Permit ref: PAN-0055141/V002

Operator: Newbridge Energy Limited

Site Address: Blazers Fuels, Brick Lane, Denbigh Road, Ruthin, LL15 2TN

Environmental Permit Variation Application

Introduction

An application to vary the above Environmental Permit was submitted to NRW on 26.01.21 by Smith Grant LLP on behalf of Newbridge Energy Ltd.

This following note has been prepared in response to an initial request for additional information / clarification received from Rebecca Williams, NRW on 12.05.21.

The individual points raised are dealt with below in turn and supporting information attached as applicable.

1. **NRW comment:** Invalid declaration on Form F1. Darren Davies who has signed the form is no longer active on companies house.

   SGP Response: Mr Darren Davies has since resigned from the company. Form F1 has therefore be revised and signed by Mr Peter Mills who became a Director of the company on 1st February 2021 (see attached Form in Appendix A).

2. **NRW Comment:** There are a few questions unanswered on Forms C2 and C3, please check all questions required are answered to avoid any ambiguity

   SGP Response: Revised versions of Forms C2 and C3 are attached in Appendix A. However, please note that we are unclear if Question 2c of Form C2 requires checking as the application is for a variation to an existing permit that was issued in 17.12.19.

3. **NRW Comment:** Appendix 8 on Form C3 – stated 8000 operational hours limitation but have not ticked the declaration box. Please make it clear if you want 8000 hours or unlimited operational hours.

   SGP Response: The declaration (question 8) has not been ticked as the application is not for an exemption under article 6(3) or article 6(8) of the medium combustion plant (i.e. is not to be operated for less than 500 hours per annum). However, the existing permit is limited to 8,000 hours per annum and this variation is made on the same basis in that the operations would be limited to 8,000 hours per annum which formed the basis of the air quality assessment.

4. **NRW Comment:** There seems confusion wrt the ELVs the new plant will be required to meet. You have applied for a new MCP and Tranche B SG. You state the plant will be fuelled only on virgin wood therefore would not be a 5.1 Part B activity. The ELVs for this plant as stated in the MCPD are as follows: NOx: 300 mg/Nm^3 and dust: 30 mg/Nm^3 as shown below (excerpt from MCPD). You have stated it would meet the existing plant ELVs on the existing permit which are as follows: NOx: 475 mg/Nm^3, dust: 50 mg/Nm^3. All ELVs stated herein are at 6 % O_2. You will need to demonstrate you can achieve the ELVs contained within the MCPD which are considerably tighter than those currently on the permit. This can be demonstrated by tech spec data or monitoring data.

SGP Response: It is noted that there is a difference between the current ELVs for the existing plant compared to the required ELVs to operate a an MCP / Generator.

As advised the required ELVs for the new plant (Identifier 2885) would be:

Table 1: Emission Limit Values (ELVs) for new medium combustion plants other than engines and gas turbines where using solid biomass

Pollutant	Concentration (mg/m^3)[1]	Comments
SO_2[2]	200	does not apply in the case of plants firing exclusively woody solid biomass
NO_x	300	Is less than the ELV of 475 mg/m^3 provided for generators (provided as 190 mg/m^3 at 15% O_2)
Dust	30[3]	

1: Defined at a temperature of 273.15K, a pressure of 101.3 kPa and after correction for the water vapour content of the waste gases at a standardised O_2 content of 6% (for MCP using solid fuels)
2: does not apply in the case of plants firing exclusively woody solid biomass
3: in the case of plants with a total rated thermal input greater than 5 MW and less than or equal to 20 MW

Table 2.2 of the supporting documentation (ref: R2298E-R03-v4) that was provided with the variation application detailed the results of monitoring data for the existing plant obtained in 2017 and 2018, as reproduced in Table 2. Additional monitoring data is also now available for 2021 and is included in Appendix B.

Table 2: Summary of Monitoring Data for Existing Plant (identifier 2885): Nitrogen oxide

Date	Lab Ref	NO_2 Emission Concentration (as quoted)(mg/Nm^3)[1]	NO_2 Emission Concentration (as adjusted)(mg/Nm^3)[2]	Comment
05.10.17	CAT-3701	82.1	131	well below required ELV
23.05.18	CAT-4237	155	232	well below required ELV
08-09.02.21	EMT00160	340	340	above required ELV – see comment below
25.03.21	EMT00668	227	227	well below required ELV

1: Oxides of nitrogen (as NO_2) concentration quoted in laboratory analysis results
2: Oxides of nitrogen (as NO_2) concentration as adjusted to reference conditions of 273K, 101.3 kPa, dry gas and 6% O_2

The monitored NO_2 emissions are below the required ELV, other than on one occasion on 08-09.02.21, when the measured concentration was above the required ELV. At this time unsuitable feedstock was being used in the plant, and consequently a repeat monitoring exercise was carried out on 25.03.21. The subsequent measured NO_2 concentration was well below the ELV. The proposed second CHP is of the same make and model and hence would similarly be expected to meet the required ELVs.

Total particulate matter (PM) stack monitoring data for the existing plant was also provided in Appendix F to the supporting documentation, and additional data is also now available for 2021. The available results are:

Table 3: Summary of Monitoring Data for Existing Plant (identifier 2885): Total Particulate Matter

Date	Lab Ref	PM Emission Concentration (as quoted)(mg/Nm^3)[1]	PM Emission Concentration (as adjusted)(mg/Nm^3)[2]	Comment
05.10.17	CAT-3701	6.4	10.2	well below required ELV
23.05.18	CAT-4237	8.6	12.3	well below required ELV
08-09.02.21	EMT00160	10.6	10.6	well below required ELV

Date	Lab Ref	PM Emission Concentration (as quoted)(mg/Nm^3)[1]	PM Emission Concentration (as adjusted)(mg/Nm^3)[2]	Comment
25.03.21	EMT00668	39.4	39.4	above required ELV – see comment below

1: Total particulate matter concentration quoted in laboratory analysis results
2: Total particulate matter concentration as adjusted to reference conditions of 273K, 101.3 kPa, dry gas and 6% O_2

The monitored total particulate matter (PM) emission concentration measured in 2017, 2018 and February 2021 was well below the required ELV being less than, or close to, 10 mg/Nm^3 compared to an ELV of 30 mg/m^3. This was consistent with the quoted maximum emission concentration provided by the OEM of 10 mg/Nm^3. A much higher concentration was recorded on 23.03.21 which although below the ELV of 50 mg/Nm^3 for the existing permitted plant was above the ELV that would be required for the new plant. This is however above the maximum emission concentration quoted by the OEM and is therefore subject to current investigation. Further information will be provided once available.

5. **NRW Comment:** Air dispersion modelling: No assessment of carbon monoxide (CO) has been completed, we would expect this to be either assessed through H1 tool or modelled for a new MCP.

   SGP Comment: In the absence of an ELV for CO for existing or new MCP, CO was not included in the modelling. This approach was accepted in relation to the existing plant. However, this will be considered and the results included with the additional modelling to be undertaken as discussed below.

6. **NRW Comment:** Air dispersion modelling: The modelling input has been monitoring data or tech spec data from supplier from the existing plant and has not been completed at the expected ELVs contained within MCPD, if monitoring data or tech spec concentrations used in the assessments are lower than ELVs contained within MCPD they will apply which leaves no headroom for variation in emissions from the plant. (I am also unsure what O_2 % the OEM data has been supplied at therefore cannot complete a comparison.) Multiple scenarios have been modelled for human health assessment. Although only one scenario has been modelled for ecological assessment and I am unsure which scenario. Also I cannot see that an incombination assessment has been completed wrt in combination effects from permissions, plans or projects at the habitat sites. I have not checked all the correct habitat sites or human health receptors have been identified.

   SGP Response: ELVs: It is acknowledged that the modelling has been carried out based on the OEM data and monitoring data, and not on the required ELVs. This approach was accepted with regards to the application for the existing plant. However, in light of the above comments additional modelling is now being undertaken and the results will be presented separately.

   Habitat assessment: The additional ecological assessment included in Appendix F of the supporting documentation (R2298E-R03-v4) was run using the OEM data (para 3.1.2). As per above however this will also now be re-run with reference to the ELVs and the results presented separately.

   In-combination assessment: an in-combination assessment has not been carried out. At no time has NRW or Denbighshire County Council dung the planning application process required such an assessment. Given the locality of the site, distance to the relevant nature conservation sites (>5km) and the negligible process contributions from the proposed operations at these

sites it is considered the likelihood of significant in-combinations effect occurring would be negligible. However, if such an assessment is now required we would required NRW to advise on any plans or projects requiring assessing.

7. **NRW Comment:** Wood drying activities have been assessed in the air dispersion modelling although have not been requested to be permitted. The Operator is responsible to ensure they have the correct permissions in place for all activities on site. This variation is only to the 5.1 Part B / MCP/ SG permit, the permit does not include any other activities, it does not include storage or treatment of waste wood prior to incineration in the existing unit, this must be addressed either through a permitted waste operation or compliance with our regulatory decision: RD071. Although this is not part of the variation application and we will only be assessing what has been applied for (the new MCP/SG) - I thought I would make you fully aware of the scope of the MCP/SG/5.1 Part B permit and that the storage and treatment of waste prior to incineration needs to be thought about separately.

   SGP Response: This is noted. The wood drying activities are understood to not require permitting. No more than 125 tonnes of 'waste wood' is to be stored on site at any time, where this refers to 'clean untreated wood'. Accordingly we were advised during the original permit application NRW advised that the operator could store up to 125t of waste wood at any one time pending use in the Part B incinerator operation in accordance with the conditions laid out in RPS213, without the need for permitting controls. It is the operators intention to continue to store waste wood pending use at the site according to the conditions of RPS 213 after the current variation has been assessed and determined.

   We have also been unable to locate a copy of the NRW regulatory decision RD071 referred to above and have requested a copy.

Additional Information

Environmental Management System

Section 3 and Appendix D of the supporting information provided with the Permit application included information on the existing Environmental Management System in place at the facility. This has since been comprehensively revised and expanded. Details of the current controlled documentation is included in Appendix C to this document. The revised EMS has been provided to the local enforcement officers for review and comment prior to final issue as part of the update process.

Prepared on behalf of Smith Grant LLP by:

Name:	**Signature:**	**Date:**
K. Hawkins, Partner		02.07.21
BSc MSc MIAQM MEnvSci CEnv		

APPENDIX A

Revised Forms

Cyfoeth Naturiol Cymru
Natural Resources Wales

Application for an environmental permit: Part F1 – Opra, charges and declarations

Fill in this part for all applications for installations, waste operations, mining waste operations and groundwater discharges onto land.

Please check that this is the latest version of the form available from our website.

For applications for water discharge and point source groundwater discharge activities you need to fill in part F2 instead.

Please read through this form and the guidance notes that came with it. All relevant guidance documents can be found on our website.

Contents

1 Working out charges (you must fill in this section)

You have to submit an application fee with your application. You can find out the charge by looking at our current environmental permitting charging scheme. This can be found on our 'How we regulate you' webpages. Please remember that the charges are revised on 1 April each year and that there is an annual subsistence charge (for site based permis) to cover the costs we incur in the ongoing regulation of the permit.

Examples: We have included examples to help you complete the table. The Tier 2 charge example is for an application for a 'New standard rule' permit. The Tier 3 charge example is for an installation Opra based charge for a normal variation (multiplier) application.

Note: for Opra charged Tier 3 Facilities you also need to complete an Opra profile (see section 2).

Table 1 – Working out charges				
Type of application	Complex Bespoke MCP / Generator / 5.1 Part B Variation			
	Summary of charges			
Tier 2 facilities (including Part A(2) and Part B)	Charge identifier	Number of facilities	Charge for each facility (£)	Charges due (£)
EXAMPLE: SR2010 No12	S060A (W)	1	1,630.00	1,630.00
Variation to existing Bespoke Permit			5,445.00	
Tier 3 facilities				
EXAMPLE: Total Opra charging score for installations	90	× charge multiplier	57	5,130.00
Total Opra charging score for installations		× charge multiplier		
Total Opra charging score for waste operations		× charge multiplier		
Total Opra charging score for mining waste facilities				
Other charges (such as one-off assessments or fixed charge applications etc.)				
			Total charges due	5,445.00

2 Opra profile (does not apply to standard facilities, or other tier 2 permit applications)

If you are submitting a bespoke application, you must include a completed electronic copy in Excel of the *current* Opra spreadsheet. You can find the current Opra spreadsheet in the 'Our charges' section on our 'How we regulate you' webpages.

For all variations, full and partial surrenders: you will need to submit a copy of your current Opra profile based on your existing profile, not a new profile following the variation or surrender.

For transfers: you will need to submit a revised Opra profile to include your own operator performance. Note: this will not change the set transfer fee.

Important: your Opra profile (score) must match our records. If you are unsure about your current Opra profile (score), you should talk to your regulatory officer before submitting your application.

Tick this box to confirm that you have included the electronic OPRA spreadsheet ☐

3 Payment

3a How do you want to pay?

Tick an option below to show how you will pay.

Electronic transfer (for example, BACS)	☒	*Go to section 3b*
Credit or Debit card	☐	*Go to section 3c*
Cheque	☐	*Go to section 3d*
Postal order	☐	*Go to section 3d*

3b Paying by electronic transfer

If you choose to pay by electronic transfer use the following information to make your payment.

Company name:	Natural Resources Wales
Company address:	Income Dept., PO BOX 663, Cardiff, CF24 0TP
Bank:	RBS
Address:	National Westminster Bank Plc, 2 ½ Devonshire Square, London, EC2M 4BA
Sort code:	60-70-80
Account number:	10014438

Reference number

You can use any reference number but we prefer the number to be 'EPR' followed by the first nine letters of your organisation name followed by a four-digit number.

For example, for a company named Joe Bloggs Ltd, the reference number might be EPRJOEBLOGGS0001. (Remember you can use any four-digit number at the end.)

The reference number you will provide will appear on our bank statements so we can check your payment. We may need to contact your bank to make sure the reference number is quoted correctly.

You should also email your payment details and payment reference number to banking.team@naturalresourceswales.gov.uk / banking.team@cyfoethnaturiolcymru.gov.uk or fax it to 0300 065 3001 and enter it in the space provided below.

BACS reference	EPRNEWBRIDGE0001
Amount paid	£5,445.00

Making payments from outside the UK

These details have changed. If you are making your payment from outside the United Kingdom (which must be received in sterling), our IBAN number is GB70 NWBK6070 8010 0144 38 and our SWIFT/BIC number is NWBKGB2L.

If you do not quote your payment reference number, there may be a delay in processing your payment and application.

3c Paying by credit or debit card

If you are paying by credit or debit card, please fill in the separate form CC1.

You can download this from our website or you can ask for one of our customer service providers to send one by post. We will destroy your card details once we have processed your payment. We can accept payments by Visa, MasterCard or Maestro UK card only.

3d Paying by cheque or postal order

You should make cheques or postal orders payable to Natural Resources Wales and they should be marked 'A/c Payee'.

We *will not* accept post-dated cheques (cheques with a future date written on them).

Cheque/ postal order number	
Amount paid	

4 The Data Protection Act 1998 and General Data Protection Regulations

We, the Natural Resources Body for Wales (hereafter "Natural Resources Wales"), will process the information you provide so that we can:

- deal with your application;
- make sure you keep to the conditions of the licence, permit or registration;
- process renewals; and
- keep the public registers up to date.

We may also process or release the information to:

- offer you documents or services relating to environmental matters;
- consult the public, public organisations and other organisations (for example, the Health and Safety Executive, local authorities, the emergency services, the Department for Environment, Food and Rural Affairs) on environmental issues;
- carry out research and development work on environmental issues;
- provide information from the public register to anyone who asks;
- prevent anyone from breaking environmental law, investigate cases where environmental law may have been broken, and take any action that is needed;
- assess whether customers are satisfied with our service, and to improve our service; and
- respond to requests for information under the Freedom of Information Act 2000 and the Environmental Information Regulations 2004 (if the Data Protection Act allows). We may pass the information on to our agents or representatives to do these things for us.

5 Confidentiality and national security

We will normally put all the information in your application on a public register of environmental information. However, we may not include certain information in the public register if this is in the interests of national security, or because the information is confidential

Confidentiality

You can ask for information to be made confidential by enclosing a letter with your application giving your reasons. If we agree with your request, we will tell you and not include the information in the public register. If we do not agree with your request, we will let you know how to appeal against our decision, or you can withdraw your application.

Only tick the box below if you wish to claim confidentiality for your application.

Please treat the information in my application as confidential ☐

Tick the box to confirm you have provided evidence to support your confidentiality claim and give us the document reference, below. ☐

Document reference

National security

You can tell the Welsh Ministers that you believe including information on a public register would not be in the interests of national security.

You must enclose a letter with your application telling us that you have told the Welsh Ministers and you must still include the information in your application. We will not include the information in the public register unless the Welsh Ministers decides that it should be included.

You can find guidance on national security in 'Core Environmental Permitting Guidance' published by Defra and available via the .Gov website.

You cannot apply for national security via this application.

6 Application checklist (you must fill in this section)

Tell us about the supporting evidence and information you have sent with this application.

Application fee - You must submit the correct application fee in line with our current charging scheme.

Tick the box to say you have included the correct fee. ☐

List all the documents you have included in Table 2. Please see the guidance notes for examples on how to complete the checklist.

If the relevant information for a question forms part of a larger document, please specify the relevant section(s) of the document. This will speed up the process of checking your application and making decisions.

If necessary, continue on a separate sheet and tell us the reference you have given the document below.

