
- Aim to resolve most complaints at first point of contact
- Deal with all complaints within 28 days
- Allow final arbitration by a suitable third party (as agreed by DECC)

## Tenants Obligations

Heat service providers will encourage their customers to act responsibly by

- Keeping appointments made to maintain the heating system, where access is required to their property;
- Not wilfully damaging any part of the heating system within their property or outside their property;
- Paying for the heat they consume and any associated standing charges.

## Definitions

*Vulnerable Customer for heat and/or hot water provision* is an occupant who is more vulnerable to a loss of heating and/or hot water by virtue of their age, a medical condition or disability. Criteria can be set on a case by case basis, but should take into account disability and age. The following criteria are based on guidelines from the electricity market and from TSA we would recommend the following criteria:

- Households with a person who is over 70 years of age
- Households with a child under the age of 5
- Households with a person who is registered disabled
- Households with a person who has a chronic illness

*Vulnerable Customer for Communication Issues* is an occupant who may require assistance in communicating with the heating provider. An example might be a customer who is blind and is unable to read a bill or read a prepayment meter. A customer who has additional communication needs does not necessarily have a vulnerability relating to a loss of heating and/or hot water. Criteria can be set on a case by case basis, but should take into account the six diversity groups of ethnicity; age; sexuality; disability; gender; and religion/belief. The following criteria are based on guidelines from the electricity market and from TSA we would recommend the following criteria:

- Households with a person who is blind or partially sighted
- Households with a person who is deaf or hard of hearing
- Households where no party is able to communicate either orally or in written form in English (and/or Welsh in Wales)

*Service provider* is the party (or parties) that encompasses both generation and supply of heat and might comprise more than one party. One example of this is where communal boilers are owned by one party while billing services and customer care are provided by another.

## Guidelines and supporting information

This section provides further detail on some of the elements of the charter. This is guidance only and may be superseded by other obligations such as those imposed by the Tenant Services Authority or the Department of Energy & Climate Change. There is no obligation to follow this guidance, but the purpose is to provide useful illustration to the service standards detailed in the heat charter.

## Complaint Handling

A complaint handling policy should ensure that a service provider deals with complaints promptly, politely and fairly. The policy and surrounding business processes should incorporate information from complaints to ensure continuous improvement in business practices, thereby improving services offered.

In line with Tenant Services Authority guidance[3], it should incorporate the following elements:

- A range of ways for occupants or other affected parties to express a complaint
- Details of what to do if the complainant is unhappy with the outcome of a complaint
- Develop, agree and monitor service standards for complaints
- Record information on complaints, and publish where required, including
    - The number of complaints received
    - The nature of the complaints
    - The business area to which the complaint relates
    - The outcome of the complaints
    - How business process have been changed to improve services as a result of the complaints

## Energy billing

Customers, who pay for their energy on a credit basis via a bill, as opposed to via a pre-payment meter, should receive a bill which contains a minimum of the following information:

- The supplier's address and phone number
- The customer reference number/account number
- The current balance on the account
- Customer name and address
- The period of time covered by the bill
- Previous and current meter readings
- Number of units used
- Price or prices per unit
- Amount of standing charge, if applicable
- Details of any discounts
- Details of any additional payments (e.g. to repay an outstanding debt in instalments)
- Amount of VAT to pay
- Meter serial number and/or meter reference number
- Emergency phone numbers

Good practice in billing would include graphical historical consumption data.

## Pricing

Service providers should provide a clear pricing policy to all occupants which explains how tariffs are calculated and when they are revised. This policy should be explicit and transparent on how tariffs are calculated, providing the formula for the calculation and the sources of information used within that calculation.

---

[3] "A new regulatory framework for social housing in England" Consultation Document, Tenant Services Authority, 12 November 2009 p44-45

Sites often have a mixture of energy generation assets, some of which might have a very low cost of production, but an intermittent and unpredictable output (e.g. solar hot water); some might have a single input fuel and two outputs (e.g. CHP with gas or biomass input and heat and electricity output), where costs must be apportioned between two products. In addition, you might have planning or environmental restrictions on your operating procedures. You may also have incentive payments.

The methodology could set out the hierarchy of production with a forecasting error payment or claw-back mechanism. The methodology might include:

- Description of the system and the hierarchy of costs;
- Estimate of likely operating hours for each technology type
- Fuel costs including buy-in electricity (where appropriate) and its associated distribution costs
- Operational costs associated with managing the system
- Landlord load estimates and whether they are passed through to consumers (where applicable)
- Estimated revenue streams contributing to the system (FIT; ROC; LEC; RHI etc) as appropriate
- Methodology for separating costs between products (e.g. apportionment of costs from a CHP into heat & electricity)
- Maintenance & renewal costs
- Reconciliation process of actual costs versus forecast costs
- Frequency of reconciliation and recalculation of tariffs
- Provision for bad debt & cashflow

The methodology will specify the output price and may be for example: (1) p/kWh; (2) £/m2 per year based on floor plan; (3) p/day plus p/kWh. The appropriate tariff structure can depend on a number of factors including whether the site has a mixture of private/tenants; whether the tenants are all very similar (such as sheltered housing, where a fixed charge only might be appropriate); how you want to charge long term fixed costs such as maintenance and renewal and whether you want to set up an explicit sinking fund; and who owns the assets (e.g. RSL, ESCO, tenants or a mixture).

## Debt and disconnection

A proportion of customers may end up with payment difficulties. The residents are in a contractual relationship with the service provider as their customer for energy and therefore the debt relationship is with the service provider and tenant. The service provider should provide a clear debt and disconnection policy to all occupants. This sets out the approach by the service provider to a customer with payment difficulties and under what circumstances a customer might be disconnected from their heat supply.

Where possible, a service provider should make provision for a pre-payment heat meter to be fitted and if necessary set the tariff such that there is a contribution to debt repayment. This should be the preferred route to managing debt rather than disconnecting customers.

Customers who are registered as a vulnerable customer for heat and/or hot water consumption should not have their heat or hot water disconnected during the winter months (as defined as October to March inclusive).

**Appendix 9;**
**Policy background**

a. **SBC Low Carbon Strategy draft document**
b. **Borders Energy Agency Constitution**

# SCOTTISH BORDERS
# LOW CARBON STRATEGY
***2012 – 2032***

## *DRAFT*

**Contents**

## 1. Why do we need a Low Carbon Economic Strategy?

### 1.1 Low Carbon Economy - Drivers

Climate change is the greatest environmental challenge that we face and the scientific consensus and growing political will to address the issue is gathering pace to change the global context in which business operates. Moving to a low carbon economy not only addresses an environmental imperative, it makes business sense.

The Stern Review states that if the world fails to stabilise emissions in a relatively short space of time, it could lead to problems on a scale similar to those associated with the world wars and the economic depression of the first half of the twentieth century. A general message is that early action will cost the World`s economies less in the long run than putting off such action. It suggested that developed economies should reasonably sacrifice just over 1% of current GDP to mitigation activities now, to avoid higher GDP losses in the future. As a rough approximation, this currently equates to around £900 million per year in Scotland.

According to the Stern Review the cost of doing nothing to address climate change is far greater than the cost of acting. The Review estimates that 'if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global *GDP* each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of *GDP* or more. In contrast, the costs of action - reducing greenhouse gas emissions to avoid the worst impacts of climate change - can be limited to around 1-2% of global *GDP* each year' [8], in other words we cannot afford not to take action. A more recent study by the Climate Change Committee identified that adapting businesses to climate change now may reduce the damage from future climate change by about 50%[9] .

Climate change presents major challenges for Scotland's land using industries, but a well planned and coordinated adaptation response can reduce the negative impacts and highlight potential opportunities.

The Government sees that reducing greenhouse gas emissions and transitioning to a low carbon economy will help create a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth.

The Climate Change (Scotland) Act 2009 received Royal Assent on August 4 2009. The Act sets ambitious targets for emissions reductions, and its key objectives are set out below.

- The Act sets an interim 42 per cent emissions reduction target for 2020, and an 80 per cent reduction target for 2050
- Contains provisions which will allow the Scottish Ministers to establish a Scottish Committee on Climate Change
- It places duties on the Scottish Ministers requiring that they report regularly to the Scottish Parliament on Scotland's emissions
- It places climate change duties on Scottish public bodies and contains powers to enable the Scottish Ministers to impose further duties on public bodies in relation to climate change.
- It includes provisions for adaptation, forestry, energy efficiency and waste reduction, with public engagement being a significant feature in all areas.

## 1.2 Definition of a Low Carbon Economy.

A 'low carbon economy' must be seen as a clear objective for all sectors within a local economy, not as a restricted list of certain industries or services. A reduction in the carbon intensity of all activities across an area is key to the success of this transition. This, along with a strategic approach to the attraction of new low carbon enterprises which can access an appropriately skilled and committed workforce, will drive this essential change and deliver increased energy security and resilience in an increasingly unpredictable future.

The characteristics of a local low-carbon economy, as defined by IDeA[1], include "Clean, secure and affordable sources of energy; low carbon infrastructure, buildings, products and services; accessible, efficient, low-carbon transport; high waste recycling and has the necessary local infrastructure to do so; innovative economies with diverse employment; high skills-development infrastructure for the current and future workforce."

A Low Carbon Economy will integrate all aspects of the economy from its manufacturing, agriculture, transportation, and power-generation, etc. around technologies that produce energy and materials with little greenhouse gas (GHG) emissions, and, thus, around populations, buildings, machines, and devices that use those energies and materials efficiently, and, dispose of or recycle its wastes so as to have a minimal output of GHGs.

Furthermore, it has been proposed that to make the transition to an LCE more economically viable in the shorter term we will have to attribute a cost (per unit output) to GHG emissions through means such as emissions trading and/or a carbon taxation. This is already having an impact on a number of organisations in the form of budgeting for the Climate Change Levy and Carbon Reduction Commitment.

A Low Carbon Economy is a key feature of the European, United Kingdom and Scottish Parliaments' policy framework and the development of a Low Carbon Economic Strategy by Scottish Borders Council is crucial to the future economy of the area.

## 1.3 Scottish Borders Economy

The draft Economic Strategy for the Scottish Borders 2011-20 sets out a series of challenges for the area. 76% of working age people in the Scottish Borders are economically active, just below the Scottish average, average earnings are also lower, operating over 5% lower than the Scottish level.

The demography of the Scottish Borders is one of under-representation of young adults compared to Scotland, and a higher proportion of people aged 65 and over compared to Scotland. To address the continued out-migration of young people, the area must offer attractive work options which can encourage people to stay in the area, new people to locate to the area, and/or raise the value of employment on offer. This is seen as a key issue for the future of the local economy.

The Scottish Borders economy must focus on areas where it has a level of competitive advantage, niche manufacturing (in textiles particularly), tourism, construction, farming and production, processing and retail of food and drink. We must add to this list a range of low carbon opportunities, especially in some of the key renewable energy sectors such as woodfuel and small scale hydro. We must also pursue the benefits of low carbon processes within all business sectors

[1] Improvement and Development Agency 2005

if they are to maintain any competitive advantage in an era of spiralling energy costs and likely issues around food security and local supply.

In developing a low carbon economic strategy, we can generate demand for new skills thus supporting increased employment opportunities.

The Economic Strategy also notes that 'the concept of a 'place' is fundamental to competitiveness, not only providing the physical, social and cultural infrastructure for businesses, it attracts and retains a workforce for the future. This concept of place should be developed into one of a dynamic, forward thinking, low carbon area, offering increased resilience to future challenges.

### 1.4 The Rural Dimension

Ambitious targets have been set by the Scottish Government for the reduction of greenhouse gas emissions, however there is as yet no single approach to developing a route to a low carbon rural economy. There is also limited understanding of how the contributions required by rural areas to these reduction targets can be quantified and delivered effectively, and how best to progress the transition to a low carbon rural economy ensuring that the benefits of such a move will benefit rather than disadvantage rural areas.

The Scottish Government has commissioned a 5 year research programme on 'Developing a 'low carbon rural economy', to be undertaken by the Scottish Agricultural College and the James Hutton Institute. This is part of a larger programme of work exploring the theme of economic adaption, and more specifically a rural economy resilient to global and local change. Case study areas will be used in a number of rural areas including Dumfries and Galloway.

### 1.5 Scottish Government Objectives

The UK and Scottish Governments are both committed to developing a low carbon economy, and key legislation in the form of the Climate Change (Scotland) Act 2009 in now in place. The Scottish Government launched a specific 'Low Carbon Economic Strategy' in November 2010 demonstrating its strong commitment towards transforming the Scottish economy into a world leading low carbon economy. Its new 'Government Economic Strategy', launched in October 2011, establishes a new Strategic Priority - Transition to a Low Carbon Economy. This reflects the significant opportunity that Scotland has to secure investment and jobs from this growing sector and to ensure that the benefits of this transformational change are shared across the economy and our communities.

The stated Scottish Government aspiration for a Scottish Low Carbon Economy is:

'The transition to a low carbon economy heralds an exciting but challenging economic and social transformation. By 2020, and certainly by 2050, Scotland will have a highly sustainable and prosperous economy where Scotland is a major player and beneficiary in the development of global low carbon markets.'

The Scottish Government believes that this transition presents a range of low carbon global market opportunities, not just in the renewables industry but in every sector and business across Scotland, exploiting natural and intellectual assets. Key issues to consider are:

- the strategic priorities and mechanisms to help realise the scale of potential market opportunities in a national and global context;
- the challenges and opportunities of helping existing firms and sectors adapt to a changing climate;
- how to increase the support in innovation, investment and skills necessary to drive change;
- the need to assist behavioural changes among businesses and individuals; and
- the need for a strategic and coherent approach across the public sector.

Many of the impacts and changes envisaged by the Scottish Government will be local impacts, but felt in all parts of Scotland, by all businesses and communities. The economic and competitive future of the Scottish Borders depends on how well our businesses and communities respond to this challenge. It is therefore crucial that we develop a clear approach and plan around how we will respond at a local level to help the transition to a low carbon economy.

The focus of central and local government and wider public sector activity will be directed at areas where most added value can be achieved. This is outlined in the strategic objectives and immediate actions for government and the wider public sector contained within the Scottish Government Low Carbon Economic Strategy.

Scottish Government Strategic Objectives

1. **Transformation Across the Whole Economy**
2. **Transforming the Energy Sector**
3. **Transforming the Built Environment**
4. **Decarbonising Transport**
5. **Scotland's Resources**

Supporting this, Scottish Enterprise has set out its view of business opportunities offered by a low carbon approach:

- Scotland's economy could gain significant productivity improvements through better management of energy, water, waste and natural resources; and
- The continued rapid development of environmental and clean technologies across all sectors could form over 10% of the Scottish economy by 2015.

## 2. Scottish Borders Low Carbon Vision and Objectives

### 2.1 Vision

The suggested vision for a Scottish Borders low carbon future is:

> **'The future direction of the Scottish Borders will be that of a resilient, low carbon economy, offering a thriving and forward thinking region to its residents and businesses.'**

The new Environment and Infrastructure Department of Scottish Borders Council has set out as series of five priorities, one of which is to *'Champion a Low Carbon Economy - we will think and operate in a way that minimises carbon emissions and delivers economic growth and quality of life improvements.'* This Priority has been developed in response to clear national strategies, as well as the duties for Local Authorities that the Climate Change (Scotland) Act 2009 has put in place.

The Scottish Borders Economic Strategy recognises the need for a Low Carbon Economic Strategy. This strategy would support the future competitiveness of our economy and provide a clear approach for the Council in fulfilling its roles as a Leader, Operator and Regulator for local low carbon issues.

The economic benefits of development of a low carbon approach are potentially considerable, and can offer long term opportunities. The Scottish Borders cannot delay in preparing for the inevitable move towards less carbon intensive activity, and must position itself to take advantage of this as an early adopter.

The outcomes of this approach could be in terms of:

- The Borders is a location of choice for renewable energy businesses and contribute to the low carbon economy of the area.
- Businesses locate in the Borders because all electricity is generated from local renewable sources
- A re-skilled workforce is able to take advantage of new business opportunities
- Opportunities for academic linkages in Research and Development are taken forward
- Wind, hydro, biomass, ground source, energy from waste and solar energy are all appropriately used without damaging the landscape
- Local communities are more self-sufficient and sustainable through the benefits of renewable energy schemes.
- Farms are instrumental in promoting and using renewable energy
- Community renewable energy and waste reduction projects are commonplace
- The Broadband and communications infrastructure enables flexible working practices and enables new business opportunities.

## 2.2 Scottish Borders Low Carbon Aims and Objectives

The Council wishes to 'Champion a Low Carbon Economy - we will think and operate in a way that minimises carbon emissions and delivers economic growth and quality of life improvements.'

Along with Community Planning Partners, we will aim to:

- Support residents to access assistance to reduce their personal carbon footprint including home energy efficiency, sustainable resource use and waste reduction;
- Support businesses in their move to become less carbon intensive in their operations, and also assistance to exploit low carbon business opportunities for instance in supply chains and new markets;
- Encourage a low carbon built environment that will reduce carbon emission through all phases of the building process;
- Reduce the need for travel and encouraging a shift to low carbon forms of transport;
- Ensure joined up development across the policy landscape, for example assisting health and social care to deliver carbon reductions.

To deliver these aims the following objectives are proposed.

### Objective 1: Carbon Reduction Support to Individuals

Existing support is available from a range of sources across direct energy efficiency advice and support for waste reduction and recycling. A range of financial support schemes have been available to domestic clients. Funding mechanisms are due to change from October 2012 when the Green Deal and the associated Energy Company Obligation is launched.

### Objective 2: Carbon Reduction Support to Businesses

As above, existing support is available from a range of sources to business clients, however financial support schemes have been limited to some renewable energy grant schemes and loan funds. Funding through the Green Deal will be available to commercial enterprises.

### Objective 3: Develop Renewable Energy Sector

The Scottish Borders has yet to develop a strategic approach to the delivery of all scales of renewable energy schemes. Huge renewable potential exists in the area which is rich in woodfuel and small scale hydro resources. The development of such initiatives has been limited and consequently the economic benefit has not been delivered in terms of reduced fuel costs and support for local skills and employment. A strategic assessment of potential schemes alongside pilot projects for demonstration purposes is essential in the short term.

**Objective 4: Low Carbon Buildings - Sustainable Places**

Scottish Building standards have been substantially reformed over the last two decades. However, the built environment still accounts for more than 40% of our carbon emissions, generated through the heating, lighting and running of buildings. Clearly it represents a major focus for efforts to reduce emissions and change behaviours and an area where there are both low carbon opportunities and challenges for businesses, investors and householders.

Improvements in the performance of existing buildings through upgrading and retrofitting as well as improved performance of new build will be essential to meet emissions reduction targets. This objective is therefore split into two sections -

**4a. New Build and**
**4b. Retrofit to Existing Buildings**

**Objective 5: Transport & Infrastructure**

The Passenger Transport Service within Scottish Borders Council is charged to achieve one of the local outcomes in the Single Outcome Agreement 2009-2012, to ensure that “The Borders has an inclusive public transport infrastructure that integrates locally, nationally, internationally.”

The provision of good quality transport services is vital for the residents of the Scottish Borders, as recognised by the new Council Administration in its Partnership Agreement document, Ambitious for the Borders 2012. To be efficient, effective and affordable, these services need to be designed to be sustainable in the longer term, with greater use of partnership working between the Council, the NHS/Scottish Ambulance Service and the voluntary sector, as recommended in the Audit Scotland Transport for Health and Social Care report, August 2011. We also have to ensure that the services meet all of the changing needs of our residents. Bus services in particular can also contribute to climate change/low carbon economy objectives if more of our residents can be encouraged to use them in preference to the private car.

**Objective 6: Skills and Education**

Looking forward to 2016, job opportunities are likely to have come from food and drink businesses expanding; a resurgence in construction sector activity; opportunities that have developed around renewable energy; the continued growth of tourism in the area; new creative sector businesses starting up in the Borders; and also increasing demand from the care sector. Textiles and agriculture, whilst not expanding, will continue to provide employment opportunities.

These growing businesses will be looking for an adaptable, multi-skilled workforce with a strong work ethic, good interpersonal skills, sound technology skills and a commitment to lifelong learning.

**Learning and Skills Partnership Strategy – Extract from ‘Meeting the Challenge’**
‘We are clear that we have a need to develop the skills of all individuals, at all levels of employment, and to contribute to the improved performance and productivity of all businesses. We aim to raise the aspirations of our young people, our current workforce and our businesses. We want to ensure that our economy is dynamic and provides opportunities for everyone.’

Of particular relevance to a low carbon transition is **Theme Four: Workforce Development of Meeting the Challenge**

A. We will develop an integrated and more coherent approach to engagement with local businesses and other employers

B. We will improve the dialogue between agencies and providers and local businesses to ensure that training opportunities are relevant to the needs of our local industries
C. We will work in partnership with local employers to improve the level and utilisation of skills in our local workforce
D. We will provide access to a range of appropriate learning and training opportunities which meet the development needs of the existing workforce.
E. We will work with public sector partners to establish workforce development plans which meet the needs of our community.

**Objective 7: Adaptation and Resilience**
In the future, Scotland's climate is likely to be warmer and wetter in winter, and drier and hotter in summer than it is now.

Scotland has a number of social, economic and environmental characteristics that will increase its vulnerability to some of the damaging impacts of a changing climate. These include an uneven spread of population across the country, an ageing and elderly people more vulnerable to the impacts of extreme weather, very remote communities that are vulnerable to transport disruption and interruption to critical services, and deprived communities which will become increasingly vulnerable to the adverse effects of a changing climate. These issues are all of clear importance to the Scottish Borders with its huge geographic area, vulnerable transport network and dispersed rural population.

## 3. Who is the Strategy Aimed at?

A Scottish Borders Low Carbon Economic Strategy is aimed at any organisation operating in the Scottish Borders which wishes to take part in the transition to a low carbon area. It is hoped that these partners will encompass government bodies, businesses, community and voluntary organisations and individuals.

The strategy process is also aimed at informing the public of what these partners intend to do, with a view to enabling the public to influence the activity of partners and to realise the benefits of a low carbon future.

Scottish Borders Council is leading the development of this strategy and sees itself as having a multiple role in the low carbon transition.

***Leader***
The Council will lead by example: changing our own decision-making and behaviour in order to adopt best practice in relation to carbon reduction and to continually improve our environmental performance.

***Operator***
The Council will co-ordinate our work with partners: integrating our policies, planning and operations, both within and between organisations, to identify low carbon opportunities across all of our service areas.

***Regulator***
The Council will use its influencing role: informing, advising and educating to ensure that carbon reduction is central to day-to-day behaviour and decision-making, from major organisations through to individual members of the public.

The LCES will form a key part of the refreshed Community Plan in the Scottish Borders, aligned to the Economy and Infrastructure theme.

The strategic objective for the community plan is:
***'To work in partnership with other key public, voluntary and private bodies together with communities and businesses to maintain and improve the quality of life and meet the needs of***

***Borders residents and their communities through the delivery of high quality public services, projects, advocacy and other actions'***

The LCES is also a mechanism for enabling the local implementation of national and international strategies and agreements, and achieving the targets contained therein.

## 4. What is happening already?

The existing strategic and policy landscape of the Scottish Borders is already laying the foundations of a low carbon transition, with a range of strategic planning processes in place or being developed. These are then complemented by a series of project areas around local landscape and habitat management, town centre regeneration, placemaking and design and major transport and infrastructure initiatives. Examples of strategic processes which will be key to underpinning the movement to a low carbon future are the Local Development Plan and the Economic Blueprint.

### 4.1 Local Development Plan

Vision – In 2024 the Scottish Borders will continue to be an excellent place in which to live and work, with improved job opportunities, housing availability and connectivity. Development will be sustainable and meet the challenges of a changing climate. The built and natural environment will continue to be high quality and support economic development and provide for recreational and leisure activities.

Inherent within the overall vision and aims of the Local Development Plan is a clear recognition of the need to move towards a low carbon future.

'The need to mitigate the causes of climate change and the need to adapt to its short and long term impacts should be taken into account in all decisions throughout the planning process. Climate change touches upon a wide range of matters including flood risk and drainage, the water environment, green networks, sustainable design, water, air and soil management, carbon storage, energy infrastructure and production, sustainable travel and waste planning.'

### 4.2 Ambitious for the Borders & Economic Strategy

As noted in section 1.3, it is intended that the Economic Blueprint will be delivered over a 10-year period to 2020, however this approach has been modified to some extent by the 'Ambitious for the Borders' commitments made by the new Council administration in May 2012. The partnership agreement for the current programme of local government sets out a range of priorities which support a localised and therefore low carbon approach to service delivery.

The key low carbon priorities are:

- Providing sustainable transport links including demand responsive transport
- Investigating proposals for public energy enterprises based on community and rural renewables

### 4.3 Zero Waste Plan for Scotland

The Scottish Zero Waste Plan is intended to create a stable framework that will provide confidence for the investment necessary to deliver a zero waste Scotland over the next 10 years. It does this by setting out a Mission and Vision for the long term. Within that context the Plan sets strategic directions in the key areas of activity for the medium term up to 5 years, with specific actions setting out immediate priorities.

A zero waste Scotland has many benefits. New waste facilities mean new investment and jobs. As businesses become more resource efficient, costs are reduced and a competitive advantage is gained. A stronger market for recycled material is promoted through separate collections, both householders and businesses will continue to be encouraged not only to recycle as much as possible in order to meet future targets but, in accordance with the Waste Hierarchy, reduce waste arisings in the first place, then consider re-use and repair before then considering recycling. In addition, education and awareness raising activity will continue to be a key priority with a view to having a positive effect on buying habits in the Borders.

**How will this be achieved?**

• Regulations to support separate collections and treatment of resources to provide opportunities for businesses to invest in reuse, recycling and recovery.

• Investigation into 'take back' schemes and other obligations on the producers of certain types of waste.

• Collect and recycle more plastics by developing facilities in Scotland.

• Encourage the public and private sector to buy products made from recycled waste.

### 4.4 Land Management - agriculture & forestry

In a Forward Strategy for Scottish Agriculture: Next Steps, published in March 2006, it was recognised that there was mounting evidence about the prospect of significant climate change. Noting that the agriculture industry could make a contribution towards mitigating climate change, and that also there were potential business opportunities, it recommended that a stakeholder group should be established to evaluate and monitor agriculture's response to climate change, through mitigation and adaptation.

The Agriculture and Climate Change Stakeholder Group (ACCSG) was formed in November 2006 to consider the implications of climate change for Scottish agriculture. The group produced a report of their findings in 2008, which had a recurring theme of the need for greater consistency and co-ordination across different land use policies, such as agriculture, forestry, flooding, biodiversity and landscape but also food and energy security and rural development.

A key outcome of the above work was the establishment of Farming for a Better Climate (FFBC), a programme focussing on 5 priority areas for farmers and land managers to address carbon reduction.

1. Using energy and fuels efficiently
2. Developing renewable energy
3. Locking carbon into the soil and vegetation
4. Optimising the application of fertiliser and manures
5. Optimising livestock management and storage of waste

**Adapting Agriculture to Climate Change**

Most analysis suggests that given adoption of appropriate farming practices and new technologies, agriculture in higher latitude countries such as Scotland can adapt to climate change and potentially benefit from new market opportunities.

It is thought that in many cases, adaptation at the individual farm level will come about automatically as farmers and land managers alter practices to meet a range of changing circumstances, environmental and economic, including wide ranging factors such as CAP reform.

### 4.5 Domestic Energy Advice - Tacking Fuel Poverty

The Scottish Borders is recognised as having a low wage economy and average weekly wages are 22% lower than the average weekly wage in Scotland as a whole. Latest Scottish Housing Condition Survey findings show that 31% (16,000) households in the Scottish Borders are fuel poor. This is a higher proportion than Scotland (25%) and a substantial deterioration since the 2002 SHCS when 17% (8,000) households were fuel poor in the Borders. However, the Scottish Borders also has a slightly higher proportion of dwellings rated 'poor' (7%) than the rest of Scotland (5%). Overall only a third of private dwellings have a good NHER rating (i.e. 8 to 10) which is lower than the rest of Scotland (45%).

Tackling fuel poverty specifically is integral across many aspects of the recently adopted Local Housing Strategy with commitments and actions set out in the Fuel Poverty Implementation Plan 2009-2014.

The objectives of the strategy are:

- To improve the understanding of fuel poverty in the Scottish Borders in order that the Council can improve targeting of services
- Provide ongoing fuel poverty advice and information to households in all tenures
- Increase energy and fuel efficiency of housing in all tenures
- Reduce the number of low income households living in fuel poverty
- Work with partner organisations to reduce the number of households in the Scottish Borders living in fuel poverty.

It is estimated that around three-quarters of savings required to deliver Scottish carbon reduction targets could be delivered from housing – this requires substantial behavioural change as well as increasing home energy efficiency and moving to low carbon heat. The energy efficiency measures required to make a difference to the emissions targets require a step change in insulation of domestic buildings, including the insulation of all suitable cavity walls in Scotland and enhancement of all loft insulation. Given the type and quality of the majority of the existing housing stock in the area, finding new and feasible ways to substantially increase energy efficiency, which is also attractive to the householder will be a challenging, yet critically important task for a low carbon strategy.

Currently free energy advice is available to Borders residents from the Council Home Energy Adviser, the Energy Saving Scotland Advice Centre (Changeworks), the Energy Saving Trust, utility companies and the Registered Social Landlords. This advice helps clients to access funding to support a range of energy efficiency support, some of which is free dependent on circumstances.

### 4.6 Renewable Energy Generation & Borders Energy Agency

Renewable energy generation figures for 2010 and 2011 showed that renewable installed capacity in Scotland reached a record high of 4.3 gigawatts (GW) over the year, and that Scotland continued to be a net exporter of electricity in 2010, exporting 21 per cent of electricity generated.

Although national and local policy support and guidance exits to encourage the appropriate installation of renewable energy technologies, the Scottish Borders has yet to develop a strategic approach to the delivery of schemes. Much renewable potential exists in the area which is rich in woodfuel and small scale hyrdo resources. Hitherto the development of such potential has been limited and consequently the economic benefit has not been delivered in terms of reduced fuel costs and support for local skills and employment.

**Need for a Borders Energy Agency**

During a Council review of Renewable Energy – the Challenges and Opportunities for the Borders[2], the need for a source of independent support and advice to communities was identified as a priority. The review also concluded that although many different organisations were involved in delivering services directly related to renewable energy there were significant gaps in service provision and a lack of co-ordination.

**Purpose**

The Borders Energy Agency (BEA) was registered as a Scottish Charitable Incorporate Organisation in February 2012, and is seeking funding to become the first ‘one-stop shop’ for renewable energy, energy management and energy conservation services in the Scottish Borders.

Although there are national and local organisations delivering some related services, at present services are not integrated and there are major gaps in provision, resulting in lost opportunities. BEA will not only address these gaps but provide, directly or indirectly, through existing agencies, companies and partners, a much broader range of services to a wide range of customers

[2] Scottish Borders Council January 2011

### 4.7 Scottish Enterprise Low Carbon Implementation Plan 2012-13

By helping to accelerate the move to a low carbon economy, Scottish Enterprise (SE) are supporting Scottish companies to become more profitable by reducing costs and exploiting new low carbon market opportunities.

The SE Low Carbon Implementation Plan summarises planned actions for 2012/13. It provides a comprehensive overview of the actions being taken to help deliver sustainable, low carbon economic development.

Key actions include:

1. SE will promote and maximise new economic opportunities from a low carbon economy in support to growing companies, sectors and the wider business environment.
2. SE will help companies realise the business benefits of sustainable business practices and resource efficiency through the strategic discussions with growth companies.
3. SE have embedded a low carbon approach into its Business Plan and will undertake carbon assessments of all projects and programmes to maximise opportunities and minimise emissions.
4. SE will reduce $CO_2$ emissions by 42% by 2020 from a 2009/10 baseline, and work with partners to promote good practice.

An example of specific support to the construction sector is the Low Carbon Built Environment (LCBE) Expert Service. This is a free service which prepares construction companies for the low carbon market by offering:

- Practical advice on commercialisation issues such as design or prototype development
- Advice on collaborative innovation between companies, academia and other organisations
- Funding opportunities and advice on relevant Scottish Enterprise products

## 5. What actions do we need to take?

The framework of actions required is set out in the attached action plan which spans three phases:

- **Short Term Actions 2012-15**
- **Medium Term Actions 2015-2022**
- **Longer Term Actions 2022-2032**

## 6. How can we make it happen?

### 6.1 Delivery & Resources

As noted in section 3, the LCES is a key priority for the Scottish Borders Community Planning Partnership, and is a key priority within the Economy and Infrastructure strategic theme, and Programme Delivery team for this theme is chaired by Rob Dickson. A report to SBC Executive Committee on 30th August 2012 states ‘It is proposed that a joint programme of work is developed under each of the 4 strategic policy themes. A Programme Delivery Team, involving partners and officers of the Council, would be established for each theme and would co-ordinate a structured programme of work, influenced by SBC’s and partners’ corporate vision and priorities. Much of the work within these programmes builds on existing joint activities that are being taken forward by partnerships.’ These proposals around community planning were approved on the 30th August 2012.

It will be important that the recently formed Borders Energy Agency is positioned to take advantage of the changing role of the Council as an enabler rather than a direct service provider, and can support much of the delivery of actions within the LCES. The establishment of a Borders Energy Agency will support a range of Council objectives, and it is intended that although the organisation is wholly independent, it is important that the Council and key partners recognise, support and empower the Borders Energy Agency. There are specific service areas which are currently under consideration for future joint delivery.

### 6.2 Monitoring & Reporting

To ensure effective delivery of the actions which will be agreed within the LCES Action Plans, a set of clear indicators will be required, which will be reported against to the Theme leads and to the Community Planning Strategic Board.

## 7. Consultation with Partners

**A consultation programme will be detailed, including:**

- Discussion programme with key stakeholders
- Open meetings linked to partner events
- Consultation through the Community Planning structure

## APPENDIX 2

| SCOTTISH BORDERS<br><br>LOW CARBON ECONOMIC STRATEGY |
|---|

**APPENDIX A: ACTION PLAN**

Proposals for action relating to each of the themes and actions introduced in **Sections 2 & 5** are shown below.

The actions are seen as priority first steps in the move to a low carbon economy, although it is accepted that not all actions will be initiated and delivered within the first 3 years of the strategy.

**Indicators** are identified to enable progress to be measured and monitored in terms of outputs, or activity, and in terms of their estimated carbon savings

The current consultation exercise is intended to produce agreement between the key partners across the Scottish Borders as to the immediate priority actions and to secure commitment to their delivery.