Document reference: See also attached note R2298-N20210611

Table 2 – application checklist

Question reference	Document title/ reference	Document section
Part C2-Q1a	R2298E-Ruthin add-Form C2&C3-N01	
Part C2-Q2b	Permit Variation Application Supporting Information-R2298E-R03	Section 2
Part C2-Q3d	Permit Variation Application Supporting Information-R2298E-R03	Section 3
Part C2-Q5	Permit Variation Application Supporting Information-R2298E-R03	Appendix A
Part C2-Q6	Permit Variation Application Supporting Information-R2298E-R03	Appendix E
Part C3-Q1b	Permit Variation Application Supporting Information-R2298E-R03 and R2298E-Ruthin add Form C2&C3-No1	
Part C3-Q2	Permit Variation Application Supporting Information-R2298E-R03	Section 2 and Appendix F
Part C3-Q3a	Permit Variation Application Supporting Information-R2298E-R03	
Part C3-Q3b	Permit Variation Application Supporting Information-R2298E-R03	Appendix F
Part C3-Q4	Permit Variation Application Supporting Information-R2298E-R03	

7 Declaration

You must read this section before making the declaration and sending your form to us.

For transfer applications - Both you and the person receiving the permit must make the declaration.

Section 7d must be completed by the current holder *and* Section 7e must be completed by the proposed new holder.

A relevant person should make the declaration. You must be a relevant person or have the authority of a relevant person to sign this application on their behalf.

Relevant people means each applicant, and in the case of a company, a director, manager, company secretary or any similar officer or employee listed on current appointments in Companies House. In the case of a Limited Liability Partnership (LLP), it includes any partner. If the permit holder is an organisation of individuals, each individual (or individual trustee) must complete the declaration.

To simplify and speed up the application process we recommend that the declaration is filled in by an officer of a company or one of the partners in a Limited Liability Partnership (LLP).

If you wish a manager, employee or consultant etc. to sign the declaration on behalf of a relevant person, we will need written confirmation from a relevant person; that is, an officer of the company, a partner in the LLP or the individual, confirming that the person has the authority to fill in the declaration.

If you are joint permit holders you should each fill in your own declaration. We have provided extra spaces for this below. Please send in a separate sheet with your application if you need more room for signatories.

Where the operator is the subject of any insolvency procedure, the declaration must be filled in by the official receiver/appointed insolvency practitioner.

7a Are you signing the form on *behalf of* a relevant person?

If you are *not* a relevant person, but want to sign the application on their behalf, you must include confirmation that you can do this.

I have included written confirmation from a relevant person to confirm I can sign on their behalf. ☐

7b Does your application include a standard facility?

If your application includes a standard facility, you also need to confirm that you are able to meet all relevant criteria of the standard rule set/sets for which you are applying.

I confirm that my standard facility will fully meet the rules that I have applied for. ☐

7c Does your application include ecological survey information?

If your application includes ecological survey information, please see the guidance notes on part F1 and tick the box below to confirm that you have no issue with us using information from any ecological survey you have supplied with your application.

I confirm I am happy for the ecological survey information I have supplied to be used as set out in the guidance. ☐

7d Declaration

If you're transferring the permit, the current holder or holders should sign this section of the declaration, and the proposed new holder or holders of the permit should sign the declaration in section 7e.

If you knowingly or recklessly make a statement which is false or misleading to help you get an environmental permit (for yourself or another person), you are committing an offence under the Environmental Permitting (England and Wales) Regulations 2016.

I declare that the information in this application is true to the best of my knowledge and belief. I understand that this application may be refused or approval withdrawn if I give false or incomplete information.

I understand that if I knowingly or recklessly make a false or misleading statement:

- **I may be prosecuted; and**
- **if convicted, I may have to pay a fine and/or go to prison.**

By signing below, you are confirming that you understand and agree with the declaration above.

Title	Mr	

First name	Peter
Last name	Mills
On behalf of (if relevant)	Newbrideg Energy Ltd
Today's date	14.6.21

If you knowingly or recklessly make a statement which is false or misleading to help you get an environmental permit (for yourself or another person), you are committing an offence under the Environmental Permitting (England and Wales) Regulations 2016.

I declare that the information in this application is true to the best of my knowledge and belief. I understand that this application may be refused or approval withdrawn if I give false or incomplete information.

I understand that if I knowingly or recklessly make a false or misleading statement:

- **I may be prosecuted; and**
- **if convicted, I may have to pay a fine and/or go to prison.**

By signing below, you are confirming that you understand and agree with the declaration above.

Title	Mr	PMills
First name	Peter	
Last name	Mills	
On behalf of (if relevant)	Newbridge Energy Ltd	
Today's date	14.6.21	

7e Declaration for the person or persons *receiving* the permit (transfers only)

The persons 'receiving the permit' is the proposed new permit holder.

Note: If you cannot trace a person or persons holding the permit you may be able to transfer the permit without their declaration (in section 7d above). Please contact us to discuss this and supply evidence in your application to confirm you are unable to trace one or all of the permit holders.

If you knowingly or recklessly make a statement which is false or misleading to help you get an environmental permit (for yourself or another person), you are committing an offence under the Environmental Permitting (England and Wales) Regulations 2016.

I declare that the information in this application is true to the best of my knowledge and belief. I understand that this application may be refused or approval withdrawn if I give false or incomplete information.

I understand that if I knowingly or recklessly make a false or misleading statement:

- **I may be prosecuted; and**
- **if convicted, I may have to pay a fine and/or go to prison.**

By signing below, you are confirming that you understand and agree with the declaration above.

Title		
First name		
Last name		
On behalf of (if relevant)		

Today's date	

If you knowingly or recklessly make a statement which is false or misleading to help you get an environmental permit (for yourself or another person), you are committing an offence under the Environmental Permitting (England and Wales) Regulations 2016.

I declare that the information in this application is true to the best of my knowledge and belief. I understand that this application may be refused or approval withdrawn if I give false or incomplete information.

I understand that if I knowingly or recklessly make a false or misleading statement:

- **I may be prosecuted; and**
- **if convicted, I may have to pay a fine and/or go to prison.**

By signing below, you are confirming that you understand and agree with the declaration above.

Title	Mr	P. Mills
First name	Peter	
Last name	Mills	
On behalf of (if relevant)	Newbridge Energy Ltd	
Today's date	14.6.21	

Application for an environmental permit:
Part C2 – General: Varying a bespoke permit

Fill in this part of the form, together with part A, the relevant parts of C3 to C7 and part F1 or F2.

Please check that this is the latest version of the form available from our website.

Note: If you are applying to convert your existing permit to a standard permit or add a standard facility you need to fill out form C1.

If you want to make an administrative change, you should complete form C0.5.

You only need to give us details in this application for the parts of the permit that will be affected (for example, if you are adding a new facility or changing existing ones).

You do not need to resend any information from your original permit application.

Please read through this form and the guidance notes that came with it. All relevant guidance documents can be found on our website.

Contents

1 About the permit

1a Discussions before your application

If you have had discussions with us before your application, give us the case reference number or details on a separate sheet.

Case or document reference	See attached sheet R2298E-Ruthin add-Form C2&C3-N01

1b Permit number

Permit number this application relates to?	PAN-005141

1c Site details

What is the name, address and postcode of the site?

Site name	Blazer Fuels
Address	Brickfield Lane
	Denbigh Road
	Ruthin
	Denbighshire
Postcode	LL15 2TN

2 About your proposed changes

2a Type of variation

What type of variation are you applying for? (Please tick)

Standalone water discharge activity or point source groundwater activity ☐

Minor technical	☐
Normal variation	☐
Substantial	☒

2b Provide a non-technical summary of your application

Please give us brief details of all the proposed changes to current activities, and any new activities you want to add to your permit.

You can use the box below, in Table 1 below. Or, you can use a separate sheet and send it to us with your application form. Tell us below the reference you have given this document.

Document reference	Permit Variation Application Supporting Information-R2298E-R03

Table 1 – Details of the proposed changes

2c Consolidating existing permits into the modern style

Consolidating you permit can mean:

- combining the original permit and all subsequent changes into a single document (modern permit), or

- combining two or more environmental permits for the same operator and site into a single permit.

Note: In both cases we may require additional information from you about, for example your management system. Therefore we would always advise you to talk to us before you submit any application to modernise or consolidate permits.

2c1 Do you want to have a modern style (consolidated) permit?

No ☐ *Go to section 2d*

Yes ☒ *Please note: An additional charge may apply for modernising your permit(s).*

2c2 Identify all the permits you want to consolidate by listing the permit numbers/ versions in Table 2 below.

Table 2 – Permit numbers

2d Low impact installations (installations only)

Are any of the regulated facilities low impact installations?

No ☒ *Go to section 2e*

Yes ☐

Please give us a description of your proposed activity telling us how you meet the conditions for a low impact installation and send it to us with your application form.

Document reference

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

2e Treating batteries

Are you planning to treat batteries? (See the guidance notes on part C2.)

No ☒

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

Document reference

2f Medium Combustion Plant

Are you applying to *add* additional new Medium Combustion Plant(s) to your existing permit

No ☐

Yes ☒ Please complete Table 3 below

Table 3 – Adding Additional Medium Combustion Plant		
	Number Currently permitted for	**Number you wish to add**
Medium Combustion Plant	**1**	**1**

Please complete Appendix 8 of Form C3 for each new Medium Combustion Plant you wish to add.

2g Combined Medium Combustion Plant and Specified Generators

2g1 Are you applying to add a Specified Generator to your existing permit?

No ☐ *Go to section 3*

Yes ☒ *Go to section 2g2* and complete Appendix 9 of Form C3 for each generator that comprises the Specified Generator.

2g2 Is the Specified Generator also a new Medium Combustion Plant?

No ☐

Yes ☒ Please complete Appendix 8 and Appendix 9 of Form C3 for each new Medium Combustion Plant you wish to add that is also a Specified Generator.

3 Your ability as an operator

If you are only applying to change or add a water discharge activity, you only have to fill in question 3d.

If you are applying to add waste installations or waste operations to a permit that has not previously had them, you need to fill in all of section 3.

If you are applying to consolidate two or more permits or have an updated permit you must fill in question 3d.

3a Relevant offences – installations, waste operations, medium combustion plant and specified generators (See guidance notes on part C2)

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

No ☒ *Go to section 3b*

Yes ☐ Please give details below

Title	
First name	
Last name	
Date of birth (DD/MM/YYYY)	
Position held at the time of the offence	
Name of the court where the case was dealt with	
Date of conviction (DD/MM/YYYY)	
Offence and penalty set	
Date any appeal against the conviction will be heard (DD/MM/YYYY)	

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

Document reference	

3b Technical ability - relevant waste operations only (see the guidance notes on part C2)

3b1 Which approved scheme are you using to show you have the suitable technical skills and knowledge to manage your facility?

CIWM / WAMITAB ☐

ESA / EU ☐

3b2 Do you already hold the relevant, formal qualifications to manage your facility?

Yes ☐ Tick to confirm you've included all original *and* continuing competence evidence. ☐

No ☐ Tick to confirm you've included evidence you've registered with a Scheme. ☐

3c Finances (installations, waste operations, mining waste operations, medium combustion plant and specified generators)

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

No ☒ *Go to section 3d.*

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

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

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

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

Bonds ☐

Escrow account ☐

Trust fund ☐

Lump sum ☐

Other ☐

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

Document reference

3d Management systems (all)

You can find guidance on management systems in both 'How to Comply' and 'Horizontal Guidance Note 6 – Environmental Management Systems'. We have also developed environmental management toolkits for some business sectors which you can use to produce your own management system. You can get these by calling 0300 065 3000 or by downloading them from our guidance webpages.

3d1 Does your management system meet the conditions set out in our guidance?

Yes ☒

No ☐

3d2 What management system will you provide for your regulated facility?

EC Eco-Management and Audit Scheme (EMAS) ☐

ISO 14001 ☐

BS 8555 (Phases 1–5) ☐

Green Dragon ☐

Own management system ☒

3d3 Make sure you include a summary of your management system which sets out any changes or additional measures you will put in place to the address risks from the proposed changes. Tick the box to confirm you've done this and tell us the reference below. ☐

Document reference: **Permit Variation Application Supporting Information-R2298E-R03**

Water discharge activities: *Go to section 5.*

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

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

4a A sewer managed by a sewerage undertaker

No ☐

Yes ☐ Please name the sewerage undertaker

4b A harbour managed by a harbour authority

No ☐

Yes ☐ Please name the harbour authority

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

No ☐

Yes ☐ Please name the fisheries committee

4d Is the installation on a site for which:

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

No ☐

Yes ☐

4d2 a policy document for preventing major accidents is needed under regulation 5 of the Control of Major Accident Hazards

No ☐

Yes ☐

5 Supporting information

5a Provide a plan or plans for the site (see guidance notes on part C2 for what needs to be marked on the plan)

Document reference: **Permit Variation Application Supporting Information-R2298E-R03**

5b Do any of the variations you plan to make need extra land to be included in the permit?

No ☒

Yes ☐ Please provide a site report for the extra land.

Document reference

5c Adding an installation

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

Document reference

6 Environmental risk assessment - if you need one (see the guidance notes on part C2)

Provide an assessment of the risks each of your proposed activities cause to the environment. The risk assessment must use H1 or an equal method.

Document reference: **Permit Variation Application Supporting Information-R2298E-R03**

Appendix 1 – Low impact installation checklist (see guidance notes on part C2)

Installation reference					
Condition	**Response**				**Do you meet this?**
A – Management techniques	Provide references to show how your application meets A.				Yes ☐ No ☐
	References				
B – Aqueous waste	Effluent created		m3/day		Yes ☐ No ☐
C – Abatement systems	Provide references to show how your application meets C.				Yes ☐ No ☐
	References				
D - Groundwater	Do you plan to release any hazardous substances or non-hazardous pollutants into the ground?		Yes ☐ No ☐		Yes ☐ No ☐
E – Producing waste	Hazardous waste		Tonnes per year		Yes ☐ No ☐
	Non-hazardous waste		Tonnes per year		
F – Using energy	Peak energy consumption		MW		Yes ☐ No ☐
G – Preventing accidents	Do you have appropriate measures to prevent spills and major releases of liquids? (See 'How to comply'.)		Yes ☐ No ☐		Yes ☐ No ☐
	Provide references to show how your application meets G.				
	Reference				
H - Noise	Provide references to show how your application meets H.				Yes ☐ No ☐
	Reference				
I - Emissions of polluting substances	Provide references to show how your application meets I.				Yes ☐ No ☐
	Reference				
J – Odours	Provide references to show how your application meets J.				Yes ☐ No ☐
	Reference				
K – History of keeping to the regulations	Say here whether you have been involved in any enforcement action as described in Compliance History Appendix 1 explanatory notes.		Yes ☐ No ☐		

Application for an environmental permit: Part C3 – Variation to a bespoke installation permit

Fill in this part of the form, together with parts A, C2 and F1, if you are varying a bespoke permit for an installation.

Please check that this is the latest version of the form available from our website.

Please read through this form and the guidance notes that came with it. All relevant guidance documents can be found on our website.

Contents

1 About your activities

1a Tell us about the activities you want to do.

Fill in Table 1a below with details of all the activities listed in schedule 1 of the Environmental Permitting Regulations (EPR) and all directly associated activities (DAAs) (in separate rows) that you propose to carry out at the installation. Please also use this table if you are applying for a Medium Combustion Plant(s) or Specified Generator(s).

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

Document reference	

Notes to help you complete Table 1a:

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

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

3 By 'capacity', we mean:

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

4 The R (recovery) and D (disposal) codes are as set out in Annex I and/or Annex II of the European Waste Framework Directive (as amended).

5 Fill this in as a separate line for each directly associated activity and give an accurate description of any other activities associated with your schedule 1 activities.

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

Table 1a – Types of activities

Important: Put your main activity first, when listing all of the activities you want to do. Note; some questions only apply to activities involving the acceptance of waste.

Schedule 1 listed activities				**For installations that take waste only**		
Installation / Activity name	Schedule references (See note 1)	Description of the Activity (See note 2)	Activity capacity (See note 3)	Annex I and Annex 2 (disposal and recovery) codes (See note 4)	Hazardous waste treatment capacity (if this applies) (See note 3)	Non-hazardous waste treatment capacity (if this applies) (See note 3)
Newbridge Energy Limited 2885	Schedule 25A / 25B	Medium Combustion Plant / Generator	5.2 MWth			

Directly associated activities (See note 5)

Name of DAA	Description of the DAA (please identify the schedule 1 activity it serves)

For installations that take waste	Total storage capacity of non-hazardous waste (See note 6)	xxxxx
	Total storage capacity of hazardous waste (See note 6)	
	Annual throughput (tonnes each year)	xxxxx

1b Do you intend to accept waste as part of your activities?

No ☒ *Go to section 2*

Yes ☐ Tell us about the waste types you want to accept. See notes below.

For each line in Table 1a (including DAAs), fill in a separate document to list those types of waste you will accept onto the site for that activity. Give the List of Wastes catalogue code and description.

If you need to exclude wastes from your activity or facility by restricting the description, quantity, physical nature, hazardous properties, composition or characteristic of the waste, include these in the document. Send it to us with your application form.

If you want to accept any waste with a code ending in 99, you must provide more information and a full description in the document. You can use Table 1b as a template.

Document references **Permit Variation Application Supporting Information-R2298E-R03**

Table 1b – Template example: types of waste accepted and restrictions	
Waste code	Description of waste
Example	Example
02 01 08*	Agrochemical waste containing dangerous substances
06 01 02*	Hydrochloric acid

2 Emissions to air, water and land

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

Fill in one table for each installation. You can use Table 2 as a template. Please provide the reference for each document.

Document references **Permit Variation Application Supporting Information-R2298E-R03**

Table 2 – Emissions (releases)				
Installation / Activity name				
Point source emissions to air				
Emission point reference and location	Source	Parameter	Quantity Unit	Unit
Point source emissions to water (other than sewers)				
Emission point reference and location	Source	Parameter	Quantity Unit	Unit
Point source emissions to sewers, effluent treatment plants or other transfers off site				

Emission point reference and location	Source	Parameter	Quantity Unit	Unit
Point source emissions to land				
Emission point reference and location	Source	Parameter	Quantity Unit	Unit

3 Operating techniques

3a Technical standards

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

You must justify your decisions in a separate document if:

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

This justification could include a reference to the Environmental Risk Assessment provided in section 6 of part C2 (General Bespoke Permit) of the application form. The documents in Table 3a should summarise the main measures you use to control the main issues identified in the H1, H1 assessment, assessment or technical guidance. For MCP/Specified Generators please use the Environment Agency's Specified Generator Tranche B Screening Tool.

For each of the activities listed in Table 3a, describe the type of operation and the options you have chosen for controlling emissions from your process.

Fill in one table for each installation. You can use Table 3a as a template. Please provide the reference for each document.

Document references

Table 3a – Technical standards		
Installation / Activity name		
Schedule activity or directly associated activity description	Relevant technical guidance note/document or best available techniques as described in BAT conclusions under IED*. You will need to refer to 'How to comply' for all permits.	Document reference (if appropriate)
	'How to comply'	
Newbridge Energy 2885	'How to comply', NRW MCPD Guidance Interim, NRW Generator Guidance Interim, Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators, Environmental Permititng Technical Note 5/1(18)	Ruthin add-EP Variation Application Supporting Information-R2298E-R03

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

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

Document references

3b General requirements

Fill in a separate Table 3b for each installation. You can use Table 3b as a template. Please provide the reference for each document.

Document references

Table 3b – General requirements	
Installation / activity name	
If the TGN or H1 assessment shows that emissions of substances not controlled by emission limits are an important issue, send us your plan for managing them	Document reference or references
If the TGN or H1 assessment shows that odours are an important issue, send us your odour management plan	Document reference or references
If the TGN or H1 assessment shows that noise or vibration are important issues, send us your noise or vibration management plan (or both)	Document reference or references
If our fire prevention guidance or H1 assessment shows that fire risk is an important issues, send us your fire management plan	Document reference or references
If the Environment Agency's Specified Generator Tranche B Screening Tool shows that dispersion modelling is not required to assess the risk to the environment, please send us a completed copy of the tool to support your decision	Document reference or references
If the Environment Agency's Specified Generator Tranche B Screening Tool shows that dispersion modelling is required to assess the risk to the environment, please send us a completed copy of the tool and your completed modelling report and modelling input files to support your application.	Document reference or references Ruthin add-EP Variation Application Supporting Information-R2298E-R03-Appendix F

3c Types and amounts of raw materials

Fill in Table 3c for all schedule 1 activities. Fill in a separate table for each installation. You can use Table 3c as a template. Please provide the reference for each document.

Document references

Table 3c – Types and amounts of raw materials				
Installation name				
Capacity (See note 1 below)				
Schedule 1 activity	Description of raw material and composition material	Maximum amount (tonnes) (See note 2 below)	Annual throughput (tonnes per year)	Description of how the raw material is used including any main hazards (include safety information sheets)

Notes

1 By ‘capacity’, we mean the total storage capacity (tonnes) or total treatment capacity (tonnes each day).

2 By ‘maximum amount’, we mean the maximum amount of raw materials on your site at any one time.

Use a separate sheet if you have a long list of raw materials and send it to us with your application form. Please provide the reference for each document.

Document reference	

3d Information for specific sectors

For some sectors, we need more information to be able to set appropriate conditions in the permit. This is as well as the information you may provide in sections 5, 6 and 7.

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

Table 3d – Questions for specific sectors	
Sector	Appendix
Combustion	See the questions in appendix 1
Chemicals	See the questions in appendix 2
Intensive farming	See the questions in appendix 3
Clinical waste	See the questions in appendix 4
Hazardous and non-hazardous waste recovery and disposal	See the questions in appendix 5
Incinerating waste	See the questions in appendix 6
Landfill sector	See the questions in appendix 7
Medium Combustion Plant (includes mobile plant)	See the questions in appendix 8
Combined Medium Combustion Plant/Specified Generator (includes mobile plant)	See the questions in appendix 8 and 9
Specified Generator (includes mobile plant)	See the questions in appendix 9

4 Monitoring

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

You should also describe any environmental monitoring. Tell us:

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

Document reference	Ruthin add-EP Variation Application Supporting Information-R2298E-R03

4b Point source emissions to air only

Provide an assessment of the sampling locations used to measure point source emissions to air. The assessment must use Technical Guidance Note M1 (Monitoring). This is available in the Guidance section on our Website.

Document reference	Summary provided in sampling methodology and analysis results in Permit Variation Application Supporting Information-R2298E-R02

5 Environmental impact assessment

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

No ☒ Now go to section 6

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

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

Document reference

6 Resource efficiency and climate change

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

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

Document reference

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

Document reference

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

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

Document reference

Yes ☐ Please give the date you entered (or the date you expect to enter) into the agreement.

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

Document reference

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

Document reference

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

If you produce waste, describe how you recover it.

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

Document reference

7 Medium Combustion Plant

7a Is the total aggregated thermal input of the MCP 20 MW thermal or more?

No ☒

Yes ☐ You must either submit a report which shows how your MCP also meets the requirements of Schedule 24 of the Environmental Permitting Regulations which implement the relevant requirements of the Energy Efficiency Directive (2012/27/EU), or an explanation of why Schedule 24 does not apply in your case.

Tell us the reference for this document, below.

Document reference

7b Is the MCP either (a) an individual unit greater than or equal to 20MWth, or (b) one that burns waste biomass as described in Article 3(18) (b) of MCPD?

Yes ☐ An individual unit greater than or equal to 20MWth *Go to section 7c*

Yes ☐ Burns waste biomass as described in Article 3(18) (b) of MCPD. *Go to section 7c*

No ☒

7c Do any of the MCPs on site meet the criteria of a Chapter 1, Section 1.1 Part B activity or Chapter 5, Section 5.1 Part B activity?

Yes ☐ Chapter 1, Section 1.1 Part B activity.

Yes ☒ Chapter 5, Section 5.1 Part B activity.

No ☐

If you have ticked 'Yes' to either Chapter 1 or 5 above you must complete a Best Available Techniques assessment in line with the relevant Environmental Permitting technical guidance note. Tell us the reference for this document, below.

Document reference **Ruthin add-EP Variation Application Supporting Information-R2298E-R03**

8 Combined Medium Combustion Plant/Specified Generators

8a Is the total aggregated thermal input of the Specified Generators 20 MW thermal or more?

No ☒

Yes ☐ You must either submit a report which shows how your MCP/Specified Generator also meets the requirements of Schedule 24 of the Environmental Permitting Regulations which implement the relevant requirements of the Energy Efficiency Directive (2012/27/EU) or an explanation of why Schedule 24 does not apply in your case.

Tell us the reference for this document, below.

Document reference

8b Is the Specified Generator an individual unit with thermal input greater than or equal to 20 MWth?

No ☒ Now complete all relevant appendices.

Yes ☐ *Go to section 8c*

8c Does the Specified Generator meet the criteria of a Chapter 1, Section 1.1 Part B activity?

No ☒ Now complete all relevant appendices.

Yes ☐ This is a Chapter 1, Section 1.1 Part B activity.

You must complete a Best Available Techniques assessment in line with the relevant Environmental Permitting technical guidance note. Tell us the reference for this document, below.

Document reference

Appendix 1 – Specific questions for the combustion sector (Not for use for Medium Combustion Plant)

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

Fill in a separate table for each installation.

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

Notes

1 Not covered by Industrial Emissions Directive 2010/75/EU.

2 'Biomass' is referred to in The Renewables Obligation Order 2002 (SI 2002 No. 914).

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

Document reference

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

Fill in a separate table for each installation.

Installation reference					
Parameter	Unit	Fuel 1	Fuel 2	Fuel 3	Fuel 4
Maximum percentage of gross thermal input	%				
Moisture	%				
Ash	% wt/wt dry				
Sulphur	% wt/wt dry				
Chlorine	% wt/wt dry				
Arsenic	% wt/wt dry				
Cadmium	% wt/wt dry				
Carbon	% wt/wt dry				
Chromium	% wt/wt dry				

Copper	% wt/wt dry				
Hydrogen	% wt/wt dry				
Lead	% wt/wt dry				
Mercury	% wt/wt dry				
Nickel	% wt/wt dry				
Nitrogen	% wt/wt dry				
Oxygen	% wt/wt dry				
Vanadium	mg/kg dry				
Zinc	mg/kg dry				
Net calorific value	MJ/kg				

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

Fill in a separate table for each installation.

Installation reference	
Fuel	NOx factor (kgt–1)
Fuel 1	
Fuel 2	
Fuel 3	
Fuel 4	
Note: kgt–1 means kilograms of nitrogen oxides released for each tonne of fuel burned	

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

No ☐ *This Annex is complete.*

Yes ☐

5 Is your plant (tick an option)

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

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

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

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

Fill in a separate table for each installation.

Installation reference	
Type of plant	Number within installation
Existing	
New	
New-new	

Gas turbine (group A)	
Gas turbine (group B)	

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

No ☐ *Go to section 9*

Yes ☐

8 Have you subsequently withdrawn your declaration?

No ☐

Yes ☐

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

Installation reference	
LCPs under NERP	LCPs with ELVs

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

Yes ☐

Tell us how you meet the monitoring requirements of Chapter III and give us the reference for this document.

Document reference

Appendix 2 – Specific questions for the chemical sector

1 Please provide a technical description of your activities

The description should be enough to allow us to understand:

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

Document reference

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

No ☐

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

Document reference

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

No ☐ This Annex is complete.

Yes ☐ Fill in Table 3a – listing each of the activities controlled under the IED.

Table 3a – activities controlled under the IED.	
Installation reference	
Activities	

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

Document reference

Appendix 3 – Specific questions for the intensive farming sector

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

Installation reference	
Type of livestock	Number of places

2 Is manure or slurry exported from the site?

No ☐

Yes ☐

3 Is manure or slurry spread on the site?

No ☐

Yes ☐

Appendix 4 – Specific questions for the clinical waste sector

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

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

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

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

Document reference

Yes ☐ Document reference

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

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

Document reference

Yes ☐ Document reference

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

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

Document reference

Yes ☐ Document reference

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

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

Document reference

Yes ☐ Document reference

5 Are you proposing to either

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

No ☐

Yes ☐ Provide justification : Document reference

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

Document reference

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

Document reference

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

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

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

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

Document reference

Yes ☐ Document reference

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

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

Document reference

Yes ☐ Document reference

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

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

Document reference

Yes ☐ Document reference

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

Document reference

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

Document reference

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

Document reference

Appendix 6 – Specific questions for the waste incineration sector

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

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

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

Yes ☐ WID applies

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

As an incinerator ☐

As a co-incinerator ☐

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

No ☐ *Go to section 4*

Yes ☐

3 How many incineration lines are there within each installation?

Fill in a separate table for each installation

Installation reference	
Number of incineration lines within the installation	
Reference identifiers for each line	

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

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

Document reference

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

Document reference

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

Document reference

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

Question 3 identifier, if necessary

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

No ☐ *Go to section 8*

Yes ☐ This article allows 'abnormal operation' of the incineration plant under certain circumstances when the CEM for releases to air have failed. Annex VI, Part 3(2) sets maximum half hourly average release levels for particulates (150mg/m3), CO (normal ELV) and TOC (normal ELV) during abnormal operation.

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

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

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

No ☐ *Go to section 9*

Yes ☐ Please give reasons for doing this.

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

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

No ☐

Yes ☐ Please give reasons for doing this.

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

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

No ☐

Yes ☐ Please give reasons for doing this.

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

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

No ☐

Yes ☐ Please give reasons for doing this.

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

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

No ☐

Yes ☐ Please give reasons for doing this.

13 If your plant uses fluidised bed technology, do you want to apply for a derogation of the CO WID ELV to a maximum of 100 mg/m_3 as an hourly average, as allowed by IED Annex VI, Part 3?

No ☐

Does not apply ☐

Yes ☐ Please give reasons for doing this.

Appendix 7 – Specific questions for the landfill sector

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

Document reference

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

Document reference

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

Document reference

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

Document reference

Templates for these four reports can be found using the links on our Guidance Webpages.

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

Document reference

Appendix 8 – Medium Combustion Plant ('MCP') and combined MCP/Specified Generator Check List

Please provide the information below for each new medium combustion plant or combined MCP/Specified Generator as identified in Annex I of the Medium Combustion Plant Directive (EU/2015/2193).

Questions	**Answers**		
1 What is the MCPD identifer[1] (As shown on site plan)?	Newbridge Energy Limited 2885		
2 What is the rated thermal input (MWth) of the medium combustion plant. Where there is more than one medium combustion plant, please provide the individual and aggregated total thermal input for all plants.	5.2 MWth	MWth (only one)	
		MWth (If more than one)	
3 Please indicate the type of medium combustion plant by ticking the appropriate option.	Diesel engine		☐
	Gas turbine		☐
	Dual fuel engine		☐
	Other engines		☐
	Other medium combustion plant		☒
4 Please state the type of fuels used	Fuel type	Tick relevant options	Share of fuels used (%)
	Solid Biomass	☒	
	Other Solid Fuels	☐	
	Gas Oil (Diesel)	☐	
	Liquid fuels other than gas oil	☐	
	Natural Gas	☐	
	Gaseous fuels other than natural gas	☐	
5 Please state the start date of the operation of the Medium Combustion Plant. Or where the exact start date is unknown, provide proof that the operation started before 20th December 2018.	24/11/2020	Start date	
	Or, if start date unknown; provide proof:		
		Document reference	
6 Please state the sector of activity of the Medium Combustion Plant or the facility in which it is applied (NACE code[2])	D.35.11 (Production of Energy)		
7 Please state the expected number of annual operating hours of the Medium Combustion Plant, and average load in use.	8,000	Hours	
		Average load in use	
8 Please confirm that where the option of exemption under article 6(3) or article 6(8) of the medium combustion plant directive is used, the medium combustion plant will not be operated more than the number of hours referred to in those paragraphs.	Yes, I/We confirm that where the option of exemption under article 6(3) or article 6(8) of the medium combustion plant directive is used, the medium combustion plant will not be operated more than the number of hours referred to in those paragraphs		☐

9 Please confirm that the operator name, registered office address and in the case of stationary medium combustion plant, the address where the plant is located is as stated in Form Part A and Form Part B1.	Yes, I/We confirm that the operator name, registered office address and in the case of stationary medium combustion plants, the address where the plant is located is as stated in Form Part A and Form Part B1.	☒

Explanatory notes to checklist

1. Identifier – the MCP must be traceable via a serial number or other unique identifier, name plate, manufacturer and/or model.

2. NACE code* means Nomenclature of Economic Activities and is the European statistical classification of economic activities.

Appendix 9 – Specific questions for Specified Generators

Please provide the information below for **each** generator identifier, which comprises the Specified Generator (Excluded generators are not required to be included in this appendix).

If your application is for a specified generator that is also a new medium combustion plant, you will also need to complete appendix 8 for each new medium combustion plant.

Questions	**Answers**	
1 What is the generator identifier[1] (As shown on the site plan)?	Newbridge Energy 2885	
2 What is the rated thermal input (MW) of the generator?	5.2 MWth	MWth
3 Please provide details of any capacity agreement(s) or balancing service agreement(s) for each individual generator, i.e. if they are Tranche A or Tranche B generators.	n/a	
4 Please state the total rated thermal input of all generators on site.	10.4 MWth	MWth
5 Please indicate if the operating hours for each individual Tranche A generator be restricted to 50 hour or less per year.	Yes	☐
	No	☒
6 Please indicate if the aggregated operating hours for all Tranche A generators be restricted to 50 hour or less per year.	Yes	☐
	No	☒
7 Will the NOx emissions of any individual Tranche A generator will be greater than 500mg/Nm3 per year (STP, 15% O_2)?	Yes	☐
	No	☒

Explanatory notes to checklist

1. Identifier – the gnerator must be traceable via a serial number or other unique identifier, name plate, manufacturer and/or model

APPENDIX B

Additional Monitoring Data

Element Materials Technology, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: Scott Pilkington (07825 991 537)
E: scott.pilkington@element.com

Stack Emissions Testing Report Commissioned by
Newbridge Energy Ltd

Installation Name & Address
Blazers Fuels Ltd
Brickfield Lane
Ruthin
Denbighshire
North Wales
LL15 2TN

Stack Reference
Biomass CHP Plant Exhaust

Dates of the Monitoring Campaign
8th - 9th February 2021

Job Reference Number
EMT00160

Report Written by
Tom Buller Team Leader MCERTS Level 2 MM 17 1415 TE1 TE2 TE3 TE4

Report Approved by
Tom Buller Team Leader MCERTS Level 2 MM 17 1415 TE1 TE2 TE3 TE4

Report Date
19th February 2021

Version
Version 1

Signature of Report Approver


CONTENTS

Opinions and interpretations expressed herein are outside the scope of Element's ISO 17025 accreditation.