**Timescale**
The following timings are suggested to assist in delivery and resource planning.

**Short:** 1-3 years
**Medium:** 3-10 years
**Long:** 10-20 years

### Objectives

1. **Carbon Reduction Support to Individuals**
2. **Carbon Reduction Support to Businesses**
3. **Develop the Renewable Energy Sector**
4. **Low Carbon Buildings – Sustainable Places**
5. **Transport and Infrastructure**
6. **Skills and Education**
7. **Adaptation and Resilience**

## OBJECTIVE 1: CARBON REDUCTION SUPPORT TO INDIVIDUALS

| Proposed Actions | Timescale (Short, medium, long) | Lead Partner | Output | Indicator |
|---|---|---|---|---|
| **1.1** Develop broadly based Fuel Poverty strategy which will deliver reductions on fuel poverty levels<br><br>1.1.2 Agree resourced implementation plan for strategy | S by Mar 2014<br><br>S by Jun 2014 | SBC (Housing Strategy Team)<br><br>SBC (Housing Strategy Team) | Fuel Poverty Strategy produced<br><br>Action plan implemented | Reduction in levels of fuel poverty in the Scottish Borders |
| **1.2** Develop co-ordinated Borders based home energy advice service (which includes objectives of Zero Waste Scotland Plan.)<br><br>1.2.1 Review of existing support offered by providers<br><br>1.2.2 Assess/analyse role of EST/ESSAC/SBC in accessing Energy Company Obligation<br><br>1.2.3 Establish sub-group of New Borders Alliance (housing network) to address ee/GD/ECO planning/delivery | S by 2014<br><br>S by June 2013<br><br>S by March 2013<br><br>S by March 2013 | SBC (Housing Strategy Team /Energy Economics)<br><br>(Housing Strategy Team /Energy Economics)<br><br>(Housing Strategy Team /Energy Economics)<br><br>SBC (Housing Strategy Team) | Establishment of process for delivery of advice. | Increase in uptake of advice and number of clients helped. |

| | | | | |
|---|---|---|---|---|
| **Proposed Actions** | **Timescale (Short, medium, long)** | **Lead Partner** | **Output** | **Indicator** |
| **1.3** Draw down maximum S Govt funding to support home energy advice<br><br>1.3.2 Develop pilot project to assess a sample of specific house types, to identify bespoke technical solutions for energy conservation linked to placemaking and heritage objectives. | S by Nov 2013<br><br>S by June 2013 | SBC (Housing Strategy Team /Energy Economics Team)/Registered Social Landlords<br><br>SBC (Heritage and Design Team) | Development of programme agreed with S Govt to deliver increased level of dedicated support to Scottish Borders | Increase in level of resource coming to Borders and number of clients helped. |
| **1.4** Maximise Green Deal (GD) and Energy Company Obligation (ECO) opportunities by developing effective local programme<br><br>1.4.1 Assess key property issues/types for GD measures as above in 1.3.2<br><br>1.4.2 Maximise ECO funding available to Scottish Borders by linking with S Govt National Retrofit Strategy and other possible funding sources | S by Oct 2013<br><br>S by June 2013<br><br>S by Dec 2013 | SBC (Housing Strategy Team /Energy Economics Team)/Registered Social Landlords | Programme with targets for number of homes with appropriate measures installed<br><br>Production of targeted strategy to secure maximum ECO funding | Increase in number of appropriate energy efficiency and renewable installations<br><br>Increase in number of homes supported to increase energy efficiency |

## OBJECTIVE 2: CARBON REDUCTION SUPPORT TO BUSINESSES

| Proposed Actions | Timescale (Short, medium, long) | Lead Partner | Output | Indicator |
|---|---|---|---|---|
| **2.1** Extend and refocus business support services to adopt low carbon activity including waste reduction and recycling activity.<br><br>**a)** Build on Scot Enterprise current programmes increase targets by 10% pa<br><br>**b)** Build support on carbon reduction issues into Business Gateway services<br><br>**c)** Build standard requirement on carbon reduction support into tourism, regeneration, events advice/facilitation. | S by Sept 2013<br><br>S by Dec 2013<br><br>S by Mar 2014<br><br>S by Mar 2015 | SBC (Economic Development Team)/Scottish Enterprise<br><br>Scottish Enterprise<br><br>SBC (Economic Development/Business Gateway)<br><br>SBC (Economic Development)/VisitScotland | Integration of low carbon advice into business support as standard | Increase in number of businesses adopting low carbon practices, reducing their carbon footprint and therefore costs. |
| **2.2** Develop pilot business loan scheme to incentivise commitment to carbon reduction and wider sustainability goals<br><br>2.2.1 Consider feasibility of additional small capital grant to install measures for priority small businesses | S by Mar 2014<br><br>S by Jan 2014 | SBC (Economic Development/Business Gateway)<br><br>SBC (Economic Development/Business Gateway) | Integration of low carbon objectives into financial support mechanisms to local businesses. | Number of grant applicants taking forward low carbon actions. |

| | | | | |
|---|---|---|---|---|
| **Proposed Actions** | **Timescale (Short, medium, long)** | **Lead Partner** | **Output** | **Indicator** |
| **2.3** Increase knowledge of low carbon options and support among local business<br><br>2.3.1 Develop directory of case studies of good practice<br><br>2.3.2 Develop 'green' business support network/'buddy' system supported by SBC Economic Development Team.<br><br>2.3.3 Deliver programme of 'carbon conversations' for local businesses supported by SBC/SE | <br><br>S by Dec 2013<br><br>S by Mar 2014<br><br>S by June 2013 | SBC (Economic Development/Business Gateway)/Chamber of Commerce/Scottish Enterprise | Integration of low carbon objectives into all support mechanisms to local businesses. Development of programme support mechanisms. | Increase in number of local businesses taking part in support activities and pursuing low carbon business models. |

## OBJECTIVE 3:  DEVELOP THE RENEWABLE ENERGY SECTOR

| Proposed Actions | Timescale (Short, medium, long) | Lead Partner | Output | Indicator |
|---|---|---|---|---|
| **3.1** Support development of the Borders Energy Agency (BEA)<br><br>3.1.1 Commission BEA to develop renewables strategy for the Borders for communities, individuals, business and public sector. | S by June 2013 | SBC (Economic Development Team)/Scottish Enterprise/BEA/Community Energy Scotland | BEA will have accessed funding to allow project delivery. | Actions/projects delivered by BEA and carbon footprint of Borders reduced. |
| **3.2** Pursue establishment of Scottish Borders Woodfuel Forum<br><br>3.2.1 Work with Forestry Commission to extend activity of SoS Woodfuel Forum as precursor to establishment of separate Borders Forum | S by Mar 2014<br><br>S by June 2013 | SBC (Econ Dev Team/Countryside and Heritage Team)/Forestry Commission/BEA | Borders Woodfuel Forum established and local support activities delivered. | Existence of Borders Woodfuel Forum and increase in information and networking activity in Scottish Borders |
| **3.3** Encourage supply chain by prioritising local woodfuel suppliers and technology installers for business support advice | S by Dec 2013 | SBC (Economic Development/Business Gateway)/Chamber of Commerce/Scottish Enterprise | Increase in value of woodfuel supply chain activity. | Number of local woodfuel businesses supported. |

| | | | | |
|---|---|---|---|---|
| **Proposed Actions** | **Timescale (Short, medium, long)** | **Lead Partner** | **Output** | **Indicator** |
| 3.3.1 Linked to 2.3 – support advice to woodfuel businesses to increase access to markets/customers, target and prioritise.<br><br>3.3.2 Consider opportunities to add value to existing timber resources through provision of kiln drying facilities. | S by Dec 2013<br><br>S by March 2014 | | Increase in value of woodfuel supply chain activity.<br><br>Pursue feasibility study for kiln drying opportunities. | Number of local woodfuel businesses supported.<br><br>Completion of feasibility study. |
| **3.4** Develop joint action with partner agencies, e.g. Scottish Water to develop new technologies and systems to reduce carbon intensity in processes | S by Mar 2015 | SBC/SE | Development of series of joint initiatives resulting in reduced carbon emissions. | Number of new low carbon processes developed and feasibility tested. |
| **3.5** Identify key industry partner to develop series of priority small scale hydro energy schemes. Schemes to act as demonstration opportunities, attracting further investment in additional sites across the area. | S by Mar 2015 | SBC (Economic Development Team/Energy Economics Team)/Scottish Enterprise | Agreement with industry partner and establishment of targeted series of small scale schemes. | Number of hydro schemes identified and progressed. |
| **3.6** Develop local strategy for delivery of district heating schemes. | S by Mar 2015 | SBC (Forward Planning Team/Energy Economics Team)/Borders Energy Agency | Agree local strategy for installation of local schemes. | Number of district heating schemes installed. |

**OBJECTIVE 4: LOW CARBON BUILDINGS - SUSTAINABLE PLACES**
**4A: NEW BUILD**

| Proposed Actions | Timescale (Short, medium, long) | Lead Partner | Output | Indicator |
|---|---|---|---|---|
| **4a.1** Include energy efficiency as a key criteria in annual Design Awards assessment, and promote buildings which have achieved high Building Regulations ratings for energy efficiency/low carbon. | S by Dec 2012 | SBC (Countryside and Heritage Team) | Addition of energy criteria to Design Awards and promotion of good practice. | Number of submissions demonstrating good practice in low carbon building. |
| **4a.2** SBC to publicise local examples of low/zero carbon demonstration developments in partnership with developer. To include examples of SBC commissioned / delivered projects / Eildon HA & private sector to show range of opportunities | M by Mar 2016 | SBC (Development Management Team) | Publication of good design practice. | Number of examples of low carbon case studies identified. |
| **4a.3** Provide programme of CPD events for design and construction professionals using key demonstration sites identified above. | S by Mar 2014 | Borders Energy Agency /SBC (Development Management Team) | Delivery of training sessions | Number of training sessions delivered. |
| **4a.4** Agree SBC approach to low carbon developments in relation to application of Building Regulations to deliver improved performance. | S by Mar 2014 | SBC (Development Management Team) | Production of SBC Advice Note | Number of applications submitted with reduced carbon impact. |

| | | | | |
|---|---|---|---|---|
| **Proposed Actions** | **Timescale (Short, medium, long)** | **Lead Partner** | **Output** | **Indicator** |
| **4a.5** Ensure implementation of above approach through provision of information and guidance to public/applicants/developers on low carbon construction and design.<br>Incentives will be required to make this work e.g. priority assessment of Building Standards applications if proposal exceeds minimum requirements. | S by Dec 2013 | SBC (Development Management Team) | Standard advice provided by SBC planning Officers | Number of applications submitted with reduced carbon impact. |
| **4a.6** Provide programme of training and awareness raising on low carbon building for officers, Elected Members and community partners<br>This is especially important for SBC Client groups / decision makers / Finance to ensure a clear understanding of requirements for additional time & budget at design stage if this is Action is to be successful. | S by Mar 2014 | SBC (Development Management Team)/Energy Economics Team | Delivery of training sessions. | Number of delegates trained. |
| **4a.7** Create a demonstration project of a small sustainable business park to attract inward development aimed at attracting micro-energy businesses. | M by Mar 2015 | SBC (Economic Development / Architects) | Energy efficient / sustainable units available for rent | Creation of facility |
| **4a.8** Create a demonstration project of private ownership low carbon housing (12 units) with the purpose of demonstrating commercial viability for the mainstream market. | M by Mar 2016 | SBC (Economic Development / Architects / Local Developer | Energy efficient housing for sale at an affordable price that looks like mainstream housing. | Creation of facility |

**OBJECTIVE 4: LOW CARBON BUILDINGS - SUSTAINABLE PLACES**
**4B: RETROFIT TO EXISTING BUILDINGS**

| Proposed Actions | Timescale (Short, medium, long) | Lead Partner | Output | Indicator |
|---|---|---|---|---|
| **4b.1** Develop effective programme of Green Deal delivery for the Scottish Borders (Link to 1.4) | S by Dec 2013 | SBC (Housing Strategy Team /Energy Economics Team)/Registered Social Landlords | Programme with targets for number of homes with appropriate measures installed | Increase in number of appropriate energy efficiency and renewable installations |
| **4b.2** Develop pilot project to assess a sample of specific house types in the Borders, to identify bespoke technical solutions for energy conservation linked to placemaking and heritage objectives. (Link to 1.4) | S by Jan 2013 | SBC (Housing Strategy Team /Energy Economics Team / Architects)/Registered Social Landlords | Delivery of pilot project | Number of bespoke applications developed. |
| **4b.3** (Link to **3.6**) Promote inclusion of local heat networks within appropriately sized new housing/business developments through planning policy and implementation process. | S by Dec 2013 (LDP timetable) | SBC (Forward Planning Team/Energy Economics Team)/Borders Energy Agency | Agree local strategy for installation of local schemes. | Number of district heating schemes installed. |

## OBJECTIVE 5: TRANSPORT & INFRASTRUCTURE

| Proposed Actions | Timescale (Short, medium, long) | Lead Partner | Output | Indicator |
|---|---|---|---|---|
| **5.1** Development of a sustainable and combined transport services project for the Scottish Borders<br><br>5.1.1 Appointment of project manager and development of Project Initiation Document<br><br>5.1.2 Development of partnership solutions. | <br><br><br>S by March 2013<br><br>M by March 2014 | SBC Chief Executives Office on behalf of Community Planning Joint Delivery Team | Range of innovative, integrated, value for money transport options for Scottish Borders residents.<br>Integrated transport solutions for older people accessing health and social care services.<br>Simple, efficient and environmentally friendly onward journey options from Stow, Galashiels and Tweedbank stations. | Increased satisfaction with public transport (Scottish Household Survey).<br><br>Increase in percentage of journeys to work made by public or active travel. |
| **5.2** Review Scottish Borders Local Transport Strategy in 2013. | S by Dec 2013 | SBC (Forward Planning Team) | Updated LTS produced. | LTS produced. |
| **5.3** Plan for expanded 'safe cycling' route network | S by Mar 2015 | SBC (Passenger Transport Team) | Plan produced. | Increase in number of proposed routes. |
| **5.4** Develop joint programme of personal travel planning support for SBC & NHS staff | S by Mar 2015 | SBC (Passenger Transport Team)/NHS Borders | Travel plan produced. | Increase in number of staff implementing personal travel plans |

| | | | | |
|---|---|---|---|---|
| **Proposed Actions** | **Timescale (Short, medium, long)** | **Lead Partner** | **Output** | **Indicator** |
| **5.5** Increase promotion and awareness of car sharing for staff | S by Mar 2013 | SBC (Treadlightly Team/NHS Borders | Delivery of promotional materials and awareness sessions. | Increase in number of staff who car share |
| **5.6** Access fuel efficient driving advice for Community Councils. | S by Dec 2013 | SBC (Community Engagement Officer)/Community Councils | Delivery of training sessions | Number of CCs which have accessed training |
| **5.7** Provide next generation broadband services to the Scottish Borders | M by 2020 | SBC/S Govt/Community Planning Partners | Broadband infrastructure in place | Percentage of premises with access to next generation broadband |
| **5.8** Ensure sufficient recharging points across the Borders for electric vehicles | M by Mar 2018 | SBC (Fleet Management Team) | Installation of points | Number of recharging points installed |
| **5.9** Investigate options for public transport shuttles between major employers and key towns | S by Dec 2013 | SBC (Passenger Transport Team) | Assessment of options and produce recommendations | Recommendations implemented |

## OBJECTIVE 6: SKILLS AND EDUCATION

| Proposed Actions | Timescale (Short, medium, long) | Lead Partner | Output | Indicator |
|---|---|---|---|---|
| **6.1** Support delivery of programme of low carbon training opportunities with Borders College | S by Sept 2013 | Borders College /SBC (Economic Development Team)/Scottish Enterprise | Training courses delivered and increase in number of trained individuals. | Increase in number of individuals having completed training courses. |
| 6.1.1 Assess current training opportunities/provision which include low carbon/energy management skills | S by Dec 2013 | Borders College /SBC (Economic Development Team)/Scottish Enterprise | Assessment complete | Recommendations for development/uptake of courses |
| 6.1.2 Assess opportunities for peer support between businesses through low carbon networks/'buddy' systems. | S by Mar 2014 | SBC (Economic Development Team)/Chamber of Commerce | Development of programme support mechanisms. | Increase in number of local businesses taking part in support activities and pursuing low carbon business models. |
| 6.1.3 Develop delivery of programme for workshops with secondary schools as part of Curriculum for Excellence | S by Aug 1014 | SBC (ELL) | Programme available for implementation | Programme delivered. |
| **6.2** Develop and resource programme of community capacity building delivering local resilience and low carbon skills | S-M by Mar 2015 | SBC (Community Engagement Officer /Registered Social Landlords | Development of resourced programme of support | Number of community groups with increased capacity and skills as a result of training etc. |
| **6.3** Work with Skills Development Scotland on low carbon apprenticeships – set annual targets for number | S by Mar 2015 | SBC (Economic Development | Agreed programme of apprentice support | Number of apprenticeships created |

| | | | | |
|---|---|---|---|---|
| of apprenticeships | | Team/Borders College /SDS | | |
| **Proposed Actions** | **Timescale (Short, medium, long)** | **Lead Partner** | **Output** | **Indicator** |
| **6.4** Investigate support required to allow local businesses to train staff on energy efficiency skills (energy assessment, installation, etc) | S by Dec 2013 | SBC (Economic Development Team/Scottish Enterprise/ Chamber of Commerce / BCIF if still in existence | Identify support required and sources of funding | Number of local businesses which have diversified into low carbon skills. |
| **6.5** Deliver Theme 4 above of Learning and Skills Partnership Plan – 'Workforce Development of Meeting the Challenge'<br><br>6.5.1 Develop action plan, targets and process for L & S Partnership to address priorities noted – key to low carbon skills development. | S by Mar 2014 | SBC (Economic Development Team)/Borders College /Scottish Enterprise /Chamber of Commerce | Production of action plan. | Delivery of priority actions within action plan. |

## OBJECTIVE 7: ADAPTATION AND RESILIENCE

| **Proposed Actions** | **Timescale (Short, medium, long)** | **Lead Partner** | **Output** | **Indicator** |
|---|---|---|---|---|
| **7.1** Full risk assessment process for climate change risks within SBC as lead partner within Community Plan | S by Dec 2013 | SBC (Properties and Facilities Management Tea/Major Projects Team/Emergency Planning Team/Adaptation Scotland | Risk assessment complete | Reduced exposure to CC risks and increased capacity to respond |
| **7.2** Support/extend community resilience planning to include all extreme weather events response | S by Dec 2013 | SBC (Emergency Planning Team)/NHS/police | Extended resilience plan approved | Number of communities supported |
| **7.3** Support development of community resilience action plans, to cover transportation, essential supplies, medical needs, etc. | S by Dec 2013 | SBC (Emergency Planning Team/NHS/police | Extended resilience plan approved | Number of communities supported |
| **7.4** Undertake scenario planning for extreme weather events using SCLIP models<br><br>7.4.1. Use CC impact to plan for likely emergency/adverse weather events. (link to 7.2)<br>7.4.2 Work with key partners to address forward planning issues, esp. NHS. | S by Mar 2014<br><br>S by Dec 2013<br><br>S by Mar 2014 | SBC (Emergency Planning Team/NHS/police | Deliver scenario planning exercise/project | Reduced exposure to CC risks and increased capacity to respond |

| | | | | |
|---|---|---|---|---|
| **Proposed Actions** | **Timescale (Short, medium, long)** | **Lead Partner** | **Output** | **Indicator** |
| **7.5** SBC to develop Adaptation Plan for all SBC infrastructure<br><br>7.5.1 Scope plan and agree process for development. | S by Dec 2014 | SBC (Properties and Facilities Management Tea/Major Projects Team/Emergency Planning Team/Adaptation Scotland | Adaptation plan produced | Improved ability to predict climate change impacts and plan/resource response |

# Constitution

# of

# Borders Energy Agency

14 November 2011

**Constitution**

**of**

**Borders Renewable Energy Agency**

| CONTENTS | | |
|---|---|---|
| **GENERAL** | type of organisation,<br>Scottish principal office,<br>name, purposes, powers,<br>liability,<br>general structure | Clauses<br>1 - 10 |
| **MEMBERS** | qualifications for membership,<br>application,<br>subscription,<br>register of members,<br>withdrawal, transfer, re-registration, expulsion | clauses 11 - 29 |
| **DECISION-MAKING BY THE MEMBERS** | members' meetings,<br>power to request members' meeting,<br>notice,<br>procedure at members' meetings,<br>voting at members' meetings,<br>written resolutions, minutes | clauses 30 - 56 |
| **BOARD (CHARITY TRUSTEES)** | number,<br>eligibility,<br>election/ retiral/ re-election,<br>termination of office,<br>register of charity trustees,<br>office bearers,<br>powers,<br>general duties,<br>code of conduct | clauses 57 - 84 |
| **DECISION-MAKING BY THE CHARITY TRUSTEES** | notice,<br>procedure at board meetings,<br>minutes | clauses 85 - 100 |
| **ADMINISTRATION** | sub-committees,<br>operation of accounts,<br>accounting records and annual accounts | clauses 101 - 109 |
| **MISCELLANEOUS** | winding up,<br>alterations to the constitution,<br>interpretation | clauses 110 - 115 |

## GENERAL

### Type of organisation

1 The organisation will, upon registration, be a Scottish Charitable Incorporated Organisation (SCIO).

### Scottish principal office

2 The principal office of the organisation will be in Scotland (and must remain in Scotland).

### Name

3 The name of the organisation is Borders Energy Agency.

### Purposes

4 The organisation's purposes are:

4.1 To provide a local source of advice, information, education, training and support on all energy matters to all sectors in the Scottish Borders

4.2 To promote renewable energy, energy conservation, carbon reduction and sustainability to all sectors in the Scottish Borders

4.3 To act to prevent or relieve poverty, in particular fuel poverty

4.4 To support the advancement of education, health, community development, science and technology and environmental protection or improvement

### Powers

5 The organisation has power to do anything which is calculated to further its purposes or is conducive or incidental to doing so.

6 No part of the income or property of the organisation may be paid or transferred (directly or indirectly) to the members - either in the course of the organisation's existence or on dissolution - except where this is done in direct furtherance of the organisation's charitable purposes.

### Liability of members

7 The members of the organisation have no liability to pay any sums to help to meet the debts (or other liabilities) of the organisation if it is wound up; accordingly, if the organisation is unable to meet its debts, the members will not be held responsible.

8 The members and charity trustees have certain legal duties under the Charities and Trustee Investment (Scotland) Act 2005; and clause 7 does not exclude (or limit) any personal liabilities they might incur if they are in breach of those duties or in breach of other legal obligations or duties that apply to them personally.

**General structure**

9 The structure of the organisation consists of:-

9.1 the MEMBERS - who have the right to attend members' meetings (including any annual general meeting) and have important powers under the constitution; in particular, the members appoint people to serve on the board and take decisions on changes to the constitution itself;

9.2 the BOARD - who hold regular meetings, and generally control the activities of the organisation; for example, the board is responsible for monitoring and controlling the financial position of the organisation.

10 The people serving on the board are referred to in this constitution as CHARITY TRUSTEES.

**MEMBERS**

**Qualifications for membership**

11 Membership is open to any individual aged 16 or over with an interest in renewable or sustainable energy or energy conservation in the Scottish Borders, who is resident within the Scottish Borders Council area or whose main occupation is based there.

12 It is also open to companies and organisations based in the Scottish Borders.

13 Employees of the organisation are not eligible for membership.

**Application for membership**

14 Any person or body who/which wishes to become a member must sign a written application for membership; in the case of a corporate body, the application must be signed by an appropriate officer of that body. The application will then be considered by the board at its next board meeting.

15 The board may, at its discretion, refuse to admit any person or body to membership. The board must notify each applicant promptly (in writing or by e-mail) of its decision on whether or not to admit him/her/it to membership. If the decision was to refuse admission, the board shall return to the applicant the remittance lodged by him/her under clause 14.

**Membership subscription**

16 Members shall require to pay an annual membership subscription; unless and until otherwise determined by the members, the amount of the annual membership subscription shall be £1.

17 The annual membership subscriptions shall be payable on or before 1st April in each year.

18 The members may vary the amount of the annual membership subscription and/or the date on which it falls due in each year, by way of a resolution to that effect passed at an AGM.

19 If the membership subscription payable by any member remains outstanding more than 6 weeks after the date on which it fell due - and providing he/she/it

has been given at least one written reminder - the board may, by resolution to that effect, expel him/her from membership.

20 A person who ceases (for whatever reason) to be a member shall not be entitled to any refund of the membership subscription.

**Register of members**

21 The board must keep a register of members, setting out:

21.1. for each current member: his/her/its full name and address; and

21.1.1 the date on which he/she was registered as a member of the organisation;

21.2 for each former member - for at least six years from the date on he/she ceased to be a member:

21.2.1 his/her name; and

21.2.2 the date on which he/she ceased to be a member.

22 The board must ensure that the register of members is updated within 28 days of any change:

22.1 which arises from a resolution of the board or a resolution passed by the members of the organisation; or

22.2 which is notified to the organisation.

23 If a member or charity trustee of the organisation requests a copy of the register of members, the board must ensure that a copy is supplied to him/her within 28 days, providing the request is reasonable; if the request is made by a member (rather than a charity trustee), the board may provide a copy which has the addresses blanked out.

**Withdrawal from membership**

24 Any person who wants to withdraw from membership must give a written notice of withdrawal to the organisation, signed by him/her; or (in the case of a corporate body) signed by an appropriate officer of that body. He/she/it will cease to be a member as from the time when the notice is received by the organisation.

**Transfer of membership**

25 Membership of the organisation may not be transferred by a member.

**Re-registration of members**

26 The board may, at any time, issue notices to the members requiring them to confirm that they wish to remain as members of the organisation, and allowing them a period of 28 days (running from the date of issue of the notice) to provide that confirmation to the board.

27 If a member fails to provide confirmation to the board (in writing or by e-mail) that he/she/it wishes to remain as a member of the organisation before the expiry of the 28-day period referred to in clause 26, the board may expel him/her/it from membership.

28 A notice under clause 26 will not be valid unless it refers specifically to the consequences (under clause 27) of failing to provide confirmation within the 28-day period.

**Expulsion from membership**

29 Any person or body may be expelled from membership by way of a resolution passed by not less than two thirds of those present and voting at a members' meeting, providing the following procedures have been observed:-

29.1 at least 21 days' notice of the intention to propose the resolution must be given to the member concerned, specifying the grounds for the proposed expulsion;

29.2 the member concerned will be entitled to be heard on the resolution at the members' meeting at which the resolution is proposed.

**DECISION-MAKING BY THE MEMBERS**

**Members' meetings**

30 The board must arrange a meeting of members (an annual general meeting or "AGM") in each calendar year.

31 The gap between one AGM and the next must not be longer than 15 months.

32 Notwithstanding clause 30, an AGM does not need to be held during the calendar year in which the organisation is formed; but the first AGM must still be held within 15 months of the date on which the organisation is formed.

33 The business of each AGM must include:-

33.1 a report by the chair on the activities of the organisation;

33.2 consideration of the annual accounts of the organisation;

33.3 the election/re-election of charity trustees, as referred to in clauses 62 to 65.

34 The board may arrange a special members' meeting at any time.

**Power to request the board to arrange a special members' meeting**

35 The board must arrange a special members' meeting if they are requested to do so by a notice (which may take the form of two or more documents in the same terms, each signed by one or more members; in the case of a member which is a corporate body, signed by an appropriate officer of that body) by members who amount to 5% or more of the total membership of the organisation at the time, providing:

35.1 the notice states the purposes for which the meeting is to be held; and

35.2 those purposes are not inconsistent with the terms of this constitution, the Charities and Trustee (Investment) Scotland Act 2005 or any other statutory provision.

36 If the board receive a notice under clause 35, the date for the meeting which they arrange in accordance with the notice must not be later than 28 days from the date on which they received the notice.

**Notice of members' meetings**

37 At least 14 clear days' notice must be given of any AGM or any special members' meeting.

38 The notice calling a members' meeting must specify in general terms what business is to be dealt with at the meeting; and

38.1 in the case of a resolution to alter the constitution, must set out the exact terms of the proposed alteration(s); or

38.2 in the case of any other resolution falling within clause 49 (requirement for two-thirds majority) must set out the exact terms of the resolution.

39 The reference to "clear days" in clause 37 shall be taken to mean that, in calculating the period of notice,

39.1 the day after the notices are posted (or sent by e-mail) should be excluded; and

39.2 the day of the meeting itself should also be excluded.

40 Notice of every members' meeting must be given to all the members of the organisation, and to all the charity trustees; but the accidental omission to give notice to one or more members will not invalidate the proceedings at the meeting.

41 Any notice which requires to be given to a member under this constitution must be: -

41.1 sent by post to the member, at the address last notified by him/her/it to the organisation; *or*

41.2 sent by e-mail to the member, at the e-mail address last notified by him/her/it to the organisation.

**Procedure at members' meetings**

42 No valid decisions can be taken at any members' meeting unless a quorum is present.

43 The quorum for a members' meeting is 4 members, present in person or (in the case of a member which is a corporate body), present via its authorised representative.

44 If a quorum is not present within 15 minutes after the time at which a members' meeting was due to start - or if a quorum ceases to be present during a members' meeting - the meeting cannot proceed; and fresh notices of meeting

will require to be sent out, to deal with the business (or remaining business) which was intended to be conducted.

45 The chair of the organisation should act as chairperson of each members' meeting.

46 If the chair of the organisation is not present within 15 minutes after the time at which the meeting was due to start (or is not willing to act as chairperson), the charity trustees present at the meeting must elect (from among themselves) the person who will act as chairperson of that meeting.

**Voting at members' meetings**

47 Every member has one vote, which must be given personally or (in the case of a member which is a corporate body), given via its authorised representative.

47A A member which is a corporate body shall be entitled to authorise an individual to attend and vote at members' meetings; he/she will then be entitled to exercise the same powers on behalf of the body which he/she represents as that body could have exercised if it had been an individual member of the organisation

48 All decisions at members' meetings will be made by majority vote - with the exception of the types of resolution listed in clause 49.

49 The following resolutions will be valid only if passed by not less than two thirds of those voting on the resolution at a members' meeting (or if passed by way of a written resolution under clause 53):

49.1 a resolution amending the constitution;

49.2 a resolution expelling a person from membership under article 26;

49.3 a resolution directing the board to take any particular step (or directing the board not to take any particular step);

49.4 a resolution approving the amalgamation of the organisation with another SCIO (or approving the constitution of the new SCIO to be constituted as the successor pursuant to that amalgamation);

49.5 a resolution to the effect that all of the organisation's property, rights and liabilities should be transferred to another SCIO (or agreeing to the transfer from another SCIO of all of its property, rights and liabilities);

49.6 a resolution for the winding up or dissolution of the organisation.

50 If there is an equal number of votes for and against any resolution, the chairperson of the meeting will be entitled to a second (casting) vote.

51 A resolution put to the vote at a members' meeting will be decided on a show of hands - unless the chairperson (or at least two other individuals present at the meeting and entitled to vote) ask for a secret ballot.

52 The chairperson will decide how any secret ballot is to be conducted, and he/she will declare the result of the ballot at the meeting.

**Written resolutions by members**

53 A resolution agreed to in writing (or by e-mail) by all the members will be as valid as if it had been passed at a members' meeting; the date of the resolution will be taken to be the date on which the last member agreed to it.

**Minutes**

54 The board must ensure that proper minutes are kept in relation to all members' meetings.

55 Minutes of members' meetings must include the names of those present; and (so far as possible) should be signed by the chairperson of the meeting.

56 The board shall make available copies of the minutes referred to in clause 54 to any member of the public requesting them; but on the basis that the board may exclude confidential material to the extent permitted under clause 100.

**BOARD**

**Number of charity trustees**

57 The maximum number of charity trustees is 10.

58 The minimum number of charity trustees is 4.

**Eligibility**

59 A person will not be eligible for election or appointment to the board unless he/she is a member of the organisation or has been nominated for election/appointment to the board by a member which is a corporate body

60 A person will not be eligible for election or appointment to the board if he/she is:

60.1 disqualified from being a charity trustee under the Charities and Trustee Investment (Scotland) Act 2005; or

60.2 an employee of the organisation.

**Initial charity trustees**

61 The individuals who signed the charity trustee declaration forms which accompanied the application for incorporation of the organisation shall be deemed to have been appointed by the members as charity trustees with effect from the date of incorporation of the organisation.

**Election, retiral, re-election**

62 At each AGM, the members may elect any member (unless he/she is debarred from membership under clause 60) to be a charity trustee.

62.1 A member which is a corporate body may (subject to clause 62.2) nominate any individual for election/appointment to the board; he/she will then be deemed to be a member of the organisation for the purposes of clauses 62 and 63.

62.2 No more than one individual nominated under clause 62.1 by each corporate member may serve as a charity trustee at any given time.

63 The board may at any time appoint any member (unless he/she is debarred from membership under clause 60) to be a charity trustee.

64 At each AGM, all of the charity trustees must retire from office - but may then be re-elected under clause 63.

65 A charity trustee retiring at an AGM will be deemed to have been re-elected unless: -

65.1 he/she advises the board prior to the conclusion of the AGM that he/she does not wish to be re-appointed as a charity trustee; or

65.2 an election process was held at the AGM and he/she was not among those elected/re-elected through that process; or

65.3 a resolution for the re-election of that charity trustee was put to the AGM and was not carried.

**Termination of office**

66 A charity trustee will automatically cease to hold office if: -

66.1 he/she becomes disqualified from being a charity trustee under the Charities and Trustee Investment (Scotland) Act 2005;

66.2 he/she becomes incapable for medical reasons of carrying out his/her duties as a charity trustee - but only if that has continued (or is expected to continue) for a period of more than six months;

66.3 he/she ceases to be a member of the organisation or (if he/she was nominated by a corporate body) the corporate body which nominated him/her ceases to be a member of the organisation;

66.4 he/she becomes an employee of the organisation;

66.5 he/she gives the organisation a notice of resignation, signed by him/her;

66.6 he/she is absent (without good reason, in the opinion of the board) from more than three consecutive meetings of the board - but only if the board resolves to remove him/her from office;

66.7 he/she is removed from office by resolution of the board on the grounds that he/she is considered to have committed a material breach of the code of conduct for charity trustees (as referred to in clause 83);

66.8 he/she is removed from office by resolution of the board on the grounds that he/she is considered to have been in serious or persistent breach of his/her duties under section 66(1) or (2) of the Charities and Trustee Investment (Scotland) Act 2005; or

66.9 he/she is removed from office by a resolution of the members passed at a members' meeting.

67 A resolution under paragraph 66.7, 66.8, 66.9 shall be valid only if: -

67.1 the charity trustee who is the subject of the resolution is given reasonable prior written notice of the grounds upon which the resolution for his/her removal is to be proposed;

67.2 the charity trustee concerned is given the opportunity to address the meeting at which the resolution is proposed, prior to the resolution being put to the vote; and

67.3 (in the case of a resolution under paragraph 66.7 or 66.8 or 66.9) at least two thirds (to the nearest round number) of the charity trustees then in office vote in favour of the resolution.

**Register of charity trustees**

68 The board must keep a register of charity trustees, setting out

68.1 for each current charity trustee:

68.1.1 his/her full name and address;

68.1.2 the date on which he/she was appointed as a charity trustee; and

68.1.3 the name of the corporate member which nominated each charity trustee (if applicable;

68.1.4 any office held by him/her in the organisation;

68.2 for each former charity trustee - for at least 6 years from the date on which he/she ceased to be a charity trustee:

68.2.1 the name of the charity trustee;

68.2.2 any office held by him/her in the organisation; and

68.2.3 the date on which he/she ceased to be a charity trustee.

69 The board must ensure that the register of charity trustees is updated within 28 days of any change:

69.1 which arises from a resolution of the board or a resolution passed by the members of the organisation; or

69.2 which is notified to the organisation.

70 If any person requests a copy of the register of charity trustees, the board must ensure that a copy is supplied to him/her within 28 days, providing the request is reasonable; if the request is made by a person who is not a charity trustee of the organisation, the board may provide a copy which has the addresses blanked out - if the SCIO is satisfied that including that information is likely to jeopardise the safety or security of any person or premises.

**Office-bearers**

71 The charity trustees must elect (from among themselves) a chair, a treasurer and a secretary.

72 In addition to the office-bearers required under clause 68, the charity trustees may elect (from among themselves) further office-bearers if they consider that appropriate.

73 All of the office-bearers will cease to hold office at the conclusion of each AGM, but may then be re-elected under clause 71 or 72.

74 A person elected to any office will automatically cease to hold that office: -

74.1 if he/she ceases to be a charity trustee; *or*

74.2 if he/she gives to the organisation a notice of resignation from that office, signed by him/her.

**Powers of board**

75 Except where this constitution states otherwise, the organisation (and its assets and operations) will be managed by the board; and the board may exercise all the powers of the organisation.

76 A meeting of the board at which a quorum is present may exercise all powers exercisable by the board.

77 The members may, by way of a resolution passed in compliance with clause 49 (requirement for two-thirds majority), direct the board to take any particular step or direct the board not to take any particular step; and the board shall give effect to any such direction accordingly.

**Charity trustees - general duties**

78 Each of the charity trustees has a duty, in exercising functions as a charity trustee, to act in the interests of the organisation; and, in particular, must:-

78.1 seek, in good faith, to ensure that the organisation acts in a manner which is in accordance with its purposes;

78.2 act with the care and diligence which it is reasonable to expect of a person who is managing the affairs of another person;

78.3 in circumstances giving rise to the possibility of a conflict of interest between the organisation and any other party:

78.3.1 put the interests of the organisation before that of the other party;

78.3.2 where any other duty prevents him/her from doing so, disclose the conflicting interest to the organisation and refrain from participating in any deliberation or decision of the other charity trustees with regard to the matter in question;

78.4 ensure that the organisation complies with any direction, requirement, notice or duty imposed under or by virtue of the Charities and Trustee Investment (Scotland) Act 2005.

79 In addition to the duties outlined in clause 78, all of the charity trustees must take such steps as are reasonably practicable for the purpose of ensuring: -

79.1 that any breach of any of those duties by a charity trustee is corrected by the charity trustee concerned and not repeated; and

79.2 that any trustee who has been in serious and persistent breach of those duties is removed as a trustee.

80 Provided he/she has declared his/her interest - and has not voted on the question of whether or not the organisation should enter into the arrangement - a charity trustee will not be debarred from entering into an arrangement with the organisation in which he/she has a personal interest; and (subject to clause 81 and to the provisions relating to remuneration for services contained in the Charities and Trustee Investment (Scotland) Act 2005), he/she may retain any personal benefit which arises from that arrangement.

81 No charity trustee may serve as an employee (full time or part time) of the organisation; and no charity trustee may be given any remuneration by the organisation for carrying out his/her duties as a charity trustee.

82 The charity trustees may be paid all travelling and other expenses reasonably incurred by them in connection with carrying out their duties; this may include expenses relating to their attendance at meetings.

**Code of conduct for charity trustees**

83 Each of the charity trustees shall comply with the code of conduct (incorporating detailed rules on conflict of interest) prescribed by the board from time to time.

84 The code of conduct referred to in clause 83 shall be supplemental to the provisions relating to the conduct of charity trustees contained in this constitution and the duties imposed on charity trustees under the Charities and Trustee Investment (Scotland) Act 2005; and all relevant provisions of this constitution shall be interpreted and applied in accordance with the provisions of the code of conduct in force from time to time

## DECISION-MAKING BY THE CHARITY TRUSTEES

### Notice of board meetings

85 Any charity trustee may call a meeting of the board *or* ask the secretary to call a meeting of the board.

86 At least 7 days' notice must be given of each board meeting, unless (in the opinion of the person calling the meeting) there is a degree of urgency which makes that inappropriate.

### Procedure at board meetings

87 No valid decisions can be taken at a board meeting unless a quorum is present; the quorum for board meetings is 4 charity trustees, present in person.

88 If at any time the number of charity trustees in office falls below the number stated as the quorum in clause 87, the remaining charity trustee(s) will have power to fill the vacancies or call a members' meeting - but will not be able to take any other valid decisions.

89 The chair of the organisation should act as chairperson of each board meeting.

90 If the chair is not present within 15 minutes after the time at which the meeting was due to start (or is not willing to act as chairperson), the charity trustees present at the meeting must elect (from among themselves) the person who will act as chairperson of that meeting.

91 Every charity trustee has one vote, which must be given personally.

92 All decisions at board meetings will be made by majority vote.

93 If there is an equal number of votes for and against any resolution, the chairperson of the meeting will be entitled to a second (casting) vote.

94 The board may, at its discretion, allow any person to attend and speak at a board meeting notwithstanding that he/she is not a charity trustee - but on the basis that he/she must not participate in decision-making.

95 A charity trustee must not vote at a board meeting (or at a meeting of a sub-committee) on any resolution which relates to a matter in which he/she has a personal interest or duty which conflicts (or may conflict) with the interests of the organisation; he/she must withdraw from the meeting while an item of that nature is being dealt with.

96 For the purposes of clause 95: -

96.1 an interest held by an individual who is “connected” with the charity trustee under section 68(2) of the Charities and Trustee Investment (Scotland) Act 2005 (husband/wife, partner, child, parent, brother/sister etc) shall be deemed to be held by that charity trustee;

96.2 a charity trustee will be deemed to have a personal interest in relation to a particular matter if a body in relation to which he/she is an employee, director, member of the management committee, officer or elected representative has an interest in that matter.

## Minutes

97 The board must ensure that proper minutes are kept in relation to all board meetings and meetings of sub-committees.

98 The minutes to be kept under clause 97 must include the names of those present; and (so far as possible) should be signed by the chairperson of the meeting.

99 [The board shall (subject to clause 100) make available copies of the minutes referred to in clause 97 to any member of the public requesting them.]

100 [The board may exclude from any copy minutes made available to a member of the public under clause 99 any material which the board considers ought properly to be kept confidential - on the grounds that allowing access to such material could cause significant prejudice to the interests of the organisation or on the basis that the material contains reference to employee or other matters which it would be inappropriate to divulge.]

## ADMINISTRATION

## Delegation to sub-committees

101 The board may delegate any of their powers to sub-committees; a sub-committee must include at least one charity trustee, but other members of a sub-committee need not be charity trustees.

102 The board may also delegate to the chair of the organisation (or the holder of any other post) such of their powers as they may consider appropriate.

103 When delegating powers under clause 101 or 102, the board must set out appropriate conditions (which must include an obligation to report regularly to the board).

104 Any delegation of powers under clause 101 or 102 may be revoked or altered by the board at any time.

105 The rules of procedure for each sub-committee, and the provisions relating to membership of each sub-committee, shall be set by the board.

## Operation of accounts

106 Subject to clause 107, the signatures of two of the signatories appointed by the board will be required in relation to all operations (other than the lodging of funds) on the bank and building society accounts held by the organisation; at least one out of the two signatures must be the signature of a charity trustee.

107 Where the organisation uses electronic facilities for the operation of any bank or building society account, the authorisations required for operations on that account must be consistent with the approach reflected in clause 106.

## Accounting records and annual accounts

108 The board must ensure that proper accounting records are kept, in accordance with all applicable statutory requirements.

109 The board must prepare annual accounts, complying with all relevant statutory requirements; if an audit is required under any statutory provisions (or if the board consider that an audit would be appropriate for some other reason), the

board should ensure that an audit of the accounts is carried out by a qualified auditor.

## MISCELLANEOUS

### Winding-up

110 If the organisation is to be wound up or dissolved, the winding-up or dissolution process will be carried out in accordance with the procedures set out under the Charities and Trustee Investment (Scotland) Act 2005.

111 Any surplus assets available to the organisation immediately preceding its winding up or dissolution must be used for purposes which are the same as - or which closely resemble - the purposes of the organisation as set out in this constitution.

### Alterations to the constitution

112 This constitution may (subject to clause 113) be altered by resolution of the members passed at a members' meeting (subject to achieving the two thirds majority referred to in clause 46) or by way of a written resolution of the members.

113 The Charities and Trustee Investment (Scotland) Act 2005 prohibits taking certain steps (e.g. change of name, an alteration to the purposes, amalgamation, winding-up) without the consent of the Office of the Scottish Charity Regulator (OSCR).

### Interpretation

114 References in this constitution to the Charities and Trustee Investment (Scotland) Act 2005 should be taken to include: -

114.1 any statutory provision which adds to, modifies or replaces that Act; and

114.2 any statutory instrument issued in pursuance of that Act or in pursuance of any statutory provision falling under paragraph 114.1 above.

115 In this constitution: -

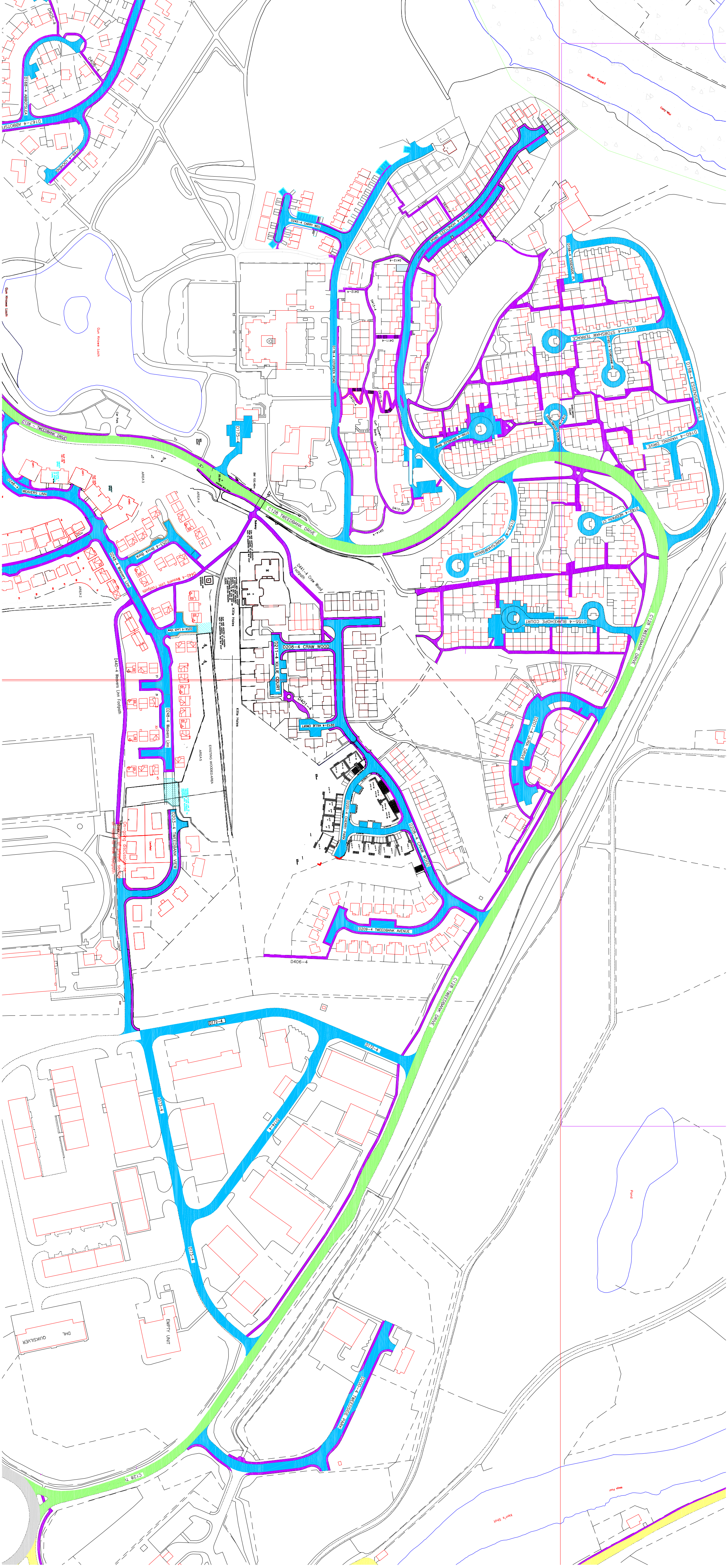
115.1 "charity" means a body which is either a "Scottish charity" within the meaning of section 13 of the Charities and Trustee Investment (Scotland) Act 2005 or a "charity" within the meaning of section 1 of the Charities Act 2006, providing (in either case) that its objects are limited to charitable purposes;

115.2 "charitable purpose" means a charitable purpose under section 7 of the Charities and Trustee Investment (Scotland) Act 2005 which is also regarded as a charitable purpose in relation to the application of the Taxes Acts.

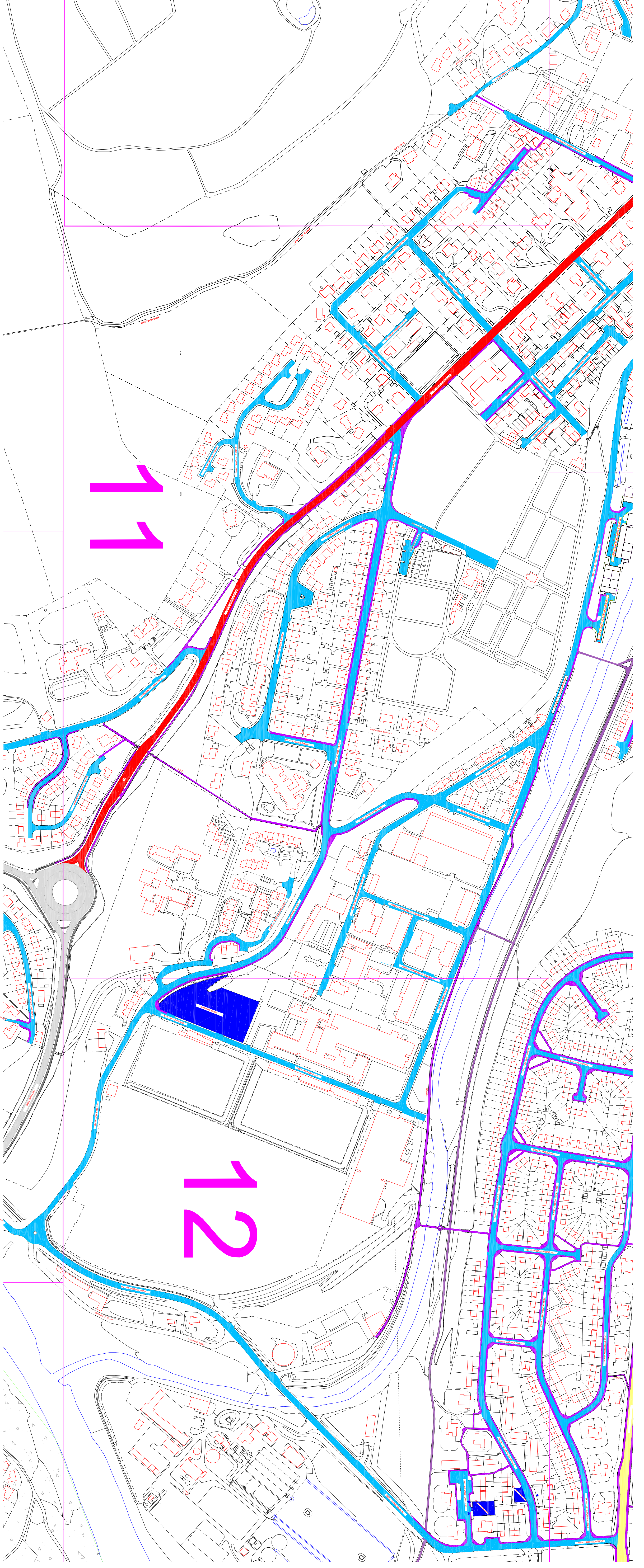
**Appendix 10.**
**Land Ownerships**

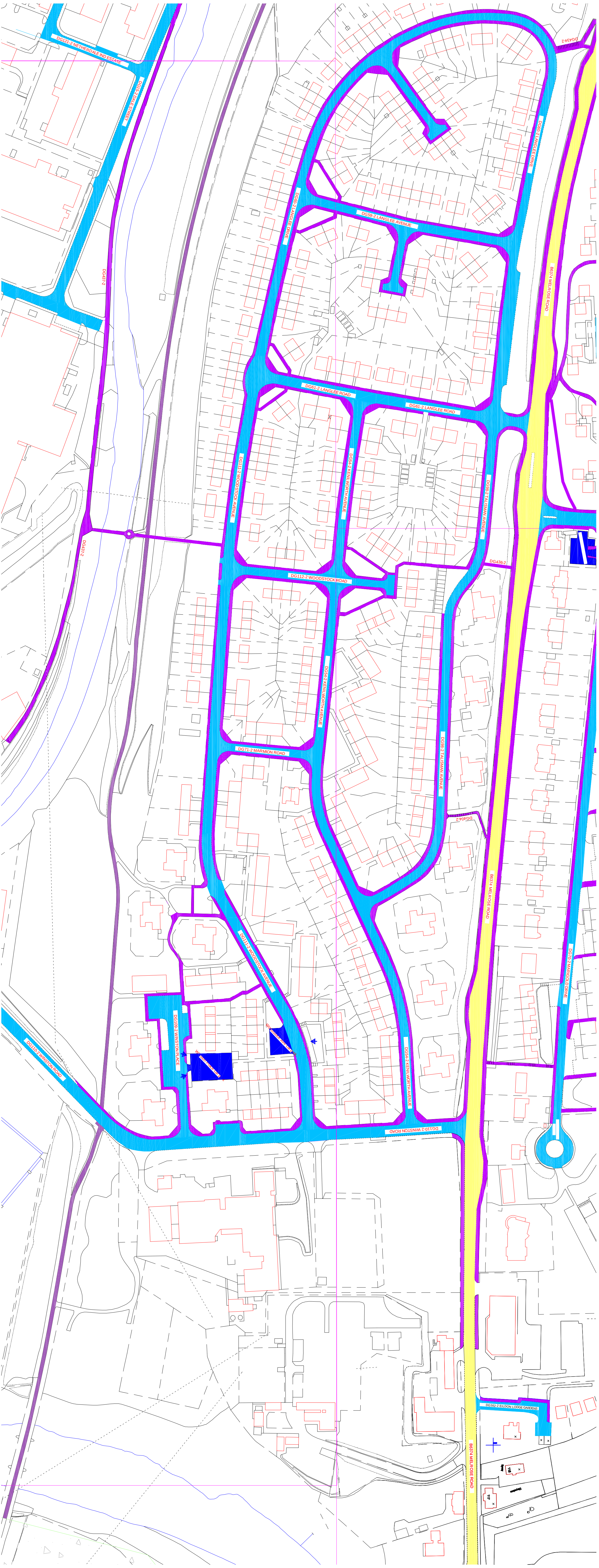
**a. map of major land ownerships**
**b. SBC adopted roads network**
**c. Network Rail route and land ownership**

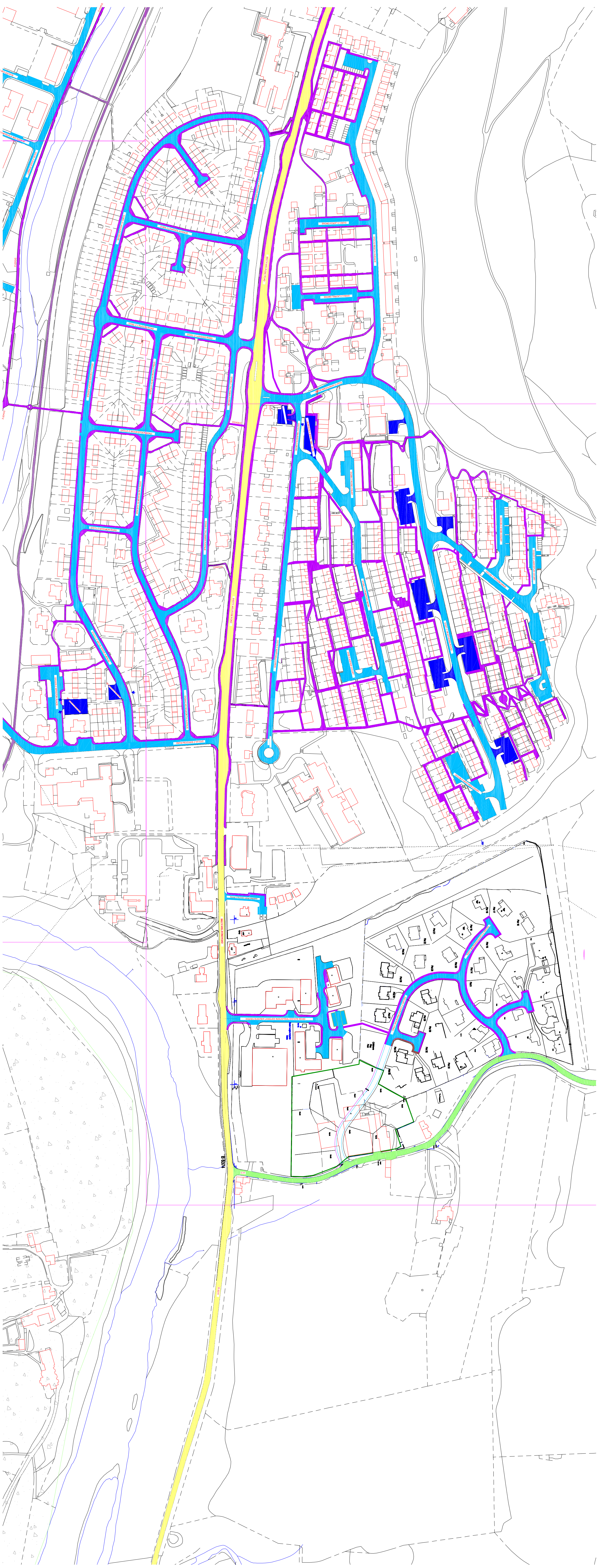

EASTER LANGLEE ATT FACILITY HEAT AND POWER PLAN LAND OWNERSHIP

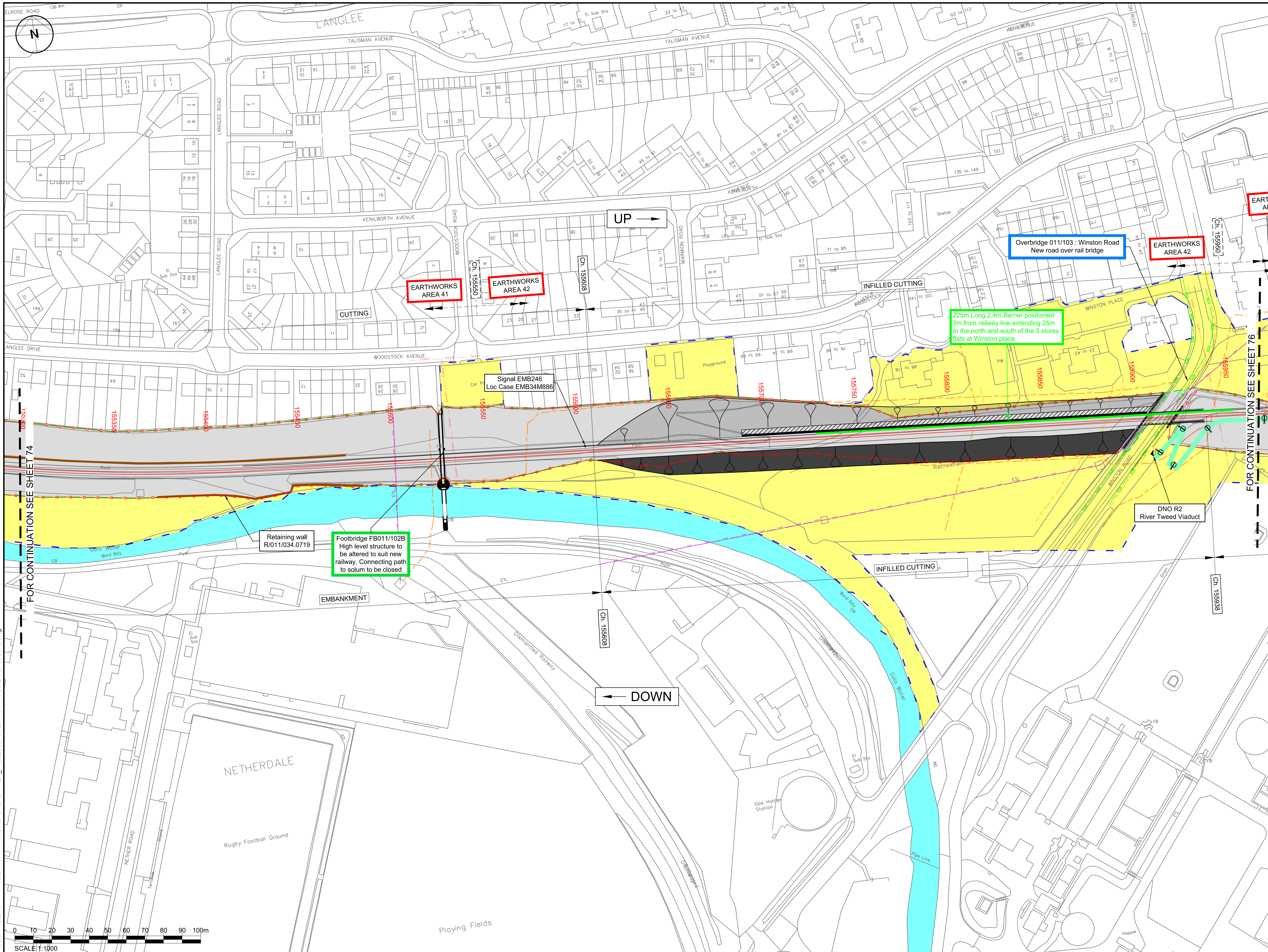


C128 TWEEDBANK DRIVE
D155-4 BURKEHOPE COURT
D208-4 CRAW WOOD
D211-4 KILLIE COURT
D209-4 TWEEDBANK AVENUE
D406-4
D172-4
D441-4 Craw Wood footpath
D440-4 Weavers Linn footpath
D248-4 Weavers Linn
EMPTY UNIT
DHL QUIKSILVER


11
12


DG121-2 NETHERDALE IND ESTATE
DG15-2 DALE STREET
DG437-2
DG434-2
DG60-2 LANGLEE DRIVE
DG59-2 LANGLEE AVENUE
DG60-2 LANGLEE DRIVE
B6374 MELROSE ROAD
DG61-2 LANGLEE ROAD
DG61-2 LANGLEE ROAD
DG111-2 WOODSTOCK AVENUE
DG54-2 KENILWORTH AVENUE
DG98-2 TALISMAN AVENUE
DG437-2
DG436-2
DG112-2 WOODSTOCK ROAD
DG54-2 KENILWORTH AVENUE
DG71-2 MARMION ROAD
DG98-2 TALISMAN AVENUE
DG404-2
B6374 MELROSE ROAD
DG111-2 WOODSTOCK AVENUE
DG70-2 MARIGOLD DRIVE
DG109-2 WINSTON PLACE
DG110-2 WINSTON ROAD
DG54-2 KENILWORTH AVENUE
DG110-2 WINSTON ROAD
DG162-2 EILDON LODGE GARDENS
116
B6374 MELROSE ROAD
117






This Ordnance Survey Map has been reproduced with the permission of the Controller of Her Majesty's Stationery Office. Atkins, accept no responsibility or liability as to the accuracy or content of the data shown herein



This Drawing displays design elements which have not been created by or drawn by Atkins. As Such, Atkins accepts no responsibility or liability as to the accuracy or content of the data shown herein

BordersRailway
Edinburgh • Midlothian • Scottish Borders

Key:

- Limit of Deviation (LOD)
- Limit of Land Acquired and Used (LLAU)
- Low Fence
- Medium Fence
- High Fence
- Noise Barrier (6 car)
- Noise Barrier (Act)
- Retaining Wall
- Gabion Basket
- Shared 3.0m path
- Shared 2.5m path
- Shared 2.0m path
- Footway 2.0m path
- Watercourse

Edinburgh, Shawfair, Eskbank, Newtongrange, Gorebridge, Heriot, Fountainhall, Stow, Galashiels, Tweedbank

Key Plan
NTS

| Rev | Date | Issue History | Drawn | Chkd | Appd |
|---|---|---|---|---|---|
| P03 | 31.01.13 | AIP ISSUE | FH | NF | KP |
| P02 | 10.08.12 | SECOND ISSUE | BJH | NF | KP |
| P01 | 30.05.12 | FIRST ISSUE | AMcP | NF | KP |

Description of Change

Drawing Status
FOR INFORMATION

ATKINS
200 Broomielaw
Glasgow
G1 4RU
Tel: +44 (0)141 220 2000
Fax: +44 (0)141 220 2001

NetworkRail bam

Project Title
BORDERS RAILWAY PROJECT

Drawing Title
INTEGRATED ENGINEERING LAYOUT PLANS
SHEET 75 OF 77

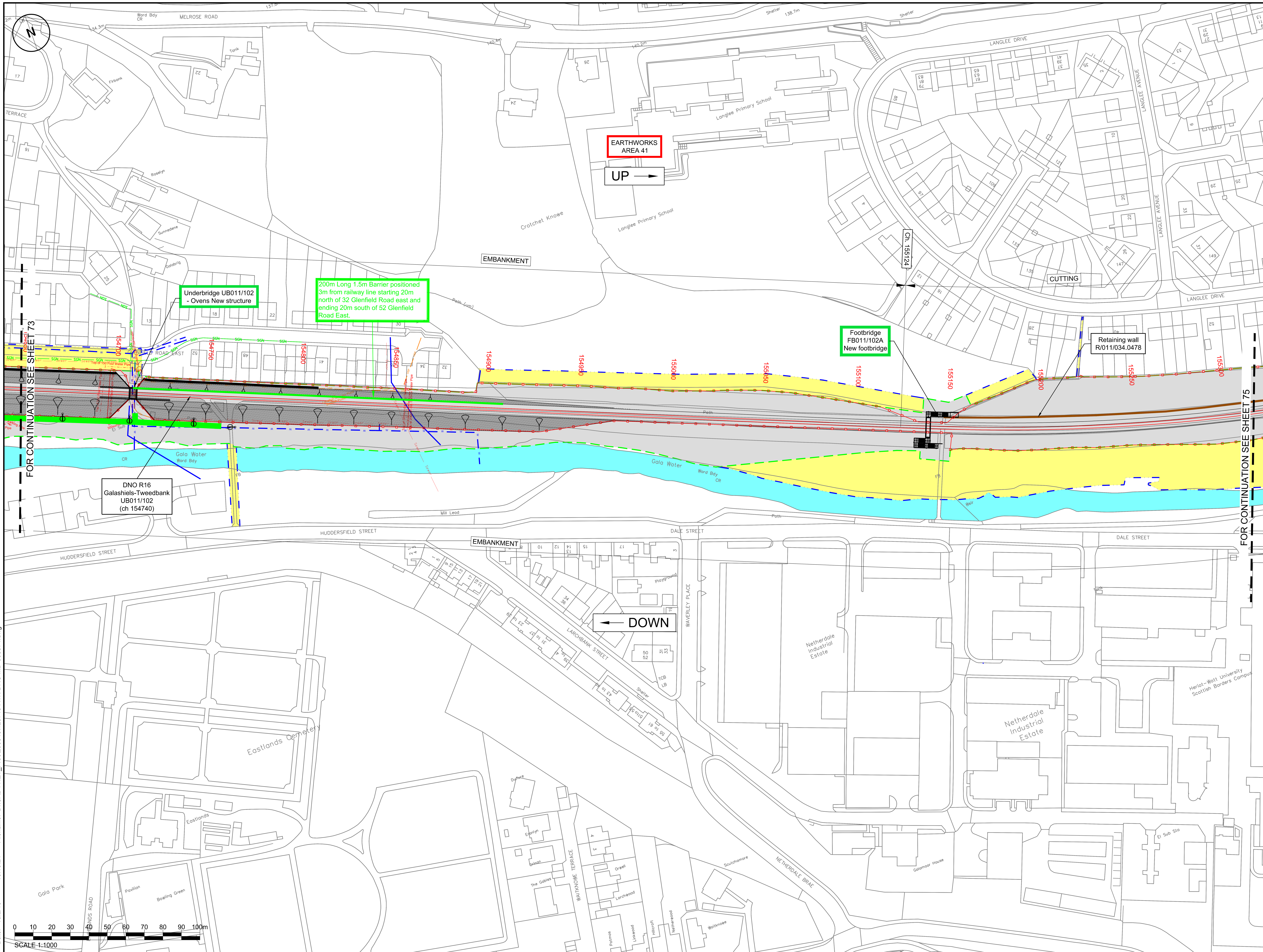
| Drawn | Date | Designed | Date |
|---|---|---|---|
| AMCP | 18.05.12 | AMCP | 18.05.12 |
| Checked | Date | Approved | Date |
| NF | 18.05.12 | KP | 18.05.12 |

| | Scale | Location |
|---|---|---|
| A1 | 1:1000 | VARIES |

Drawing Number: 129713-ATK-DRG-MD-000075
Revision: P03

Username: kos49216 Date: 13/2/13 16:21:19 Filename: D:\CAB-i-NET_Proc\290549\129713-ATK-DRG-MD-000075.dwg

Millimetres 0 10 100




This Ordnance Survey Map has been reproduced with the permission of the Controller of Her Majesty's Stationery Office. Atkins, accept no responsibility or liability as to the accuracy or content of the data shown herein



This Drawing displays design elements which have not been produced or drawn by Atkins. As Such, Atkins accepts no responsibility or liability as to the accuracy or content of the data shown herein

Username: kos49216 Date: 13/2/13 16:18:24 Filename: D:\CAB-i-NET_Proc\290548\129713-ATK-DRG-MD-000074.dwg

BordersRailway
Edinburgh • Midlothian • Scottish Borders

Key:

- Limit of Deviation (LOD)
- Limit of Land Acquired and Used (LLAU)
- Low Fence
- Medium Fence
- High Fence
- Noise Barrier (6 car)
- Noise Barrier (Act)
- Retaining Wall
- Gabion Basket
- Shared 3.0m path
- Shared 2.5m path
- Shared 2.0m path
- Footway 2.0m path
- Watercourse

Key Plan
NTS

Edinburgh, Shawfair, Eskbank, Newtongrange, Gorebridge, Heriot, Fountainhall, Stow, Galashiels, Tweedbank

| Rev | Date | Issue History | Drawn | Chkd | Appd |
|---|---|---|---|---|---|
| P03 | 31.01.13 | AIP ISSUE | FH | NF | KP |
| P02 | 10.08.12 | SECOND ISSUE | BJH | NF | KP |
| P01 | 30.05.12 | FIRST ISSUE | AMcP | NF | KP |

Description of Change

Drawing Status
FOR INFORMATION

ATKINS
200 Broomielaw
Glasgow
G1 4RU
Tel: +44 (0)141 220 2000
Fax: +44 (0)141 220 2001

NetworkRail bam

Project Title
BORDERS RAILWAY PROJECT

Drawing Title
INTEGRATED ENGINEERING LAYOUT PLANS
SHEET 74 OF 77

| Drawn | Date | Designed | Date |
|---|---|---|---|
| AMCP | 18.05.12 | AMCP | 18.05.12 |
| Checked | Date | Approved | Date |
| NF | 18.05.12 | KP | 18.05.12 |

| | Scale | Location |
|---|---|---|
| A1 | 1:1000 | VARIES |

| Drawing Number | Revision |
|---|---|
| 129713-ATK-DRG-MD-000074 | P03 |

## Appendix 11.

## Copies of Consultees Response letters to this report

| | |
|---|---|
| **From:** | Ronnie Dumma |
| **To:** | Scott Robertson |
| **Subject:** | RE: Langlee district heating study |
| **Date:** | 15 February 2013 09:14:19 |
| **Attachments:** | image001.png<br>image003.jpg |

Scott

I acknowledge receipt of your email and copy of Draft Heat and Power Plan which you intend to submit to SBC

As advised to you at meeting neither Jake nor I have the authority to make decisions on something as large and sensitive as this. Executive Team and Board would need to consider. Internal discussions not held yet.

We will come back to you once discussions concluded internally

Ronnie

Ronnie Dumma MRICS
Development Manager
Eildon HA
The Weaving Shed
Ettrick Mill
Dunsdale Road
Selkirk TD7 5EB

(DD) 01750 724871

www.eildon.org.uk

**From:** Scott Robertson [mailto:scott.robertson@energeticpm.com]
**Sent:** 14 February 2013 19:19
**To:** Ronnie Dumma
**Subject:** Langlee district heating study

Ronnie,

firstly, thank you for your assistance in information gathering for this project, and for making your time avauilable to discuss the intent and how this might fit int with your development plans.

I have now collated the data and this is included in the draft Heat and Power plan which will be submitted to SBC planning and SEPA very shortly.

can I ask that you have a quick scan of this and come back to me with any queries, or if you think I have missed something about your estate. Once any points are dealt with, I will be in touch again, probably next week looking for a back letter from you. at this stage, all it requires is confirmation that the consultation with yourselves took place, that the figures and details included reflect your estate and that, subject to further commercial and contractual discussions, your organmisation is, in principle, interested in being a customer of, or participating in, a future district heating scheme along the lines set out.  This is simply to demonstrate to SBC and SEPA that due process is being followed and does not constitute any agreement or commit you to proceeding if the scheme does not fit with your longer term objectives and plans.

I look forward to hearing from you.

Scott Robertson
Director
Energetic project management Ltd

018907 81463 / 018907 60156 / 07885 648854
Moffat House, Ayton, Berwickshire TD14 5QJ

www.energeticpm.com

Registered in Scotland; SC 382026
Registered office; Elliot & Co WS, 8 Charlotte Street, Perth PH1 5LL



---

| | |
|---|---|
| **From:** | AVass@sbha.org.uk |
| **To:** | scottarobertson1959@btinternet.com |
| **Cc:** | amacnaughton@sbha.org.uk; JMulloy@sbha.org.uk |
| **Subject:** | RE: Langlee DH project- SBHA Land ownership |
| **Date:** | 14 March 2013 10:14:56 |
| **Importance:** | High |

---

Hi Scott, we can arrange for these to be issued to you and if you can come in that would be best. I can arrange for my Technical Co-Ordinator (Derek Gibson) to have these copied for you.

With regard to the following sent in your email dated 14 Feb 2013

probably next week looking for a back letter from you. at this stage, all it requires is confirmation that the consultation with yourselves took place, that the figures and details included reflect your estate and that, subject to further commercial and contractual discussions, your organisation is, in principle, interested in being a customer of, or participating in, a future district heating scheme along the lines set out.

SBHA can confirm we are interested in this scheme at this stage subject to further commercial and contractual discussions and as discussed will look at the options of shareholding within the Energy Supply Company as part of this process and would welcome further details of this company for us to consider.

I look forward to hearing from you in the near future

Kind regards

**Alan Vass**
**Director of Technical Services**
Scottish Borders Housing Association
South Bridge House, Whinfield Road
Selkirk, TD7 5DT
Tel: 01750 724453

---

**From:** Scott Robertson [mailto:scottarobertson1959@btinternet.com]
**Sent:** 11 March 2013 17:29
**To:** Vass, Alan
**Cc:** MacNaughton, Amy
**Subject:** Langlee DH project- SBHA Land ownership

Alan,

with submission to planning due shortly, NES are keen to confirm land ownership in the Langlee area for network planning. When we met with Julia Mulloy, you noted that SBHA had plans of their ownership (possibly for grounds maintenance etc?). I would be very grateful if these could be issued so we can compare them with SBC ownerships, adopted roads etc to identify any gaps or "ransom strips". Ideally, if these are available in pdf format that would be great, but I am happy to come to SBHA offices if copying from originals is required and can return originals as quickly as required.

if there is any difficulty in identifying or issuing these plans, can you please call me so we can resolve any problems.

thanks

Scott

Scott Robertson
Director
Energetic project management Ltd

018907 81463 / 018907 60156 / 07885 648854
Moffat House, Ayton, Berwickshire TD14 5QJ

www.energeticpm.com

Registered in Scotland; SC 382026
Registered office; Elliot & Co WS, 8 Charlotte Street, Perth PH1 5LL



---

Robert Asquith
Planning and Permitting Director
New Earth Solutions Group Ltd
Key House
35 Black Moor Road
Ebblake Industrial Estate
Verwood
Dorset
BH31 6AT

Jim Hewit Properties
Park Lane
Croft Park
Kelso
TD5 7ET



Dear Mr Asquith

**Possible use of land at Easter Langlee Mains (175 acres) for District Heating and related infrastructure**

We have discussed these possibilities for the use of my land and I have also had discussions with Scott Robertson, your District Heating consultant.

My objective is to see development of this land for residential, mixed use, educational or other types of built development and I have promoted it through the Local Plan and had numerous discussions with the planners at SBC. Following the Local Plan inquiry (letter dated 28 September 2010) the Reporter stated that the land may be developed in the future. This was after the Council had included the area in its consultation on the Local Plan. The main constraint to development was stated to be the stand-off necessary from the gas flare and the landfill site.

Since then the Council stated in 2011:

*The area at Easter Langlee mains is currently not appropriate for longer term development, but can be reconsidered in future Local plan Reviews depending on the development of waste disposal and recycling related facilities in the surrounding area.*

Obviously, your development is going to massively reduce the amount of waste being filled and therefore reduce and, hopefully, eliminate these issues. With the Borders Railway expected to bring more development to the area from around 2015 onwards it is my hope that these plans will be realised sooner than later as that timescale matches yours for diverting much of the waste from the landfill.

The use of low carbon sustainable or renewable energy in the form of hot water through a district heating system, which is what I understand your proposals offer, would clearly improve the likely environmental impact of a scheme on the land. It would be the closest area taking heat from the project. I am very happy to support your project on the basis that it might enable my land to be developed in a more sustainable way.