MONITORING OBJECTIVES

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
8th - 9th February 2021

Overall Aim of the Monitoring Campaign

Element were commissioned by Newbridge Energy Ltd to carry out stack emissions testing for Blazers Fuels Ltd on the Biomass CHP Plant Exhaust at Ruthin.

The aim of the monitoring campaign was to perform testing, as requested by the customer, for a number of prescribed pollutants. There are no emission limits set for any of the pollutants at this time.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, PM_{10}, $PM_{2.5}$, Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2), Carbon Monoxide

Executive Summary

MONITORING RESULTS

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
8th - 9th February 2021

where MU = Measurement Uncertainty associated with the Result

	Concentration				Mass Emission			
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Total Particulate Matter [1]	mg/m³	10.6	0.92	50.0	g/hr	88.4	8.8	-
PM_{10} [1]	mg/m³	0.82	0.64	-	g/hr	6.8	5.3	-
$PM_{2.5}$ [1]	mg/m³	0.65	0.66	-	g/hr	5.4	5.5	-
Total VOCs (as Carbon) [1]	mg/m³	9.9	0.88	30.0	g/hr	82.6	8.3	-
Oxides of Nitrogen (as NO_2) [1]	mg/m³	340	14.3	475	g/hr	2830	181	-
Carbon Monoxide [1]	mg/m³	23.3	1.5	225	g/hr	193	15.5	-
Oxygen	% v/v	Dry 12.0	0.36					
Water Vapour	% v/v	17.5	0.9					
Stack Gas Temperature	°C	163						
Stack Gas Velocity	m/s	12.6	0.21					
Volumetric Flow Rate (ACTUAL)	m³/hr	26904	1295					
Volumetric Flow Rate (REF) [1]	m³/hr	8314	400					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

[1] Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 6% oxygen.

Executive Summary

MONITORING DATE(S) & TIMES

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
8th - 9th February 2021

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	6.1	g/hr	51.0	08/02/2021	13:36 - 14:06, 14:07 - 14:37	60
Total Particulate Matter	R2	mg/m³	7.2	g/hr	59.7	08/02/2021	14:56 - 15:26, 15:27 - 15:57	60
Total Particulate Matter	R3	mg/m³	18.6	g/hr	155	09/02/2021	14:04 - 14:34, 14:35 - 15:35	60
PM_{10}	R1	mg/m³	0.82	g/hr	6.8	09/02/2021	10:32 - 11:32	60
$PM_{2.5}$	R1	mg/m³	0.65	g/hr	5.4	09/02/2021	10:32 - 11:32	60
Total VOCs (as Carbon)	R1	mg/m³	9.9	g/hr	82.6	08/02/2021	21:15 - 22:15	60
Oxides of Nitrogen (as NO_2)	R1	mg/m³	340	g/hr	2830	08/02/2021	21:15 - 22:15	60
Carbon Monoxide	R1	mg/m³	23.3	g/hr	193	08/02/2021	21:15 - 22:15	60
Oxygen	R1	% v/v	11.9			08/02/2021	21:15 - 22:15	60
Velocity Traverse	R1					08/02/2021	11:52 - 11:59	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
8th - 9th February 2021

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	3 Tonnes / Hour
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Wood Chips
Abatement System	Bag Filter & Cyclone
Abatement System Running Status	On
Fuel	Wood Chips
Plume Appearance	None Visible

MONITORING & ANALYTICAL METHODS

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
8th - 9th February 2021

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Total Particulate Matter	EN 13284-1	CAT-TP-01	MCERTS	EET	CAT-TP-03	Gravimetric	MCERTS	EET	MCERTS	0.24 mg/m³
PM_{10}	US EPA M201A	CAT-TP-18	MCERTS	EET	CAT-TP-03	Gravimetric	MCERTS	EET	MCERTS	0.31 mg/m³
$PM_{2.5}$	US EPA M201A	CAT-TP-18	MCERTS	EET	CAT-TP-03	Gravimetric	MCERTS	EET	MCERTS	0.33 mg/m³
Water Vapour	EN 14790	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	MCERTS	EET	Flame Ionisation Detection by Sick 3006 FID				MCERTS	0.32 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-39	MCERTS	EET	Chemiluminescence by Horiba PG-350E				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	CAT-TP-39	MCERTS	EET	NDIR by Horiba PG-350E				MCERTS	0.25 mg/m³
Oxygen	EN 14789	CAT-TP-39	MCERTS	EET	Dry Paramagnetic Cell by Horiba PG-350E				MCERTS	0.1 %
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.2 m/s

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element Materials Technology (EET)	ISO 17025 Accreditation Number: 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All Parameters	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.87
Width	m	-
Area	m²	0.59
Port Depth	cm	30
Orientation of Duct	-	Vertical
Number of Ports	-	2
Sample Port Size	-	5" Flange

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Permanent
Inside / Outside	Inside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
Platform has vertical base boards (approx. 0.25m high)	Yes
Platform has chains / self closing gates at top of ladders	No
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

In the interest of improved Health and Safety, it would be advantageous to install some form of chain or self closing gate at the top of the sampling platform ladder.

EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	73.2	> 5 Pa	Yes
Mean Velocity	m/s	12.31	-	-
Lowest Gas Velocity	m/s	11.77	-	-
Highest Gas Velocity	m/s	13.62	-	-
Ratio of Above	: 1	1.16	< 3 : 1	Yes
Maximum Angle of Swirl	°	4.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

PLANT PHOTOS

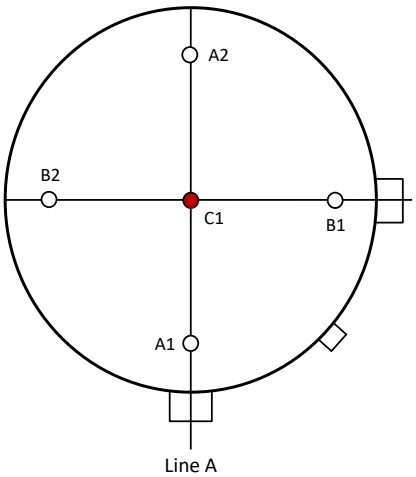
Photo 1

Photo 2

Photo 3

Photo 4

SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point not sampled at
● = combustion gases sample point
● = non-isokinetic sample point

APPENDIX CONTENTS

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Tom Buller	MCERTS Level 2	MM 17 1415	TE1 TE2 TE3 TE4
Trainee	Joe Watson	MCERTS Trainee	N/A	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	CAT 7.54
Control Box DGM (2)	-
Box Thermocouples (1)	CAT 3.316
Box Thermocouples (2)	-
Umbilical (1)	CAT 3.316
Umbilical (2)	-
Oven Box (1)	CAT 12.104
Oven Box (2)	-
Heated Probe (1)	CAT 5.120
Heated Probe (2)	CAT 5.115
Heated Probe (3)	CAT 5.140
S-Pitot (1)	CAT 21P.82/21P.87
S-Pitot (2)	CAT 21S.48
L-Pitot	-
Site Balance	CAT 17.39
500g / 1Kg Check Weights	CAT 17.39
Last Impinger Arm	CAT 4.402/4.826
Callipers	CAT 23.36
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-350E	CAT 39.3
Horiba PG-250	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
JCT JCC P1 Cooler	CAT 4.43
Gasmet DX4000	-
Gasmet Sampling System	-
Bernath 3006 FID	CAT 8.27
M&C PSS	CAT 12.81
Mass Flow Controller (1)	CAT 6.55
Mass Flow Controller (2)	CAT 6.56
Mass View (1)	CAT 25.43
Mass View (2)	CAT 25.53
Hioki 5043 (V)	CAT 11.112
Hioki 5043 (V)	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	CAT 13.35
Digital Manometer (2)	-
Digital Temperature Meter	-
Stopwatch	CAT 14.53
Barometer	CAT 13.35
Stack Thermocouple (1)	CAT 4.1287
Stack Thermocouple (2)	CAT 4.1298
Stack Thermocouple (3)	CAT 4.984
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
10m Heated Line (1)	CAT 20.110
20m Heated Line (1)	-
20m Heated Line (2)	-
Dual Channel Heater Controller	CAT 3.37
Single Channel Heater Controller	-
Laboratory Balance	CAT 1.18, 1.18a, 1.18b
Tape Measure	CAT 16.43

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
PM_{10}	US EPA M201A	CAT-TP-18
$PM_{2.5}$	US EPA M201A	CAT-TP-18
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-39
Carbon Monoxide	EN 15058	CAT-TP-39
Oxygen	EN 14789	CAT-TP-39
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.87
Stack Width, W	m	-
Stack Area, A	m^2	0.59
Average Stack Gas Temperature, T_a	°C	172.8
Average Stack Gas Pressure	Pa	80.5
Average Stack Static Pressure, P_{static}	kPa	-0.111
Average Barometric Pressure, P_b	kPa	101.0
Average Pitot Tube Calibration Coefficient, C_p	-	0.85

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m³ p	Conc kg/m³ p_i
CO_2 (Estimated)	-	8.00	6.60	0.0800	44.01	1.9635	0.15708
O_2	-	12.03	9.92	0.1203	32.00	1.4277	0.17171
N_2	-	79.97	65.94	0.7997	28.01	1.2498	0.99953
Moisture (H_2O)	-	-	17.55	0.1755	18.02	0.8037	0.14105

Where: p = M / 22.41

p_i = r x p

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P_{STD}	kg/m³	1.328
Wet Density (STP), P_{STW}	kg/m³	1.236
Dry Density (Actual), P_{Actual}	kg/m³	0.810
Average Wet Density (Actual), $P_{ActualW}$	kg/m³	0.754

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

$P_{Actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times ((P_{static} + P_b) / T_a)$

$P_{ActualW}$ (at each sampling point) $= P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF [1]
Temperature	°C	172.8	0.0
Total Pressure	kPa	100.9	101.3
Moisture	%	17.55	0.00
Oxygen (Dry)	%	12.0	6.0

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m³/hr	26349
Gas Volumetric Flowrate (STP, Wet)	m³/hr	16069
Gas Volumetric Flowrate (STP, Dry)	m³/hr	13249
Gas Volumetric Flowrate REF [1]	m³/hr	7926

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID)

(1 of 1)

Parameter	Units	Value
Date of Survey	-	08/02/2021
Time of Survey	-	11:52 - 11:59
Atmospheric Pressure	kPa	101.0
Average Stack Static Pressure	Pa	-111
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C_p	-	0.85
Number of Lines Available	-	2
Number of Lines Used	-	2

		Sampling Line A					Sampling Line B				
Traverse Point	**Depth m**	**ΔP Pa**	**Temp °C**	**Wet Density kg/m³**	**Velocity m/s**	**Swirl °**	**ΔP Pa**	**Temp °C**	**Wet Density kg/m³**	**Velocity m/s**	**Swirl °**
STATIC (Units: Pa)		*-111.5*					*-110.3*				
Mean		**75.3**	**172.8**	**0.754**	**11.93**		**85.7**	**172.9**	**0.754**	**12.69**	
1	0.13	75.8	172.7	0.754	11.97	3.0	73.2	172.9	0.754	11.77	4.0
2	0.74	74.7	172.9	0.754	11.89	3.0	98.1	172.8	0.754	13.62	3.0

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID) - MEASUREMENT UNCERTAINTY

(1 of 1)

Performance characteristics (Uncertainty Components)	Uncertainty	Value	Units
Standard Uncertainty on the coefficient of the Pitot Tube	u(k)	0.005	-
Standard Uncertainty associated with the mean local dynamic pressures	u(Δpi)	1.692	Pa
- Resolution	u(res)	0.00087	
- Calibration	u(cal)	0.674	
- Drift	u(drift)	0.083	
- Lack of Fit	u(fit)	1.104	
- Overall corrections to dynamic measurements	u(Cf)	1.862	
Standard uncertainty associated with the molar mass of the gas	u(M)	0.00010	-
- $\varphi O_2,w$	-	9.916	
- $\varphi CO_2,w$	-	6.596	
- Oxygen, dry	u(ϕO_2,d)	0.368	
- Carbon Dioxide, dry	u(ϕCO_2,d)	0.245	
- Water Vapour	u(ϕH_2O)	0.895	
- Oxygen, wet	u(ϕO_2,w)	0.322	
- Carbon Dioxide, wet	u(ϕCO_2,w)	0.214	
Standard uncertainty associated with the stack temperature	u(Tc)	2.275	K
Standard uncertainty associated with the absolute pressure in the duct	u(pc)	175.696	Pa
- Atmospheric Pressure	u(patm)	175.692	
- Static Pressure	u(pstat)	1.196	
Standard uncertainty associated with the density in the duct	u(ρ)	0.00406	-
Standard uncertainty associated with the local velocities	u(vi)	0.153	Pa
Standard uncertainty associated with the mean velocity	u(v)	0.103	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	Uc(v)	0.202	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	Uc,rel(v)	1.64	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	Uc(qV,w)	1268.3	m^3/hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00060	
- $u^2(qV,w)$	-	418745	
- $u(qV,w)$	-	647.1	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	Uc,rel(qV,w)	4.81	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3		Mean
Concentration	mg/m³	6.1	7.2	18.6		10.6
Uncertainty	±mg/m³	0.66	0.73	1.4		0.92
Mass Emission	g/hr	51.0	59.7	155		88.4
Uncertainty	±g/hr	6.0	6.7	13.7		8.8

Parameter	Units	Run 1	Run 2	Run 3		Mean
Water Vapour	% v/v	18.2	17.3	20.1		18.5
Uncertainty	±% v/v	0.89	0.85	0.99		0.91

Blank Runs

Parameter	Units	Blank 1	Blank 2		Maximum
Concentration	mg/m³	0.24	0.24		0.24

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	2 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4 / 4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, B1 & B2	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	Run 2	Run 3
Absolute pressure of stack gas, P_s				
Barometric pressure, P_b	mmHg	756.1	758.3	757.6
Stack static pressure, P_{static}	mmH_2O	-8.9	8.9	-8.9
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	755.4	759.0	756.9
Volume of water vapour collected, V_{wstd}				
Total mass collected in impingers (liquid trap)	g	219.3	123.7	197.8
Total mass collected in impingers (silica trap)	g	21.1	86.1	35.3
Total mass of liquid collected, V_{lc}	g	240.4	209.8	233.1
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.2995	0.2614	0.2904
Volume of gas metered dry, V_{mstd}				
Volume of gas sample through gas meter, V_m	m^3	1.3732	1.2750	1.1706
Gas meter correction factor, Y_d	-	1.0470	1.0470	1.0470
Average dry gas meter temperature, T_m	°C	18.4	19.2	18.1
Average pressure drop across orifice, ΔH	mmH_2O	57.9	55.6	49.8
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	1.3474	1.2511	1.1513
Moisture content, B_{wo} & R_{wv}				
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.1819	0.1728	0.2015
B_{wo} as a percentage	% v/v	18.19	17.28	20.15
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	18.19	17.28	20.15
Volume of gas metered wet, V_{mstw}				
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	1.6469	1.5125	1.4417
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$				
IED & Incinerates Hazardous Material? (Yes = no positive O_2 correction)	-	No	No	No
% wet oxygen measured in gas stream, $ACT\%O_{2w}$	% v/v	10.34	10.15	9.16
% dry oxygen measured in gas stream, $ACT\%O_{2d}$	% v/v	12.54	12.31	11.11
% oxygen reference condition, $REF\%O_2$	% v/v	6.00	6.00	6.00
O_2 Reference Factor wet $(O_{2REFw}) = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$	-	1.41	1.38	1.27
O_2 Reference Factor dry $(O_{2REFd}) = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$	-	1.77	1.73	1.52
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m^3	1.1705	1.0941	1.1383
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m^3	0.7599	0.7248	0.7594
Molecular weight of dry gas stream, M_d				
CO_2 (Estimated)	% v/v	6.00	6.00	6.00
O_2	% v/v	12.54	12.31	11.11
Total	% v/v	18.54	18.31	17.11
N_2	% v/v	81.46	81.69	82.89
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	29.46	29.45	29.40
Molecular weight of stack gas (wet), M_s				
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	27.38	27.47	27.11
Velocity of stack gas, V_s				
Pitot tube velocity constant, K_p	-	34.97	34.97	34.97
Velocity pressure coefficient, C_p	-	0.84	0.84	0.84
Average of velocity heads, ΔP_{avg}	mmH_2O	8.63	8.92	8.49
Average square root of velocity heads, √ΔP	$\sqrt{mmH_2O}$	2.94	2.99	2.91
Average stack gas temperature, T_s	°C	153.5	153.8	177.7
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s} + 273)) / (\sqrt{(M_s)(P_s)})$	m/s	12.37	12.53	12.67
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})				
Area of stack, A_s	m^2	0.59	0.59	0.59
$Q_a = (60)(A_s)(V_s)$	m^3/min	441.4	447.1	452.0
Conversion factor (K/mm.Hg), C_f	-	0.3592	0.3592	0.3592
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m^3/min	280.8	285.6	272.7
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	229.8	236.3	217.8
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m^3/min	199.6	206.6	215.3
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m^3/min	129.6	136.9	143.6
Percent isokinetic, %I				
Nozzle diameter, D_n	mm	8.03	8.03	8.03
Nozzle area, A_n	mm^2	50.61	50.61	50.61
Total sampling time, q	min	60	60	60
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	114.8	103.7	103.5