In the first instance I note your desire to locate an energy centre comprising pumps, a buffer tank and back up boilers on the southern part of the land and also for the main pipes linking your site to the Langlee area to pass through. In principle I am happy to accommodate this, subject to satisfactory terms, and I will be pleased to discuss this with the district heating company in due course.

I also understand areas of my land are being considered for uses such as poly tunnels or biomass drying. Again in principle and subject to acceptable terms I would be happy to accommodate these. That would be on the proviso that the ultimate use of the land would be built development and the poly tunnels or dryers would relocate so as not to compromise this.

As I have said to you in person I am very supportive of your Heat and Power Plan and wish for it to succeed. I believe my land can contribute by hosting infrastructure, poly tunnel typer horticultural development and, ultimately, built development.

Yours sincerely

Jim Hewit

# Borders Energy Agency

RECEIVED
15 MAR 2013

Dear Rob

**ESCO – LANGLEE, SCOTTISH BORDERS**

I am writing on behalf of BEA to express our support for the creation of an Energy Services Company for the Langlee waste-energy plant. This is a crucial and effective measure to enable the real benefits of your development to be shared more widely with residents and businesses in the Borders. The ability to sell heat and related energy services would also help to embed NES in the community as an important contributor to social, environmental and economic wellbeing.

The potential to access otherwise waste heat as an affordable and sustainable source of energy in an area of low wage and no-wage residents is very desirable. Similarly, local businesses which need to survive and prosper to supply work opportunities for local communities need to have price stability and energy supply continuity. The ability to provide such benefits locally is an opportunity which must be seized.

BEA is aware that a model ESCO for Langlee, once established, would provide a template for the development of other energy services which we are keen to support and which could directly contribute to our stated purposes to:

1. provide a local source of advice, information, education, training and support on all energy matters to all sectors in the Scottish Borders

2. promote renewable energy, energy conservation, carbon reduction and sustainability to all sectors in the Scottish Borders

3. act to prevent or relieve poverty, in particular fuel poverty

4. support the advancement of education, health, community development, science and technology and environmental protection or improvement

If BEA can be of any assistance with enabling this proposal to be taken forward I would be pleased to help. Please note our company address point below.

Yours Sincerely

Ian M Lindley BA (Hons), MA, MBA
Chair Borders Energy Agency

Borders Energy Agency, a Scottish Charitable Incorporated Organisation, SC042947
c/o The Southern Uplands Partnership, Studio 2, Lindean Mill, Galashiels, TD1 3PE

SP ENERGY NETWORKS

New Earth Solutions Group Ltd
Key House
35 Blackmoore Road
Ebblake Industrial Estate
Verwood
Dorset

RECEIVED
-7 MAY 2013

SP Power Systems Ltd
Shared Service Centre
3rd Floor
Avondale House
Phoenix Crescent
Strathclyde Business Park
Bellshill
ML4 3NJ

For the attention of: Mr Peter Golden

Our Ref : 91351
Your Ref :
1st May.2013

Dear Sirs,

**Offer by SP Distribution Ltd for a Load and Distributed Generation Connection to the Electricity Distribution System**
**Re Easter Langlee ATT Fuel Preparation and Energy Production Facility, Langlee Road, Galashiels, Scottish Borders, TD1 (the "site")**

We, SP Power Systems Limited, thank you for your request to the Distributor regarding electricity connection(s) at the Site. The Distributor as a licensed distributor of electricity has appointed us to act as its agent regarding your request for electricity connection(s) to the Distributor's System. We have pleasure in submitting the following offer to you to provide Connection(s) on the terms and conditions set out in this offer, the Schedule and the Conditions which is in accordance with Section 16A(5) of the Electricity Act 1989. The provisions in the Schedule and the Conditions are incorporated into and form part of this offer.

1. **Meanings**

The meanings set out in this paragraph apply in this letter, the Schedule and the Conditions:

| | |
|---|---|
| **"Conditions"** | the General Terms and Conditions for Connection to the Electricity Distribution System dated 1st May 2012 (the "conditions") |
| **"Distributor"** | SP Distribution Ltd (Company Number SC189125) having its registered office at 1 Atlantic Quay, Glasgow, G2 8SP; |
| "Site" | the area of land at the location given in the heading to this letter; |

and all other capitalised terms shall have the meanings given to them in the Conditions.

2. **Charge(s)**

The Charge(s) are payable in accordance with Part 1 of the Schedule and amount to:

The Connection Charge quoted is indicative and may be subject to revision by the Distributor. The Distributor shall provide a revised Connection Charge and payment profile at a later date, following your unconditional acceptance of the Adoption Agreement and once tender returns for all major plant items, works and any other material expenditure associated with the Distributor's Works have been received. The Distributor reserves the right to revise the indicative Connection Charge to reflect actual costs following receipt of such tender returns;

| | |
|---|---|
| The cost for this work will be | £771,943.09 (exclusive of VAT) |
| VAT will be charged at | £154,388.60 |
| This equates to a total cost of | £926,331.69 (inclusive of VAT) |

Further detail regarding the Charge(s) and payment options, if applicable, are detailed in Part 1 of the Schedule.

## 3. Payment

Payment terms will be in accordance with the Conditions and Part 1 of the Schedule.

## 4. Scope of Works

### 4.1 General

This offer is based on your original enquiry dated 06/07/12 and the following information (where applicable):

You have requested permission to connect the proposed Load and Distributed Generator(s) in parallel with a new HV three phase power supply at Easter Langlee ATT Fuel Preparation and Energy Production Facility, Langlee Road, Galashiels, Scottish Borders, TD1.

### 4.2 Distributor's Works

The Distributor's Works are set out in Part 3 of the Schedule.

### 4.3 Customer's Works

The Customer's Works are set out in Part 4 of the Schedule.

### 4.4 On Site Works

This offer assumes that all permanent reinstatement of our excavations at the Site will be your responsibility, as will the installation of mains ducting, service ducting and the supply and installation of meter board(s) in a position acceptable to the Distributor. A plan of the proposed routes may be forwarded to you on request after receipt of your signed and dated unqualified acceptance of this offer. Substation Accommodation, if applicable, shall be provided as set out in Part 5 of the Schedule.

Cable ducting is available on request.

## 5. Connection Characteristics

The Connection(s) shall have the Connection Characteristics (including earthing requirements) as detailed in Part 2 of the Schedule. Connection Conditions are detailed in Part 8 of the Schedule. Please note that an electricity supplier should only offer supply terms based on these Connection Characteristics and Connection Conditions.

## 6. Assumptions and Clarifications

The Distributor has made assumptions in respect of the preparation of this offer. Details of these assumptions and other clarifications in respect of this offer are set out in Part 7 of the Schedule.

7. **Appointment of Electricity Supplier**

This letter is an offer for **Connection(s) to the Distributor's System ONLY**. Please note that it is essential that an electricity supplier is appointed by the Customer for each new Connection in order to have that Connection energised. If you intend to export onto the distribution system from your site it will also be necessary to agree an export contract with a supplier/purchaser.

On our receipt of your signed and dated unqualified acceptance of this offer, we will send you the Electricity Supply Number(s) for the Connection(s).
This information is unique to each Connection and will be required by the chosen electricity supplier(s) to supply and fit metering and register a Connection.

The Distributor cannot provide an energised Connection until the Distributor has received an instruction to do so from the registered electricity supplier for that Connection. Please note that there will be a period of time between the appointment of an electricity supplier and that electricity supplier instructing the Distributor to energise a Connection.

8. **Revision of Offer**

The Distributor is entitled to determine, in its sole discretion, whether further studies are required as a result of the actual connection and design parameters of the Customer's Electrical Installation differing from that provided by the Customer to the Distributor in the Customer's application for this offer. Where such studies are required the Distributor shall be entitled to revise the Distributor's Works, the Charge and all dates specified in this Agreement by giving written notice to this effect to the Customer and this Agreement shall be read and construed as if such revisions were incorporated in it.

9. **Important Safety Matters**

You shall follow the guidance notes enclosed with this letter in respect of the requirements set out as to what you must do prior to the Distributor's Works commencing and read all other enclosures with this letter and comply with any other requirements set out in them.

To avoid danger from cables and overhead lines, it is very important that you, your contractors and subcontractors follow the advice given in documents HSE HSG 47 Avoiding Danger from Underground Services & HSE GS 6 Avoidance of Danger from Overhead Electric Power Lines available from the HSE.

10. **Customer's Electrical Installation**

It is essential that you procure that the Customer's Electrical Installation is constructed and installed according to the British Standard Requirements for Electrical Installations BS 7671:2001 IEE Wiring Regulations 17$^{th}$ Edition. You must procure that the Customer's Electrical Installation is inspected and tested in accordance with the general provisions of such British Standard Requirements and, where applicable, the Electricity Safety, Quality and Continuity Regulations 2002. If requested by us at any time, you must complete and sign a Confirmation of Electrical Installation/Extension Form W33/2 before a Connection can be energised.

11. **Connection Agreement and Site Responsibility Schedule**

All standard LV demand connections, single phase generation and micro generation (connected under Engineering Recommendation G38) are subject to the National Terms of Connection (NTC) as published by the Electricity Networks Association (ENA) at http://www.connectionterms.co.uk.

For all other connection types, a Site-specific Connection Agreement and interface Site Responsibility Schedule will require to be completed and entered into prior to the Connection being energised.

When the Distributor's Works have been completed and commissioned the Connection Agreement will, except to the extent that any obligations in this offer Letter remain to be implemented, supersede these terms and conditions but without prejudice to any outstanding liabilities.

For your information and further guidance a partially completed DRAFT Connection Agreement is enclosed with this offer.

## 12. Competition in Connections

You have the right to seek a competitive quotation for certain elements of the work required to make your Connection to the Distribution System (the "Contestable Works"). Only suitably accredited connection companies may carry out these Contestable Works. Information on accredited connection companies currently operating within the Distributor's area can be found: http://www.lloydsregister.co.uk/scheme_search.php

Other activities must remain under the Distributor's responsibility (the "Non-contestable Works").

Further information relating to the process by which a quotation can be obtained from the Distributor for the Non-contestable Works only (and competition in connections generally) can be found at:

http://www.sppowersystems.co.uk/NewConnections/specifications.asp.

## 13. Quotation Accuracy Scheme

Our Quotation Accuracy Scheme (QAS) is open to certain types of connection and service alteration requests. The QAS is a mechanism under which you are able to challenge the accuracy of charges quoted. Should our charges fall outside the corresponding ranges of costs published in our Connection Charging Statement (without adequate explanation for the difference) you may be entitled to a compensation payment of up to £500.

Further details regarding the types of services covered by the QAS and how challenges might be made can be found at:

http://www.spenergynetworks.com/NetworkConnections/quotation_accuracy.asp

Our Connection Charging Statement can be found at:

http://www.scottishpower.com/ConnectionsUseMetering.htm

## 14. Acceptance

Should you wish to proceed with your request for the Connection(s), as has been provided in this offer, please sign, date and return the enclosed acceptance form with payment of the Charge(s) in full and a completed, signed and dated CDM Information Request Form **without delay.**

This offer is open for unqualified acceptance by you, reaching us no later than 3 months from the date of this letter, after which date we shall have the option to decline such acceptance. This offer may be withdrawn by us at any time prior to such acceptance.

This offer may include a contribution towards an element of network reinforcement, which has been identified by the Distributor. If not the situation may change and on expiry of this offer any new or revised offer issued subsequently may be subject to a contribution towards any reinforcement assets identified by the Distributor. Any contribution towards reinforcement costs will be apportioned in accordance with our Condition 14 (1b) Connection Charging Methodology Statement.

We would however, advise you not to rely on any expired offer and we reserve the right to revise the terms (including the Connection Change and scope of the Distributor's Works) of any offer not accepted by you within the 3 month acceptance period.

Following receipt of your unqualified acceptance of this offer we will contact you in accordance with the requirements of the Electricity (Connection Standards of Performance) Regulations 2010 to discuss and agree your delivery requirements. Subject to the terms and conditions of this offer we will commence the Distributor's Works as soon as is reasonably practicable thereafter. The commencement of the Distributor's Works will be conditional on:

(i) All relevant Consents having been obtained;

(ii) You having complied with all the relevant provisions of the Agreement placing obligations on you in respect of such connection; and

(iii) If you are required to provide the Substation Accommodation, our acceptance of the Substation Accommodation and associated building work.

Please note: the date upon which we will be able to commence the Distributor's Works may be subject to you providing us with at least 16 weeks' prior written notice. We would ask that you take account of this when determining your delivery requirements.

If all of the Distributor's Works are not completed within 12 months from the date of our receipt of your unqualified acceptance of this offer, we shall be entitled, to amend and/or vary any terms and conditions of this offer and/or the Agreement, including, without limitation, the Charge(s) and/or other payments, to the extent that it is reasonable to do so.

This offer only relates to Connection(s) at the Site, it does not cover work on the Customer's Electrical Installation beyond the point of Connection.

Once this offer has been accepted the project manager for this project will be notified to you. If you wish further clarification of this offer and enclosures, please do not hesitate to contact me on 0141 614 1235.

Yours faithfully,

Scott Mathieson
For and on behalf of SP Distribution Ltd

Second Signatory

Enclosures:
1. Acceptance copy of this offer
2. General Terms and Conditions for Connection to the Electricity Distribution System dated 1st May 2012
3. CDM Information Request Form
4. Site Conditions for the Installation of SP Distribution Ltd Equipment
5. **SP Power Systems Limited Guidance Documents:** Getting it Right ; Your On-Site Responsibilities; Wayleaves and Consents; NRSWA (New Roads and Street Works Act 1999)
6. Draft Connection Agreement

**THIS IS THE SCHEDULE REFERRED TO IN THE FOREGOING OFFER BY SP DISTRIBUTION LTD FOR CONNECTION(S) TO THE ELECTRICITY DISTRIBUTION SYSTEM**

## Part 1

## Charge(s)

### 1. Charge Breakdown

A breakdown of the Charge(s) (exclusive of VAT) is provided in the table below:

| Category | Connection | Diversion | Reinforcement |
|---|---|---|---|
| Circuit Land & Fees | 4,560.00 | £0.00 | £0.00 |
| Ground-Mounted Substation | 124,454.88 | £0.00 | £0.00 |
| Substation Land & Fees | 9,848.00 | £0.00 | £0.00 |
| 11kV Underground Line | 633,080.21 | £0.00 | £0.00 |

### 2. Additional Charges

In addition to the Charge stated in this Part 1 of the Schedule the Distributor may require the Customer to pay additional charges as detailed below. Such charges will be payable in accordance with the provisions of this Agreement. The Distributor will notify the Customer from time to time of any such additional charges.

This offer is based on the following:

a) The proposed route is based upon a desk-top assessment and initial survey. If an alternative route is required or deviations to the proposed route increase the overall route length the Customer will pay for any reasonable and necessary additional costs incurred to facilitate the provision of that new route including any additional cables, lines or works and the Distributor will revise the Charge accordingly.

b) No allowance has been made in this offer for any noise studies, ground surveys, earthing studies, environmental impact surveys, studies and/or statements. If these studies, etc. are required the Customer will pay the Distributor's reasonable costs (including the costs of using external specialists and legal costs) associated with this work. If any reasonable additional costs arise out of the need to meet the requirements of these studies then the Customer will pay for the cost of this work.

c) The Customer is responsible for the removal (and disposal) and for the cost of the removal and disposal of any contaminated land, soil, etc from the Site and making good the Site.

## 3. Payment

The Charge(s) are payable in three staged payments, each payable in full prior to the commencement of any of the Distributors works.

The indicative Connection Charge for the plant and engineering works is £771,943.09 (Seven hundred and seventy One thousand Nine hundred and Forty Three pounds and Nine pence, plus VAT). The Connection Charge has been calculated in accordance with the Distributor's Connection Charging Methodology Statement.

http://www.scottishpower.com/uploads/statementofmethodology.pdf

The Connection Charge will be paid in the following stages:

| | | |
|---|---|---|
| 1. | Payment on acceptance of the Offer | £50,000.00 plus VAT |
| 2. | Payment ten working days in advance of placing contract for switchgear and cable procurement. | £200,000.00 plus VAT |
| 3. | Payment ten working days in advance of placing cable laying contract and substation installation. | £521,943.09 plus VAT |
| | **Connection Charge** | **£ 771,943.09 plus VAT** |

## 4. CUSC REQUIREMENTS - STATEMENT OF WORKS

You are advised that the Distributor may be required to request a Statement of Works for the Easter Langlee ATT Fuel Preparation and Energy Production Facility and that NGET may as a result impose upon the Distributor certain costs or restrictions that could result in the Distributor being required to vary the scope of the Distributor's Works, the Target Date, the Connection Charge and any other provision contained within this Offer, For this reason this offer is made conditional upon the results of any Statement of Works subsequently provided by NGET and the Distributor reserves the right to modify the provisions of this offer to take account of any such costs or restrictions imposed upon it by NGET.

A Statement of Works provided by NGET may impose on the Distributor certain costs or restrictions that could result in the Distributor being required to vary the scope of the Distributor Works, the target date, the Connection Charge and any other provision contained within this offer. For this reason, this Offer is made conditional upon the results of any Statement of Works subsequently provided by NGET and the Distributor reserves the right to modify the provisions of this offer to take account of any such costs or restrictions imposed upon it by NGET. Further costs (to cover NGET fees) shall be levied upon you, should NGET determine that the Distributor is required to submit a modification application as a result of the request for a Statement of Works. Any failure by you to comply with the requirements to pay to the Distributor the costs in respect of NGETs fees will result in this quotation being withdrawn.

## Part 2

## Connection Characteristics

A supply of 1.1MVA with an Export capacity of 4.7368MVA (4.5MW with a power factor range of 0.97lagg to 0.95lead) will apply with the power balanced over three phases. The supply will be 11kV (+ or - 6%) 3 phase, 3 wire, 50 hertz (+ or - 1%) AC. The design fault level is 250MVA at 11kV.

The point of connection will be the high voltage metered circuit breakers within the substation and it is your responsibility to install suitable cables from that board to your own switchgear and materials required for termination in a dry cable box. Your switchgear must be located in the switchroom immediately adjacent to the substation building provided for the Distributors equipment.

**Earthing System**

TT earthing will apply in accordance with the British Standard Requirements for Electrical Installations BS 7671:2008 (IEE Wiring Regulations 17th Edition). An earth terminal will not be provided, consequently you will be required to make your own earthing arrangements.

## Part 3

## Distributor's Works

The Distributor will carry out, the following works, which will remain the property of the Distributor:

1. The Distributor will provide this connection by looping in the new on-site 11kV metered connection point from a new 11kV switching station in the vicinity of Boleside Road, Galashiels which will connect to a suitable point on the existing 11kV circuit and extending the existing 11kV circuit by installing 5.64km of new 11kV 185(3) XLPE underground cable. The 2.82km double 11kV cable circuit track will comprise of a route that will consist of road and verge and will include a trenchless river crossing.

2. Install and commission all switch gear and associated equipment in the Distributors on-site secondary substation and off-site secondary switching station. Obtain all consents for, installing and commissioning of new network to connect your substation to the Distributors existing distribution system.

3. Oversee termination of the customer's cable at the Distributors metered circuit breakers.

4. Issue a Connection Agreement for the site.

5. Witnessing of Customers G59/2 compliance tests up to a maximum period of one normal working day.

There are no reinforcement costs included or required within this quotation.

The Point of Connection to the existing network is: 350840, 634664

## Part 4

## Customer's Works

All on site excavation including road crossing, mains and service ducting, backfill and permanent reinstatement will be the customer's responsibility. Please note that all trenches to be blinded with graded sand before and after cable(s) are laid, the trench then to be back-filled with fine-fill excavated material and reinstatements carried out by you. See above Section (On Site Work).See enclosed Power Systems Guidance Documents. You will be required to provide and attach a backboard of suitable size and fireproof material to the wall at the new meter position. Our equipment will then be fixed to this board. An Energy Networks representative will visit your site before the programmed date to check your ducting is installed correctly, all excavations are completed, and that the site is generally ready for our works to commence. Should the site not be ready your job may be postponed. Your electrical contractor is responsible for your wiring installation. Your contractor will make the final connection to the outgoing terminals of the metering circuit breaker.

Distributed Generation Subject to the provisions of this Letter of Offer, the Customer will carry out or provide or procure the carrying out and provision of the following works and other matters:

1) Installation of site works including generators, transformers, cables, protection and telecommunications equipment. Installation of the Customers 11kV circuit breakers, protection, earthing systems, telecommunications equipment and meters.

2) Provision of a levelled and drained substation site, and indoor facility to accommodate the Distributors 11kV switchgear, associated metering, protection and telecommunications equipment.

3) Provision of suitable access from the public highway to the compound/substation location, suitable for the transport of all of the Distributors equipment and future operational access.

4) Provision of a 230 volt single phase supply for the Distributors battery charger and accommodation for this equipment.

## Part 5

## Substation, Metering and Protection Equipment Accommodation

You will be required to make available suitable accommodation for the Distributor's 11,000 volt metering switchgear by provision of a levelled and drained substation site and indoor accommodation to be agreed with the Distributor. Provision of suitable access from the public highway to the compound/substation location, suitable for the transport of all of the Distributors equipment and future operational 24 hour unrestricted access shall be provided by the customer. In addition you will be required to provide suitable accommodation, including a backboard, for the Distributors metering equipment, battery charger and NVD protection relay. Each space provided should be 1000mm high, 1000mm wide, and 1000 mm deep, and between 500mm and 2000mm above floor level. A minimum of 750mm access in front of the equipment should be provided. Any variations to these dimensions must be agreed with the Distributor.

The above will be provided to the satisfaction of the Distributor at your expense. Notwithstanding any other provisions of this Agreement, any obligation on the Distributor to provide the Substation Accommodation, carry out the Distributors Works and meet any time scales is subject to the Customer, if required by the Distributor, granting, or procuring the grant, to the Distributor of a lease (free of charge save for a nominal premium of £1) to occupy the substation site(s) in such form and on such terms as required by the Distributor. A copy of the Distributors standard form of lease is available on request. Where the Distributor requires that such lease be provided, the Customer shall immediately instruct a lawyer to urgently progress the legal work which requires to be undertaken on behalf of the Customer in order to produce that lease, as any delay in that legal work being undertaken may cause delay to the Distributor providing the Substation Accommodation, carrying out the Distributors Works and meeting any time scales.

## Part 6

## Information Relevant to Competition in Connections

### NON-CONTESTABLE WORKS AND ASSOCIATED COSTS

| Charge Description | Total Cost |
|---|---|
| Charge for the non contestable connection to the network | £ 40,273.76 |
| Reinforcement costs | £ 0 |
| Diversionary works costs | £ 0 |
| **Total Non-Contestable Cost Exclusive of VAT** | £ 40,273.76 |

The Non Contestable Works costs are indicative only and do not include the fees for design approval, inspection and monitoring, witness of testing etc. You have the right to seek a competitive quotation for certain elements of the work required to make your Connection to the Distribution System (the "Contestable Works"). Only suitably accredited connection companies may carry out these Contestable Works. Information on accredited connection companies currently operating within the Distributor's area can be found: http://www.lloydsregister.co.uk/scheme_search.php.

A suitably accredited connection company once appointed can apply for and accept a formal Point of Connection quotation.

## Part 7

## Assumptions and Clarifications

The Distributor has assumed the following within this offer:

This offer and the enclosed design are based upon a desk-top assessment utilising information from existing utility records and information provided by you at the time of application. On occasion the enclosed design may require to be altered. It will be your responsibility to pay for any reasonable and necessary additional costs incurred, including any additional cables, lines or works, in the following circumstances:

a) Where, following completion of a survey of the route, an alternative route is required or deviations to the proposed route are required; and/or
b) Where technical investigations of ground conditions demonstrate that additional work or amendments to the proposed works are required

We will notify you of any additional charges which shall be payable in accordance with the provisions of this Agreement. Where the findings of the survey(s) and/or technical investigations result in a rebate of charges, you shall be notified by us of the amount of the rebate and the timescales within which payment shall be returned to you.

We have provided an undefined provisional sum of £43,470.00 to cover the directional drilling works required to cross the Gala River and any variance to this allowance will constitute a variation to the connection charge.

Should you otherwise require any changes to the enclosed design, please inform us as soon as possible in order that we might consider any necessary changes to the scope of Our Works.

The offer is based on all works being carried out during normal working hours (Monday to Friday 08.30hrs to 16.30hrs). Should there be a third party requirement which results in us having to work out-with normal working hours or reduce the working day, we will notify the Customer of this variation to the works and the Customer shall reimburse the Distributors in accordance with the relevant Conditions. We have not seen or been provided with copies of any reports pertaining to environmental, animal welfare, archaeological digs, areas of special scientific interest, hydrological and topographical matters. We have made no allowance within the Offer sum to cover such matters.

Security for the on-site works shall be provided free of charge by you. You are responsible for insuring the works against loss, theft or damage for the duration of our works. Any loss or damage necessarily incurred by us, howsoever caused, shall be recompensed to us.

We would require a variation order to be instructed to cover any specific matters arising during the course of the works. As we have not been provided with site investigation and / or trial hole details along the route we have made no time or monetary allowance for excavation and reinstatement of any alternative route and / or secondary sub-surface categories subsequently encountered or required for whatever reason. Any additional costs and time incurred in the re-routing, removal and / or making good of same shall constitute a variation to the contract and shall be reimbursed to the Distributor in accordance with the relevant Conditions.

We have made no time or monetary allowance for any noise studies, ground surveys, earthing studies, environmental impact surveys, studies and/or statements. If these studies, etc. are required they shall constitute a variation to the contract and shall be reimbursed to the distributor in accordance with the relevant Conditions (including the cost of using external specialists and legal costs) associated with this work together with any reasonable additional costs arising out of the need to meet the requirements of these studies. We are entitled to determine, in its sole discretion, whether further studies are required as a result of the aforementioned. Where such studies are required we shall be entitled to revise the Scope of the works, the Connection Charge and any dates specified within this Offer by giving written notice to this effect to the Customer and this Offer shall be read and construed as if such revisions were incorporated init.

We have made no allowance for dealing with the excavation and removal of any unforeseen hard materials. e.g. rock, concrete or reinforced concrete etc.

We have made no allowance for costs associated with specialist contractor excavation /reinstatement of non standard surface types. e.g Granite Sets, Caithness slabs etc.

We have made no allowance for working in or the treatment of and/or removal of contaminated /hazardous materials or for the rectification of unavoidable land damage. e.g. field drains, crop damage etc.

## Part 8

## Connection Conditions

### *Connection Agreement*

A Connection Agreement will be required, and needs to be completed before the Customer's installation can be energised. The site specific details (including these in the Offer Letter) will need to be included and any technical or other conditions we may need to impose.

### *Connection/Energisation of Generating Plant*

We are not obliged to permit connection of the Customers Installation (including the Generating Plant) directly or indirectly to the Distribution System unless we are satisfied such Generating Plant will not cause danger to or undue interference with our Distribution System or supply to others. The point of connection will be at the outgoing terminals of the Distributors metering unit. The Distributor shall not be obliged to permit connection of the Customers Installation to the Distribution System nor to energise the Connection Point unless all payments due under this Agreement at that time have been made.

### *Phase Balance and Power Factor*

The Generating Plant output and connected load must be balanced over the three phases and across the circuits, complying with Engineering Recommendation P29 (Planning Limits for Voltage Unbalance). The vector sum of the real and reactive power should not exceed the kVA limit as specified.

### *Distribution Code, etc*

Both parties shall comply with their respective obligations as in the Distribution Code. Other relevant regulations include the Electricity Safety, Quality and Continuity Regulations 2002.Your attention is drawn to the provisions of our Distribution Code under which we are required to prepare and agree with you a responsibility schedule and an operation diagram showing the agreed ownership boundaries. We also refer you to the Electricity at Work Regulations 1989 and the need to ensure that high voltage equipment is operated by competent persons

### *Emergency Trip Facilities*

An individual emergency trip facility will be provided adjacent to the Connection Point metering panel for connection. This will enable you to disconnect your own incoming high voltage supply in an emergency. (The Distributor will be required to re-set this trip facility and re-energise the supply).

### *Variations in Voltage and Frequency*

On occasions incidents outside our control may cause variations in the voltage and frequency referred to above. This may affect the normal operation of sensitive electronic equipment. If there are any problems, we should be contacted on the published telephone number.

### *Disturbance on our Distribution System*

The Generating Plant output and connected load must not cause disturbances on our Distribution System and it is essential that your load characteristics comply with the requirements of Engineering Recommendations G5/4-1 (Limits for Harmonics), P13/1 (Electric motors - Starting Conditions) and P28 (Planning Limits for Voltage Fluctuations). You must submit full details of any load which might cause disturbances, before connection of the Customers Installation (including the Generating Plant) whether covered by these guidance documents or not, for our consideration. Further information is available on request.

***Protection Relays***

It will be necessary for you to contact this office in order to discuss the settings on the protection relays. Protection arrangements and details will be made available on request.

***Generation***

Any installation for generation must comply with the requirements of the Electricity Safety, Quality and Continuity Regulations 2002 and the principles of Engineering Recommendation G59/2 and G75/1 issued by the Energy Networks Association and with the requirements embodied in G5/4-1 and P28 at the connection point. Precise methods of protection and mode or restriction of operation (e.g. Voltage regulation) to be agreed subsequently between the Customer and the Distributor and written into the Connection Agreement. In addition to P28 if your generation causes a voltage depression greater than 1%, no similar voltage depression should be caused within two hours. This is to be achieved by a timing relay. Precise methods of protection and mode or restriction of operation (e.g. Voltage regulation) to be agreed subsequently between the Customer and the Distributor and written into the Connection Agreement.

***Substation***

You are required to provide the Substation Accommodation civil works in a position approved by us and in accordance with our guidance drawings and specifications which will be submitted to you. All builders working drawings must be submitted to us for comment before the commencement of any civil works. You are also required to ensure that the land upon which the Substation Accommodation will be constructed is free from any environmental hazards contamination or pollution and also free from any conducting media including mains drains, sewers, pipes, wires or cables which would prevent or restrict or interfere with the operation of the substation equipment or impose any financial obligations or burdens on the Distributor. The Customer shall be responsible for any works or costs required to comply with the obligations and conditions contained in this paragraph.

The following conditions also apply:-

The Substation Accommodation must be provided by you at your cost on land you own or lease and hold good title to the reasonable satisfaction of the Distributor`s solicitors and you must obtain all Consents of any kind necessary to allow such provision (including any Consents to enable a valid substation Lease to be granted). You must complete the Substation Accommodation civil works:-

a) in a good and workmanlike manner in accordance with good sound working practices and you must obtain at your expense all necessary Consents required (including planning permission and building regulation approval);

b) in accordance with all requisite Consents (including planning permission and building regulation approval);

c) in accordance with the builders working drawings submitted to and approved by us (such approval not to be unreasonably withheld or delayed) and to our reasonable satisfaction; and

d) in accordance with all statutory requirement and subordinate legislation relating in any way to the Substation Accommodation or the construction of it including the Construction and Design Management regulations.

No plant or equipment will be installed in the Substation Accommodation by us or our contractors until we have notified you in writing that the building work (including the construction of the access road) associated with the construction of the Substation Accommodation has been completed to the reasonable satisfaction of our building surveyor and ownership and access rights have been secured by the Distributor.

You shall make available a main 100 amp, 1 phase, 400/230V 50Hz AC electricity supply within the Substation Accommodation and install, maintain and provide these services together with any other services reasonably required by us.

These low voltage supplies must be made available on handover of the Substation Accommodation and the Customer is responsible for the ongoing provision of these supplies. The supplies shall be from secure sources (stand-by generators are not acceptable) to support battery chargers supplying protection.

Where the Distributor gives any approval under the provisions of this Agreement such approval shall be given solely for the purpose of this Agreement and save where express written representations are made the Distributor does not give any warranty or guarantee express or implied as the matter the subject of the approval and the Customer must rely on its own skill and judgement as regards such matters.

The Distributor will provide the Customer with details of the Distributor requirements for the Substation Accommodation to assist with the Customer`s obligations under this Offer Letter including the planning application.

***Metering***

You or your chosen supplier must appoint an approved meter operator who will be responsible for the installation of the necessary import/export metering which must comply with the relevant metering code of practice.

***Special Generation Connection Conditions***

Schedule 4 of the Connection Agreement sets out the details of these conditions. Some of these conditions will apply prior to the connection being made. The following restrictions and constraints on the availability of the export capacity shall apply:-

a) The connection provided is "Unfirm".

b) During System Normal the maximum export capacity is as stated in part 2 Connection Characteristics above.

c) The Distributor may plan and execute other outages of its distribution system as mentioned in the Connection Agreement.

The above special conditions do not cater for the emergency situations, which may occur from time to time. The Distributor also reserves the right to instruct generators to reduce or curtail power export and reactive power import during time of operational difficulties (or as so directed by our control engineer).

The provision of this clause will be repeated in the Connection Agreement.

## ACCEPTANCE COPY - TO BE RETURNED TO SP POWER SYSTEMS LIMITED

TO
SP Power Systems Ltd
Shared Service Centre
3rd Floor Avondale House
Phoenix Crescent
Strathclyde Business Park
Bellshill ML4 3NJ

From
New Earth Solutions Group Ltd
Key House
35 Blackmoore Road
Ebblake Industrial Estate
Verwood Dorset

**Offer of Load and Distributed Generation – Re QAS 91351 Easter Langlee ATT Fuel Preparation and Energy Production Facility, Langlee Road, Galashiels, Scottish Borders, TD1**

The cost for this work will be £771,943.09 (exclusive of vat) The Connection Charge will be paid in the following stages:

| | | |
|---|---|---|
| 1. | Payment on acceptance of the Offer | £50,000.00 plus VAT |
| 2. | Payment ten working days in advance of placing contract for switchgear and cable procurement. | £200,000.00 plus VAT |
| 3. | Payment ten working days in advance of placing cable laying contract and substation installation. | £521,943.09 plus VAT |

**[Cheques should be made payable to SP Distribution Ltd for the staged payment amount.]**

A supply of 1.1MVA with an Export capacity of 4.7368MVA will apply to the site. Please refer to Part 2 of the above Schedule for the full Connection Characteristics. TT earthing will apply in accordance with the British Standard Requirements for Electrical Installations BS 7671:2008 (IEE Wiring Regulations 17th Edition).