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3
Sampling Times	-	13:36 - 14:06, 14:07 - 14:37	14:56 - 15:26, 15:27 - 15:57	14:04 - 14:34, 14:35 - 15:35
Sampling Dates	-	08/02/2021	08/02/2021	09/02/2021
Sampling Device	-	ISO	ISO	ISO
Volume Sampled (REF)	m^3	0.7599	0.7248	0.7594
Filter I.D. Number	-	47-77305	47-77440	47-77433
Start Filter Mass	g	0.14790	0.14933	0.14996
End Filter Mass	g	0.15078	0.15276	0.16198
Total Mass on Filter	g	0.00288	0.00343	0.01202
Probe Rinse I.D. Number	-	PR-47-77305	PR-47-77440	PR-47-77433
Start Probe Rinse Mass	g	3.02838	3.09758	2.93127
End Probe Rinse Mass	g	3.03016	3.09935	2.93336
Total Mass in Probe Rinse	g	0.00178	0.00178	0.00210
Total Mass Collected	mg	4.66	5.21	14.11
Calculated Concentration	mg/m^3	6.13	7.18	18.59
Balance Uncertainty / LOD	mg/m^3	0.24	0.25	0.24

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	Blank 2
Blank Dates	-	08/02/2021	09/02/2021
Average Volume Sampled (REF)	m^3	0.7480	0.7480
Filter I.D. Number	-	47-77432	47-77302
Start Filter Mass	g	0.15063	0.14858
End Filter Mass	g	0.15066	0.14866
Total Mass on Filter	g	0.00003	0.00008
Probe Rinse I.D. Number	-	PR-47-77432	PR-47-77302
Start Probe Rinse Mass	g	2.99480	3.06341
End Probe Rinse Mass	g	2.99467	3.06329
Total Mass in Probe Rinse	g	-0.00013	-0.00012
Total Mass Collected	mg	-0.10	-0.04
Calculated Concentration	mg/m^3	-0.13	-0.06
Balance Uncertainty / LOD	mg/m^3	0.24	0.24

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	Run 2	Run 3
Mean Sampling Rate	l/min	24.0	22.2	20.4
Pre-Sampling Leak Rate	l/min	0.09	0.15	0.14
Allowable Leak Rate	l/min	0.40	0.40	0.40
Leak Test Acceptable	-	Yes	Yes	Yes

Water Droplets	Units	Run 1	Run 2	Run 3
Are Water Droplets Present	-	No	No	No

MU (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3
Measurement Uncertainty (MU)	%	4.9	4.9	4.9
Allowable MU	%	20.0	20.0	20.0
MU Acceptable	%	Yes	Yes	Yes

Silica Gel (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3
Less than 50% Faded	%	Yes	Yes	Yes

Isokinetic Criterion Compliance	Units	Run 1	Run 2	Run 3
Isokinetic Variation	%	114.8	103.7	103.5
Allowable Isokinetic Range	%	95 - 115	95 - 115	95 - 115
Isokineticity Acceptable	-	Yes	Yes	Yes

Weighing Uncertainty Criteria	Units	Run 1	Run 2	Run 3
Overall Weighing Uncertainty	± mg	0.36	0.36	0.36
Overall Weighing Uncertainty	± mg/m³	0.47	0.50	0.47
ELV [Daily ELV for IED]	mg/m³	50.00	50.00	50.00
Allowable Weighing Uncertainty	mg/m³	2.50	2.50	2.50
Weighing Uncertainty Acceptable	-	Yes	Yes	Yes

Filter Temperatures	Units	Run 1	Run 2	Run 3
Pre-Conditioning Temperature	°C	180	180	180
Post-Conditioning Temperature	°C	160	160	160
Maximum Filter Temperature	°C	155	155	180

Test Conditions	Units	Run 1	Run 2	Run 3
Ambient Temperature Recorded?	-	Yes	Yes	Yes

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1	Blank 2
Expected Sampling Rate	l/min	20.0	20.0
Pre-Sampling Leak Rate	l/min	0.18	0.04
Allowable Leak Rate	l/min	0.40	0.40
Leak Test Acceptable	-	Yes	Yes

Validity of Blank vs ELV	Units	Blank 1	Blank 2
Allowable Blank	mg/m^3	5.0	5.0
Blank Acceptable	-	Yes	Yes

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number 1	2	3	
There are no deviations associated with the sampling employed.	wx	wx	wx	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

		Value				Standard uncertainty				
Measured Quantities	**Symbol**	**Run 1**	**Run 2**	**Run 3**		**Symbol**	**Units**	**Run 1**	**Run 2**	**Run 3**
Sampled Volume (Actual)	V_m	1.3732	1.2750	1.1706		uV_m	m^3	0.0275	0.0255	0.0234
Sampled Gas Temperature	T_m	291.4	292.2	291.1		uT_m	K	2.00	2.00	2.00
Sampled Gas Pressure	ρ_m	100.7	101.2	100.9		$u\rho_m$	kPa	0.50	0.50	0.50
Sampled Gas Humidity	H_m	0.00	0.00	0.00		uH_m	% v/v	1.00	1.00	1.00
Leak	L	0.38	0.67	0.69		uL	%	-	-	-
Mass of Particulate	m	4.66	5.21	14.11		um	mg	0.18	0.18	0.18
Uncollected Mass	UCM	-0.04	-0.04	-0.04		uUCM	mg	-	-	-

	Uncertainty as a Percentage				
Measured Quantities	**Units**	**Run 1**	**Run 2**	**Run 3**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	2.00	2.00	≤2%
Sampled Gas Temperature	%	0.69	0.68	0.69	≤1%
Sampled Gas Pressure	%	0.50	0.49	0.50	≤1%
Sampled Gas Humidity	%	1.00	1.00	1.00	≤1%
Leak	%	0.38	0.67	0.69	≤2%
Mass of Particulate	%	0.47	0.50	0.47	<5% of ELV
Uncollected Mass	%	-	-	-	-

		Uncertainty in Measurement Units				Sensitivity Coefficient		
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 2**	**Run 3**	**Run 1**	**Run 2**	**Run 3**
Sampled Volume (STP)	V_m	m^3	1.3474	1.2511	1.1513	4.55	5.74	16.14
Leak	L	mg/m^3	0.013	0.028	0.074	1.00	1.00	1.00
Mass of Particulate	L_r	mg	4.660	5.207	14.113	1.32	1.38	1.32
Uncollected Mass	UCM	mg	-0.03	-0.03	-0.03	1.32	1.38	1.32

	Uncertainty in Result			
Measured Quantities	**Units**	**Run 1**	**Run 2**	**Run 3**
Sampled Volume (STP)	mg/m^3	0.149	0.174	0.450
Leak	mg/m^3	0.0133	0.0280	0.0735
Mass of Particulate	mg/m^3	0.2369	0.2483	0.2370
Uncollected Mass	mg/m^3	-0.0329	-0.0345	-0.0329

	Oxygen Correction Part of MU Budget			
Measured Quantities	**Units**	**Run 1**	**Run 2**	**Run 3**
O_2 Correction Factor	-	1.77	1.73	1.52
Stack Gas O_2 Content	% v/v	12.54	12.31	11.11
MU for O_2 Correction	-	0.10	0.10	0.08
Overall MU For O_2 Measurement	%	5.91	5.75	5.05

Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Combined uncertainty	mg/m^3	0.28	0.31	0.51
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	0.55	0.60	1.01
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	0.66	0.73	1.38
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	0.66	0.73	1.38
Reported Uncertainty	mg/m^3	0.66	0.73	1.38
Expanded uncertainty (95% confidence), without Oxygen Correction	%	9.0	8.4	5.4
Expanded uncertainty (95% confidence), with Oxygen Correction	%	10.8	10.2	7.4
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	10.8	10.2	7.4
Reported Uncertainty	%	10.8	10.2	7.4

PM_{10}: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	0.82		0.82
Uncertainty	±mg/m³	0.64		0.64
Mass Emission	g/hr	6.8		6.8
Uncertainty	±g/hr	5.3		5.3

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	17.1		17.1
Uncertainty	±% v/v	0.85		0.85

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.31		0.31

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	US EPA M201A	
Technical Procedure	CAT-TP-18	
Sizing Device	TCR Tecora MSSI 3-Stage Cascade Impactor	
Sizing Device Material	Stainless Steel	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	B2	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

PM_{10}: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	757.6	
Stack static pressure, P_{static}	mmH_2O	-8.9	
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	756.9	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	280.4	
Total mass collected in impingers (silica trap)	g	5.5	
Total mass of liquid collected, V_{lc}	g	285.9	
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.3562	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m^3	1.7124	
Gas meter correction factor, Y_d	-	1.0470	
Average dry gas meter temperature, T_m	°C	11.5	
Average pressure drop across orifice, ΔH	mmH_2O	105.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	1.7325	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.1706	
B_{wo} as a percentage	% v/v	17.06	
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	17.06	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	2.0887	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O_2 correction)	-	No	
% wet oxygen measured in gas stream, $ACT\%O_{2w}$	% v/v	9.80	
% dry oxygen measured in gas stream, $ACT\%O_{2d}$	% v/v	11.88	
% oxygen reference condition, $REF\%O_2$	% v/v	6.00	
O_2 Reference Factor wet $(O_{2REFw}) = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$	-	1.34	
O_2 Reference Factor dry $(O_{2REFd}) = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$	-	1.65	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m^3	1.5597	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m^3	1.0528	
Molecular weight of dry gas stream, M_d			
CO_2 (Estimated)	% v/v	8.00	
O_2	% v/v	11.88	
Total	% v/v	19.88	
N_2	% v/v	80.12	
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	29.76	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	27.75	
Velocity of stack gas, V_{spt}			
Velocity pressure coefficient, C_p	-	0.84	
Average stack gas temperature, T_s	°C	163.9	
Velocity of stack gas (pre-test from traverse), V_{spt}	m/s	12.64	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m^2	0.59	
$Q_a = (60)(A_s)(V_s)$	m^3/min	450.7	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_{sj})(C_f)) / ((T_s) + 273)$	m^3/min	280.5	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	232.7	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m^3/min	209.5	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m^3/min	141.4	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	10.02	
Nozzle area, A_n	mm^2	78.92	
Total sampling time, q	min	60	
Velocity at nozzle, V_n	m/s	11.76	
$\%I = V_n / V_{spt} \times 100$	%	93.1	

PM_{10}: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	10:32 - 11:32
Sampling Dates	-	09/02/2021
Sampling Device	-	ISO
Volume Sampled (REF)	m^3	1.0528
2nd Stage of Cascade Impactor (PM_{10} to $PM_{2.5}$)		
Filter I.D. Number (2nd Stage)	-	PM2-02560
Start Filter Mass (2nd Stage)	g	0.12744
End Filter Mass (2nd Stage)	g	0.12762
Total Mass	g	0.00018
3rd Stage of Cascade Impactor (≤ $PM_{2.5}$)		
Filter I.D. Number (3rd Stage)	-	PM3-02560
Start Filter Mass (3rd Stage)	g	0.15130
End Filter Mass (3rd Stage)	g	0.15198
Total Mass	g	0.00068
Total Mass Collected	mg	0.86
Calculated Concentration	mg/m^3	0.82
Balance Uncertainty / LOD	mg/m^3	0.31

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	09/02/2021
Average Volume Sampled (REF)	m^3	1.0528
2nd Stage of Cascade Impactor (PM_{10} to $PM_{2.5}$)		
Filter I.D. Number (2nd Stage)	-	PM2-02554
Start Filter Mass (2nd Stage)	g	0.12972
End Filter Mass (2nd Stage)	g	0.12978
Total Mass	g	0.00006
3rd Stage of Cascade Impactor (≤ $PM_{2.5}$)		
Filter I.D. Number (3rd Stage)	-	PM3-02554
Start Filter Mass (3rd Stage)	g	0.14962
End Filter Mass (3rd Stage)	g	0.14970
Total Mass	g	0.00008
Total Mass Collected	mg	0.14
Calculated Concentration	mg/m^3	0.14
Balance Uncertainty / LOD	mg/m^3	0.31

PM_{10}: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Expected Sampling Rate	l/min	30.0
Pre-Sampling Leak Rate	l/min	0.39
Allowable Leak Rate	l/min	0.60
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.0
Allowable MU	%	20.0
MU Acceptable	%	Yes

Silica Gel (Concurrent Water Vapour)	Units	Run 1
Less than 50% Faded	%	Yes

Isokinetic Criterion Compliance	Units	Run 1
Isokinetic Variation	%	93.1
Allowable Isokinetic Range	%	90 - 130
Isokineticity Acceptable	-	Yes

Filter Temperatures	Units	Run 1
Pre-Conditioning Temperature	°C	180
Post-Conditioning Temperature	°C	160
Maximum Filter Temperature	°C	170

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

Cut Size	Units	Run 1
D_{50} Cut Size	µm	10.04
Allowable D_{50} Cut Size	µm	9 - 11
D_{50} Cut Size Acceptable	-	Yes

PM_{10}: QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	30.0
Pre-Sampling Leak Rate	l/min	0.17
Allowable Leak Rate	l/min	0.60
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m^3	N/A
Blank Acceptable	-	N/A

Method Deviations

Nature of Deviation (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number	
	1	
There are no deviations associated with the sampling employed.	wx	

PM_{10}: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**
Sampled Volume (Actual)	V_m	1.7124		uV_m	m^3	0.0342
Sampled Gas Temperature	T_m	284.5		uT_m	K	2.00
Sampled Gas Pressure	ρ_m	100.9		$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.00
Leak	L	1.30		uL	%	-
Mass of Particulate	m	0.86		um	mg	0.33
Uncollected Mass	UCM	0.14		uUCM	mg	-
Particulate Sizing	PS	10.00		uPS	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.70	≤1%
Sampled Gas Pressure	%	0.50	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	1.30	≤2%
Mass of Particulate	%	-	<5% of ELV
Uncollected Mass	%	-	-
Particulate Sizing	%	10.0	-

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m^3	1.7325	0.47
Leak	L	mg/m^3	0.006	1.00
Mass of Particulate	L_r	mg	0.863	0.95
Uncollected Mass	UCM	mg	0.08	0.95
Particulate Sizing	PS	mg	0.05	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m^3	0.019
Leak	mg/m^3	0.0062
Mass of Particulate	mg/m^3	0.3093
Uncollected Mass	mg/m^3	0.0786
Particulate Sizing	mg/m^3	0.0473

	Oxygen Correction Part of MU Budget	
Measured Quantities	**Units**	**Run 1**
O_2 Correction Factor	-	1.65
Stack Gas O_2 Content	% v/v	11.88
MU for O_2 Correction	-	0.09
Overall MU For O_2 Measurement	%	5.49

Parameter	**Units**	**Run 1**
Combined uncertainty	mg/m^3	0.32
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	0.63
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	0.64
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	0.64
Reported Uncertainty	mg/m^3	0.64
Expanded uncertainty (95% confidence), without Oxygen Correction	%	77.3
Expanded uncertainty (95% confidence), with Oxygen Correction	%	77.4
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	77.4
Reported Uncertainty	%	77.4

$PM_{2.5}$: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	0.65		0.65
Uncertainty	±mg/m³	0.66		0.66
Mass Emission	g/hr	5.4		5.4
Uncertainty	±g/hr	5.5		5.5

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	17.1		17.1
Uncertainty	±% v/v	0.85		0.85

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.33		0.33

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	US EPA M201A	
Technical Procedure	CAT-TP-18	
Sizing Device	TCR Tecora MSSI 3-Stage Cascade Impactor	
Sizing Device Material	Stainless Steel	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	B2	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

$PM_{2.5}$: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	757.6	
Stack static pressure, P_{static}	mmH_2O	-8.9	
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	756.9	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	280.4	
Total mass collected in impingers (silica trap)	g	5.5	
Total mass of liquid collected, V_{lc}	g	285.9	
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.3562	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m^3	1.7124	
Gas meter correction factor, Y_d	-	1.0470	
Average dry gas meter temperature, T_m	°C	11.5	
Average pressure drop across orifice, ΔH	mmH_2O	105.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	1.7325	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.1706	
B_{wo} as a percentage	% v/v	17.06	
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	17.06	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	2.0887	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O_2 correction)	-	No	
% wet oxygen measured in gas stream, $ACT\%O_{2w}$	% v/v	9.80	
% dry oxygen measured in gas stream, $ACT\%O_{2d}$	% v/v	11.88	
% oxygen reference condition, $REF\%O_2$	% v/v	6.00	
O_2 Reference Factor wet $(O_{2REFw}) = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$	-	1.34	
O_2 Reference Factor dry $(O_{2REFd}) = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$	-	1.65	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m^3	1.5597	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m^3	1.0528	
Molecular weight of dry gas stream, M_d			
CO_2 (Estimated)	% v/v	8.00	
O_2	% v/v	11.88	
Total	% v/v	19.88	
N_2	% v/v	80.12	
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	29.76	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	27.75	
Velocity of stack gas, V_{spt}			
Velocity pressure coefficient, C_p	-	0.84	
Average stack gas temperature, T_s	°C	163.9	
Velocity of stack gas (pre-test from traverse), V_{spt}	m/s	12.64	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m^2	0.59	
$Q_a = (60)(A_s)(V_s)$	m^3/min	450.7	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_{sj})(C_f)) / ((T_s) + 273)$	m^3/min	280.5	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	232.7	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m^3/min	209.5	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m^3/min	141.4	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	10.02	
Nozzle area, A_n	mm^2	78.92	
Total sampling time, q	min	60	
Velocity at nozzle, V_n	m/s	11.76	
$\%I = V_n / V_{spt} \times 100$	%	93.1	

$PM_{2.5}$: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	10:32 - 11:32
Sampling Dates	-	09/02/2021
Sampling Device	-	ISO
Volume Sampled (REF)	m^3	1.0528
3rd Stage of Cascade Impactor (≤ $PM_{2.5}$)		
Filter I.D. Number (3rd Stage)	-	PM3-02560
Start Filter Mass (3rd Stage)	g	0.15130
End Filter Mass (3rd Stage)	g	0.15198
Total Mass	g	0.00068
Total Mass Collected	mg	0.68
Calculated Concentration	mg/m^3	0.65
Balance Uncertainty / LOD	mg/m^3	0.33

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	09/02/2021
Average Volume Sampled (REF)	m^3	1.0528
3rd Stage of Cascade Impactor (≤ $PM_{2.5}$)		
Filter I.D. Number (3rd Stage)	-	PM3-02554
Start Filter Mass (3rd Stage)	g	0.14962
End Filter Mass (3rd Stage)	g	0.14970
Total Mass	g	0.00008
Total Mass Collected	mg	0.08
Calculated Concentration	mg/m^3	0.08
Balance Uncertainty / LOD	mg/m^3	0.33

$PM_{2.5}$: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Expected Sampling Rate	l/min	30.0
Pre-Sampling Leak Rate	l/min	0.39
Allowable Leak Rate	l/min	0.60
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.0
Allowable MU	%	20.0
MU Acceptable	%	Yes

Silica Gel (Concurrent Water Vapour)	Units	Run 1
Less than 50% Faded	%	Yes

Isokinetic Criterion Compliance	Units	Run 1
Isokinetic Variation	%	93.1
Allowable Isokinetic Range	%	90 - 130
Isokineticity Acceptable	-	Yes

Filter Temperatures	Units	Run 1
Pre-Conditioning Temperature	°C	180
Post-Conditioning Temperature	°C	160
Maximum Filter Temperature	°C	170

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

Cut Size	Units	Run 1
D_{50} Cut Size	µm	2.51
Allowable D_{50} Cut Size	µm	2.25 - 2.75
D_{50} Cut Size Acceptable	-	Yes

$PM_{2.5}$: QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	30.0
Pre-Sampling Leak Rate	l/min	0.17
Allowable Leak Rate	l/min	0.60
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m^3	N/A
Blank Acceptable	-	N/A

Method Deviations

Nature of Deviation (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number 1	
There are no deviations associated with the sampling employed.	wx	

$PM_{2.5}$: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**
Sampled Volume (Actual)	V_m	1.7124		uV_m	m^3	0.0342
Sampled Gas Temperature	T_m	284.5		uT_m	K	2.00
Sampled Gas Pressure	ρ_m	100.9		$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.00		uH_m	% v/v	1.00
Leak	L	1.30		uL	%	-
Mass of Particulate	m	0.68		um	mg	0.35
Uncollected Mass	UCM	0.08		uUCM	mg	-
Particulate Sizing	PS	10.0		uPS	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.70	≤1%
Sampled Gas Pressure	%	0.50	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	1.30	≤2%
Mass of Particulate	%	-	<5% of ELV
Uncollected Mass	%	-	-
Particulate Sizing	%	10.0	-

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m^3	1.7325	0.37
Leak	L	mg/m^3	0.005	1.00
Mass of Particulate	L_r	mg	0.683	0.95
Uncollected Mass	UCM	mg	0.05	0.95
Particulate Sizing	PS	mg	0.04	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m^3	0.015
Leak	mg/m^3	0.0049
Mass of Particulate	mg/m^3	0.3297
Uncollected Mass	mg/m^3	0.0439
Particulate Sizing	mg/m^3	0.0375

	Oxygen Correction Part of MU Budget	
Measured Quantities	**Units**	**Run 1**
O_2 Correction Factor	-	1.65
Stack Gas O_2 Content	% v/v	11.88
MU for O_2 Correction	-	0.09
Overall MU For O_2 Measurement	%	5.49

Parameter	**Units**	**Run 1**
Combined uncertainty	mg/m^3	0.34
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	0.66
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	0.66
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	0.66
Reported Uncertainty	mg/m^3	0.66
Expanded uncertainty (95% confidence)	%	101.2
Expanded uncertainty (95% confidence), with Oxygen Correction	%	101.3
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	101.3
Reported Uncertainty	%	101.3

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	9.9		9.9
Uncertainty	±mg/m³	0.88		0.88
Mass Emission	g/hr	82.6		82.6
Uncertainty	±g/hr	8.3		8.3

General Sampling Information

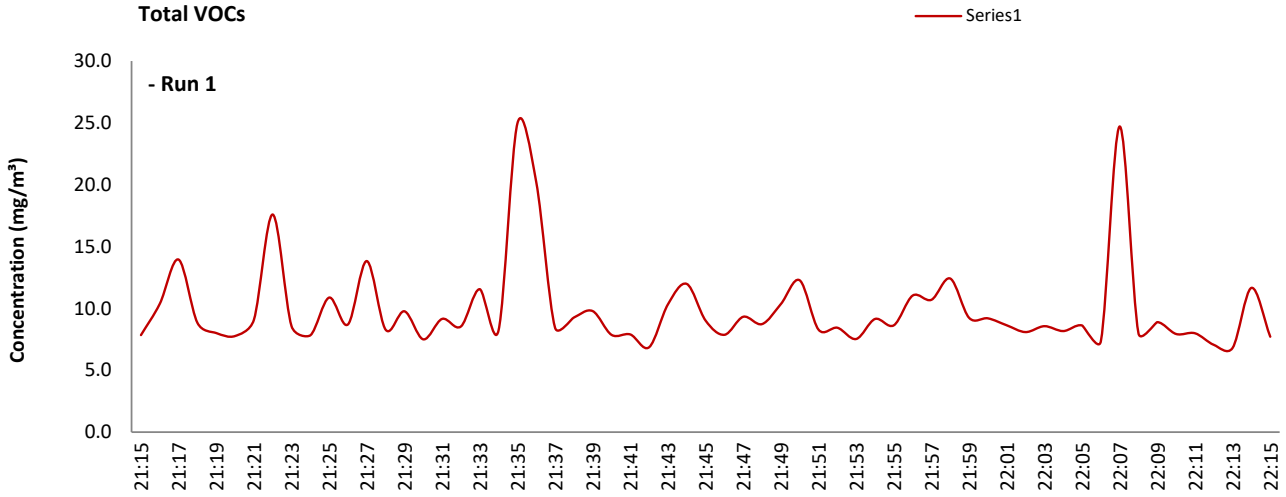
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane in 11% O_2 in N_2 (5 Grade)	
Span Gas Reference Number	CYL 12.0313 in N_2 | CYL 1.0328a in AIR	
Span Gas Expiry Date	18/08/2022 | 31/05/2023	
Span Gas Start Pressure (bar)	100 | 50	
Gas Cylinder Concentration (ppm)	85.75 | 79.82	
Span Gas Set Point (ppm)	82.64	This is the blended concentration of both propane cylinders
Span Gas Uncertainty (%)	2 | 2	
Zero Gas Type	11% O_2 in N_2 (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	C1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	21:15 - 22:15
Sampling Dates	-	08/02/2021
Instrument Range	ppm	100
Span Gas Value	ppm	82.6

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.10
CAL 1	Zero Down Sampling Line (Post)	ppm	1.80
CAL 1	Zero Drift	ppm	1.70
	Allowable Zero Drift	± ppm	4.13
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	81.20
CAL 1	Span Down Sampling Line (Post)	ppm	82.80
CAL 1	Span Drift	ppm	1.60
	Allowable Span Drift	± ppm	4.13
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	6 - 8

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	30.0		mg/m³ (REF)
Allowable MU	15.0		%
Measured concentration	5.82		mg/m³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m³
Cal gas conc.	82.6		ppm
Conversion	1.61		ppm to mg/m³
MCERTS Range [B]	15.0		mg/m³
Lower of [A] or [B]	15.0		mg/m³
Cal gas conc.	132.7		mg/m³

Performance characteristics	RUN 1		Units
Response time	45		seconds
Number of readings in measurement	60		-
Repeatability at zero	2.00		% full scale
Repeatability at span level	0.00		% full scale
Deviation from linearity	0.31		% of value
Zero drift	0.00		% full scale
Span drift	1.97		% full scale
Volume or pressure flow dependence	1.60		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	1.40		% full scale/10K
Combined interference	0.45		% range
Dependence on voltage	0.50		% full scale/10V
Losses in the line (leak)	1.82		% of value
Uncertainty of calibration gas	2.83		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.00		mg/m³
Lack of fit	0.03		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.01		mg/m³
Ambient temperature dependence	0.20		mg/m³
Combined interference (from MCERTS Certificate)	0.04		mg/m³
Dependence on voltage	0.06		mg/m³
Losses in the line (leak)	0.06		mg/m³
Uncertainty of calibration gas	0.10		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	5.82		mg/m³
Combined uncertainty			0.25		mg/m³
Expanded uncertainty	k =	1.96	0.48		mg/m³
Uncertainty corrected to std conds. (O_2)			0.83		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	8.30		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.61		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	8.81		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	4.04		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	15.3		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	340		340
Uncertainty	±mg/m³	14.3		14.3
Mass Emission	g/hr	2830		2830
Uncertainty	±g/hr	181		181

General Sampling Information

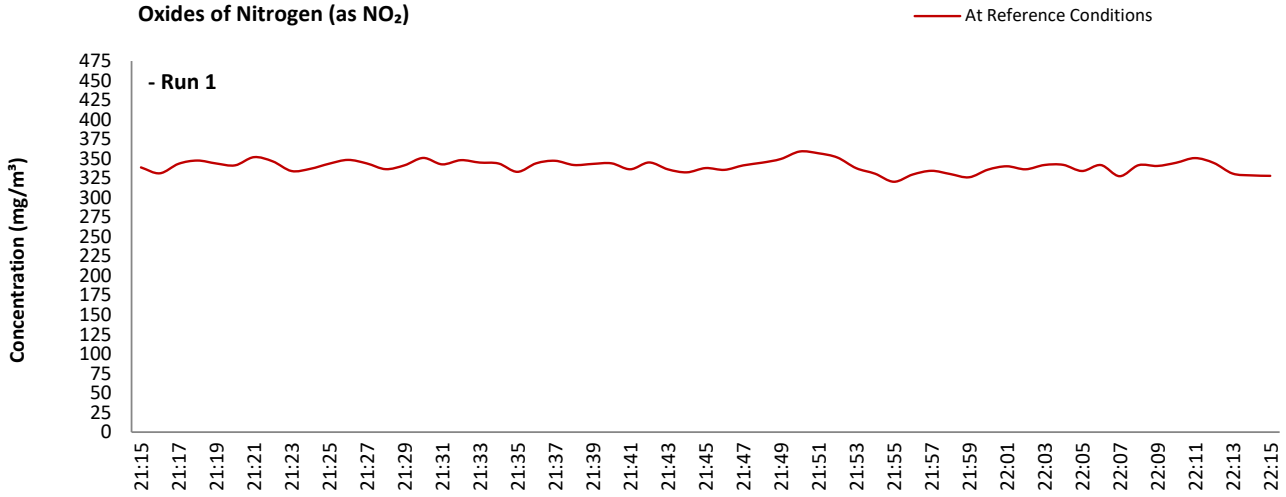
Parameter	Value	
Standard	EN 14792	
Technical Procedure	CAT-TP-39	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	19/09/2020 - 95%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	CYL 12.0313	
Span Gas Expiry Date	18/08/2022	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	408.1	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	C1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO_2): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	21:15 - 22:15
Sampling Dates	-	08/02/2021
Instrument Range	ppm	500
Span Gas Value	ppm	408.1

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	0.50
CAL 1	Zero Drift	ppm	0.50
CAL 1	Zero Drift	%	0.12
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	408.10
CAL 1	Span at Analyser (Post)	ppm	401.20
CAL 1	Span Drift	ppm	-6.90
CAL 1	Zero Adj. Span Drift	%	1.81
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	6 - 8

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	475.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	205.87		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	500.0		ppm
Range Used [A]	1026.1		mg/m³
Cal gas conc.	408.1		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	205.0		mg/m³
Lower of [A] or [B]	205.0		mg/m³
Cal gas conc.	837.5		mg/m³

Performance characteristics	RUN 1		Units
Response time	31		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.00		% full scale
Repeatability at span level	0.10		% full scale
Deviation from linearity	0.47		% of value
Zero drift	0.12		% full scale
Span drift	-1.81		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.10		% of value/kPa
Ambient temperature dependence	0.04		% full scale/10K
Combined interference	0.63		% range
Dependence on voltage	-0.23		% full scale/10V
Converter efficiency	95.0		%
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.01		mg/m³
Lack of fit	0.56		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.06		mg/m³
Ambient temperature dependence	0.01		mg/m³
Combined interference (from MCERTS Certificate)	0.75		mg/m³
Dependence on voltage	-0.03		mg/m³
Converter efficiency	0.30		mg/m³
Losses in the line (leak)	0.00		mg/m³
Uncertainty of calibration gas blending	1.66		mg/m³
Uncertainty of calibration gas	2.38		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	205.87		mg/m³
Combined uncertainty			3.15		mg/m³
Expanded uncertainty	k =	1.96	6.18		mg/m³
Uncertainty corrected to std conds. (O_2)			10.21		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.00		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.30		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	10.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.21		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.65		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	10.4		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	23.3		23.3
Uncertainty	±mg/m³	1.5		1.5
Mass Emission	g/hr	193		193
Uncertainty	±g/hr	15.5		15.5

General Sampling Information

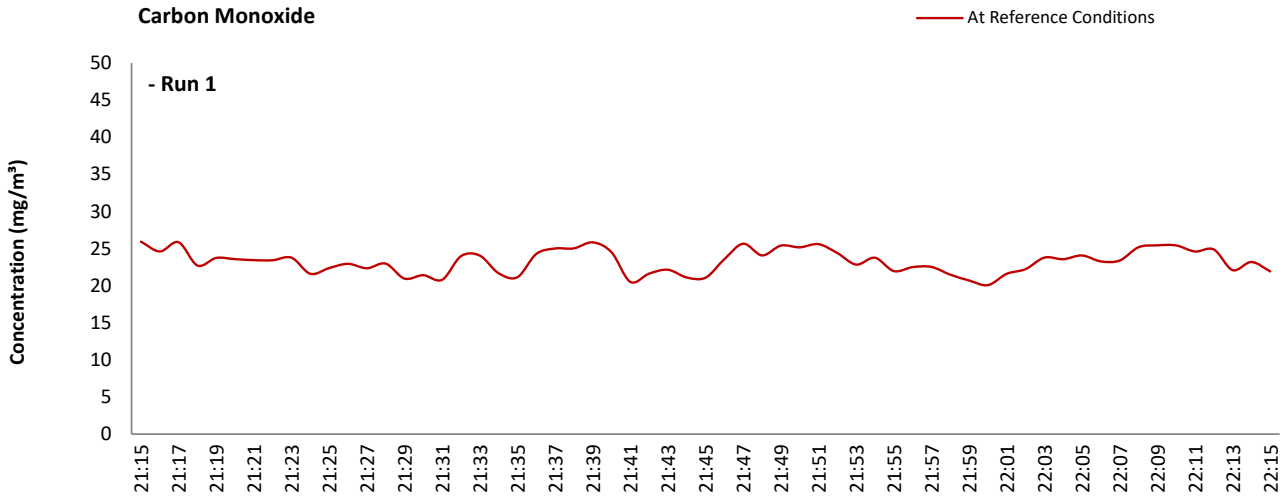
Parameter	Value	
Standard	EN 15058	
Technical Procedure	CAT-TP-39	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	CYL 12.0313	
Span Gas Expiry Date	18/08/2022	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	395	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	C1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	21:15 - 22:15
Sampling Dates	-	08/02/2021
Instrument Range	ppm	500
Span Gas Value	ppm	395.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	0.30
CAL 1	Zero Drift	ppm	0.30
CAL 1	Zero Drift	%	0.08
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	395.00
CAL 1	Span at Analyser (Post)	ppm	394.00
CAL 1	Span Drift	ppm	-1.00
CAL 1	Zero Adj. Span Drift	%	0.33
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	6 - 8

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	225.0		mg/m³ (REF)
Allowable MU	6.0		%
Measured concentration	14.07		mg/m³ (STP, dry)
Range Used	500.0		ppm
Range Used [A]	624.6		mg/m³
Cal gas conc.	395.0		ppm
Conversion	1.25		ppm to mg/m³
MCERTS Range [B]	75.0		mg/m³
Lower of [A] or [B]	75.0		mg/m³
Cal gas conc.	493.4		mg/m³

Performance characteristics	RUN 1		Units
Response time	28		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.10		% full scale
Repeatability at span level	0.20		% full scale
Deviation from linearity	0.43		% of value
Zero drift	0.08		% full scale
Span drift	-0.33		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.22		% of value/kPa
Ambient temperature dependence	-0.20		% full scale/10K
Combined interference	-0.48		% range
Dependence on voltage	-0.35		% full scale/10V
Losses in the line (leak)	0.46		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.03		mg/m³
Lack of fit	0.19		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.05		mg/m³
Ambient temperature dependence	-0.03		mg/m³
Combined interference (from MCERTS Certificate)	-0.21		mg/m³
Dependence on voltage	-0.04		mg/m³
Losses in the line (leak)	0.04		mg/m³
Uncertainty of calibration gas blending	0.11		mg/m³
Uncertainty of calibration gas	0.16		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	14.07		mg/m³
Combined uncertainty			0.41		mg/m³
Expanded uncertainty	k =	1.96	0.80		mg/m³
Uncertainty corrected to std conds. (O_2)			1.32		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	5.70		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	0.36		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	6.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	6.42		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.01		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	6.7		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 6% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