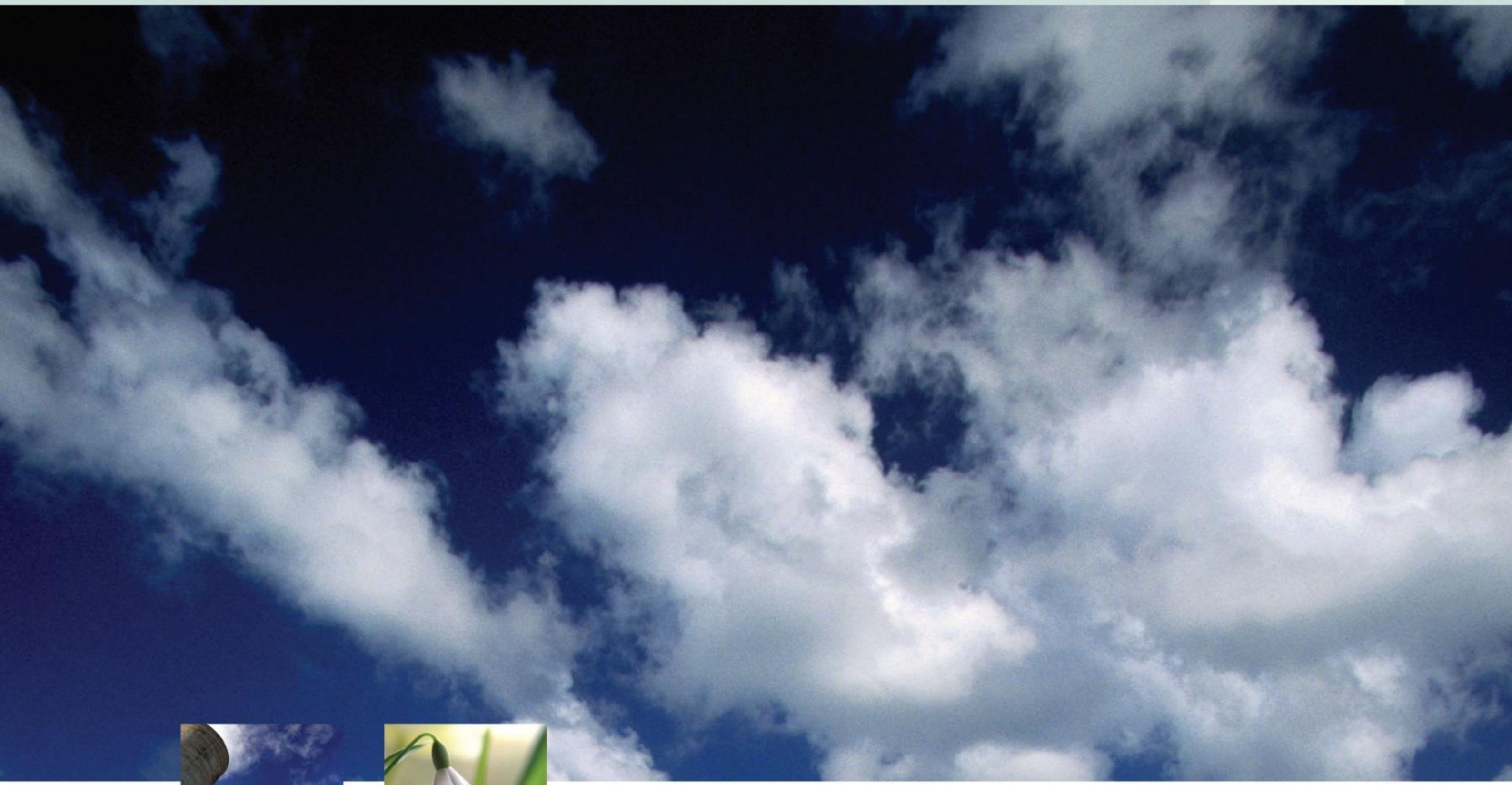
**Acceptance and Declaration**

1. I/We accept the offer and agree to the terms and conditions set out in the offer letter referenced above.
2. I/We enclose the first of the Charge(s) associated with the above connection made payable to SP Distribution Ltd
3. I/We warrant that I/we will employ a competent electrical contractor who will ensure that the Customer's Electrical Installation is constructed and installed according to the British Standard Requirements for Electrical Installations BS 7671:2001 IEE Wiring Regulations 17th Edition.
4. I/We warrant that I am/we are not the nominee or agent of an undisclosed principal and that I/we will assume sole and complete responsibility for the performance of the Customer's obligations under the Agreement.
5. I warrant that I am appointed by and acting with the authority of the Customer and that I am an authorised signatory for the Customer with full authority to enter into the Agreement on behalf of the Customer. If I do not have such authority, I shall be personally liable under the Agreement.
6. I/We warrant that SP Distribution Ltd will be informed of a change of responsibility for the electricity supply and / or connection.
7. I/We understand that an electricity supplier must be appointed before a meter can be installed to complete the connection.
8. I/We understand that there is a choice of Electricity Suppliers available. **Upon payment and acceptance SP Power systems Ltd will issue the MPAN reference number(s) which I/we will need in order to enter into a contract with a chosen Energy Supplier.**
9. **Once I/we have entered into a supply contract I/we shall return the Supplier Notification Letter with the relevant information.**
10. I/We understand that 1/we will have to enter into a contract with an Energy Purchaser who will issue an export MPAN reference number. **Once I/we have entered into an export contract and have an export MPAN reference number I/we will return the Supplier Notification letter with the relevant information.**

| | |
|---|---|
| **For and on behalf of the Customer:** | **Date:** |
| **Print Full Name:** | **Position:** |
| Site contact name: | Site telephone number: |
| Requested connection date: | I enclose payment of: £50,000 (plus VAT) |

**This acceptance requires to be signed by a person with the necessary authority to bind the Customer, e.g. a Director.** Please complete and return the following with your acceptance: CDM Information Request Form

# APPENDIX F. END OF WASTE APPLICATION






# END OF WASTE APPLICATION
## Synthesis Gas

## New Earth Energy Ltd
## New Earth Advanced Thermal (NEAT)

Prepared by:
**Sol Environment Ltd**

Date:
**May 2013**

Project or Issue Number:
**SOL1212NE01**

**Sol Environment Ltd** | Malvern | Bristol | Edinburgh
enquiries@sol-environment.co.uk | t. +44(0)1684 572727 (Switchboard) | +44(0)117 9372811 (Bristol)

| VERSION CONTROL RECORD | | | |
|---|---|---|---|
| **Contract/Proposal Number:** | | SOL1212NE_01 | |
| **Authors Name:** | | Steve Butler | |
| **Signature:** | | | |
| **Issue** | Description of Status | **Date** | **Reviewer Initials** |
| C | Draft for Submission | 21st May 2013 | SMB |

# CONTENTS



## ANNEXES

# EXECUTIVE SUMMARY

This application is on the behalf of New Earth Energy Ltd for an end of waste determination 'opinion' to be sought from the Scottish Environmental Protection Agency in relation to the synthesis gas produced by their proprietary advanced conversion technology utilising pyrolysis.

New Earth Energy has developed an advanced conversion technology (namely the 'New Earth Advanced Thermal' or NEAT process) that has been designed to generate clean pyrolysis (synthesis) gas from waste derived feedstock materials. The technology can be used with clean virgin materials and waste derived products alike.

The primary feedstock for the NEAT process will be a manufactured RDF product that complies with a consistent fuel supply specification that forms part of the company's externally accredited Quality Management System.

The sole purpose of the NEAT process is to generate a synthesis gas that can be used to fuel industrial gas engines and electrical generation sets for the purposes of generating clean renewable energy. As well as the gas quality and GCV meeting the requirements of Ofgem Synthesis Gas requirements thus enabling qualification under the Renewables Obligation Order 2009, the synthesis gas will be manufactured in accordance to a quality specification.

All synthesis gas being produced by the plant can be used directly as part of a close coupled CHP scheme or be exported to a neighbouring third party for similar use.

There are a number of gas engines on the market that have been specifically designed to operate using industrial gases with similar (and significantly worse) properties. These engines produce electrical power at a comparable output with a comparable level of emissions (NOx and CO) when compared with the combustion of Natural Gas used in similar applications.

The NEAT process plant and the synthesis gas produced will be subject to a very detailed monitoring regime that will ensure that a quality specification is met at all times. In the event that the gas or the upstream production plant cannot meet the quality specification, the production of synthesis gas will cease and any residual quantities flared. The specification parameters for the synthesis gas used within this application are largely identical to those previously derived and determined meet 'End of Waste' by the Environment Agency in England.

New Earth Energy's NEAT technology when operated as described in this application, successfully converts RDF materials into a distinct and marketable product. The gas produced by the NEAT process can be combusted in a number of commercially available gas engine types in a similar manner as mains supplied natural gas or other industrial or bio-methane gas sources. The combustion of synthesis gas is no more polluting than the combustion of natural gas in similar applications.

In demonstrating the pollution potential of the synthesis gas produced by the NEAT process, an evaluation of carbon intensity has been made. This method of assessment of carbon used in power generation is widely recognised as a key metric for assessing the environmental effect of greenhouse gas emissions in power generation. The carbon intensity is expressed as kg of $CO_2$ per kW of electricity for power generation. Using this methodology a significant saving in $CO_2$ emissions saving is shown.

Further analysis of the $CO_2$ impacts using the WRATE software tool (Waste and Resources Assessment Tool for the Environment) has been carried out. This software compares the environmental impacts of different municipal waste management systems. WRATE uses life cycle assessment to include the resources used, waste transportation and operation of a whole range of waste management processes with their environmental costs and benefits.

The output of the WRATE tool indicated that with user defined waste composition, comparable to the waste to be used with pyrolysis of the residual waste, a carbon intensity of 0.34 was found compared to carbon floor of 0.4.

The outputs from WRATE also demonstrate and support the position that the use of syngas has a lower environmental impact than using natural gas for power generation. These results are provided in Annex E.

The renewable electricity generated by the pyrolysis to syngas plant also addresses other issues to which natural gas makes no contribution:

- Proximity Principle mandates use of locally sourced biogenic renewable fuel, rather than remotely sourced natural gas; and with this scenario increases security of supply. The scenario decreases the relative effect on the environment of use of syngas over use of natural gas.
- Landfill or other sub-optimal waste management processes such as dilution or feedstock to low efficiency incinerators is avoided; and in landfill the substantial contribution of methane to the atmosphere (even with methane recovery) cannot be offset where natural gas is used.
- Power generated will contribute to the Carbon Reduction Credits and Resource Efficiency in ways not available with natural gas.

Based on the above it is therefore the consideration of New Earth Energy Ltd that the clean synthesis gas produced by their proprietary pyrolysis plant, when operated as described above, meets the published definition of '*End of Waste'*.

# 1. BACKGROUND INFORMATION

This Section provides general information on the applicant, including contact details, permitted activities and the proposed waste types that are to be processed.

| Table 1A – General Information | |
|---|---|
| Organisation Name | New Earth Energy Ltd |
| Address | Key House,<br>Ebblake Industrial Estate,<br>Verwood,<br>Dorset, BH31 6AT |
| E-mail | Robert.Asquith@newearthgroup.co.uk |
| Company Registration | 06586399 |
| Telephone Number | 01202 812300 |

| Table 1B – Activities | |
|---|---|
| Permit Reference Number | N/A |

**Over view Description of permitted activities**

New Earth Energy Ltd are the supplier of a proprietary waste pyrolysation and energy generation equipment that utilises a licensed and patent protected technology. The process is referred to as the New Earth Advanced Technology (NEAT) process and is the conversion technology that forms the basis of programme of waste to energy projects across the UK.

The company has a commercial scale plant (3 tonnes per hour) at their Mechanical Biological Treatment (MBT) Plant at Canford in Dorset, South of England and a 60,000 tonne per annum facility now under full operation in Avonmouth, Bristol, with a second processing line that will be operational at the end of 2013 that will double the capacity to 120,000 TPA. The company plans to roll out a series of similar Installations across the UK.

The NEAT technology is unique in how it combines the gasification of the generated solid (char) fraction of the pyrolisation process to produce the primary heat source for the main pyrolysis process. All synthesis gas (*the 'product' and subject of this application*) produced by the pyrolysation process (a rotating drum retort) is processed through a ceramic gas filtration plant and water quench to remove solid, liquid and acid contaminants.

The resulting synthesis gas is then suitable for use directly as either a fuel to generate electrical power (through the use of a gas engine or turbine generators) or to provide heat.

This pyrolyser has been trialled over a wide range of fuels and waste feedstocks and proven to produce a clean synthesis gas. In all of New Earths installations the NEAT system will be used to process RDF fuel feedstock produced from a close coupled or remote MBT or 'Dirty' MRF facility.

A simplified process description and photos of the NEAT process have been included within Annex A of this application document.

## Table 1C – Incoming Waste Information

The materials used for a feedstock for the pyrolysation process processed by New Earth, will be supplied directly by New Earth from a close coupled or remote MBT or 'Dirty' MRF plant which will be providing a manufactured RDF feedstock that complies with New Earths pre-determined quality specification.

All material feedstocks being introduced into the process will be subject to acceptance testing, will be produced in accordance to New Earth's quality management system and be prepared from non-hazardous waste feedstocks.

All material accepted for the NEAT process will be non-hazardous, free from of metals, hazardous waste content and aggregate and be supplied in accordance to the following specification;

| Table 1C: Incoming RDF Specification | | |
|---|---|---|
| **Description** | **Units** | **Value** |
| Moisture Content (MC) | % mass as received | 15-40 |
| LCV as received | MJ/kg | 10-20 |
| Ash Content | % mass as received | 8 (with 40% MC)<br>18 (with 15% MC) |
| Chlorine | % mass as received | 0.7 |
| Bulk Density | Kg/m$^3$ | 80 - 350 |
| Size | mm | 100 x 100 x 100 |

| Table 1D: Typical RDF Analysis | | |
|---|---|---|
| **Parameter** | **Constituent % m/m** | **Details** |
| Biomass Content | 75.0% | Moisture: 17.83%<br>Dry Basis: 48.77%<br>Plastics: 2.02%<br>Inerts: 6.40%<br>Metals: 0.00 |
| Inerts | 3.0% | 3.0% |
| Plastics | 15.6% | Plastics: 13.4%<br>Moisture: 2.2% |
| Metals | 6.4% | 6.4% |
| | | |
| Total | 100% | 100% |
| Total Ash | 11.1% | |
| Total Moisture | 20.00% | |
| Biomass (Mass Basis) | 75.0% | |
| Gross CV | 15.3 MJ/kg | |
| Net CV | 12.6 MJ/kg | |
| Biomass (Energy Basis) | 43.9% | |

Detailed analysis of the typical RDF materials processed by the plant is included in Annex B.

Prior to processing into RDF, all wastes accepted into the plant will be subjected to stringent waste acceptance criteria (*Procedure .43 (27.1 AVO) Waste Acceptance and Monitoring*) in accordance with the Company's Integrated Management System and associated procedures (see Table 2C).

The Waste Acceptance and Monitoring procedures are provided in Annex C.

| ***Waste Type 1 – RDF*** |
|---|
| **EWC Code: 19-12-10** |
| **Description:**<br>All RDF feedstocks processed by the NEAT process will be supplied in accordance to specification requirements in accordance with site quality management and acceptance standards.[1]<br><br>All materials will undergo inspection and acceptance when it arrives at site and be passed as suitable for processing by the site/process manager. |

**Photo 1:** Example RDF Materials prepared for processing

[1] Outline details of waste acceptance procedures provided in Section 1C of this document.

# 2. END OF WASTE JUSTIFICATION

This Section provides a justification for the proposed fuels in order to satisfy the end of waste criteria, in particular how the material meets the questions identified by Annex 4 of the European Waste Framework Directive.

| Waste Framework Directive - Annex 4 Questions |
|---|
| i. What is the non-waste material that it will be substituting for and is it a suitable substitute?<br>*Question (i) is largely met within Table 2A and 2B which provides full details of the processing to which it has been subjected and the way in which it is marketable e.g.*<br>- *what makes the synthesis gas distinct from the original waste?*<br>- *what is the intended market for the synthesis gas?*<br><br>ii. Will the material actually be used in the same way as the non-waste material it is being compared with?<br><br>iii. Is further processing required before use? If the answer is 'yes', the substance or object may still be waste.<br>*Question (ii) and (iii) is answered within Table 2C which provides the details of the virgin fuel (Natural Gas) that the waste derived synthesis gas replaces and the applications that product will be used in.*<br><br>iv. If used in the same way as the comparable non-waste material, can it be used under the same conditions of environmental protection as the non-waste material without any greater danger of harm to human health or the environment? with no worse environmental effects<br><br>*Question (iv)has been addressed in Table 2Cc, Table 2E and 2F which identifies any parameters unique to the syngas that would not be found in Natural Gas. Specific details on the potential contaminants that could be present in Natural Gas have been provided from information produced by the Environment Agency's Biomethane Injection Technical Advisory Group.*<br><br>*Specific information is provided in Section 2C that details both a specification of the virgin comparator and a specification for the synthesis gas by which a comparison can be drawn. Information has been provided that defines how every batch of syngas will comply with the above technical specification, along with the associated sampling and analytical methods. Tables 2E and F focus specifically on the Carbon Intensity and combustion emissions of the syngas when compared against the Natural gas comparator.*<br><br>*This application provides details of New Earths waste acceptance procedures, quality assurance procedures, sampling and analytical methods (including limits of detection) that ensure that the Synthesis Gas will consistently meet the specifications determined above. Information is provided to how batches be dealt with if they fail the specification.*<br><br>v. Is there certainty that the waste will be used and will it be used in accordance with (ii)?<br><br>*In all cases the synthesis gas will be used in the same manner as natural gas so therefore this question is not discussed further within this application.*<br><br>vi. Is the person accepting this recovered 'waste' being paid to accept it?<br>*Question 6 is not relevant for this application as the synthesis gas is passed directly to New Earths closed coupled CHP plant for use directly as a fuel.* |

This application also gives consideration to the EU Judgment of the Court (Second Chamber) of 4 December 2008 (reference for a preliminary ruling from the Korkein hallinto-oikeus —Finland) — Lahti Energia Oy (Case C-317/07), which decreed that;

"*a gas plant whose objective is to obtain products in gaseous form, in this case purified gas, by thermally treating waste must be classified as a 'co-incineration plant' within the meaning of Article 3(5) of Directive 2000/76";*

and that *'a power plant which uses as an additional fuel, in substitution for fossil fuels used for the most part in its production activities, a purified gas obtained by the co-incineration of waste in a gas plant does not fall within the scope of that directive*.'

Reference has also been made within this application to the Lord Reid & Longannet (2004) case which decreed that; *"…the material in question can and will be used without further processing in the same way as a non-waste material……..and under the same conditions of environmental protection as the non-waste material with which it is otherwise comparable, without any greater danger of harm to human health or the environment"*

On the basis of the above decisions, although it is fully accepted that the pyrolysis aspects of the NEAT process will be regarded as being an incineration plant under the Industrial Emissions Directive (and the former Waste Incineration Directive) the clean synthesis gas produced by the NEAT process is considered to meet the definitions of 'Fully Recovered' and therefore its combustion within the associated power plant (CHP Engines) is not considered to fall under the scope of the Industrial Emissions Directive.

The following sections of the Application provides the following information;

- A Process Overview and Non Technical description of the operations by which the waste will be converted into a distinct and marketable product is provided in Table 2A.
- Description of applications in which the waste-derived fuel can be used is provided Table 2B.
- Provision of validated specifications and sampling / analytical methods of both the waste-derived fuel and a comparator fuel (natural gas and/or non waste derived biogas), in order to demonstrate the compostional similarities (including fuel and environmental parameters) between the two fuels is provided in Table 2C.
- Use of the WRATE software to compare the environmental impacts of different municipal waste management systems. WRATE uses life cycle assessment to include the resources used, waste transportation and operation of a whole range of waste management processes with their environmental costs and benefits.
- A comparison of the combustion emissions of syngas and natural gas takes which takes into account the renewable carbon from the biogenic content of the waste is provided in Table 2D-F; and
- Provision of Waste Acceptance Procedures to be utilised during site operation (including Waste Rejection) is included within the Appendices.

Accordingly, the combustion of the resultant pyrolysis gas produced by the pyrolysis plant within the CHP plant does not fall under the controls and monitoring requirements stipulated by Section 5.1 Part A(1) of the Industrial Emissions Directive (IED).

| Table 2A – Process Overview | |
|---|---|
| **Process Name:** | New Earth Advanced Technology (NEAT) Process (Pyrolysis) |

**Process Overview / Justification**

New Earth Energy Ltd have developed a unique and patent protected 'Advanced Pyrolysis'[2] process which can be used for the production of synthesis gas from biomass containing virgin and refuse derived fuel feedstock materials.

The technology produces a high quality synthesis gas which can be utilised in a multitude of combustion applications which can be either directly or indirectly coupled for the generation of either onsite or offsite heat or electrical power.

A process schematic is provided in Annex A.

New Earth Energy Ltd are in the process of installing their NEAT process in a number of their existing MBT or 'Dirty MRF' facilities within the UK. Although the schemes all vary in their application, they will all take RDF produced to the exact same specification for processing to clean synthesis gas.

The synthesis gas produced by the NEAT process will meet a defined quality specification and be either used directly, or exported to a neighbouring facility for the production of heat and/or electrical power.

The production of synthesis gas from the waste feedstock provides a sustainable alternative to mains supplied gas. The synthesis gas is a flammable mixture of carbon monoxide (CO), carbon dioxide ($CO_2$), hydrogen ($H_2$), methane ($CH_4$) and other short chain hydrocarbon gases. This mixture is sometimes also referred to as producer gas or town gas.

The cleanliness specification of the synthesis gas compares favourably when compared to those prescribed and defined by the UK Gas Safety (Management) Regulations and the EASEE European Gas Quality Specification document CBP 2005-001/02. (CBP 2005-001/02 specification provided – see Table 2C). Comparison has also been made against the quality specifications derived as part of the Environment Agency's Biomethane Injection Technical Advisory Group.

The use and combustion of the renewable/waste derived synthesis gas will also have a significantly lower intrinsic environmental impact than regular mains supplied gas, as it is both regarded as a renewable[3] (i.e. non fossil fuel) source and will lead to a reduction in the generation of methane that would otherwise arise from the land filling of such materials.

The pyrolysis process itself produces very little waste as the majority of the by-products (such as chars, tars and heat) are re-introduced and used by the process.

Significant product testing has occurred (validated by MCERTS/UKAS approved contractors), demonstrating the properties of all main products and by-products arising from the process have been carried out.

[2] "Advanced Pyrolysis" means electricity generated from a liquid or gaseous fuel which is produced from waste or biomass by means of pyrolysis, and (a) in the case of a gaseous fuel, has a gross calorific value when measured at 25 degrees Celsius and 0.1 megapascals at the inlet to the generating station of at least 2 mega joules per metre cubed. (Source Ofgem)

3 The quality of the synthesis gas meets the definition of a renewable (i.e. non fossil fuel derived) fuel as defined by the Renewables Obligations Order and associated regulations

Using the analysis results a specification has been derived for the fuel.

Analysis of the main products and by products generated by the process, demonstrates that key pollutants are removed from the gas stream and retained in the solid and liquid fractions of the process. The resultant gas product is therefore clean and similar in nature to natural gas.

All solid and liquid by products are managed as waste products and disposed in accordance to regulatory requirements.

Detailed analysis and the derived synthesis gas specification has been appended to this application as Annex B and summarised in Table 2A.

The critical elements of the technology are as follows;

- Fuel Feed Hopper and Screw Compaction System;
- Drum Chamber & Feed Rate;
- Char Recovery & Delivery System;
- Gas Cleaning & Conditioning;
- Char Gasifier.

A summary of the process is detailed within the Non Technical Summary below.

## Non-Technical Summary

New Earth Energy have a proprietary pyrolysis process (NEAT) which converts RDF fuel feedstocks into clean synthesis gas. This gas can be directly used for the generation of renewable heat or power as part of an integrated, close coupled energy from waste scheme.

All feedstock will be accepted and pre-processed in accordance to New Earths Quality Management Standards. These standards ensure that recyclable and inert substances are as far as possible, removed prior to thermal processing. The feedstock specification is provided in Section 1C.

The RDF materials will be introduced directly to the feed hoppers, from which they are then fed into the feed and compaction system of the pyrolyser.

The NEAT process comprises the following:

**Fuel Feed and Compaction System**

The fuel feed system is an integral part of the design parameters to ensure uniform input of feedstock into the retort without the ingress of air. This objective is achieved through the compaction of the feed stock with a piston against a closed gate valve, to remove any intrinsic air in the fuel feed stock and thus exclude oxygen. Excluding oxygen prevents combustion of the fuel and ensures that no dioxins can be formed. By increasing the piston loading speed increased gas and char production is achieved.

Photo 2: Feed Hopper and Retort Entry

**Rotating Drum Retort & Synthesis Gas Generation**

From the compactors the feedstock will be continuously fed into the pyrolyser. On entering the pyrolyser, the feedstock is delivered into the pyrolysis chamber which is heated to a temperature of 850-1,000°C. The retention time is variable, but typically the feedstock remains in the chamber for 40 minutes.

The ability to vary the temperature and residence time of the fuel within the pyrolysis chamber allows the process to be tuned for various feed materials, including un-shredded or un-dried fuel or for variable moisture content.

The fuel passes through three distinct processes in the thermal plant:

- Material drying – where moisture is driven off in the first portion of the pyrolysis chamber;
- Pyrolysis – where final thermal decomposition of the material and its by-products takes place to produce pyrogas (consisting of methane, hydrogen, carbon monoxide and water vapour), and residual material, in the form of solid carbon char;
- Gas Clean up –The synthesis gas releases any gaseous contaminant compounds (chlorine, sulphur etc) with a volatilisation temperature below the operating temperature of the pyrolysis drum. The syngas from the pyrolysis process is drawn, under negative pressure, through a ceramic filter to remove particulates and collect the char from pyrolysis. From there it passes through a wet quench, to rapidly reduce temperature to condense out the tars and oils and prevent de novo dioxin formation. This quench is pH dosed with chemicals to remove acid gases such as HCl, HF and $H_2S$.

All biomass and other combustible material within the pyrolysis chamber is thermally decomposed 'cracked' into a carbon monoxide, carbon dioxide, methane and hydrogen synthesis gas stream, which forms the main **product** (synthesis gas) of the process.

The drum design progressively advances the feedstock alongside the inside of the chamber. This ensures maximum fuel residence time, uniform constant heat exposure and minimal shell stress while the fuel is converted into two products: 1) a synthesis gas and, 2) char (charcoal) at an optimum rate.

Photo 3: Drum Pyrolysation Chambers

The control of temperature and retention times within the pyrolysation process controls the quality of gas being generated and therefore the cracking of the hydrocarbons. The gas is subsequently conditioned and washed to remove all water-soluble contaminants for onsite utilization or export to third parties.

The synthesis gas produced in the pyrolysis chamber is a mixture of light gases, heavier gases and condensable organics. The light gases, which comprise the main fraction, include hydrogen, carbon monoxide, carbon dioxide, methane and ethane and similar short chain hydrocarbons.

The gas specification produced by the plant is provided within Section 2C.

**Secondary Char Gasification Recovery and Delivery System**

The char and particulate collected in the ceramic filter has a residual chemical energy. This is liberated in the gasifier, to produce a low grade gasification gas. The gasification of the pyrolysis char is achieved by injecting a controlled ratio of steam and air through a bed of char in a gasification chamber; this chamber is continually filled by the char feed system. The resultant gas - the 'gasifier' synthesis gas is then combusted to provide recovered indirect heat to the pyrolysis process to liberate the pyrogas leading to a self-sustaining process.

The combustion of these gases within a dedicated combustion chamber provides the necessary parasitic heat for the primary process and ensures that a high level of thermal efficiency is achieved by the process. The hot exhaust gases from the secondary gasifier gases are exhausted at approximately 900°C, and are used to heat the external surfaces of the retort.

Photo 4: Char gasifier

The temperature set point for the external combustion gases circulating around the pyrolysis drum exceed 850°C / 2 seconds thus achieving residence time requirements of Article 50 of the IED.

Some key design and safety features of the NEAT secondary char gasifier;

- Minimum exhaust temperature in set in excess of 850°C based on the char having less than 1% halogenated organic substances.
- Temperature measurement in the combustor will be at the outlet, ahead of the regenerator to ensure IED temperature compliance.
- Computational Flow Dynamics (CFD) modelling and design calculations confirm 2 seconds residence time for the gasification system as required per Article 50 of the IED.
- Airflow to the gasification system is monitored by thermal dispersion mass flow meters.
- Pressure monitored in gasification chamber and exhaust ducts.

**Gas Clean Up**

The gas product from pyrolysis retort contain quantities of particulates, tars, and other constituents which are required to be removed through gas cleaning and conditioning to enable marketing and use as an end product.

Gas contaminants in the synthesis gas are mostly water-soluble gases and vaporised tars which can be removed through the conventional gas cleaning technologies including Ceramic Filtration and Quench (wash tower) Scrubbing. This system ensures the removal of all tars and water soluble components of the gas to ensure a clean marketable synthesis gas.

| Table 2B - Specification of applications in which the synthesis gas can be used in |
|---|
| The pyrolysis plant has been developed by New Earth Energy as an efficient system to convert non-hazardous RDF into a clean-burning synthesis gas that can be combusted in reciprocating gas engines or turbines for electricity production, steam generation or the production of hot water.<br><br>The NEAT pyrolysis plant offers gas cleanliness, gas yields and gas quality at rates which suggests that this form of thermal treatment, once correctly operated and combined with adequate pre-treatment and engine type, can surpass the carbon intensity of a number other conventional forms of thermal treatment and demonstrate best available techniques (BAT).<br><br>The electrical efficiency of the plant as a whole is very attractive and overall efficiency (electrical and thermal) reaches values comparable to CHP systems.<br><br>The gas results arising from the NEAT process compare very well against the reported data within scientific literature on biomass feedstocks and non-hazardous RDF's. The Net Calorific Value that the NEAT process achieves from their process is approximately 18 -22 $MJ/Nm^3$ (or greater) and is more than twice what is commonly recorded for other thermal conversion technologies.<br><br>The cleaned synthesis gas compares well with the required cleanliness specifications of the UK Gas Supply Regulations and the EASEE European Gas Quality Specification document CBP 2005-001/02.<br><br>The clean synthesis gas can be used in a multitude of industrial applications the most applicable being electrical generation using gas engines. There are a number of plant manufacturers who manufacture gas engines capable of being operated on New Earth's synthesis gas, a number of which have been successfully proven to be able to operate with lower CV fuels than natural gas. |

| Table 2C – Fuel Parameters | |
|---|---|
| **Product** | Synthesis Gas (Waste-derived) |
| **Comparator Fuel** | Mains (natural) Gas |
| **Relevant Specification** | The majority of natural gases are mixtures of saturated hydrocarbons where methane prevails; they come from underground accumulations of gases alone or gases associated with oil. There are thus as many compositions of natural gases as exploited hydrocarbon layers. Apart from the methane which is the prevailing element, the crude natural gas usually contains decreasing volumetric percentages of ethane, propane, butane, pentane, etc.<br><br>The ultimate analysis of a natural gas thus includes/understands the molar fraction of hydrocarbons in $CH_4$, $C_2H_6$, $C_3H_8$, $C_4H_{10}$ and the remainder of heavier hydrocarbons is generally indicated under the term $C_5$+. Table 2Ca gives typical compositions. Apart from these hydrocarbons, one often finds one or more minor elements, or impurities, quoted hereafter:<br><br>• Nitrogen $N_2$: its inert character has no combustion properties and is commercially disadvantageous;<br>• Carbon Dioxide $CO_2$: provides no combustion benefit and is commercially disadvantageous;<br>• Hydrogen sulphide $H_2S$: is harmful by its corrosive properties,<br>• Helium *He*: it can be developed commercially,<br>• Water $H_2O$: the natural gas of a layer is generally saturated with steam.<br><br>The typical chemical composition of natural gas is presented in the table below[4]. |

**Table 2Ca**

| Fuel | $CH_4$ | $C_2H_6$ | $C_3H_8$ | $C_4H_{10}$ | $C_5H_{12}$ | $N_2$ | $CO_2$ | MN |
|---|---|---|---|---|---|---|---|---|
| **Ave** | 90.0 | 7.60 | 0.50 | 0.20 | 0.10 | 1.5 | - | 78.19 |

The synthesis gas produced by the NEAT process exhibits very similar components to natural gas albeit with lower % concentrations of hydrocarbons and higher % concentrations inert nitrogen and hydrogen, oxygen, nitrogen and carbon monoxide and oxides. As such, methane, $C_2$, $C_3$ and $C_4$ hydrocarbon gases constitute approximately 30% - 40% of the gas content when compared with the ~90% methane content of natural gas. Accordingly the GCV figures are also proportionally lower.

Although the presence of greater % hydrogen, oxygen, nitrogen and carbon monoxide and dioxide has no direct impact on the pollutants released during combustion, their presence does reduce the gross calorific value of the synthesis gas thus requiring a different stoichiometric ratio (gas / air mixture) to ensure complete combustion.

4 Gas composition provided by Leeds University and from 'Natural gas: physical properties and combustion features; Le Corre Olivier and Loubar Khaled'

**Applicable Gas Standards and Specifications**

In the UK there are two types of quality specifications for gas, those set out in the Gas Safety (Management) Regulations[5], which relate to the supply of domestic gas, and those which relate to specific commercial and industrial contracts which will be plant / contract specific and will relate specifically to the requirements of an end user.

The GS(M)R has been used by the Environment Agency TAG as a means of reference for the Biomethane Injection Protocol Project.

The GS(M)R does however provide a set of requirements in relation to the following pollutant parameters:

**Table 2Cb – Domestic Gas Quality Parameters**

| Parameter | Purpose | Specification | Relevance |
|---|---|---|---|
| Hydrogen Sulphide levels | Toxic Pollutant | < 5 mg/m$^3$ | Relevant to industrial gases |
| Total Sulphur | Acid gas forming compound | < 50 mg/m$^3$ | Relevant to industrial gases |
| Impurities | Water, glycol, amines, methanol, oils, salts chlorides, sand, dirt, carbon | No limits provided, specification only states *'shall not interfere with integrity of with pipes or appliances'* | Not relevant to industrial gas |

In order to determine other potential contaminants that are present within mains supplied natural gas a number of sources have been consulted, including the National Grid Energy Balance and Tracking Teams and the Environment Agency.

It has been concluded by the Environment Agency (Waste Protocols and TAG Teams) that there are no reliable sources of information of trace gases from natural gas to make a comparison. As such, when deriving a comparison standard for the biomethane to grid inject project the Environment Agency concentrated on a risk assessment approach and considered the impacts of the trace gases on people and the environment from their use.

The Environment Agency risk assessment methodology originally developed from the French *'Avis de l Afsset'*, from which a database of trace gas analysis for both landfill gases and biogases from AD plant has been developed, which includes details of around 250 gases.

For each of the trace gases, a concentration has been identified and a health criteria value established and a risk assessment carried out considering the critical pathway. In this instance the pathway was the use of the gas in a gas cooker within a small kitchen. Although this pathway is unlikely ever to manifest itself with the synthesis gas associated with this application, the use

5 The GS(M)R is not concerned with safe combustion at industrial sites as industrial burners and equipment can be adjusted to accommodate the gas received.

of this risk methodology to establish a specification for the synthesis gas guarantees that no hazardous effects / impacts will arise from the combustion of the synthesis gas. The long term and short term concentrations were calculated and compared to the relevant health criteria value.

It has been determined by the Environment Agency that the majority of the gases considered posed no risk to human health or the environment.

However for the following gases the Environment Agency have identified a risk that needs to be managed and hence specification limits derived.

**Halogenated hydrocarbons:** (including 1,2-dichloroethane, vinyl chloride, tetrachloroethene, 1,1,2-tricholoroethane, chlorobenezene, dichloromethane, tetrachloroethane, and trichloroethene).

This showed a high risk of impact at the concentration within the gas however an assessment considering the limit set within the network entry agreement demonstrated that these gases at this concentration did not pose an unacceptable risk.

For a range of other compounds (i.e. PAH's, Toxic Metals, Chlorinated Hydrocarbons, and Ammonia) The Environment Agency determined an acceptable concentration using the risk assessment.

Annex D provides the Risk Assessment Concentration Derived by the EA as part of the TAG Biomethane injection project.

The syngas specification is provided in Table 2Cc below.

**Fuel Parameters**

| Table 2Cc: Waste-Derived Synthesis Gas Comparison | | | | |
|---|---|---|---|---|
| **Relevant parameter** | **Units** | **Typical UK natural Gas Composition** | **Syn Gas Spec (%)** | **Comments** |
| Hydrogen ($H_2$) | % vol / vol | <0.1 mol% | < 19.5 % | Converted to water during combustion |
| Oxygen ($O_2$) | % vol / vol | 0-0.2% | < 0.1 % | Low levels of Oxygen will have little effect on combustion. |
| Nitrogen ($N_2$) | % vol / vol | 0-5% | < 3.2 % | None |
| Carbon Monoxide (CO) | % vol / vol | No Limits Stated | < 20.2 % | Will be converted to $CO_2$ during combustion |
| Methane ($CH_4$) | % vol / vol | 70-90% | < 18.5 % | Will be converted to $CO_2$ during combustion |
| Carbon Dioxide ($CO_2$) | % vol / vol | 0-8% | < 22 % | Unaffected during combustion |
| Ethene ($C_2H_4$) | % vol / vol | No Limits Stated | < 10 % | Converted to $CO_2$ and water during combustion |
| Ethane ($C_2H_6$) | % vol / vol | 0-20% | < 2.7 % | Converted to $CO_2$ and water during combustion |
| Propane ($C_3H_8$) | % vol / vol | No Limits Stated | 0.5 % | Converted to $CO_2$ and water during combustion |
| Sulphur | % vol / vol | <50mg/m$^3$ | < 28 mg/m$^3$ | Removed during gas scrubbing |
| Hydrogen Sulphide ($H_2S$) and other reduced sulphur compounds | % vol / vol | 0-5 % | < 2.8 % | Removed during gas scrubbing. Very odorous |
| Acid Gases | mg/kg | Trace | < LOD 2mg/kg | Trace concentration present within synthesis gas |
| Rare gases (A, He, Ne, Xe) | % vol / vol | Trace | None | Trace concentration present within synthesis gas |
| **Halogenated Hydrocarbons**[6] | | | | |
| 1,2 Dichloroethane | mg/m$^3$ | <8.15E+02 | < 4.52E+02 | Trace concentration present within synthesis gas – removed by gas scrubbing stages |
| Vinyl chloride | mg/m$^3$ | <2.16E+03 | < 1.2E+03 | Trace concentration present within synthesis gas – removed by gas scrubbing stages |
| Tetrachloroethene | mg/m$^3$ | <9.32E+03 | < 5.17E+03 | Trace concentration present within synthesis gas – removed by gas |

6 Reference figures taken from EA 'safe levels for biomethane injection', provided by Steve Storey

| | | | | |
|---|---|---|---|---|
| | | | | scrubbing stages |
| 1,1,2, Trichloroethane | mg/m³ | <2.33E+00 | < 1.29E+00 | Trace concentration present within synthesis gas – removed by gas scrubbing stages |
| Chlorobenzene | mg/m³ | <8.18E+04 | < 4.54E+04 | Trace concentration present within synthesis gas – removed by gas scrubbing stages |
| Dichloromethane | mg/m³ | <3.49E+03 | < 1.93E+03 | Trace concentration present within synthesis gas – removed by gas scrubbing stages |
| Tetrachloroethane | mg/m³ | <0.00E+00 | < 0.00E+00 | Trace concentration present within synthesis gas – removed by gas scrubbing stages |
| Trichloroethene | mg/m³ | <1.16E+03 | < 0.64E+03 | Trace concentration present within synthesis gas – removed by gas scrubbing stages |
| PAH's | mg/m³ | <9.32E+03 | < 5.17E+03 | Trace concentration present within synthesis gas –removed by gas cleaning stages |
| **Metals (see list below)** | | | | |
| Arsenic | mg/kg | Trace | < LOD 2mg/kg | Trace concentrations only - all metals retained in Char |
| Beryllium | mg/kg | Trace | < LOD 0.5 mg/kg | Trace concentrations only - all metals retained in Char |
| Cadmium | mg/kg | Trace | < LOD 0.5 mg/kg | Trace concentrations only – all metals retained in Char |
| Hexavalent Chromium | mg/kg | Trace | < LOD 2 mg/kg | Trace concentrations only – all metals retained in Char |
| Lead | mg/kg | Trace | < LOD 0.5 mg/kg | Trace concentrations only – all metals retained in Char |
| Mercury | mg/kg | Trace | < LOD 0.12 mg/kg | Trace concentrations only – all metals retained in Char |
| Chlorinated Hydrocarbons | % vol /vol | Trace | None | Trace concentration present within synthesis gas |
| Ammonia | mg/m³ | <2.91E+03 | < 1.61E+03 | Trace concentration present within synthesis gas - removed by gas cleaning stages |
| Gross Calorific Value | | 39.7 MJ/m³ | < 22 MJ/m³ | |
| | | 100% | 100% | |

Based on the gas specification above, when compared with the allowable UK and EU specifications and the Risk Assessed Limits of the EA biogas injection protocols of mains pressure gas, the combustion of synthesis gas will not lead to the releases of any greater level of pollutants than the combustion of natural gas.