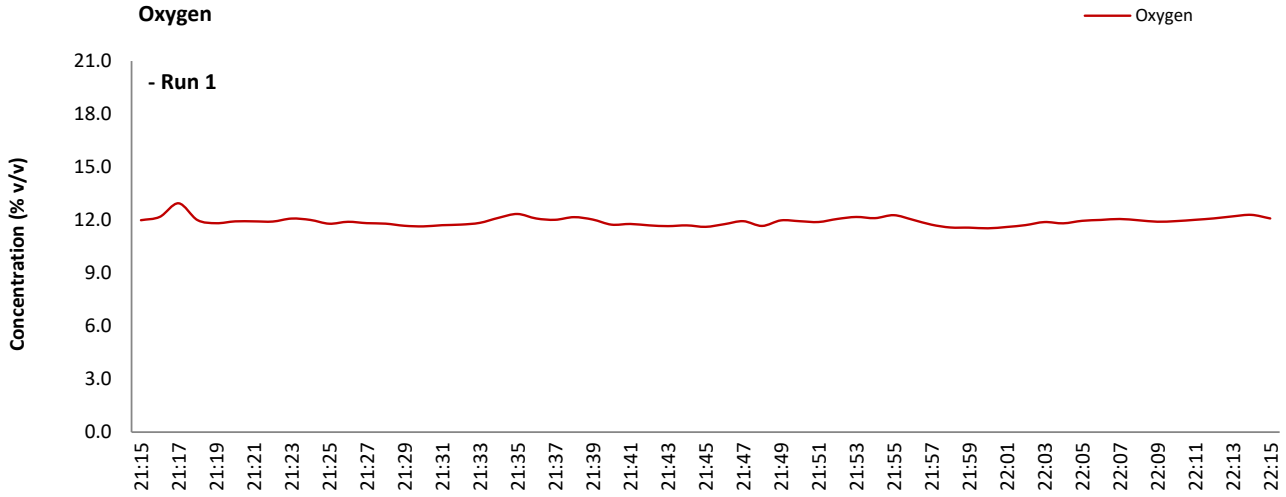
Parameter	Units	Run 1		Mean
Concentration	% v/v	11.9		11.9
Uncertainty	±% v/v	0.35		0.35

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	CAT-TP-39	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 11.0455	
Span Gas Expiry Date	20/01/2026	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (% v/v)	21.28	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	C1	

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	21:15 - 22:15
Sampling Dates	-	08/02/2021
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	10.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	% v/v	0.00
CAL 1	Zero at Analyser (Post)	% v/v	0.05
CAL 1	Zero Drift	% v/v	0.05
CAL 1	Zero Drift	%	0.47
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	% v/v	10.57
CAL 1	Span at Analyser (Post)	% v/v	10.22
CAL 1	Span Drift	% v/v	-0.35
CAL 1	Zero Adj. Span Drift	%	4.00
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	6 - 8

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	11.93		%vol
Range Used	25.0		%vol
Cal gas conc.	21.3		%vol

Performance characteristics	RUN 1		Units
Response time	41		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.02		% full scale
Repeatability at span level	0.02		% full scale
Deviation from linearity	0.27		% of value
Zero drift	0.47		% full scale
Span drift	0.00		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.19		% of value/kPa
Ambient temperature dependence	-0.21		% full scale/10K
Combined interference	0.00		% range
Dependence on voltage	0.02		% full scale/10V
Losses in the line (leak)	1.50		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.00		%vol
Lack of fit	0.04		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.01		%vol
Ambient temperature dependence	-0.03		%vol
Combined interference (from MCERTS Certificate)	0.00		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.10		%vol
Uncertainty of calibration gas	0.14		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	11.93		%vol
Combined uncertainty			0.18		%vol
Expanded uncertainty	k =	1.96	0.35		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.95		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client

Element Materials Technology, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
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Stack Emissions Testing Report Commissioned by
Newbridge Energy Ltd

Installation Name & Address
Blazers Fuels Ltd
Brickfield Lane
Ruthin
Denbighshire
North Wales
LL15 2TN

Stack Reference
Biomass CHP Plant Exhaust

Dates of the Monitoring Campaign
25th March 2021

Job Reference Number
EMT00668

Report Written by
Tom Buller Team Leader MCERTS Level 2 MM 17 1415 TE1 TE2 TE3 TE4

Report Approved by
Tom Buller Team Leader MCERTS Level 2 MM 17 1415 TE1 TE2 TE3 TE4

Report Date
7th April 2021

Version
Version 1

Signature of Report Approver


CONTENTS

Opinions and interpretations expressed herein are outside the scope of Element's ISO 17025 accreditation.

MONITORING OBJECTIVES

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
25th March 2021

Overall Aim of the Monitoring Campaign

Element were commissioned by Newbridge Energy Ltd to carry out stack emissions testing for Blazers Fuels Ltd on the Biomass CHP Plant Exhaust at Ruthin.

The aim of the monitoring campaign was to perform testing, as requested by the customer, for a number of prescribed pollutants. There are no emission limits set for any of the pollutants at this time.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, PM_{10}, $PM_{2.5}$, Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2), Carbon Monoxide

Executive Summary

MONITORING RESULTS

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
25th March 2021

where MU = Measurement Uncertainty associated with the Result

	Concentration				Mass Emission			
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Total Particulate Matter [1]	mg/m³	39.4	3.2	50.0	g/hr	360	34.2	-
PM_{10} [1]	mg/m³	8.6	1.3	-	g/hr	79.5	12.5	-
$PM_{2.5}$ [1]	mg/m³	5.7	0.94	-	g/hr	52.8	9.0	-
Total VOCs (as Carbon) [1]	mg/m³	0.67	0.78	30.0	g/hr	6.1	7.1	-
Oxides of Nitrogen (as NO_2) [1]	mg/m³	227	9.7	475	g/hr	2078	133	-
Carbon Monoxide [1]	mg/m³	15.9	2.3	225	g/hr	145	22.3	-
Oxygen	% v/v	**Dry** 12.8	0.39					
Water Vapour	% v/v	12.4	0.65					
Stack Gas Temperature	°C	167						
Stack Gas Velocity	m/s	14.5	0.24					
Volumetric Flow Rate (ACTUAL)	m³/hr	31034	1493					
Volumetric Flow Rate (REF) [1]	m³/hr	9138	439					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

[1] Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 6% oxygen.

MONITORING DATE(S) & TIMES

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
25th March 2021

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	39.4	g/hr	360	25/03/2021	11:17 - 11:47, 11:48 - 12:18	60
PM_{10}	R1	mg/m³	8.6	g/hr	79.5	25/03/2021	12:30 - 13:30	60
$PM_{2.5}$	R1	mg/m³	5.7	g/hr	52.8	25/03/2021	12:30 - 13:30	60
Total VOCs (as Carbon)	R1	mg/m³	0.67	g/hr	6.1	25/03/2021	14:25 - 15:10, 15:25 - 15:40	60
Oxides of Nitrogen (as NO_2)	R1	mg/m³	227	g/hr	2078	25/03/2021	14:25 - 15:10, 15:25 - 15:40	60
Carbon Monoxide	R1	mg/m³	15.9	g/hr	145	25/03/2021	14:25 - 15:10, 15:25 - 15:40	60
Oxygen	R1	% v/v	12.7			25/03/2021	14:25 - 15:10, 15:25 - 15:40	60
Velocity Traverse	R1					25/03/2021	10:25 - 10:43	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
25th March 2021

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	3 Tonnes / Hour
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Wood Chips
Abatement System	Bag Filter & Cyclone
Abatement System Running Status	On
Fuel	Wood Chips
Plume Appearance	None Visible

MONITORING & ANALYTICAL METHODS

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust
25th March 2021

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Total Particulate Matter	EN 13284-1	CAT-TP-01	MCERTS	EET	CAT-TP-03	Gravimetric	MCERTS	EET	MCERTS	0.27 mg/m³
PM_{10}	US EPA M201A	CAT-TP-18	MCERTS	EET	CAT-TP-03	Gravimetric	MCERTS	EET	MCERTS	0.24 mg/m³
$PM_{2.5}$	US EPA M201A	CAT-TP-18	MCERTS	EET	CAT-TP-03	Gravimetric	MCERTS	EET	MCERTS	0.26 mg/m³
Water Vapour	EN 14790	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	MCERTS	EET	Flame Ionisation Detection by Sick 3006 FID				MCERTS	0.32 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-21	MCERTS	EET	Chemiluminescence by Horiba PG-250				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	CAT-TP-21	MCERTS	EET	NDIR by Horiba PG-250				MCERTS	0.25 mg/m³
Oxygen	EN 14789	CAT-TP-21	MCERTS	EET	Dry Zirconia Cell by Horiba PG-250				MCERTS	0.1 %
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.2 m/s

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element Materials Technology (EET)	ISO 17025 Accreditation Number: 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All Parameters	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.87
Width	m	-
Area	m²	0.59
Port Depth	cm	30
Orientation of Duct	-	Vertical
Number of Ports	-	2
Sample Port Size	-	5" Flange

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Permanent
Inside / Outside	Inside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
Platform has vertical base boards (approx. 0.25m high)	Yes
Platform has chains / self closing gates at top of ladders	No
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

All platforms should be designed in accordance with the requirements in EPA Guidance Note AG1 and EN 15259.

EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	101.5	> 5 Pa	Yes
Mean Velocity	m/s	14.61	-	-
Lowest Gas Velocity	m/s	13.59	-	-
Highest Gas Velocity	m/s	15.53	-	-
Ratio of Above	: 1	1.14	< 3 : 1	Yes
Maximum Angle of Swirl	°	5.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

PLANT PHOTOS

Photo 1

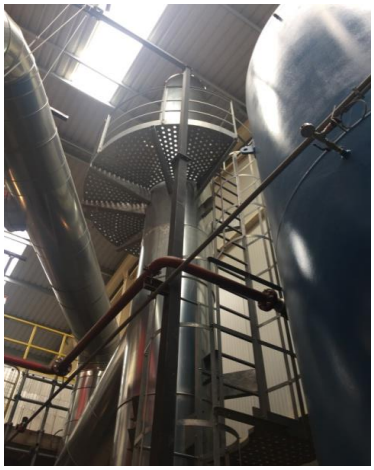
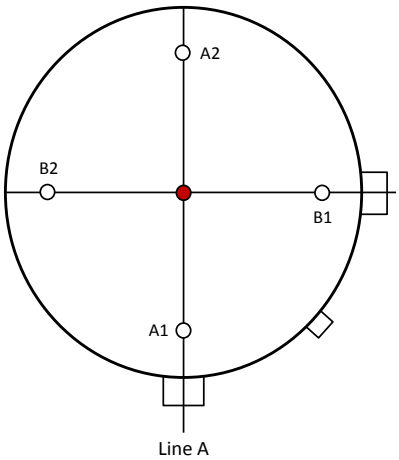


Photo 2

Photo 3

Photo 4

SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point not sampled at
● = combustion gases sample point
○ = non-isokinetic sample point

APPENDIX CONTENTS

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Tom Buller	MCERTS Level 2	MM 17 1415	TE1 TE2 TE3 TE4
Trainee	Joe Watson	MCERTS Trainee	MM 21 1619	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	CAT 7.32
Control Box DGM (2)	-
Box Thermocouples (1)	CAT 3.316
Box Thermocouples (2)	-
Umbilical (1)	CAT 3.316
Umbilical (2)	-
Oven Box (1)	CAT 12.104
Oven Box (2)	-
Heated Probe (1)	CAT 5.120
Heated Probe (2)	CAT 5.115
Heated Probe (3)	CAT 5.140
S-Pitot (1)	CAT 21P.82/21P.87
S-Pitot (2)	CAT 21S.48
L-Pitot	-
Site Balance	CAT 17.39
500g / 1Kg Check Weights	CAT 17.39
Last Impinger Arm	CAT 4.402/4.826
Callipers	CAT 23.36
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-350E	-
Horiba PG-250	CAT 9.7
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
JCT JCC P1 Cooler	CAT 4.43
Gasmet DX4000	-
Gasmet Sampling System	-
Bernath 3006 FID	CAT 8.27
M&C PSS	CAT 12.81
Mass Flow Controller (1)	CAT 6.55
Mass Flow Controller (2)	CAT 6.56
Mass View (1)	CAT 25.43
Mass View (2)	CAT 25.53
Hioki 5043 (V)	CAT 11.112
Hioki 5043 (V)	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	CAT 13.35
Digital Manometer (2)	-
Digital Temperature Meter	-
Stopwatch	CAT 14.53
Barometer	CAT 13.35
Stack Thermocouple (1)	CAT 4.1287
Stack Thermocouple (2)	CAT 4.1298
Stack Thermocouple (3)	CAT 4.984
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
10m Heated Line (1)	CAT 20.110
20m Heated Line (1)	-
20m Heated Line (2)	-
Dual Channel Heater Controller	CAT 3.37
Single Channel Heater Controller	-
Laboratory Balance	CAT 1.18, 1.18a, 1.18b
Tape Measure	CAT 16.43

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
PM_{10}	US EPA M201A	CAT-TP-18
$PM_{2.5}$	US EPA M201A	CAT-TP-18
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-21
Carbon Monoxide	EN 15058	CAT-TP-21
Oxygen	EN 14789	CAT-TP-21
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.87
Stack Width, W	m	-
Stack Area, A	m^2	0.59
Average Stack Gas Temperature, T_a	°C	167.5
Average Stack Gas Pressure	Pa	117.7
Average Stack Static Pressure, P_{static}	kPa	-0.121
Average Barometric Pressure, P_b	kPa	101.4
Average Pitot Tube Calibration Coefficient, C_p	-	0.85

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m^3 p	Conc kg/m^3 p_i
CO_2 (Estimated)	-	8.00	7.01	0.0800	44.01	1.9635	0.15708
O_2	-	12.82	11.22	0.1282	32.00	1.4277	0.18296
N_2	-	79.18	69.35	0.7918	28.01	1.2498	0.98969
Moisture (H_2O)	-	-	12.42	0.1242	18.02	0.8037	0.09980

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P_{STD}	kg/m^3	1.330
Wet Density (STP), P_{STW}	kg/m^3	1.264
Dry Density (Actual), P_{Actual}	kg/m^3	0.824
Average Wet Density (Actual), $P_{ActualW}$	kg/m^3	0.784

Where: P_{STD} = sum of component concentrations, kg/m^3 (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m^3 (including water vapour)

$P_{Actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times ((P_{static} + P_b) / T_a)$

$P_{ActualW}$ (at each sampling point) $= P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF [1]
Temperature	°C	167.5	0.0
Total Pressure	kPa	101.3	101.3
Moisture	%	12.42	0.00
Oxygen (Dry)	%	12.8	6.0

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m^3/hr	31277
Gas Volumetric Flowrate (STP, Wet)	m^3/hr	19381
Gas Volumetric Flowrate (STP, Dry)	m^3/hr	16975
Gas Volumetric Flowrate REF [1]	m^3/hr	9262

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID)

(1 of 1)

Parameter	Units	Value
Date of Survey	-	25/03/2021
Time of Survey	-	10:25 - 10:43
Atmospheric Pressure	kPa	101.4
Average Stack Static Pressure	Pa	-121
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C_p	-	0.85
Number of Lines Available	-	2
Number of Lines Used	-	2

		Sampling Line A					Sampling Line B				
Traverse Point	**Depth m**	**ΔP Pa**	**Temp °C**	**Wet Density kg/m³**	**Velocity m/s**	**Swirl °**	**ΔP Pa**	**Temp °C**	**Wet Density kg/m³**	**Velocity m/s**	**Swirl °**
STATIC (Units: Pa)		*-119.7*					*-123.0*				
Mean		**117.1**	**167.5**	**0.784**	**14.56**		**118.4**	**167.5**	**0.783**	**14.66**	
1	0.13	101.5	167.4	0.784	13.59	2.0	109.2	167.5	0.783	14.10	3.0
2	0.74	132.6	167.5	0.783	15.53	5.0	127.5	167.5	0.783	15.23	3.0

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID) - MEASUREMENT UNCERTAINTY

(1 of 1)

Performance characteristics (Uncertainty Components)	Uncertainty	Value	Units
Standard Uncertainty on the coefficient of the Pitot Tube	u(k)	0.005	-
Standard Uncertainty associated with the mean local dynamic pressures	u(Δpi)	2.434	Pa
- Resolution	u(res)	0.00087	
- Calibration	u(cal)	1.442	
- Drift	u(drift)	0.083	
- Lack of Fit	u(fit)	3.396	
- Overall corrections to dynamic measurements	u(Cf)	4.922	
Standard uncertainty associated with the molar mass of the gas	u(M)	0.00007	-
- $\varphi O_2,w$	-	11.224	
- $\varphi CO_2,w$	-	7.007	
- Oxygen, dry	u(ϕO_2,d)	0.392	
- Carbon Dioxide, dry	u(ϕCO_2,d)	0.245	
- Water Vapour	u(ϕH_2O)	0.634	
- Oxygen, wet	u(ϕO_2,w)	0.353	
- Carbon Dioxide, wet	u(ϕCO_2,w)	0.220	
Standard uncertainty associated with the stack temperature	u(Tc)	2.247	K
Standard uncertainty associated with the absolute pressure in the duct	u(pc)	175.700	Pa
- Atmospheric Pressure	u(patm)	175.692	
- Static Pressure	u(pstat)	1.721	
Standard uncertainty associated with the density in the duct	u(ρ)	0.00422	-
Standard uncertainty associated with the local velocities	u(vi)	0.179	Pa
Standard uncertainty associated with the mean velocity	u(v)	0.121	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	Uc(v)	0.238	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	Uc,rel(v)	1.63	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	Uc(qV,w)	1504.2	m^3/hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00060	
- $u^2(qV,w)$	-	589016	
- $u(qV,w)$	-	767.5	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	Uc,rel(qV,w)	4.81	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	39.4		39.4
Uncertainty	±mg/m³	3.2		3.2
Mass Emission	g/hr	360		360
Uncertainty	±g/hr	34.2		34.2