Combustion of synthesis gas, in general, produces lower emissions for heat and power generation than conventional liquid and solid fuels. The composition of the synthesis gas strongly influences the level of emissions. Hydrogen and carbon monoxide in synthesis gases results in elevated combustion temperature that facilitates the thermal formation of NO and $NO_2$. In contrast, higher temperatures also promote complete combustion and reduce the emission of organic volatiles, which are formed mainly from minor fractions of hydrocarbons in synthesis gases.

Particulate matter, metallic compounds and other undesired pollutants **will not be present in the synthesis gas** beyond trace concentrations as they are all removed by the gas clean up stages. The table included in Annex E provides a summary of all of the potential pollutant materials and their environmental fate. The purpose of this table is to demonstrate the mechanisms and key control parameters by which all pollutants / contaminant materials are removed from the synthesis gas.

Third party gas analysis has been carried out by New Earth Energy and is provided within Annex B. This analysis provides the makeup of synthesis gas demonstrates that the gas comfortably meets the accepted specifications of the Natural Gas comparator fuel.

In summary:

- Materials that are in vapour phase (metals, VOC's, acid forming gases etc) at temperatures below 850$^{o}$C are removed through condensing and scrubbing of the synthesis gas. These materials are either retained in the gas clean up sediments or retained in solution within the scrubber liquors;
- Tars and oils are condensed and re-injected into the pyrolyser;
- Materials that remain solid at 850$^{o}$C and below are removed in the char and then retained in the pyrolysis ash;

Therefore cleaned synthesis gas when combusted conventionally will produce combustion products of a very similar nature as natural gas. Further details of the combustion products, carbon intensity and associated carbon emissions are provided in Table 2E.

## Monitoring / Sampling Summary

In order to ensure operational control and subsequent product quality is maintained, all New Earth operations will adopt the Company's Integrated Management System (IMS) which comprises a number of core procedures that correspond to specific process stages (including waste acceptance, monitoring and fuel production).

In addition to the working plan, detailed operation and maintenance manuals (as well as training) will be provided for all operators and technicians working for the process plant. The default generation of clean synthesis gas is entirely reliant on the upstream control of the pyrolyser and ancillary gas cleaning and thermal oxidation equipment. Therefore in order to ensure that gas cleanliness is assured, a very high level of process control and monitoring is required.

All gas produced by the pyrolyser will be continuously monitored for volume, temperature and GCV prior to combustion. Any changes in the gas composition will be monitored and controlled in accordance with the process logic of the SCADA systems.

The table below provides an outline of the key process control and monitoring equipment that provides all the necessary process parameters to ensure good quality gas is produced. In the event that these control measures fail or exceed the required operational parameters, the plant will be shut down and the synthesis gas released to the emergency flare where t will be thermally oxidised.

This table only details the key control parameters related to gas generation.

All of the system parameters are controlled using a SCADA instrumentation and control system. All pressure, flow and temperature instrumentation senses and controls continuously and in real time.

**Table 2Cd – Synthesis gas Quality Control and Monitoring Measures**

| Parameter | Purpose | Control Philosophy | Mitigation |
|---|---|---|---|
| Fuel Supply Quality | To control the quality of all fuel supplied to the plant | All feed stocks will be supplied in accordance to an agreed Quality Specification.<br><br>Each batch of fuel will be inspected upon arrival in accordance to Site acceptance procedures. | All fuel will be inspected for compliance to specification in accordance to acceptance procedures.<br><br>All non compliance feedstock will be rejected in accordance to procedure and returned to supplier. |
| Fuel feed rate | Accurate control of the fuel feed rate will ensure a consistent gas generation rate. | Inlet feed rate interlocked and controlled with:<br>• Retort pressure | The inlet feed rate is controlled and monitored on a continuous basis and is adjusted in accordance to the retort pressure and |

| | | | |
|---|---|---|---|
| | | • Gas outlet flow rate<br>• Scrubber pressure<br>• Quench temperature | outlet gas flow rate.<br>Plant will modulate automatically, alarm and enter a controlled shut down if control set-points are not maintained.<br><br>All gas will be diverted to the thermal oxidiser. |
| Retort Chamber temperature | Accurate and steady state retort temperature is a fundamental requirement for synthesis gas quality. If the temp exceeds the set point, gasification of certain metals may occur. | Temperature is monitored in the retort through a pyrometer. Temperature is also monitored at the muffle, to the heat recovery system and in the flue gas lines from the thermal oxidiser. The temperature control function, together with fuel type helps to create the optimum gas composition to give the highest calorific value $MJ/m^3$.<br><br>Heat is delivered to the retort secondary gasifier and subject to flow, pressure and temperature control. Oxygen levels are also monitored at the flue exit from the gasification combustion chamber as it enters the retort. | The gasification combustion systems are controlled and monitored on a continuous basis and adjusted in real time.<br><br>If the retort does not reach, or exceeds temperature the plant will alarm and enter a controlled shutdown.<br><br>All gas will be diverted to the thermal oxidiser. |
| Retort Atmosphere | The atmosphere within the retort is a key parameter for the formation of synthesis gas. The presence of oxygen can lead to the formation of dioxins and combustion products. | Synthesis gas is generated by applying a temperature of approximately 850°C to a feed material of known composition in the presence of an oxygen-depleted environment.<br><br>The pressure in the retort chamber is kept positive to the outside atmosphere through the addition of $N_2$ and specific gas pressure control parameters. | The retort pressure is continuously monitored as part of the SCADA control system.<br><br>The SCADA controls will automatically modulate and control within the set point parameters.<br><br>Operation of the plant outside of these parameters will alarm the plant and enter a controlled shutdown. |
| Gas booster pressure | The gas compressor fan draws synthesis gas from the retort through the scrubber systems and directs it the gas engines or flare. The pressure of this system is key control requirement | The gas compressor pressure is continuously monitored and interlocked to only operate when the gas scrubbing systems are operational.<br><br>The fan is controlled on pressure and is set to match the rate of generation of gas within the retort | The gas compressor system is interlocked with the gas scrubber systems.<br><br>The system will not draw gas from the retort if the scrubbing systems fail or do not operate correctly.<br>In the case of the fan failure no gas will be drawn from the retort and the plant will enter a controlled shut down. |

| | | | |
|---|---|---|---|
| | | | In the case of a scrubber failure the fans will shut down and discharge to the thermal oxidiser. |
| Scrubber Operation | The gas scrubber operation is a key parameter for the cleanliness of the synthesis gas. | The scrubber and gas cleaning train is monitored continuously for gas flow rate, gas inlet and outlet temperature, liquor temperature & pH, and conductivity. | The gas scrubbing plant is interlocked to all of the key plant operations. In the event of a scrubber plant failure the retort and all associated ancillary plant will enter a controlled shut down sequence. All gas will be diverted to the thermal oxidiser. |
| Gas Quality | The steady temperature, flow rate and GCV of the gas are essential for safe and consistent operation of the process plant. | All gas being produced by the pyrolyser will be continuously monitored to ensure that the GCV, temperature and volume meets with the engine and plant performance requirements. | The monitoring equipment will operate continuously and provide feedback into the control plant. The failure of the plant to produce consistent gas will result in a controlled shutdown. |
| Engine management system (close coupled CHP plant only) | The gas engines (if fitted) will provide continuous feedback into the performance of the engines. | In the event that the engines reduce in power or that the required set point parameters are not met the plant will not operate.<br><br>All gas will be routed to flare. | The engine management system will operate continuously and provide feedback into the control systems as required. |

The above control philosophy will ensure that the synthesis gas produced by the plant is free of solid and gaseous contaminants.

The entire plant has been subject to a HAZOP study and appropriate controls and mitigation applied accordingly. As such there are a number of key duty and standby components to ensure that plant stability is maintained. For example:

- Critical Hydraulic pumps
- Cooling Water pumps
- Quench pumps
- Gas cleaning filters etc.

Furthermore, incoming waste is subject to stringent acceptance Quality Standard in order to ensure the composition of the final product is not compromised, therefore the site will only accept those wastes detailed within Table 1A.

## Gas sampling

Under the Renewables Obligation Order 2013, generating stations using gasification or pyrolysis to produce a gaseous fuel are obliged to measure the gross calorific value of this fuel so that Ofgem can place generation from a gasification / pyrolysis station within the appropriate band in a given month. This requirement is set out in Schedule 2.1 Part 1 of the Order.

In accordance with this requirement, all synthesis gas being produced by the plant will be subject to continuous measurement and analysis. The analysers used by the plant will comprise high speed process gas analyser for monitoring and control of Calorific value, Wobbe Index, Specific gravity and the Air/Fuel ratio of process gas.

This analyser will feed back directly into the SCADA control system and be used to control a number of the key input parameters of the plant (i.e. retort speed, fuel feed rate etc).

In addition the synthesis gas produced by the plant will be subject to periodic compliance sampling to double check and verify the online analysers and to confirm other gas quality aspects (gas chemical analysis etc).

In addition, the gas engines that will be used for downstream electrical generation will all be fitted as standard with engine management systems that will as standard modulate in accordance to any variations in gas parameters. The gas engines will typically control by continuously monitoring gas CO levels, gas pressure, flow rate and temperature.

The gas engines will be interlocked to the pyrolyser control system to ensure that any significant fluctuations in gas quality outside of the stated specification leads to a controlled shut down of the system.

## Table 2E – Biogenic Carbon Content & Carbon Intensity

In assessing whether the synthesis gas will have no worse environmental effect than using natural gas a comparison of Carbon to Hydrogen ratio of natural gas spec compared with the synthesis gas mas been made.

To determine the Carbon to Hydrogen ratio, an evaluation of the carbon intensity of the syngas compared to natural gas has been provided. This method of assessment of carbon used in power generation is widely recognised as a key metric for assessing the environmental effect of greenhouse gas emissions in power generation.

The carbon intensity is expressed as kg of $CO_2$ per kW of electricity for power generation.

The overall $CO_2$ comparison between syngas and natural gas takes into account the renewable carbon from biomass derived fuel.

The hydrogen/carbon (H/C) ratios are provided assume a base synthesis gas of similar nature to New Earth Energy Ltd (i.e. a high CV and methane volume approximately 17-22%).

Table 2E/1 below shows the volumetric or molar composition of a typical (mid range) pyrolysis gas. The H/C ratios are given for the total carbon, total carbon minus the entrained C from $CO_2$ in the fuel gas and for the entrained carbon.[7]

**Table 2E/1:Molar Composition**

| Parameter | Natural gas (% vol) | Synthesis gas (% vol) |
|---|---|---|
| | | Pyrolysis (base case) |
| $CH_4$ | 90.00 | 17.25 |
| $C_2H_4$ | | 6.00 |
| $C_2H_6$ | 7.60 | 1.80 |
| $C_3H_8$ | 0.50 | 2.80 |
| $C_6H_6$ | 0.10 | 0.05 |
| $C_4H_{10}$ | 0.20 | |
| $C_5H_{12}$ | 0.10 | 0.02 |
| | | |
| CO | | 30.00 |
| $CO_2$ | | 18.50 |
| | | |
| $H_2$ | | 16.50 |
| | | |
| $H_2S$ | | 0.20 |
| $N_2$ | 1.50 | 6.58 |
| $O_2$ | | 0.30 |

7 Source: University of Leeds

Table 2E/2 below shows the composition of the exhaust gas post combustion. The Primary elements are $CO_2$ and Nitrogen ($N_2$) with some Oxygen ($O_2$).

| Table 2E/2: Exhaust gas | | |
|---|---|---|
| | Natural gas | Synthesis gas |
| | | |
| $CO_2$ % vol | **13.38** | **12.23** |
| $H_2O$ | 0.00 | 0.00 |
| $SO_2$ | 0.00 | 0.03 |
| $N_2$ | 78.86 | 79.95 |
| $O_2$ | 7.76 | 7.79 |

Table 2E/2 shows the composition of the exhaust gas as a percentage by volume. The only GHG of concern in this case is $CO_2$ as neither $N_2$ and $O_2$ are greenhouse gases. The results show that, by volume, the $CO_2$ syngas emissions are slightly less than that of natural gas.

Table 2E/3 below shows the performance characteristics when generating power using the various gas types. The model shows the $CO_2$/kWh generated for total carbon and biogenic carbon.

Two biogenic fractions are modelled; 65% which is the standard operating conditions and 50% which would be the worst case.

| Table 2E/3- Carbon Intensity | | | |
|---|---|---|---|
| | Natural gas | | Synthesis gas |
| | Combined cycle | Open cycle | Pyrolysis (base case) |
| | | | |
| H kg / kg | 0.24 | 0.24 | 0.07 |
| Cw total kg / kg | 0.74 | 0.74 | 0.43 |
| Cwe without entrained kg / kg | 0.74 | 0.74 | 0.34 |
| Ce entrained kg / kg | 0.00 | 0.00 | 0.09 |
| | | | |
| H / Cw | 0.32 | 0.32 | 0.17 |
| H / Cwe | 0.32 | 0.32 | 0.22 |
| H / Ce | | | 0.84 |
| | | | |
| CV MJ/kg | 53.67 | 53.67 | 18.49 |
| CV MJ/$m^3$ | 42.11 | 42.11 | 20.70 |
| kg $CO_2$ / kg | 2.72 | 2.72 | 1.58 |
| kg $CO_2$ / GJ | 50.63 | 50.63 | 85.48 |

| | | | |
|---|---|---|---|
| | | | |
| Electrical efficiency | 0.46 | 0.38 | 0.38 |
| kg $CO_2$ / kWh | 0.40 | 0.48 | 0.81 |
| | | | |
| Biogenic fraction | 0.00 | 0.00 | 0.65 |
| **kg $CO_2$n / kWh** | **0.40** | **0.48** | **0.28** |
| | | | |
| Biogenic fraction | 0.00 | 0.00 | 0.50 |
| **kg $CO_2$n / kWh** | **0.40** | **0.48** | **0.40** |

Table 2E3 shows that using natural gas in an internal combustion engine produces 0.48kg$CO_2$/kWh compared to 0.28kg$CO_2$/kWh for the base case syngas.

Therefore the use of synthesis gas as a substitute of natural gas yields a $CO_2$ emissions reduction saving of 42%.

Therefore it can be concluded from the comparison of biogenic carbon that the combustion of synthesis gas for the purposes of energy generation has a positive environmental impact, when compared to the use of natural gas.

| Table 2F - WRATE |
|---|
| Annex F shows the inputs and results of using WRATE (Waste and Resources Assessment Tool for the Environment).<br><br>The WRATE software compares the environmental impacts of different municipal waste management systems. WRATE uses life cycle assessment to include the resources used, waste transportation and operation of a whole range of waste management processes with their environmental costs and benefits.<br><br>The WRATE tool has been developed in conjunction with a number of specific commercially available waste technologies and hence does perfectly suit the NEAT pyrolysis technology. However the information produced by the WRATE tool has been provided for comparison.<br><br>Using the default waste composition and process performance figures provided within the software, the pyrolysis of the residual waste for energy generation using gas engines, a carbon intensity of 0.34 was calculated. This figure compares against a carbon floor of 0.4.<br><br>Therefore the outputs from WRATE model compare reasonably well with the calculation provided in section 2F and support the position that the use of syngas has a lower environmental impact than using natural gas for power generation.<br><br>The renewable electricity generated by the pyrolysis to syngas plant also addresses other issues to which natural gas makes no contribution:<br>• Proximity Principle mandates use of locally sourced biogenic renewable fuel, rather than remotely sourced natural gas; and with this scenario increases security of supply. The scenario decreases the relative effect on the environment of use of syngas over use of natural gas.<br>• Landfill or other sub-optimal waste management processes such as dilution or feedstock to low efficiency incinerators is avoided; and in landfill the substantial contribution of methane to the atmosphere (even with methane recovery) cannot be offset where natural gas is used.<br>• Power generated will contribute to the Carbon Reduction Credits and Resource Efficiency in ways not available with natural gas.<br><br>Therefore it can be concluded from the outputs of the WRATE software model that the combustion of synthesis gas for the purposes of energy generation has a positive environmental impact, when compared to the use of natural gas. |

# 3. SUMMARY

New Earth Energy Ltd has developed an advanced conversion technology that has been designed to generate clean synthesis gas from RDF materials. The technology can be used with clean virgin materials and waste derived feedstocks alike.

The purpose of the plant is to generate a synthesis fuel gas that can be used in gas engines and generation sets for the purposes of generating clean renewable energy. The gas quality and GCV meets the requirements of Ofgem Synthesis Gas requirements and will enable the plant to qualify under the Renewables Obligation Order 2009.

New Earths Advanced Conversion Technology (NEAT) pyrolysation technology when operated as described in this application, successfully converts the waste material into a distinct and marketable product. New Earth Energy's synthesis gas can be combusted conventionally in a number of commercially available gas engine types in the same manner as mains supplied gas. The combustion of synthesis gas is no more polluting than the combustion of natural gas in similar applications.

The pyrolysis plant and the gas produced is all subject to a very detailed monitoring regime that will ensure that a quality specification is met at all times. In the event that the gas or the upstream production plant cannot meet the quality specification, the production of synthesis gas will cease and any residual quantities flared.

There are a number of gas engines on the market that have been specifically designed to operate using industrial gases with similar (and significantly worse) properties.

All gas being produced by the plant will be used directly as part of a close coupled CHP scheme.

Based on the above it is therefore the consideration of New Earth Energy Ltd that the synthesis gas produced by their pyrolysis plant, when operated as described above, meets the published definition of '*End of Waste'.*

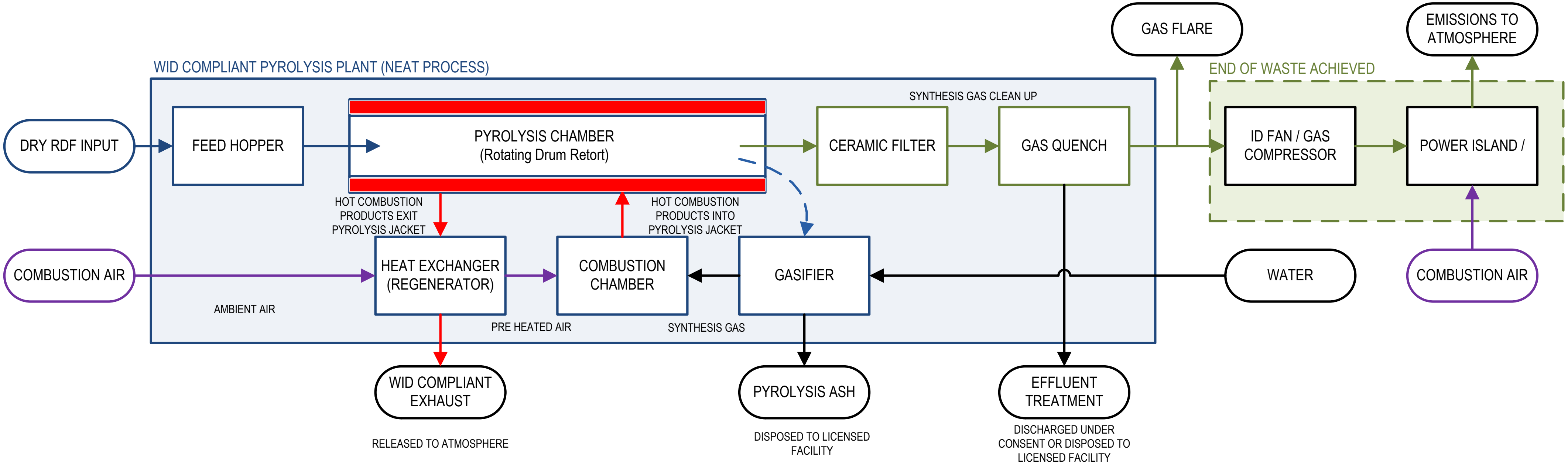
# ANNEX A – PROCESS SCHEMATIC

FEED HOPPER & RETORT ENTRY

RETORT EXIT

CHAR GASIFIER

POWER ISLAND




1. Do not scale off this drawing
2. All dimensions to be confirmed on site
3. This drawing is copyright of Sol Environment Ltd
4. This drawing is to be read in conjunction with relevant consultant drawings and specifications

| Rev: | Date: | Desc: |
|---|---|---|
| 0 | JAN 13 | Original |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Client:** | New EARTH ENERGY LTD | **Job No:** | SOL1212NE_01 | **Drawing No: NE01** | | **Revision:** 0 | |
| **Project:** | END OF WASTE APPLICATION – SYNTHESIS GAS | | | | | | |
| **Drawing Title:** | SIMPLIFIED PROCESS SCHEMATIC | **Drawn By:** | STEVE BUTLER | **Scale:** | NTS | **Date:** 15/01/13 | |


sol environment

**Sol Environment Ltd**
3rd Floor,
23 Christchurch Road, Malvern,
Worcestershire WR14 3BH
t: +44(0)1684 572727
e: enquiries@sol-environment.co.uk
www.sol-environment.co.uk

# ANNEX B: Third Party Sampling / Analysis

- Laboratory Analysis of feedstocks
- synthesis gas and;
- chars

# LABORATORY ANALYSIS FEEDSTOCKS

Marchwood Scientific Services

371 Millbrook Road West
Southampton
Hampshire
SO15 0HW
Tel: 02380-786979

New Earth Solutions Group Ltd
Zinc Road, off Boundry Road
Kings Weston Lane
Avonmouth
Bristol
BS11 8AZ

| | |
|---|---|
| **Certificate No.** | 112/8867 Page 1 of 2 |
| **Date received** | 09.11.12 |
| **Ref.** | NES/112/8867 |

26th November 2012

**Re. Analysis of an SRF Sample Ref. NES/AVON/Residuals for a Range of Determinands-**

Please find below the tabulated results for the sample received, (AR = as received; D = dry basis; DAF = dry ash-free basis)

| **Determinand** | **Units** | **AR** | **D** | **DAF** |
|---|---|---|---|---|
| Gross CV | KJ/Kg | 13020 | - | - |
| Net CV | KJ/Kg | 12011 | - | - |
| Moisture | % w/w | 40.3 | - | - |
| Ash | % w/w | 15.5 | 25.8 | - |
| Volatile Matter | % w/w | 39.2 | 65.9 | 90.2 |
| Fixed Carbon | % w/w | 5.0 | 8.3 | 9.8 |
| Sulphur | % w/w | 0.4 | 0.7 | 0.8 |
| Chlorine | % w/w | 1.00 | 1.67 | 1.96 |
| Fluorine | % w/w | <0.01 | <0.01 | <0.01 |
| Bromine | % w/w | <0.01 | <0.01 | <0.01 |
| Iodine | % w/w | <0.01 | <0.01 | <0.01 |
| Carbon | % w/w | 28.4 | 47.3 | 55.7 |
| Hydrogen | % w/w | 4.4 | 7.3 | 8.6 |
| Nitrogen | % w/w | 0.6 | 1.0 | 1.2 |
| Oxygen by difference | % w/w | 9.4 | 15.7 | 18.4 |

(cont.)

| Determinand | Units | D |
|---|---|---|
| Sodium | mg/Kg | 2005 |
| Potassium | mg/Kg | 671 |
| Antimony | mg/Kg | 51 |
| Arsenic | mg/Kg | <1 |
| Cadmium | mg/Kg | <1 |
| Chromium | mg/Kg | 36 |
| Cobalt | mg/Kg | 12 |
| Copper | mg/Kg | 175 |
| Lead | mg/Kg | 21 |
| Manganese | mg/Kg | 37 |
| Mercury | mg/Kg | <1 |
| Nickel | mg/Kg | 8.1 |
| Thallium | mg/Kg | <1 |
| Vanadium | mg/Kg | <1 |
| Zinc | mg/Kg | 203 |
| % Biomass (by CV)-CEN/TS 15440 | % w/w | 48.2 |

……………………………………......................
J.Fursman
For/on behalf of Marchwood Scientific Services Ltd

MSS
Marchwood Scientific Services

371 Millbrook Road West
Southampton
Hampshire
SO15 0HW
Tel: 02380-786979

New Earth Solutions Group Ltd
Arena Way
Canford Magna
Wimborne
BH21 3BW

| | |
|---|---|
| **Certificate No.** | 112/8996 Page 1 of 1 |
| **Date received** | 13.11.12 |
| **Ref.** | NES/112/8996 |

26th November 2012

**Re. Analysis of an SRF Sample Ref. Splitbale R2/Midsize/Oversize for a Range of Determinands-**

Please find below the tabulated results for the sample received, (AR = as received; D = dry basis; DAF = dry ash-free basis)

| **Determinand** | **Units** | **AR** | **D** | **DAF** |
|---|---|---|---|---|
| Gross CV | KJ/Kg | 15160 | - | - |
| Net CV | KJ/Kg | 14003 | - | - |
| Moisture | % w/w | 38.5 | - | - |
| Ash | % w/w | 12.1 | 19.5 | - |
| Volatile Matter | % w/w | 44.6 | 72.8 | 91.2 |
| Fixed Carbon | % w/w | 4.8 | 7.7 | 8.8 |
| Sulphur | % w/w | 0.2 | 0.3 | 0.3 |
| Chlorine | % w/w | 0.51 | 0.82 | 0.93 |
| Fluorine | % w/w | <0.01 | <0.01 | <0.01 |
| Carbon | % w/w | 32.0 | 52.5 | 68.3 |
| Hydrogen | % w/w | 5.1 | 8.2 | 9.3 |
| Nitrogen | % w/w | 0.3 | 0.5 | 0.5 |
| Oxygen by difference | % w/w | 11.3 | 18.2 | 20.7 |

| **Determinand** | **Units** | **AR** | **D** | **DAF** |
|---|---|---|---|---|
| Sodium | % w/w | - | 1650 | - |
| Potassium | % w/w | - | 663 | - |
| Biomass Content-CEN/TS 15440 | % w/w | - | 57.1 | - |

John Fursman
…………………………………………..........................
J.Fursman
For/on behalf of Marchwood Scientific Services Ltd

Marchwood Scientific Services

371 Millbrook Road West
Southampton
Hampshire
SO15 0HW
Tel: 02380-786979

New Earth Solutions Group Ltd
Cotesbach Landfill
Gibbet Lane
Shawell
Leicestershire
LE17 6AA

| **Certificate No.** | 112/8942 Page 1 of 1 |
|---|---|
| **Date received** | 12.11.12 |
| **Ref.** | NES/112/8942 |

26th November 2012

**Re. Analysis of an SRF Sample Ref. COT-Q3-RDF-no Plastic + Screening for a Range of Determinands-**

Please find below the tabulated results for the sample received, (AR = as received; D = dry basis; DAF = dry ash-free basis)

| **Determinand** | **Units** | **AR** | **D** | **DAF** |
|---|---|---|---|---|
| Gross CV | KJ/Kg | 13578 | - | - |
| Net CV | KJ/Kg | 12523 | - | - |
| Moisture | % w/w | 40.2 | - | - |
| Ash | % w/w | 11.9 | 19.8 | - |
| Volatile Matter | % w/w | 42.7 | 71.5 | 90.2 |
| Fixed Carbon | % w/w | 5.2 | 8.7 | 9.8 |
| Sulphur | % w/w | 0.3 | 0.5 | 0.6 |
| Chlorine | % w/w | 0.34 | 0.57 | 0.64 |
| Fluorine | % w/w | <0.01 | <0.01 | <0.01 |
| Carbon | % w/w | 31.1 | 52.1 | 68.1 |
| Hydrogen | % w/w | 5.0 | 8.3 | 9.5 |
| Nitrogen | % w/w | 0.3 | 0.5 | 0.6 |
| Oxygen by difference | % w/w | 10.9 | 18.2 | 20.6 |

| **Determinand** | **Units** | **AR** | **D** | **DAF** |
|---|---|---|---|---|
| Sodium | % w/w | - | 1745 | - |
| Potassium | % w/w | - | 609 | - |
| Biomass Content-CEN/TS 15440 | % w/w | - | 51.6 | - |

John Fursman

……………………………………........................

J.Fursman
For/on behalf of Marchwood Scientific Services Ltd

# LABORATORY ANALYSIS SYNTHESIS GAS (TEDLAR GAS)

Queens Road, Penkhull, Stoke-on-Trent,
Staffordshire, ST4 7LQ, UK

**tel:** (customer enquiries) +44 (0)1782 764428
**tel:** (switchboard) +44 (0)1782 764444
**fax:** +44 (0)1782 412331
**email:** enquiries@ceram.com
**web:** www.ceram.com

# ORGANIC ANALYSIS REPORT

| | |
|---|---|
| **Ceram Reference:** | (132231) |
| **Client:** | EnviroDat Ltd<br>Science & Technology Centre<br>Earley Gate<br>Whiteknights Road<br>Reading<br>Berkshire<br>RG6 6BZ |
| **For the Attention of:** | Mr Bruce Kester |
| **Date Logged:** | 08-May-2013 |
| **Report Date:** | 17-May-2013 |
| **Purchase Order No.:** | 110603/BK |
| **Work Location:** | Ceram UK |

Please find attached the results for the samples recently submitted for analysis.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

**Mr Malcolm Rose**
**Author**

**Ceram Reference:** (132231)

## Analysis of Gas - Bulk Gases (Standard)

**GC (Method C72)**

**Date of Test:** 14-May-2013 to 17-May-2013

| Ceram Sample Reference | | (132231)-9837 | (132231)-9838 | (132231)-9839 |
|---|---|---|---|---|
| **Material Type** | | Gas | Gas | Gas |
| **Your Reference** | | R13073/1005 3/5/13 | R13073/1030 3/5/13 | R13073/1055 3/5/13 |
| **Result(s)** | **Units** | | | |
| Methane | % | 7.8 | 7.2 | 9.0 |
| Carbon Dioxide | % | 12.9 | 10.9 | 12.0 |
| Nitrogen | % | 42.4 | 47.4 | 44.6 |
| Oxygen | % | 2.7 | 1.6 | 1.6 |
| Hydrogen | ppm | 41500 | 42800 | 61600 |
| Ethylene | ppm | 57400 | 62000 | 74200 |
| Ethane | ppm | 17500 | 13600 | 14600 |
| Acetylene | ppm | 627 | 604 | 811 |
| UKAS Accredited | | Yes | Yes | Yes |

| Ceram Sample Reference | | (132231)-9840 | (132231)-9841 |
|---|---|---|---|
| **Material Type** | | Gas | Gas |
| **Your Reference** | | R13073/1135 3/5/13 | R13073/1205 3/5/13 |
| **Result(s)** | **Units** | | |
| Methane | % | 7.5 | 7.9 |
| Carbon Dioxide | % | 11.9 | 11.6 |
| Nitrogen | % | 46.5 | 49.8 |
| Oxygen | % | 1.2 | 0.9 |
| Hydrogen | ppm | 64200 | 49600 |
| Ethylene | ppm | 68600 | 49100 |
| Ethane | ppm | 10800 | 6900 |
| Acetylene | ppm | 650 | 776 |
| UKAS Accredited | | Yes | Yes |

Mr Malcolm Rose
Author

**Ceram Reference:** (132231)

## Determination of Hydrogen Sulphide

**GC (Method C74)**

**Date of Test:** 14-May-2013 to 14-May-2013

| **Ceram Sample Reference** | | (132231)-9837 | (132231)-9838 | (132231)-9839 |
|---|---|---|---|---|
| **Material Type** | | Gas | Gas | Gas |
| **Your Reference** | | R13073/1005 3/5/13 | R13073/1030 3/5/13 | R13073/1055 3/5/13 |
| **Result(s)** | **Units** | | | |
| Hydrogen Sulphide | ppm | 43 | 35 | 36 |
| UKAS Accredited | | Yes | Yes | Yes |

| **Ceram Sample Reference** | | (132231)-9840 | (132231)-9841 |
|---|---|---|---|
| **Material Type** | | Gas | Gas |
| **Your Reference** | | R13073/1135 3/5/13 | R13073/1205 3/5/13 |
| **Result(s)** | **Units** | | |
| Hydrogen Sulphide | ppm | 46 | 47 |
| UKAS Accredited | | Yes | Yes |

## Analysis of Gas - Bulk Gases (Extra)

**GC (Method C72)**

**Date of Test:** 16-May-2013 to 17-May-2013

| **Ceram Sample Reference** | | (132231)-9837 | (132231)-9838 | (132231)-9839 |
|---|---|---|---|---|
| **Material Type** | | Gas | Gas | Gas |
| **Your Reference** | | R13073/1005 3/5/13 | R13073/1030 3/5/13 | R13073/1055 3/5/13 |
| **Result(s)** | **Units** | | | |
| n-Propane | ppm | 42100 | 31800 | 28800 |
| n-Butane | ppm | <5 | <5 | <5 |
| i-Butane | ppm | 91 | 32 | 38 |
| UKAS Accredited | | Yes | Yes | Yes |

Mr Malcolm Rose
Author

**Ceram Reference:** (132231)

## Analysis of Gas - Bulk Gases (Extra)

**GC (Method C72)**

**Date of Test:** 16-May-2013 to 17-May-2013

| **Ceram Sample Reference** | | (132231)-9840 | (132231)-9841 |
|---|---|---|---|
| **Material Type** | | Gas | Gas |
| **Your Reference** | | R13073/1135 3/5/13 | R13073/1205 3/5/13 |
| **Result(s)** | **Units** | | |
| n-Propane | ppm | 32000 | 20700 |
| n-Butane | ppm | <5 | <5 |
| i-Butane | ppm | 41 | 22 |
| UKAS Accredited | | Yes | Yes |

## Determination of Carbon Monoxide

**GC (Method C227)**

**Date of Test:** 15-May-2013 to 15-May-2013

| **Ceram Sample Reference** | | (132231)-9837 | (132231)-9838 | (132231)-9839 |
|---|---|---|---|---|
| **Material Type** | | Gas | Gas | Gas |
| **Your Reference** | | R13073/1005 3/5/13 | R13073/1030 3/5/13 | R13073/1055 3/5/13 |
| **Result(s)** | **Units** | | | |
| Carbon Monoxide | ppm | 181000 | 146000 | 148000 |
| UKAS Accredited | | Yes | Yes | Yes |

| **Ceram Sample Reference** | | (132231)-9840 | (132231)-9841 |
|---|---|---|---|
| **Material Type** | | Gas | Gas |
| **Your Reference** | | R13073/1135 3/5/13 | R13073/1205 3/5/13 |
| **Result(s)** | **Units** | | |
| Carbon Monoxide | ppm | 153000 | 171000 |
| UKAS Accredited | | Yes | Yes |

**End of Test Report**

Mr Malcolm Rose
Author

Queens Road, Penkhull, Stoke-on-Trent,
Staffordshire, ST4 7LQ, UK

**tel:** (customer enquiries) +44 (0)1782 764428
**tel:** (switchboard) +44 (0)1782 764444
**fax:** +44 (0)1782 412331
**email:** enquiries@ceram.com
**web:** www.ceram.com

# ORGANIC ANALYSIS REPORT

| | |
|---|---|
| **Ceram Reference:** | (132231) |
| **Client:** | EnviroDat Ltd<br>Science & Technology Centre<br>Earley Gate<br>Whiteknights Road<br>Reading<br>Berkshire<br>RG6 6BZ |
| **For the Attention of:** | Mr Bruce Kester |
| **Date Logged:** | 08-May-2013 |
| **Report Date:** | 20-May-2013 |
| **Purchase Order No.:** | 110603/BK |
| **Work Location:** | Ceram UK |

Please find attached the results for the samples recently submitted for analysis.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

**Mr Stuart Watson**
**Author**

**Ceram Reference:** (132231)

**LFG Trace Suite**

**GCMS (Method C51)**

**Date of Test:** 16-May-2013 to 20-May-2013

| **Ceram Sample Reference** | | (132231)-9839 |
|---|---|---|
| **Material Type** | | Gas |
| **Your Reference** | | R13073/1055 3/5/13 |
| **Result(s)** | **Units** | |
| Dichloromethane | mg/m³ | <1.0 |
| 1,1,1-Trichloroethane | mg/m³ | <1.0 |
| Trichloroethylene | mg/m³ | <1.0 |
| Tetrachloroethylene | mg/m³ | <1.0 |
| 1,1-Dichloroethane | mg/m³ | <1.0 |
| cis-1,2-Dichloroethylene | mg/m³ | <1.0 |
| Vinyl Chloride | mg/m³ | >8.0 |
| 1,1-Dichloroethylene | mg/m³ | <1.0 |
| trans-1,2-Dichloroethylene | mg/m³ | <1.0 |
| Chloroform | mg/m³ | <1.0 |
| 1,2-Dichloroethane | mg/m³ | <1.0 |
| 1,1,2-Trichloroethane | mg/m³ | <1.0 |
| Chlorobenzene | mg/m³ | 1.7 |
| Dichlorobenzene | mg/m³ | <1.0 |
| Chloroethane | mg/m³ | 2.4 |
| Carbon Tetrachloride | mg/m³ | <1.0 |
| Freon 113 | mg/m³ | <1.0 |
| Freon 11 | mg/m³ | <1.0 |
| Freon 12 # | mg/m³ | <1.0 |
| Freon 21 | mg/m³ | <1.0 |
| Freon 22 | mg/m³ | <1.0 |
| Freon 114 # | mg/m³ | <1.0 |
| Freon 142b # (semi-quantitative) | mg/m³ | <1.0 |
| Dimethylsulphide | mg/m³ | <1.0 |
| Dimethyldisulphide | mg/m³ | <1.0 |
| Ethane Thiol # | mg/m³ | <1.0 |
| Carbon Disulphide | mg/m³ | 19.7 |
| Diethyl Sulphide | mg/m³ | <1.0 |
| Methane Thiol # | mg/m³ | <1.0 |
| Ethylmethylsulphide | mg/m³ | <1.0 |
| Diethyldisulphide | mg/m³ | <1.0 |
| 1,2-Dichloropropane | mg/m³ | <1.0 |
| Bromochloromethane | mg/m³ | <1.0 |
| cis-1,3-Dichloropropene | mg/m³ | <1.0 |
| trans-1,3-dichloropropene # | mg/m³ | <1.0 |
| Dibromochloromethane | mg/m³ | <1.0 |
| Dibromomethane # | mg/m³ | <1.0 |
| Bromoform | mg/m³ | 0.0 |
| UKAS Accredited | | Yes |

Results marked with a # are not covered by the Ceram UKAS ISO17025 scope of accreditation.

Mr Stuart Watson
Author

**Ceram Reference:** (132231)

## LFG Trace Suite

**GCMS (Method C51)**

**Date of Test:** 16-May-2013 to 20-May-2013

| **Ceram Sample Reference** | | (132231)-9839 |
|---|---|---|
| **Material Type** | | Gas |
| **Your Reference** | | R13073/1055 3/5/13 |
| **Result(s)** | **Units** | |
| Total Chlorinated Compounds | mg/m³ | >71.4 |
| Total Fluorinated Compounds | mg/m³ | <1 |
| Total Organo-Sulphur Compounds | mg/m³ | 19.7 |
| Total Chlorinated Compounds as Cl | mg/m³ | >40.0 |
| Total Fluorinated Compounds as F | mg/m³ | None Detected |
| Total Organo-Sulphur Compounds as S | mg/m³ | 16.6 |
| iso-Pentane | ppm | 9 |
| Pentane | ppm | 451 |
| Hexane | ppm | 34 |
| Heptane | ppm | 18 |
| Octane | ppm | 10 |
| Nonane | ppm | 2 |
| Decane | ppm | <1 |
| Dodecane | ppm | <1 |
| Butyl Acetate | mg/m³ | <1.0 |
| Ethyl Acetate | mg/m³ | <1.0 |
| iso-Propyl Acetate | mg/m³ | <1.0 |
| Propyl Acetate | mg/m³ | <1.0 |
| Amyl Acetate | mg/m³ | <1.0 |
| sec-Butyl Acetate | mg/m³ | <1.0 |
| tert-Butyl Acetate | mg/m³ | <1.0 |
| Benzyl Acetate | mg/m³ | <1.0 |
| Cumene | mg/m³ | 12.7 |
| d-Limonene | mg/m³ | 1.3 |
| alpha-Pinene | mg/m³ | <1.0 |
| beta-Pinene | mg/m³ | <1.0 |
| 3-Carene | mg/m³ | <1.0 |
| Methyl Butyrate | mg/m³ | 4.4 |
| UKAS Accredited | | Yes |

Mr Stuart Watson
Author

# LABORATORY ANALYSIS CHAR & ASH

M J Church
Star Farm
Marshfield
Nr Chippenham
SN14 8LH

FAO Hannah Jones

# LABORATORY TEST REPORT

**Results of analysis of 1 sample**
**received 8 January 2013**

**New Earth Advanced Technology**

Chemtest
The right chemistry to deliver results

**Report Date**
**10 January 2013**

| | | | | | |
|---|---|---|---|---|---|
| **Login Batch No** | | | | | **219931** |
| Chemtest LIMS ID | | | | | AI12661 |
| Sample ID | | | | | IBA Pyrolised Char |
| Sample No | | | | | |
| Sampling Date | | | | | 7/1/2013 |
| Depth | | | | | |
| *Matrix* | | | | | *SOIL* |
| SOP↓ | Determinand↓ | CAS No↓ | Units↓ | * | |
| 2010 | pH | | | M | 8.0 |
| 2175 | Sulfur (total TRL report 447) | | % | M | 0.21 |
| 2325 | Sulfide (Easily Liberatable) | 18496258 | mg kg-¹ | M | 1.9 |
| 2230 | Phosphate (available) | 14265442 | mg kg-¹ | N | 200 |
| 2120 | Boron (hot water soluble) | 7440428 | mg kg-¹ | M | 4.5 |
| | Sulfate (2:1 water soluble) as SO4 | 14808798 | g l-¹ | M | 0.55 |
| 2430 | Magnesium (total) | 7439954 | mg kg-¹ | N | 95 |
| 2490 | Chromium (hexavalent) | 18540299 | mg kg-¹ | N | <0.5 |
| 2430 | Aluminium | 7429905 | mg kg-¹ | N | 17000 |
| | Iron | 7439896 | mg kg-¹ | N | 17000 |
| 2450 | Arsenic | 7440382 | mg kg-¹ | M | 9.8 |
| | Barium | 7440393 | mg kg-¹ | M | 570 |
| | Beryllium | 7440417 | mg kg-¹ | M | <1.0 |
| | Cadmium | 7440439 | mg kg-¹ | M | 9.2 |
| | Cobalt | 7440484 | mg kg-¹ | M | 30.0 |
| | Chromium | 7440473 | mg kg-¹ | M | 77 |
| | Copper | 7440508 | mg kg-¹ | M | 12000 |
| | Mercury | 7439976 | mg kg-¹ | M | <0.10 |
| | Nickel | 7440020 | mg kg-¹ | M | 930 |
| | Lead | 7439921 | mg kg-¹ | M | 230 |
| | Antimony | 7440364 | mg kg-¹ | N | 130 |
| | Selenium | 7782492 | mg kg-¹ | M | <0.20 |
| | Vanadium | 7440622 | mg kg-¹ | M | 28 |

¹The sample container/fill level was not appropriate for the specified analysis - these results may be compromised. The accreditation for these results remains unaffected.

All tests undertaken between 08/01/2013 and 10/01/2013

* Accreditation status

***This report should be interpreted in conjuction with the notes on the accompanying cover page.***

M J Church
Star Farm
Marshfield
Nr Chippenham
SN14 8LH

FAO Hannah Jones

# LABORATORY TEST REPORT

**Results of analysis of 1 sample**
**received 8 January 2013**

**New Earth Advanced Technology**

Chemtest
The right chemistry to deliver results

**Report Date**
**10 January 2013**

| | | | | | **219931** |
|---|---|---|---|---|---|
| | | | | | AI12661 |
| | | | | | IBA Pyrolised Char |
| | | | | | |
| | | | | | 7/1/2013 |
| | | | | | |
| | | | | | *SOIL* |
| 2450 | Zinc | 7440666 | mg kg-1 | M | 1800 |
| 2670 | TPH >C5-C6 | | mg kg-1 | U | < 0.1 [1] |
| | TPH >C6-C7 | | mg kg-1 | U | 4.6 [1] |
| | TPH >C7-C8 | | mg kg-1 | M | 4.8 [1] |
| | TPH >C8-C10 | | mg kg-1 | M | 31 [1] |
| | TPH >C10-C12 | | mg kg-1 | M | 52 [1] |
| | TPH >C12-C16 | | mg kg-1 | M | 150 [1] |
| | TPH >C16-C21 | | mg kg-1 | M | 100 [1] |
| | TPH >C21-C35 | | mg kg-1 | M | 450 [1] |
| | Total Petroleum Hydrocarbons | | mg kg-1 | U | 790 [1] |
| 2700 | Naphthalene | 91203 | mg kg-1 | M | 1.7 |
| | Acenaphthylene | 208968 | mg kg-1 | M | 0.64 |
| | Acenaphthene | 83329 | mg kg-1 | M | 1.3 |
| | Fluorene | 86737 | mg kg-1 | M | 0.57 |
| | Phenanthrene | 85018 | mg kg-1 | M | 3.3 |
| | Anthracene | 120127 | mg kg-1 | M | 3.3 |
| | Fluoranthene | 206440 | mg kg-1 | M | 1.9 |
| | Pyrene | 129000 | mg kg-1 | M | 1 |
| | Benzo[a]anthracene | 56553 | mg kg-1 | M | 0.95 |
| | Chrysene | 218019 | mg kg-1 | M | 0.74 |
| | Benzo[b]fluoranthene | 205992 | mg kg-1 | M | < 0.1 |
| | Benzo[k]fluoranthene | 207089 | mg kg-1 | M | < 0.1 |
| | Benzo[a]pyrene | 50328 | mg kg-1 | M | < 0.1 |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-1 | M | < 0.1 |

[1] The sample container/fill level was not appropriate for the specified analysis - these results may be compromised. The accreditation for these results remains unaffected.

All tests undertaken between 08/01/2013 and 10/01/2013

* Accreditation status

***This report should be interpreted in conjuction with the notes on the accompanying cover page.***

M J Church
Star Farm
Marshfield
Nr Chippenham
SN14 8LH

FAO Hannah Jones

# LABORATORY TEST REPORT

**Results of analysis of 1 sample**
**received 8 January 2013**

**New Earth Advanced Technology**

Chemtest
The right chemistry to deliver results

**Report Date**
**10 January 2013**

| | | | | | 219931 |
|---|---|---|---|---|---|
| | | | | | AI12661 |
| | | | | | IBA Pyrolised Char |
| | | | | | |
| | | | | | 7/1/2013 |
| | | | | | |
| | | | | | SOIL |
| 2700 | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-[1] | M | < 0.1 |
| | Benzo[g,h,i]perylene | 191242 | mg kg-[1] | M | < 0.1 |
| | Total (of 16) PAHs | | mg kg-[1] | M | 15 |
| | Benzo[j]fluoranthene by FID | 205823 | mg kg-[1] | | <0.1 |
| 2750 | Fuel Type (soils) | | | N | Indiscernible |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised. The accreditation for these results remains unaffected.

All tests undertaken between 08/01/2013 and 10/01/2013
* Accreditation status
***This report should be interpreted in conjuction with the notes on the accompanying cover page.***


LIMS sample ID range AI12661 to AI12661

# ANNEX C: Company Quality Management Procedures

# 4.3 (27.1 AVO) WASTE ACCEPTANCE AND MONITORING

*WARNING: The reader must refer to the electronic master copy of this procedure. Printed copies may be out of date.*

## INTRODUCTION

New Earth Solutions facilities are designed to process solid mixed municipal waste materials. However, as with many processes there are some materials that the facility cannot process. Should these occur frequently or in abnormal quantities then they can have an adverse effect on the process and the quality of its outputs. This could be due to the physical capabilities of the facility, or due to the effects these waste materials might have on the performance of the facility and its process. As with any waste management facility the site's Environmental Permit restricts the waste materials that can be treated. As a consequence there needs to be a protocol setting out a waste acceptance methodology and a protocol for assessing waste deposited at the site to ensure its suitability for processing. Certain constituent materials can be described as OBJECTIONABLE, and others PROHIBITED, when set against the process requirements and the Environmental Permit. This Waste Acceptance Protocol seeks to ensure that the processing plant is not adversely affected by such materials, thereby ensuring it can maximise the recovery of quality recyclables and compost. Every person involved in this operation must have a copy of this Guidance Note.

## SAFETY EQUIPMENT & CLOTHING

**All personnel will wear, as a minimum requirement, the following PPE: -**

- **Safety helmet/hard hat**
- **Safety footwear incorporating steel toe caps and steel mid-sole plates**
- **Hi-visibility waistcoat or jacket**
- **Protective gloves**
- **Eye Protection (if necessary)**
- **P3 rated dust mask (when inside buildings)**

**In addition, all personnel must ensure that they are equipped with a fully functional two way radio.**

## WEIGHBRIDGE HEALTH & SAFETY/QUALITY CONTROL

The Weighbridge Operator will determine whether the load is suitable for delivery to the treatment facility based upon the EWC code and information related to the origin of the waste provided on arrival.

Where possible the weighbridge operator will visually check that each load complies with the EWC Code, description on the Waste Transfer Note and Environmental Permitting Regulations (EPR) Permit. If any load is suspected of not conforming to the above, then this will be recorded in the site diary and reported to the Facility Manager/Site Supervisor.

At least one vehicle per week will, at random, be assessed against the description of its load as detailed on the Duty of Care Waste Transfer Note, using the Waste Assessment & Inspection Form at the back of this document. Records of such compliance checks will be held on site.

The weighbridge operator will carry out a site specific induction with all drivers on their first visit to the site, and then at annual intervals. The weighbridge operator will ensure that each driver has read and understood the site rules, and be wearing the mandatory PPE before proceeding on to site. A limited supply of hard hats, hi-viz vests and safety boots will be held at the weighbridge office. A record of inducted drivers will be maintained on the weighbridge system by the weighbridge operator.

## RECEPTION HALL

Vehicles delivering waste will be directed from the weighbridge to the waste reception building where the load will be discharged. All loads will be discharged under the supervision of a member of staff.

# 4.3 (27.1 AVO) WASTE ACCEPTANCE AND MONITORING

*WARNING: The reader must refer to the electronic master copy of this procedure. Printed copies may be out of date.*

During discharge, all loads will be assessed by the Reception Hall mobile plant operators against the description provided on the Waste Transfer Note. A delivery will be regarded as non-compliant in the event that:

- The proportion of OBJECTIONABLE MATERIAL is considered to be greater than 5% by volume.
- Any specific item of PROHIBITED MATERIAL is found that is considered to pose a serious health and/or safety threat to personnel or risk to the efficiency of the process.

**WASTE ACCEPTANCE CRITERIA**

**ACCEPTABLE WASTE**

Acceptable Waste is material that falls into one of the categories in the table below.

| Category of Waste | EWC Code |
|---|---|
| Municipal Waste | 20 03 01 mixed municipal waste<br>20 03 03 street cleansing residues<br>20 03 02 waste from markets |
| Garden and Parks Waste | 20 02 01 biodegradable garden |

**OBJECTIONABLE MATERIAL**

The following items will be considered as Objectionable Material when assessing the acceptability of a delivered load for treatment:-

- Hardcore, rubble and soils.
- Bulky waste including, without limitation, mattresses, bedsteads, sofas, carpets, household and garden furniture, tree trunks and large plastic toys.
- Hazardous waste including, without limitation non-portable batteries, asbestos, pesticides and other chemicals and gas cylinders.
- Electrical items
- Street cleansing residues that include any of the items above.
- Any specific item of contamination that is considered to pose a serious health and/or safety threat to personnel, or that does not conform to the Environmental Permit.

Should NES determine, acting reasonably, that a delivered load contains greater than 5% Objectionable Material it will be removed to a quarantine area and the Waste Partnership Officer will be informed accordingly. A note of which Council delivered the waste and its contractor will be made at this point.

The WPO will be provided with an opportunity to conduct a joint inspection, involving, if appropriate, the relevant Authority's contractor and their operational officers.

**PROHIBITED MATERIAL**

Prohibited Material is material that falls into one of the categories in the table below.

| Category of Waste | EWC Code |
|---|---|
| Solvents | 20 01 13* |
| Acids | 20 01 14* |
| Alkalines | 20 01 15* |
| Photochemicals | 20 01 17* |
| Pesticides | 20 01 19* |

# 4.3 (27.1 AVO) WASTE ACCEPTANCE AND MONITORING

*WARNING: The reader must refer to the electronic master copy of this procedure. Printed copies may be out of date.*

| | |
|---|---|
| Fluorescent tubes and other mercury-containing waste | 20 01 21* |
| Discarded equipment containing chlorofluorocarbons | 20 01 23* |
| Edible oil and fat | 20 01 25 |
| Oil and fat other than those mentioned in 20 01 25 | 20 01 26* |
| Paint, inks, adhesives and resins containing dangerous substances | 20 01 27* |
| paint, inks, adhesives and resins other than those mentioned in 20 01 27 | 20 01 28 |
| Detergents containing dangerous substances | 20 01 29* |
| Detergents other than those mentioned in 20 01 29 | 20 01 30 |
| Cytotoxic and cytostatic medicines | 20 01 31* |
| Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries | 20 01 33* |
| Batteries and accumulators other than those mentioned in 20 01 33 | 20 01 34 |
| Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components | 20 01 35* |
| Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35 | 20 01 36 |
| Wood containing dangerous substances | 20 01 37* |

Should NES determine, acting reasonably, that a delivered load contains Prohibited Material it will be removed to a quarantine area and the WPO will be informed accordingly. A note of which Authority delivered the waste and its delivery contractor will be recorded at this point.

The WPO will be provided with an opportunity to conduct a joint inspection, involving if appropriate, the relevant Authority's contractor and operational officers.

**NON COMPLIANT LOADS – INSPECTION PROCEDURE**

In the event of any non-compliant delivery, the driver will be invited to inspect the load discharged from his vehicle in conjunction with a member of the site staff. Confirmation of the load's initial acceptability or not will be given at this time in order not to detain the delivery vehicle unnecessarily. This inspection should take no more than five minutes. In order to ensure no further disruption to site operations, any load suspected of being non-compliant will be removed to a designated quarantine area where it may be further assessed.

At this point photographic records may be made and the WPO invited to conduct a joint inspection with the Facility Manager/Site Supervisor. Should the load fall outside of the agreed input specification then, dependent upon the nature and extent of the contamination identified, the load may be subjected to either of two further courses of action, these being: -

- The cleaning of the load by removal of contaminants and continued processing of the remaining waste,
- Rejection of the load in its entirety and its reloading and removal to a suitably licensed waste management facility dependent on the composition of the waste.

NES will always endeavour to treat contaminated loads such that they may be accepted for treatment. The rejection of an entire load from the facility will take place as a last resort and only after all reasonable attempts to remove the contamination have been exhausted.

Contaminants removed on an ongoing basis will be stored on site in a secure container (skip), where clients may inspect them.

In the event of a specific item of contamination occurring that is considered by NES to pose a serious health and/or safety threat to personnel e.g. clinical waste, or threat to the mechanical sort or biological process (e.g. hazardous chemicals) the entire load may be considered for rejection. In such circumstances, the WPO will be informed.

# 4.3 (27.1 AVO) WASTE ACCEPTANCE AND MONITORING

*WARNING: The reader must refer to the electronic master copy of this procedure. Printed copies may be out of date.*

**I have read and understood this Guidance Note.**

**Name:** **Date:**

**Signature:** **Company:**

# ANNEX D: Contaminant Fate and Environment Agency Biomethane Risk Assessment Concentration

# D1 - Contaminant Fate

## Annex D: Environmental Fate of contaminants

| Component | Range | Primary Action | Secondary Action | Environmental Fate | Evidence |
|---|---|---|---|---|---|
| Moisture (%) | 5 .0 – 30.0 | All water content dried in retort feed system and flashes to steam in gasifier.<br><br>% will react with Carbon to produce Hydrogen and Carbon monoxide | Water Vapour condensed within gas quench<br><br>CO and $H_2$ in gaseous form remain in Synthesis gas | Excess water is cleaned with water treatment plant and bled to drain<br><br>CO and $H_2$ combusted to $CO_2$ and $H_2O$ in engine | Annex B |
| Ash content (%) | 10 – 20 | Retained in Char | Melts but does not boil off in Secondary Converter | Forms a vitrified ash. All solids (metal etc) locks in many solids that do not melt | Refer to Annex B – Char Analysis |
| Sulphur (%) | 0 – 0.2% | Boils and forms a gas phase metal within the retort | Stripped from gas stream and put into solution in quench. | Water neutralised by pH correction | Refer to Annex B – Gas Analysis |
| Chlorine (%) | 0-1.0 | Forms a gas phase within the primary gasifier | Stripped from gas stream and put into solution in quench. | Converts to sodium chloride solution in the during gas quench and washing. | Refer to Annex B – Gas Analysis |
| Arsenic (mg/kg) | 0 - 0 35 | Boils and forms a gas phase metal within the primary gasifier | Stripped from gas stream and put into solution in quench. | Contained in solution | Refer to Annex B – Gas Analysis |
| Cadmium (mg/kg) | 0 - 85 | Remain solid phase and retained within char | Remains in solid phase and retained in char | Encapsulated in vitrified ash | Refer to Annex B – Gas Analysis |
| Fluorine (%) | 0 – 0.0026 | Forms a gas in primary gasifier | Stripped from gas stream and put into solution in quench. | Water neutralised by ph correction | Refer to Annex B – Gas |
| Chromium (mg/kg) | 0-1500 | Remain solid phase and retained within char | Remains in solid phase and retained in char | Encapsulated in vitrified ash | Refer to Annex B – Char Analysis |
| Lead (mg/kg) | 0 -4500 | Melts to liquid phase but retained in char | Remains in solid phase and retained in char | Encapsulated in vitrified ash | Refer to Annex B – Char Analysis |
| Mercury (mg/kg) | 0 – 3 | Boils and forms a gas phase metal within the gasifier | Reformed to solid on quench | Settles as a sludge at bottom of oils separation tank | Refer to Annex B – Char Analysis |
| Nickel (mg/kg) | 0 - 500 | Remain solid phase and retained within char | Remains in solid phase and retained in char | Encapsulated in vitrified ash | Refer to Annex B – Char Analysis |
| Manganese Mn (mg/kg) | 0 - 2800 | Remain solid phase and retained within char | Remains in solid phase and retained in char | Encapsulated in vitrified ash | Refer to Annex B – Char Analysis |
| Vanadium (mg/kg) | 0 – 180 | Remain solid phase and retained within char | Remains in solid phase and retained in char | Encapsulated in vitrified ash | Refer to Annex B – Char Analysis |
| Zinc (mg/kg) | 1 - 2150 | Remain solid phase and retained within char | Encapsulated in vitrified ash | Encapsulated in vitrified ash | Refer to Annex B – Char Analysis |
| Thallium (mg/kg) | 0 – 0.30 | Boils and forms a gas phase metal within the primary gasifier | Remains in solid phase and retained in char | Encapsulated in vitrified ash | Refer to Annex B – Char Analysis |
| Antimony (mg/kg) | 0 -110 | Remain solid phase and retained within char | Remains in solid phase and retained in char | Encapsulated in vitrified ash | Refer to Annex B – Char Analysis |
| Cobalt (mg/kg) | 0 – 7.5 | Remain solid phase and retained within char | Remains in solid phase and retained in char | Encapsulated in Vitrified ash | Refer to Annex B – CharAnalysis |

# D2 - Environment Agency Risk Biomethane Assessment Concentration

| Trace Gas | Acceptable Concentration | | | |
|---|---|---|---|---|
| | Instantaneous (mg/m$^3$) | Ratio | Long term (mg/m$^3$) | Ratio |
| **Raw Biomethane** | | | | |
| *Halogenated hydrocarbons* | | | | |
| 1,2 Dichloroethane | 8.15E+02 | 4.48E-01 | 4.41E+01 | 2.42E-02 |
| Vinyl chloride | 2.16E+03 | 2.95E+00 | 1.22E+02 | 1.68E-01 |
| Tetrachloroethene | 9.32E+03 | 1.21E+00 | 3.06E+04 | 3.97E+00 |
| 1,1,2, Trichloroethane | 2.33E+00 | 2.33E-01 | 2.45E+01 | 2.45E+00 |
| Chlorobenzene | 8.18E+04 | 2.73E+01 | 1.59E+04 | 5.30E+00 |
| Dichloromethane | 3.49E+03 | 2.29E+00 | 5.51E+04 | 3.61E+01 |
| Tetrachloroethane | 0.00E+00 | 0.00E+00 | 6.45E+02 | 1.29E+01 |
| Trichloroethene | 1.16E+03 | 1.32E+01 | 2.82E+03 | 3.20E+01 |
| *Aromatics* | | | | |
| Benzene | 2.42E+02 | 3.32E+00 | 3.92E+02 | 5.37E+00 |
| Toluene | 9.32E+03 | 7.45E+00 | 8.27E+03 | 6.61E+00 |
| Xylenes | 7.71E+04 | 1.25E+00 | 6.99E+03 | 1.13E-01 |
| Naphthalene | 9.32E+03 | 5.48E+02 | 9.54E+01 | 5.61E+00 |
| *Reduced sulphur compounds* | | | | |
| Hydrogen sulphide | 1.75E+02 | 3.01E-01 | 4.77E+03 | 8.22E+00 |
| Dimethyl sulphide | 0.00E+00 | 0.00E+00 | 1.59E+02 | 6.54E+00 |
| Dimethyl disulphide | 0.00E+00 | 0.00E+00 | 1.59E+02 | 1.32E+01 |
| Carbon disulphide | 1.16E+02 | 6.85E-01 | 3.18E+03 | 1.87E+01 |
| *Other* | | | | |
| Arsenic | 0.00E+00 | 0.00E+00 | 7.34E-01 | 1.71E+00 |
| Ammonia | 2.91E+03 | 1.37E-01 | 5.72E+03 | 2.69E-01 |
| | **Short term (mg/m$^3$)** | **Ratio** | **Long term (mg/m$^3$)** | **Ratio** |
| **Combustion Gas** | | | | |
| $SO_2$ | 3.82E+01 | 3.82E-01 | 2.63E+01 | 2.64E-01 |
| *Acid Gases* | | | | |
| HCl | 8.18E+01 | 9.62E-02 | 0.00E+00 | 0.00E+00 |
| HF | 1.74E+01 | 2.37E-02 | 3.37E+00 | 4.58E-03 |
| *Aromatics* | | | | |
| Benzene | 2.27E+01 | 6.74E+02 | 2.18E+00 | 6.47E+01 |
| Toluene | 8.72E+02 | 1.60E+04 | 5.48E+01 | 1.01E+03 |
| *Polycyclic aromatic hydrocarbons (PAHs)* | | | | |
| Naphthalene | 8.72E+02 | 8.87E+04 | 6.32E-01 | 6.42E+01 |
| Acenaphthylene | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Acenaphthene | 0.00E+00 | 0.00E+00 | 4.42E+01 | 1.48E+06 |
| Fluorene | 0.00E+00 | 0.00E+00 | 2.95E+01 | 6.57E+05 |
| Phenanthrene | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Anthracene | 0.00E+00 | 0.00E+00 | 2.21E+02 | 5.75E+06 |

| | | | | |
|---|---|---|---|---|
| Fluoranthene | 0.00E+00 | 0.00E+00 | 9.27E+00 | 1.93E+05 |
| Pyrene | 0.00E+00 | 0.00E+00 | 2.21E+01 | 2.76E+05 |
| Benzo-a-anthracene | 0.00E+00 | 0.00E+00 | 1.70E-03 | 5.90E+01 |
| Chrysene | 0.00E+00 | 0.00E+00 | 5.67E-03 | 1.97E+02 |
| Benzo-b-fluoranthene | 0.00E+00 | 0.00E+00 | 1.70E-03 | 5.90E+01 |
| Benzo-k-fluoranthene | 0.00E+00 | 0.00E+00 | 1.70E-03 | 5.90E+01 |
| Benzo-a-pyrene | 0.00E+00 | 0.00E+00 | 1.70E-04 | 8.85E+00 |
| Dibenzo-ah-anthracene | 0.00E+00 | 0.00E+00 | 8.90E-05 | 4.63E+00 |
| Benzo-ghi-perylene | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Indeno-123-cd-pyrene | 0.00E+00 | 0.00E+00 | 2.13E-03 | 7.37E+01 |
| *Metals* | | | | |
| Cd | 0.00E+00 | 0.00E+00 | 1.05E-03 | 5.98E-02 |
| As | 0.00E+00 | 0.00E+00 | 4.08E-03 | 1.27E+00 |
| Se | 0.00E+00 | 0.00E+00 | 4.21E+00 | 1.10E+04 |
| Cu | 6.54E+00 | 4.81E+02 | 4.21E-01 | 3.09E+01 |
| Co | 6.54E-01 | 4.86E+02 | 6.80E-02 | 5.05E+01 |
| Cr | 1.64E+01 | 7.29E+02 | 5.27E-04 | 2.35E-02 |
| CrVI | 0.00E+00 | 0.00E+00 | 1.36E-04 | 6.07E-03 |
| Mn | 1.64E+02 | 2.69E+04 | 3.16E-02 | 5.19E+00 |
| Ni | 0.00E+00 | 0.00E+00 | 1.36E-02 | 4.04E-01 |
| Pb | 0.00E+00 | 0.00E+00 | 5.27E-02 | 7.15E+00 |
| V | 1.09E-01 | 2.96E+00 | 2.11E-01 | 5.72E+00 |
| Hg | 8.18E-01 | 1.96E+02 | 4.21E-02 | 1.01E+01 |
| Ba | 5.45E-01 | 7.74E+00 | 1.05E-01 | 1.49E+00 |
| Zn | 1.09E+02 | 2.35E+02 | 1.05E+01 | 2.27E+01 |
| *Chlorinated hydrocarbons* | | | | |
| 1,2 Dichloroethylene | 0.00E+00 | 0.00E+00 | 1.26E+01 | 6.74E+01 |
| 1,1 Dichloroethylene | 0.00E+00 | 0.00E+00 | 8.42E+01 | 4.49E+02 |
| Trichloroethylene | 1.09E+02 | 5.82E+02 | 1.56E+01 | 8.34E+01 |
| Tetrachloroethylene | 8.72E+02 | 4.65E+03 | 1.70E+02 | 9.07E+02 |
| 1,1,1 Trichloroethane | 2.42E+04 | 1.29E+05 | 4.42E+02 | 2.36E+03 |
| 1,1 Dichloroethane | 1.80E+04 | 9.60E+04 | 8.68E+02 | 4.63E+03 |
| 1,2 Dichloroethane | 7.63E+01 | 4.07E+02 | 2.45E-01 | 1.31E+00 |
| Chlorobenzene | 7.66E+03 | 4.08E+04 | 1.05E+02 | 5.62E+02 |
| Dichlorobenzene | 0.00E+00 | 0.00E+00 | 2.11E+02 | 1.12E+03 |
| 1,2 Dichlorobenzene | 2.18E+02 | 1.16E+03 | 2.11E+02 | 1.12E+03 |
| 1,3 Dichlorobenzene | 0.00E+00 | 0.00E+00 | 2.11E+02 | 1.12E+03 |
| 1,4 Dichlorobenzene | 3.34E+03 | 1.78E+04 | 2.11E+02 | 1.12E+03 |
| 1,2,4 Trichlorobenzene | 2.49E+02 | 1.33E+03 | 1.60E+01 | 8.54E+01 |

# ANNEX E: WRATE SOFTWARE OUTPUTS

**Summary:** This worksheet present the results of the GHG Ready Reckoner Tool, and details whether the EPS and Carbon Intensity Floor are achieved.

Back to overview

The results presented in this worksheet are a factor of the data inputted by the user, the technology choices and the carbon factor selections. Results are presented in tonnes of carbon dioxide equivalent (tCO2e), that is to say that other non carbon dioxide gases with a greenhouse potential have been converted to a carbon equivalent e.g. 1 tonne of methane is equivalent to 21 tonnes of carbon dioxide.

### 6.1 Consistency Check

| | MSW Input | Recycling Input | Organic Input | Residual Input |
|---|---|---|---|---|
| Consistency check | OK | OK | OK | OK |

HINT:
If "Error" is returned, go to relevant Input Sheet and look for red shaded cells. All cells must show "OK" for consistent model.

PAN RIGHT TO VIEW A SCHEMATIC OF WASTE MOVEMENTS

## • Credit associated with reuse

| | |
|---|---|
| Total tonnes reused | |

#### 6.2 Resuse composition

| | Default | User | Carbon (tCO2e/t) | Total Carbon (tCO2e) |
|---|---|---|---|---|
| Textiles | 30% | | -22 | 0 |
| Furniture | 20% | | -1 | 0 |
| WEEE | 50% | | -1 | 0 |

Reuse results in a saving of:
0 tonnes CO2e

## • Summary results

Include transportation

Emissions Performance Standard

The waste management services modelled within this file are estimated to generate:
**0.00** tonnes CO2e

A negative value represents a net avoided burden (saving) of greenhouse gases. A positive value represents a net burden of Greenhouse gases. See detailed results for further breakdown of this total emission figure. Improvements in total GHG emissions are acheived through increased recycling (in particular metals, textiles and plastics) increasing diversion from landfill and increasing energy and heat recovery of residual treatment plants.

based on the management of **24,000** tonnes of waste, and reaching a source segregated recycling rate of **18.41%**

This is the equivalent to **0.000** tonnes CO2e per tonne of waste managed.

The EPS in the year **2012** is set at **-0.034** tCO2e/t waste therefore the EPS is NOT MET
[ Straight line increase ]

EPS in preceding and superseding years:

| | 2010 | 2011 | 2013 | 2014 |
|---|---|---|---|---|
| EPS (tCO2e/t) | 0.030 | -0.002 | -0.066 | -0.098 |
| EPS Met? | MET | NOT MET | NOT MET | NOT MET |

Carbon Intensity Floor

The **energy generating residual waste treatment technologies and AD processes** specified in this file are estimated to generate:

**12,603,252** kWh of energy

and result in direct combustion emissions of **4,284,093** kgCO2e.

This is the equivalent to **0.340** kgCO2e/kWh of energy generated.

The carbon intensity floor in the year **2012** is set at **0.4** kgCO2e/kWh therefore the Carbon Intensity Floor is MET
[ DECC Marginal electricity ]

## • Credit associated with reduction (for information only)

Note that the information provided below is for information purposes only and does not impact on the EPS and Carbon Intensity Floor results.

The current model estimates **0** tonnes CO2e

If there was a : 0% reduction in waste arisings

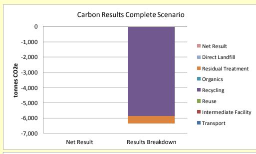
Hint:
Insert % reduction in D60

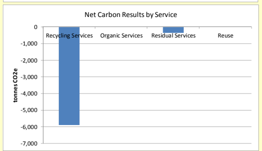
This would result in GHG emissions of **0** tonnes CO2e

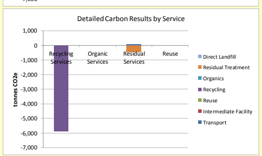
## • Detailed results

### 6.3 Detailed results

| | tonnes CO2e Recycling Services | Organic Services | Residual Services | Reuse | Total |
|---|---|---|---|---|---|
| Transport | 0 | #N/A | 96 | | #N/A |
| Intermediate Facility | 0 | 0 | 0 | | 0 |
| Reuse | | | | 0 | 0 |
| Recycling | -5,895 | | | | -5,895 |
| Organics | | 0 | | | 0 |
| Residual Treatment | | | -452 | | -452 |
| Direct Landfill | | | 0 | | 0 |
| Net Result | -5,895 | #N/A | -356 | 0 | #N/A |
| Total Waste Managed | | | | | 24,000 |
| co2/ tonne | | | | | 0.000 |
| EPS met? | | | | | EPS NOT MET |
| Carbon Intensity Floor | | | | | 0.340 |
| Carbon Floor met? | | | | | CARBON FLOOR MET |




## • Scenario Modelling

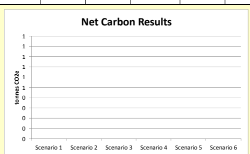
If assessing several different waste management options, the User can present multiple options in one table / chart using the are below

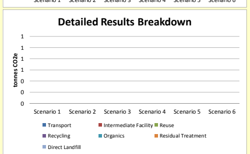
Data should be copied from the Output Results sheet (F47:F53) and pasted into the table below as values.

| Scenarion Name | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 | Scenario 5 | Scenario 6 |
|---|---|---|---|---|---|---|
| | | | | | | |
| Total tonnes CO2e | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | |
| Transport | | | | | | |
| Intermediate Facility | | | | | | |
| Reuse | | | | | | |
| Recycling | | | | | | |
| Organics | | | | | | |
| Residual Treatment | | | | | | |
| Direct Landfill | | | | | | |
| Net Result | | | | | | |
| Total Waste Managed | | | | | | |
| co2/ tonne | | | | | | |
| EPS met? | | | | | | |
| Carbon Intensity Floor | | | | | | |
| Carbon Floor met? | | | | | | |

| Lowest CO2 Impact | Scenario name |
|---|---|
| | |
| 0 | Scenario 1 |
| | |
| 0 | #N/A |
| 0 | #N/A |
| 0 | #N/A |
| 0 | #N/A |
| 0 | #N/A |
| 0 | #N/A |
| 0 | #N/A |
| 0 | #N/A |

| User comments | | | | | | |
|---|---|---|---|---|---|---|




END OF RESULTS OUTPUT

| MSW |
|---|
| 24,000 |

*Arisings*

| RECYCLING | |
|---|---|
| KERBSIDE | 4,419 |
| HWRC | 0 |
| BRING | 0 |

| ORGANICS | |
|---|---|
| KERBSIDE | 0 |
| HWRC | 0 |
| PARKS&GARDENS | 0 |

| RESIDUAL | |
|---|---|
| KERBSIDE | 19,581 |
| HWRC | 0 |
| OTHER | 0 |

*Intermediate Facilities*

| RECYCLING | |
|---|---|
| BULKING STATION | 0 |
| DIRECT | 4,419 |
| MRF | 0 |

| ORGANICS | |
|---|---|
| BULKING STATION | 0 |
| DIRECT | 0 |

| RESIDUAL | |
|---|---|
| BULKING STATION | 0 |
| DIRECT | 19,581 |

*Treatment, Reprocessor and Disposal*

| RECYCLING | |
|---|---|
| REPROCESSOR | 4,419 |

| ORGANICS | |
|---|---|
| AD Biogen Greenfinch | 0 |
| AD Linde | 0 |
| IVC Agrivert | 0 |
| IVC TEG | 0 |
| IVC ORTEC | 0 |
| OW Sita | 0 |

| RESIDUAL | |
|---|---|
| MHT | 0 |
| MBT aerobic | 0 |
| MBT biostabilised | 0 |
| MBT anaerobic | 0 |
| Incineration | 0 |
| Gasification | 0 |
| Gasification (Gas Engines) | 19,581 |
| True Pyrolysis | 0 |
| Dirty MRF | 0 |
| Landfill | 0 |

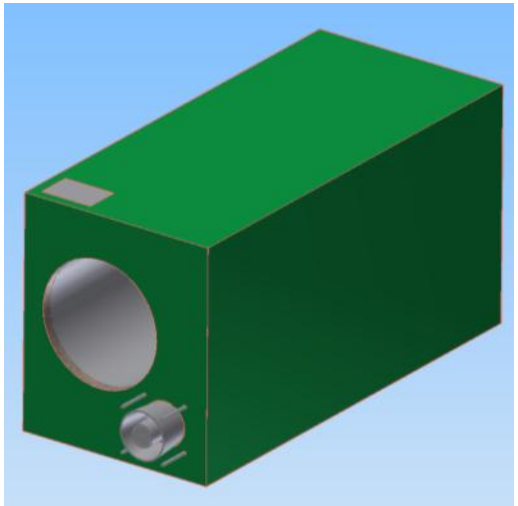
# APPENDIX G. CANFORD R&D COMBUSTION CHAMBER CFD MODELLING

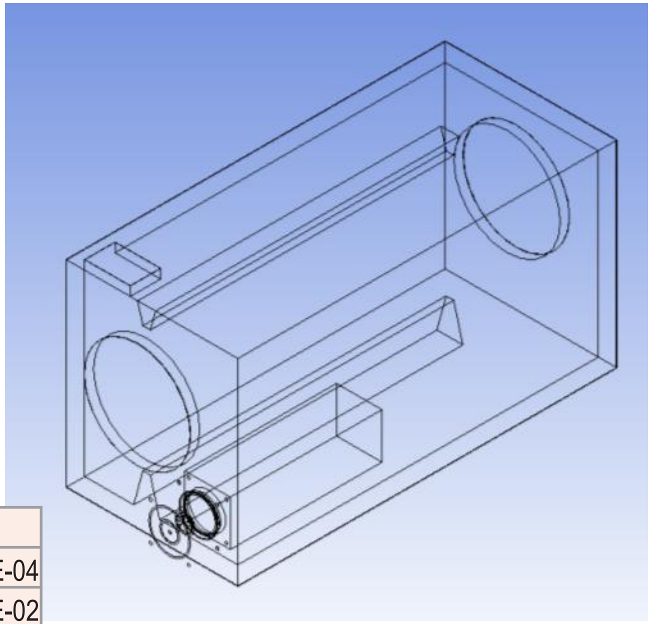
# New Earth Advanced Thermal

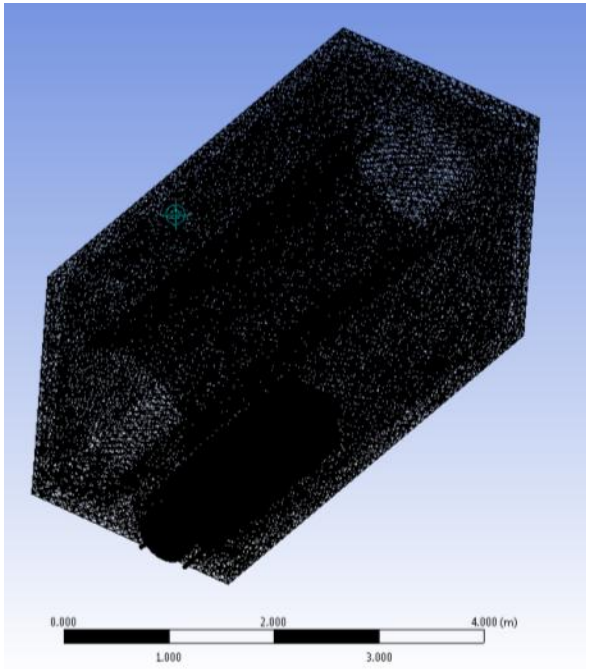
## NEAT Canford R&D Combustion Chamber Design

May 13

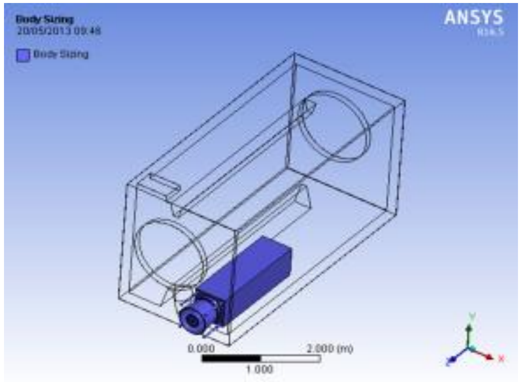
# Geometry & Mesh








| Mesh Sizing | | Fine |
|---|---|---|
| Min Size | m | 9.33E-04 |
| Max Face Size | m | 9.33E-02 |
| Max Size | m | 0.18658 |
| Growth Rate | | 1.85 |
| Minimum Edge Length | m | 3.00E-03 |
| | | |
| Default Tolerance | m | 4.66E-04 |
| Nodes | | 1592177 |
| Elements | | 1165645 |



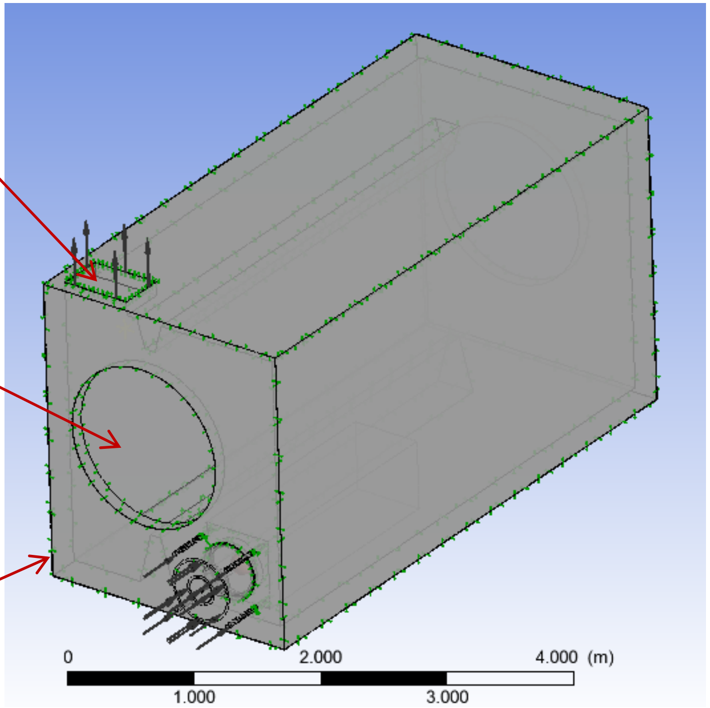

Finer mesh placed on Burner & Combustion Zone

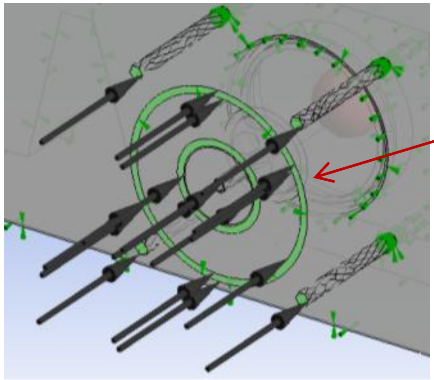
# Basic Geometric Set up

Outlet - Exhaust Port

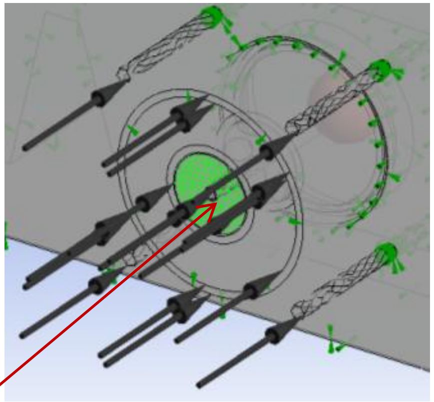
Wall - Drum

Wall – External Sides



Inlet - Air



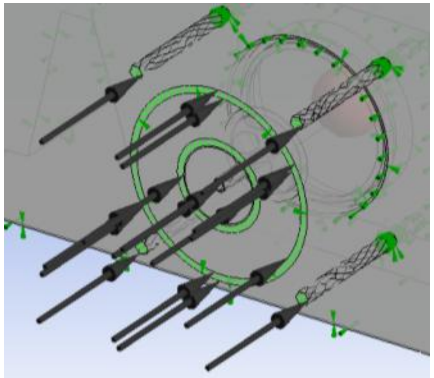
Inlet – Gasification Gas

# Boundary Conditions – Air Inlet

| Combustion Air | | % Vol Dry 100% | % Vol Wet 100% | Mass Fraction | Density kg/Nm3 1.28 |
|---|---|---|---|---|---|
| N2(g) | Nitrogen | **78.09%** | **76.76%** | **0.7472** | 0.96 |
| O2(g) | Oxygen | **20.95%** | **20.59%** | **0.2290** | 0.29 |
| CO2(g) | Carbon dioxide | **0.03%** | **0.03%** | **0.0005** | 0.00 |
| H2O(g) | Water | | **1.70%** | **0.0106** | 0.01 |
| H2(g) | Hydrogen | **0%** | **0.00%** | **-** | - |
| CH4(g) | Methane | **0%** | **0.00%** | **-** | - |
| Ar(g) | Argon | **0.93%** | **0.91%** | **0.0127** | 0.02 |

| | | |
|---|---|---|
| Air Temp | Deg C | **400** |
| Stiochio Air | Nm3/s | **0.17** |
| Excess Air | % | **24%** |
| Air Flow | Nm3/s | **0.21** |
| | Nm3/hr | **757.71** |
| | kg/s | **0.27023** |
| | Am3/hr | 1,867.91 |
| Gas Velocity | m/s | **35.000** |
| Port Area | mm2 | **14,824.66** |

| | | |
|---|---|---|
| Flow Regime | | Sub Sonic |
| Turbulence | | 5% |
| Radiation | | Local temp |

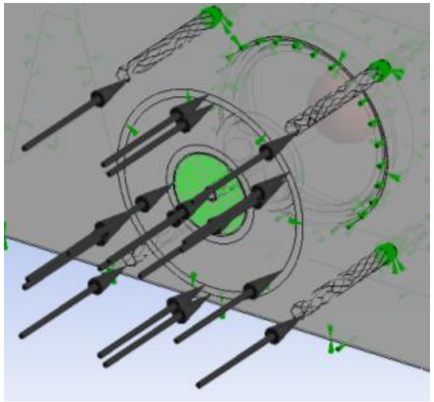


# Boundary Conditions – Gasification Gas Inlet

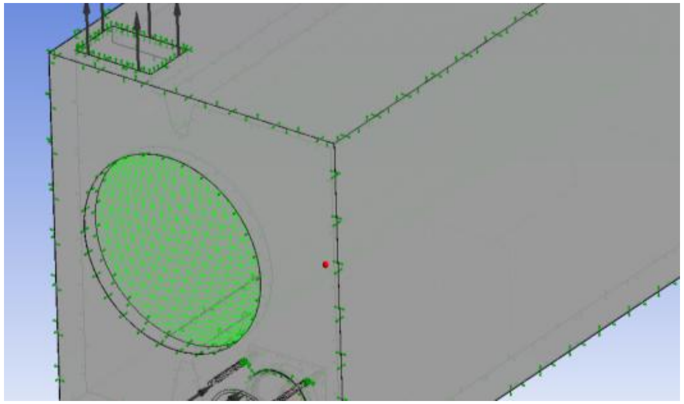
| Gasifier Gas | | % Vol | Density kg/Nm3 | Mass | LCV MJ/Nm3 | Stoichio Air vol/vol |
|---|---|---|---|---|---|---|
| | | **100%** | **1.25** | Fraction | **3.87** | **0.825** |
| N2(g) | Nitrogen | **50%** | 0.62 | **0.4989** | 0 | 0 |
| CO(g) | Carbon monoxide | **13%** | 0.16 | **0.1297** | 1.64 | 0.32 |
| CO2(g) | Carbon dioxide | **17%** | 0.33 | **0.2665** | - | 0 |
| H2O(g) | Water | **10%** | 0.08 | **0.0642** | - | 0 |
| H2(g) | Hydrogen | **5%** | 0.00 | **0.0036** | 0.64 | 0.12 |
| CH4(g) | Methane | **4%** | 0.03 | **0.0229** | 1.60 | 0.39 |
| Ar(g) | Argon | **1%** | 0.02 | **0.0142** | - | 0 |

| | | |
|---|---|---|
| Heat Input | kW | **800** |
| Gas Temp | Deg C | **600** |
| Gas Flow | Nm3/s | **0.21** |
| | Nm3/hr | **743.23** |
| | kg/s | **0.259** |
| | Am3/hr | 2,376.71 |
| Gas Velocity | m/s | **35.000** |
| Port Area | mm2 | **18,862.77** |
| No Ports | # | **6** |
| Nozzle Diameter | mm | 63.27 |

| | |
|---|---|
| Flow Regime | Sub Sonic |
| Turbulence | 5% |
| Radiation | Local temp |



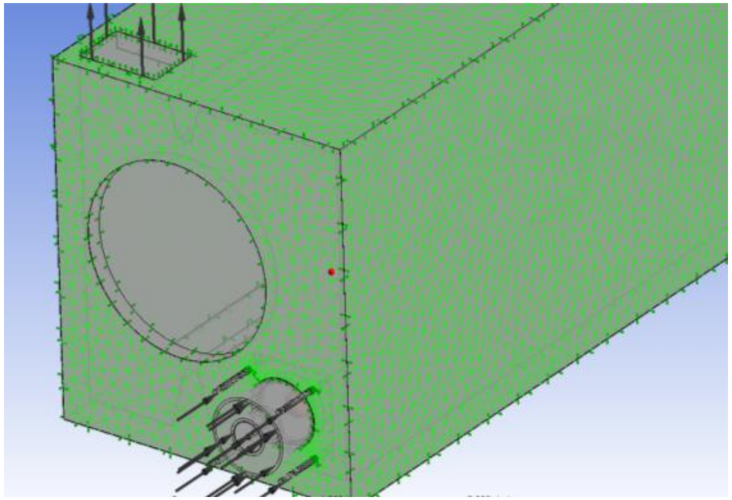
# Boundary Conditions – Walls



| | | |
|---|---|---|
| Mass & Momentum | | Specified Shear |
| Cylinderical Components | | |
| Axial | Pa | 0 |
| Radial | Pa | 0 |
| Theata | Pa | 0.3 |
| Axis | | Z Axis |
| Rough Wall | m | 0.01 |
| Heat Flux In | W/m^2 | -20000 |

Specified Shear used to simulate the rotation of the Drum.

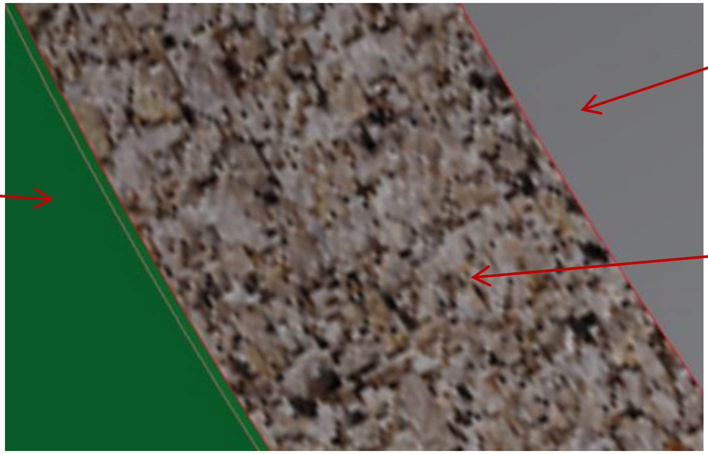
Drum Heat input requirement 400kW , Drum surface area 20m2 thus a flux of -20kW/m2



| | | |
|---|---|---|
| Temperature | Deg C | 60 |

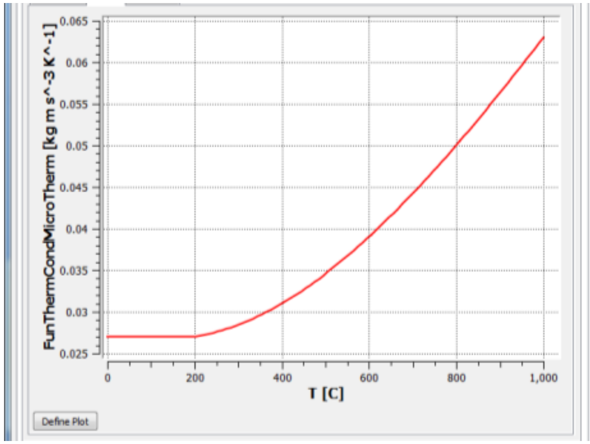
Surface temperature set to 60 Deg C (Safety of Machinery Directive) and heat loss calculated.

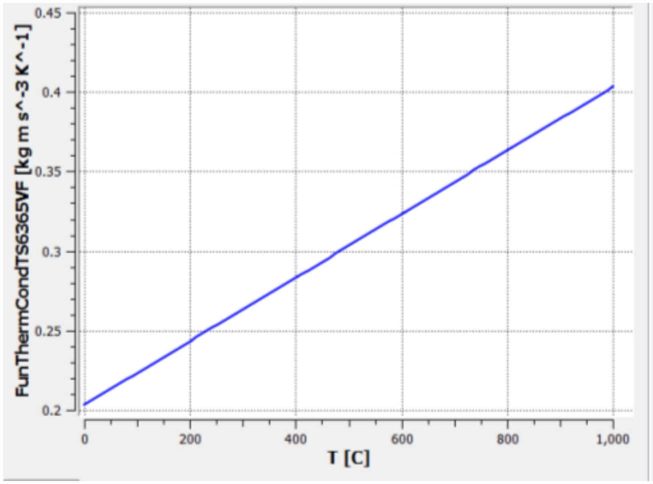
# Solid Bodies



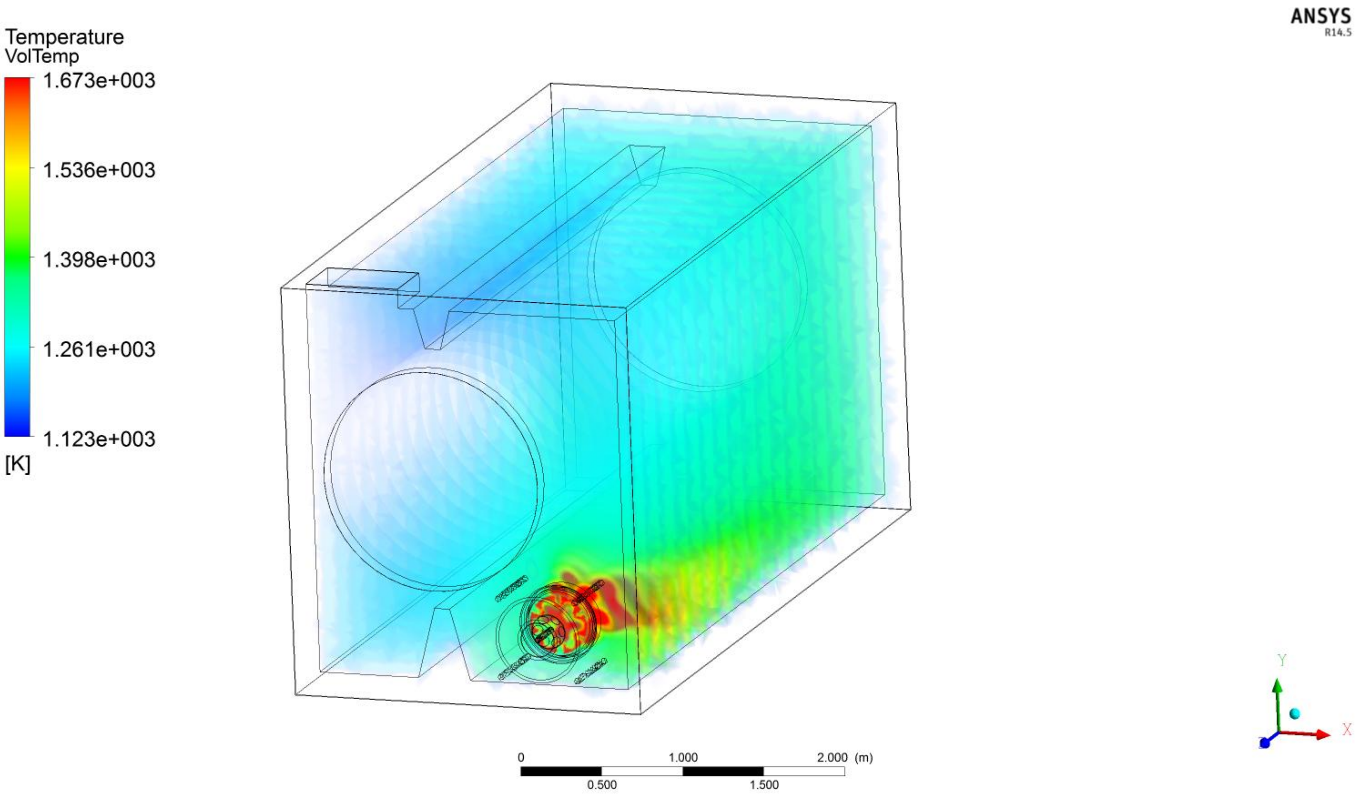

| MicroTherm | | |
|---|---|---|
| Molar Mass | kg/kmol | 162 |
| Density | kg/m3 | 260 |
| Specific Heat Capacity | J/kg/K | 1000 |

| Refractory Fire Brick (TS6365VF) | | |
|---|---|---|
| Molar Mass | kg/kmol | 220 |
| Density | kg/m3 | 780 |
| Specific Heat Capacity | J/kg/K | 1000 |



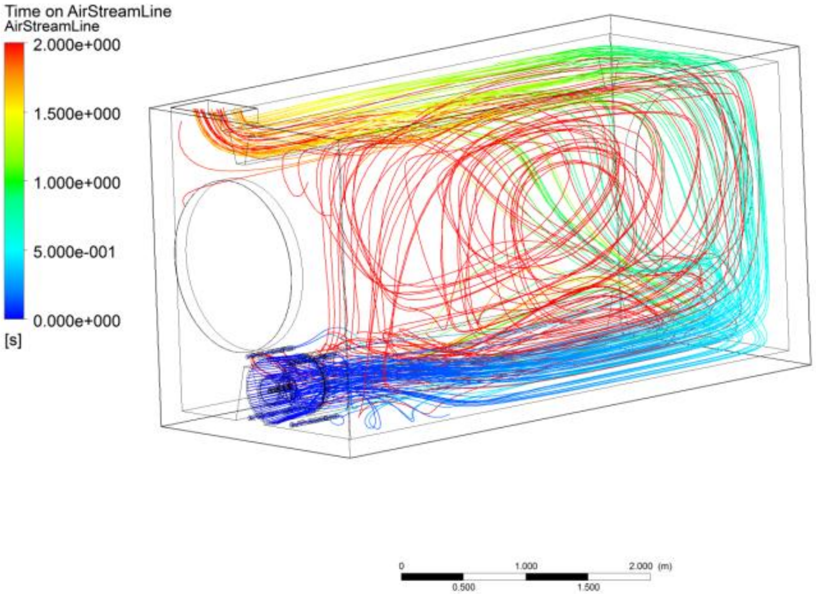



# Results – Chamber Temperature

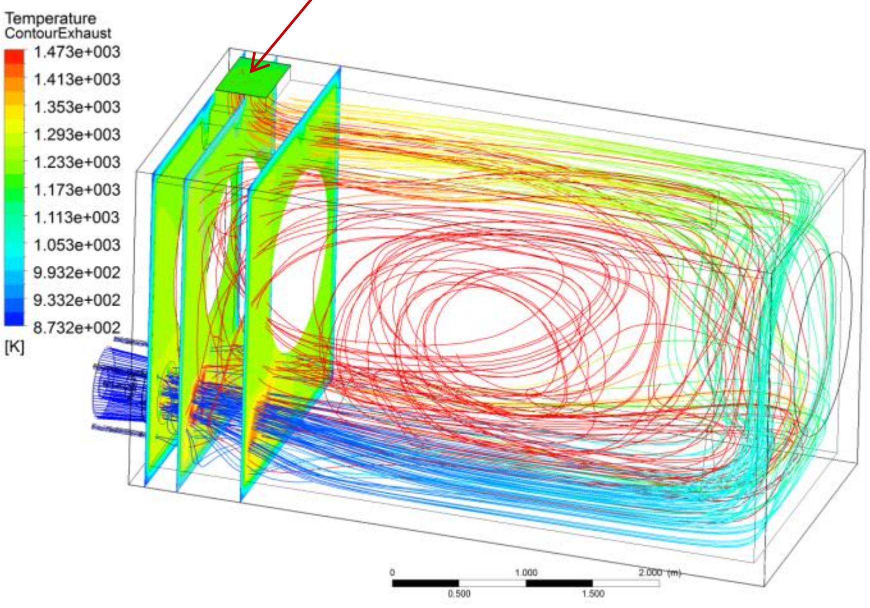



The combustion is well mixed with a chamber temperature above 850 Deg C throughout.

# Results – Time on Streamline

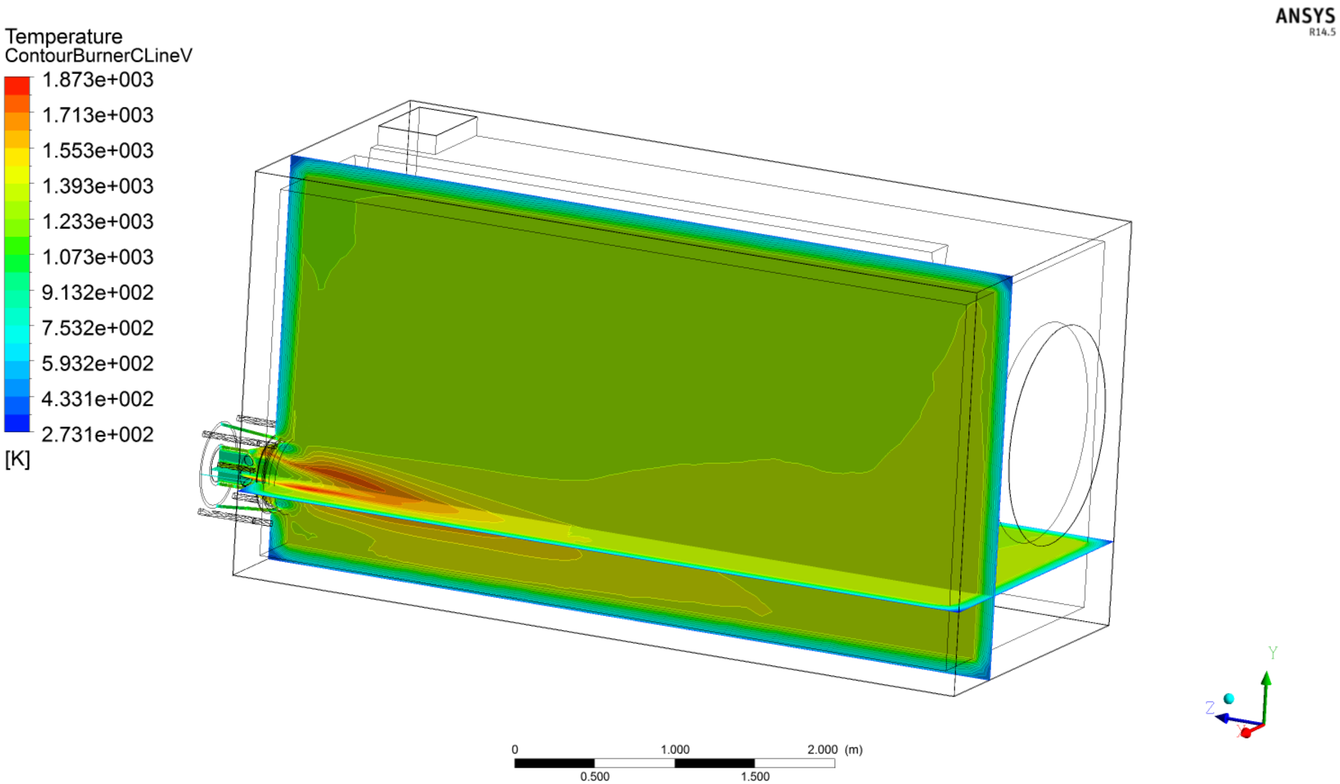



The exit temperature is above 850 Deg C – circa 960 Deg C



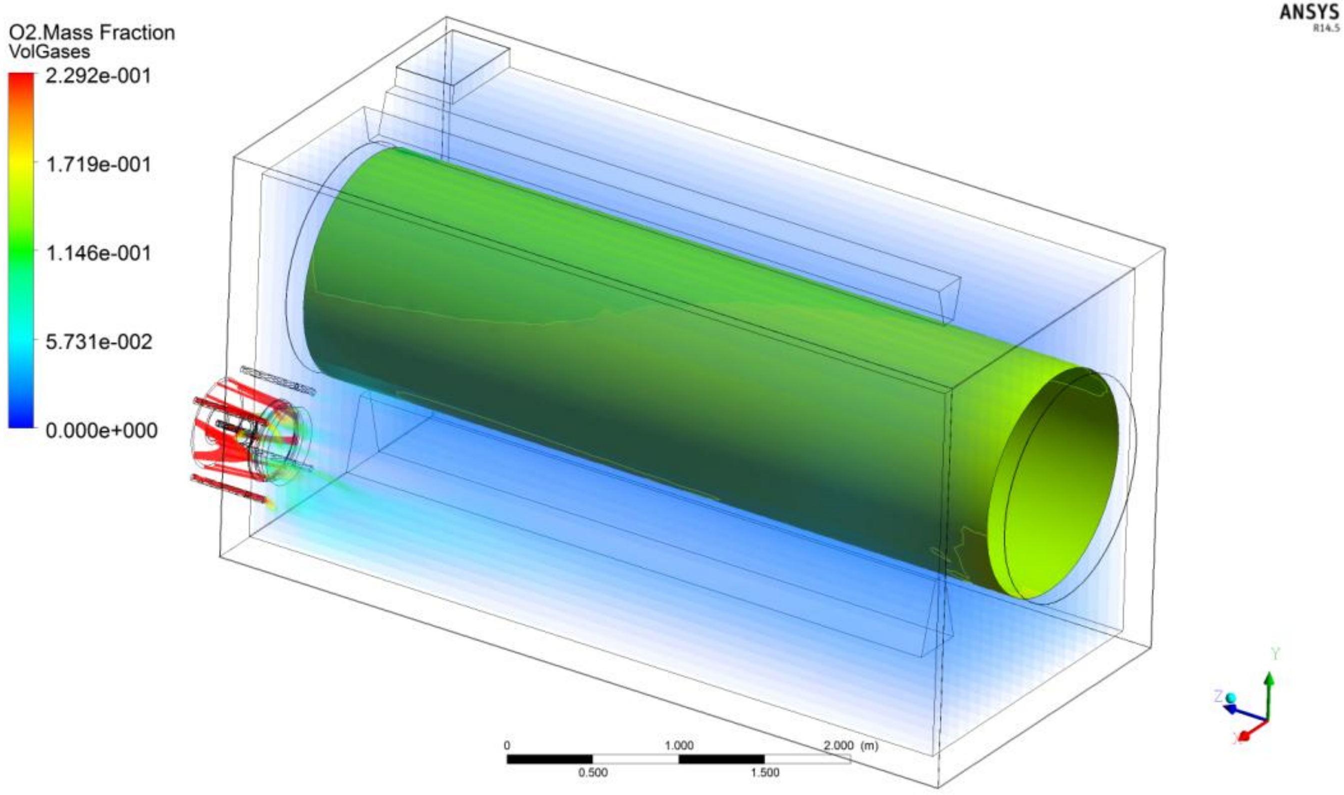

The stream line path lines show that the gas is within the chamber for 2s. It still has to pass into the regenerator to be cooled rapidly giving up its heat to the combustion air.

# Results – Flame Temperature Profile



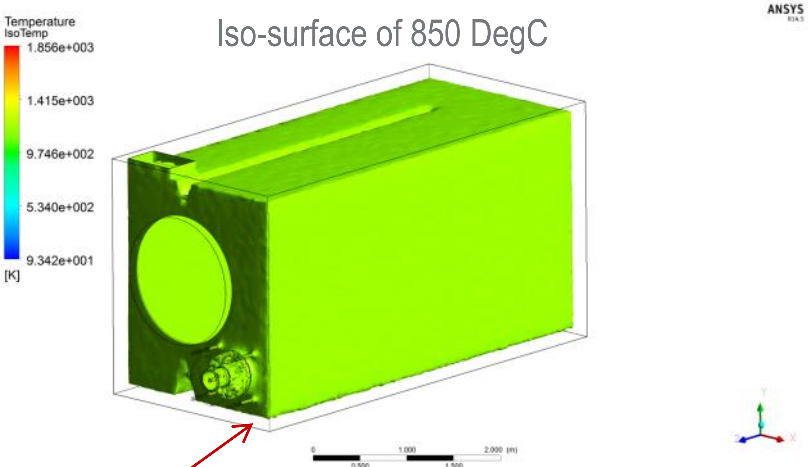

The burner design allows for good mixing whilst reducing peak flame temperatures.

# Results – Flame Temperature Profile



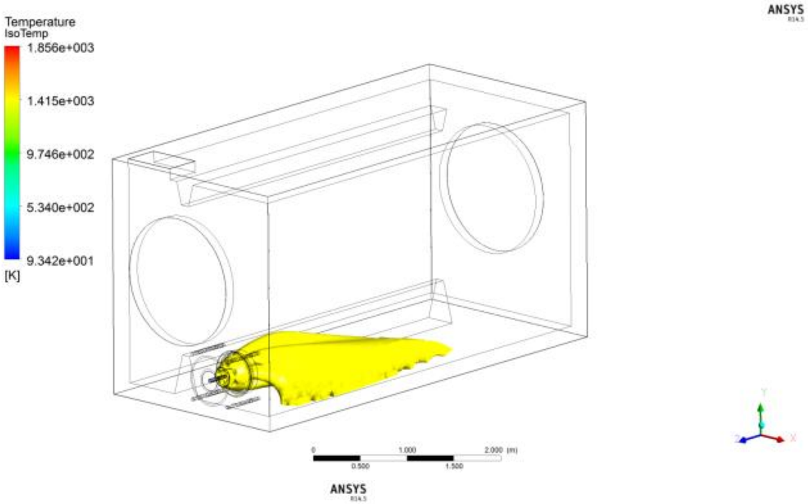

There are no free oxygen trails – good mixing – good combustion.

# Results – Combustion Chamber Profile

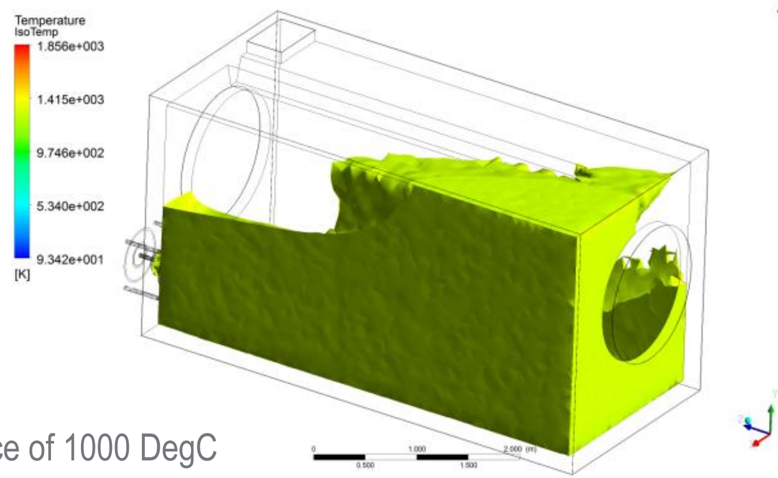



Iso-surface of 850 DegC

Internal refractory wireframe not visible – 850 Deg C layer is within the walls




Iso-surface of 1150 DegC




Iso-surface of 1000 DegC

Paul Yates
Atkins Limited
The Axis
10 Holiday Street
Birmingham
B1 1TF

Email paul.t.yates@atkinsglobal.com
Direct telephone +44 (0) 121 4835532
Fax +44(0) 121 4835858