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	15.5		15.5
Uncertainty	±% v/v	0.81		0.81

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.27		0.27

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	2 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	2 / 2	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, B1 & B2	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	761.3	
Stack static pressure, P_{static}	mmH_2O	-12.2	
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	760.4	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	170.4	
Total mass collected in impingers (silica trap)	g	12.2	
Total mass of liquid collected, V_{lc}	g	182.6	
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.2275	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m^3	1.3791	
Gas meter correction factor, Y_d	-	0.9710	
Average dry gas meter temperature, T_m	°C	23.6	
Average pressure drop across orifice, ΔH	mmH_2O	61.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	1.2421	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.1548	
B_{wo} as a percentage	% v/v	15.48	
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	15.48	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	1.4696	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O_2 correction)	-	No	
% wet oxygen measured in gas stream, $ACT\%O_{2w}$	% v/v	11.38	
% dry oxygen measured in gas stream, $ACT\%O_{2d}$	% v/v	12.99	
% oxygen reference condition, $REF\%O_2$	% v/v	6.00	
O_2 Reference Factor wet $(O_{2REFw}) = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$	-	1.56	
O_2 Reference Factor dry $(O_{2REFd}) = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$	-	1.87	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m^3	0.9429	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m^3	0.6634	
Molecular weight of dry gas stream, M_d			
CO_2 (Estimated)	% v/v	6.00	
O_2	% v/v	12.99	
Total	% v/v	18.99	
N_2	% v/v	81.01	
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	29.48	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	27.70	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.84	
Average of velocity heads, ΔP_{avg}	mmH_2O	9.62	
Average square root of velocity heads, √ΔP	$\sqrt{mmH_2O}$	3.10	
Average stack gas temperature, T_s	°C	166.4	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s} + 273)) / (\sqrt{(M_s)(P_s)})$	m/s	13.19	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m^2	0.59	
$Q_a = (60)(A_s)(V_s)$	m^3/min	470.4	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_{sj})(C_f)) / ((T_s) + 273)$	m^3/min	292.4	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	247.2	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m^3/min	187.6	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m^3/min	132.0	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	8.01	
Nozzle area, A_n	mm^2	50.36	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	98.9	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	11:17 - 11:47, 11:48 - 12:18
Sampling Dates	-	25/03/2021
Sampling Device	-	ISO
Volume Sampled (REF)	m^3	0.6634
Filter I.D. Number	-	47-77063
Start Filter Mass	g	0.14950
End Filter Mass	g	0.17390
Total Mass on Filter	g	0.02440
Probe Rinse I.D. Number	-	PR-47-77063
Start Probe Rinse Mass	g	2.65674
End Probe Rinse Mass	g	2.65848
Total Mass in Probe Rinse	g	0.00174
Total Mass Collected	mg	26.14
Calculated Concentration	mg/m^3	39.40
Balance Uncertainty / LOD	mg/m^3	0.27

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	25/03/2021
Average Volume Sampled (REF)	m^3	0.6634
Filter I.D. Number	-	47-77303
Start Filter Mass	g	0.14776
End Filter Mass	g	0.14774
Total Mass on Filter	g	-0.00002
Probe Rinse I.D. Number	-	PR-47-77303
Start Probe Rinse Mass	g	2.94480
End Probe Rinse Mass	g	2.94477
Total Mass in Probe Rinse	g	-0.00002
Total Mass Collected	mg	-0.04
Calculated Concentration	mg/m^3	-0.07
Balance Uncertainty / LOD	mg/m^3	0.27

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	22.3
Pre-Sampling Leak Rate	l/min	0.17
Post-Sampling Leak Rate	l/min	
Allowable Leak Rate	l/min	0.40
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.2
Allowable MU	%	20.0
MU Acceptable	%	Yes

Silica Gel (Concurrent Water Vapour)	Units	Run 1
Less than 50% Faded	%	Yes

Isokinetic Criterion Compliance	Units	Run 1
Isokinetic Variation	%	98.9
Allowable Isokinetic Range	%	95 - 115
Isokineticity Acceptable	-	Yes

Weighing Uncertainty Criteria	Units	Run 1
Overall Weighing Uncertainty	± mg	0.36
Overall Weighing Uncertainty	± mg/m³	0.54
ELV [Daily ELV for IED]	mg/m³	50.00
Allowable Weighing Uncertainty	mg/m³	2.50
Weighing Uncertainty Acceptable	-	Yes

Filter Temperatures	Units	Run 1
Pre-Conditioning Temperature	°C	180
Post-Conditioning Temperature	°C	160
Maximum Filter Temperature	°C	167

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	20.0
Pre-Sampling Leak Rate	l/min	0.19
Post-Sampling Leak Rate	l/min	
Allowable Leak Rate	l/min	0.40
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m^3	5.0
Blank Acceptable	-	Yes

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number 1	
There are no deviations associated with the sampling employed.	wx	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**	**Symbol**	**Units**	**Run 1**
Sampled Volume (Actual)	V_m	1.3791	uV_m	m^3	0.0276
Sampled Gas Temperature	T_m	296.6	uT_m	K	2.00
Sampled Gas Pressure	ρ_m	101.4	$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.00	uH_m	% v/v	1.00
Leak	L	0.76	uL	%	-
Mass of Particulate	m	26.14	um	mg	0.18
Uncollected Mass	UCM	-0.04	uUCM	mg	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.67	≤1%
Sampled Gas Pressure	%	0.49	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	0.76	≤2%
Mass of Particulate	%	0.54	<5% of ELV
Uncollected Mass	%	-	-

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m^3	1.2421	31.72
Leak	L	mg/m^3	0.173	1.00
Mass of Particulate	L_r	mg	26.140	1.51
Uncollected Mass	UCM	mg	-0.03	1.51

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m^3	1.014
Leak	mg/m^3	0.1733
Mass of Particulate	mg/m^3	0.2713
Uncollected Mass	mg/m^3	-0.0377

	Oxygen Correction Part of MU Budget	
Measured Quantities	**Units**	**Run 1**
O_2 Correction Factor	-	1.87
Stack Gas O_2 Content	% v/v	12.99
MU for O_2 Correction	-	0.12
Overall MU For O_2 Measurement	%	6.24

Parameter	**Units**	**Run 1**
Combined uncertainty	mg/m^3	1.07
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	2.09
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	3.23
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	3.23
Reported Uncertainty	mg/m^3	3.23
Expanded uncertainty (95% confidence), without Oxygen Correction	%	5.3
Expanded uncertainty (95% confidence), with Oxygen Correction	%	8.2
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	8.2
Reported Uncertainty	%	8.2

PM_{10}: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	8.6		8.6
Uncertainty	±mg/m³	1.3		1.3
Mass Emission	g/hr	79.5		79.5
Uncertainty	±g/hr	12.5		12.5

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	10.9		10.9
Uncertainty	±% v/v	0.58		0.58

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.24		0.24

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	US EPA M201A	
Technical Procedure	CAT-TP-18	
Sizing Device	TCR Tecora MSSI 3-Stage Cascade Impactor	
Sizing Device Material	Stainless Steel	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A2	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

PM_{10}: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	760.6	
Stack static pressure, P_{static}	mmH_2O	-12.0	
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	759.7	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	226.4	
Total mass collected in impingers (silica trap)	g	18.6	
Total mass of liquid collected, V_{lc}	g	245.0	
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.3053	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m^3	2.7813	
Gas meter correction factor, Y_d	-	0.9710	
Average dry gas meter temperature, T_m	°C	25.1	
Average pressure drop across orifice, ΔH	mmH_2O	100.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	2.4994	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.1088	
B_{wo} as a percentage	% v/v	10.88	
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	10.88	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	2.8046	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O_2 correction)	-	No	
% wet oxygen measured in gas stream, $ACT\%O_{2w}$	% v/v	11.25	
% dry oxygen measured in gas stream, $ACT\%O_{2d}$	% v/v	12.85	
% oxygen reference condition, $REF\%O_2$	% v/v	6.00	
O_2 Reference Factor wet $(O_{2REFw}) = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$	-	1.54	
O_2 Reference Factor dry $(O_{2REFd}) = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$	-	1.84	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m^3	1.8226	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m^3	1.3584	
Molecular weight of dry gas stream, M_d			
CO_2 (Estimated)	% v/v	8.00	
O_2	% v/v	12.85	
Total	% v/v	20.85	
N_2	% v/v	79.15	
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	29.79	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.51	
Velocity of stack gas, V_{spt}			
Velocity pressure coefficient, C_p	-	0.84	
Average stack gas temperature, T_s	°C	166.9	
Velocity of stack gas (pre-test from traverse), V_{spt}	m/s	15.16	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m^2	0.59	
$Q_a = (60)(A_s)(V_s)$	m^3/min	540.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m^3/min	335.4	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	298.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m^3/min	218.0	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m^3/min	162.4	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	10.05	
Nozzle area, A_n	mm^2	79.39	
Total sampling time, q	min	60	
Velocity at nozzle, V_n	m/s	15.82	
$\%I = V_n / V_{spt} \times 100$	%	104.4	

PM_{10}: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	12:30 - 13:30
Sampling Dates	-	25/03/2021
Sampling Device	-	ISO
Volume Sampled (REF)	m^3	1.3584
2nd Stage of Cascade Impactor (PM_{10} to $PM_{2.5}$)		
Filter I.D. Number (2nd Stage)	-	PM2-02641
Start Filter Mass (2nd Stage)	g	0.12331
End Filter Mass (2nd Stage)	g	0.12723
Total Mass	g	0.00392
3rd Stage of Cascade Impactor (≤ $PM_{2.5}$)		
Filter I.D. Number (3rd Stage)	-	PM3-02641
Start Filter Mass (3rd Stage)	g	0.14824
End Filter Mass (3rd Stage)	g	0.15598
Total Mass	g	0.00774
Total Mass Collected	mg	11.66
Calculated Concentration	mg/m^3	8.58
Balance Uncertainty / LOD	mg/m^3	0.24

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	25/03/2021
Average Volume Sampled (REF)	m^3	1.3584
2nd Stage of Cascade Impactor (PM_{10} to $PM_{2.5}$)		
Filter I.D. Number (2nd Stage)	-	PM2-02561
Start Filter Mass (2nd Stage)	g	0.12797
End Filter Mass (2nd Stage)	g	0.12798
Total Mass	g	0.00001
3rd Stage of Cascade Impactor (≤ $PM_{2.5}$)		
Filter I.D. Number (3rd Stage)	-	PM3-02561
Start Filter Mass (3rd Stage)	g	0.15206
End Filter Mass (3rd Stage)	g	0.15208
Total Mass	g	0.00002
Total Mass Collected	mg	0.03
Calculated Concentration	mg/m^3	0.02
Balance Uncertainty / LOD	mg/m^3	0.24

PM_{10}: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Expected Sampling Rate	l/min	30.0
Pre-Sampling Leak Rate	l/min	0.32
Allowable Leak Rate	l/min	0.60
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.3
Allowable MU	%	20.0
MU Acceptable	%	Yes

Silica Gel (Concurrent Water Vapour)	Units	Run 1
Less than 50% Faded	%	Yes

Isokinetic Criterion Compliance	Units	Run 1
Isokinetic Variation	%	104.4
Allowable Isokinetic Range	%	90 - 130
Isokineticity Acceptable	-	Yes

Filter Temperatures	Units	Run 1
Pre-Conditioning Temperature	°C	180
Post-Conditioning Temperature	°C	160
Maximum Filter Temperature	°C	167

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

Cut Size	Units	Run 1
D_{50} Cut Size	µm	10.05
Allowable D_{50} Cut Size	µm	9 - 11
D_{50} Cut Size Acceptable	-	Yes

PM_{10}: QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	30.0
Pre-Sampling Leak Rate	l/min	0.28
Allowable Leak Rate	l/min	0.60
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m^3	N/A
Blank Acceptable	-	N/A

Method Deviations

Nature of Deviation (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number 1	
There are no deviations associated with the sampling employed.	wx	

PM_{10}: MEASUREMENT UNCERTAINTY CALCULATIONS

		Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**
Sampled Volume (Actual)	V_m	2.7813		uV_m	m^3	0.0556
Sampled Gas Temperature	T_m	298.1		uT_m	K	2.00
Sampled Gas Pressure	ρ_m	101.3		$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.00
Leak	L	1.07		uL	%	-
Mass of Particulate	m	11.66		um	mg	0.33
Uncollected Mass	UCM	0.03		uUCM	mg	-
Particulate Sizing	PS	10.00		uPS	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.67	≤1%
Sampled Gas Pressure	%	0.49	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	1.07	≤2%
Mass of Particulate	%	-	<5% of ELV
Uncollected Mass	%	-	-
Particulate Sizing	%	10.0	-

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m^3	2.4994	3.43
Leak	L	mg/m^3	0.053	1.00
Mass of Particulate	L_r	mg	11.660	0.74
Uncollected Mass	UCM	mg	0.02	0.74
Particulate Sizing	PS	mg	0.50	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m^3	0.221
Leak	mg/m^3	0.0529
Mass of Particulate	mg/m^3	0.2397
Uncollected Mass	mg/m^3	0.0128
Particulate Sizing	mg/m^3	0.4956

	Oxygen Correction Part of MU Budget	
Measured Quantities	**Units**	**Run 1**
O_2 Correction Factor	-	1.84
Stack Gas O_2 Content	% v/v	12.85
MU for O_2 Correction	-	0.11
Overall MU For O_2 Measurement	%	6.13

Parameter	**Units**	**Run 1**
Combined uncertainty	mg/m^3	0.60
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	1.17
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	1.28
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	1.28
Reported Uncertainty	mg/m^3	1.28
Expanded uncertainty (95% confidence), without Oxygen Correction	%	13.6
Expanded uncertainty (95% confidence), with Oxygen Correction	%	14.9
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	14.9
Reported Uncertainty	%	14.9

$PM_{2.5}$: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	5.7		5.7
Uncertainty	±mg/m³	0.94		0.94
Mass Emission	g/hr	52.8		52.8
Uncertainty	±g/hr	9.0		9.0

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	10.9		10.9
Uncertainty	±% v/v	0.58		0.58

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.26		0.26

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	US EPA M201A	
Technical Procedure	CAT-TP-18	
Sizing Device	TCR Tecora MSSI 3-Stage Cascade Impactor	
Sizing Device Material	Stainless Steel	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A2	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

$PM_{2.5}$: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	760.6	
Stack static pressure, P_{static}	mmH_2O	-12.0	
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	759.7	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	226.4	
Total mass collected in impingers (silica trap)	g	18.6	
Total mass of liquid collected, V_{lc}	g	245.0	
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.3053	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m^3	2.7813	
Gas meter correction factor, Y_d	-	0.9710	
Average dry gas meter temperature, T_m	°C	25.1	
Average pressure drop across orifice, ΔH	mmH_2O	100.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	2.4994	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.1088	
B_{wo} as a percentage	% v/v	10.88	
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	10.88	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	2.8046	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O_2 correction)	-	No	
% wet oxygen measured in gas stream, $ACT\%O_{2w}$	% v/v	11.25	
% dry oxygen measured in gas stream, $ACT\%O_{2d}$	% v/v	12.85	
% oxygen reference condition, $REF\%O_2$	% v/v	6.00	
O_2 Reference Factor wet $(O_{2REFw}) = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$	-	1.54	
O_2 Reference Factor dry $(O_{2REFd}) = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$	-	1.84	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m^3	1.8226	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m^3	1.3584	
Molecular weight of dry gas stream, M_d			
CO_2 (Estimated)	% v/v	8.00	
O_2	% v/v	12.85	
Total	% v/v	20.85	
N_2	% v/v	79.15	
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	29.79	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.51	
Velocity of stack gas, V_{spt}			
Velocity pressure coefficient, C_p	-	0.84	
Average stack gas temperature, T_s	°C	166.9	
Velocity of stack gas (pre-test from traverse), V_{spt}	m/s	15.16	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m^2	0.59	
$Q_a = (60)(A_s)(V_s)$	m^3/min	540.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m^3/min	335.4	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	298.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m^3/min	218.0	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m^3/min	162.4	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	10.05	
Nozzle area, A_n	mm^2	79.39	
Total sampling time, q	min	60	
Velocity at nozzle, V_n	m/s	15.82	
$\%I = V_n / V_{spt} \times 100$	%	104.4	

$PM_{2.5}$: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	12:30 - 13:30
Sampling Dates	-	25/03/2021
Sampling Device	-	ISO
Volume Sampled (REF)	m^3	1.3584
3rd Stage of Cascade Impactor (≤ $PM_{2.5}$)		
Filter I.D. Number (3rd Stage)	-	PM3-02641
Start Filter Mass (3rd Stage)	g	0.14824
End Filter Mass (3rd Stage)	g	0.15598
Total Mass	g	0.00774
Total Mass Collected	mg	7.74
Calculated Concentration	mg/m^3	5.70
Balance Uncertainty / LOD	mg/m^3	0.26

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	25/03/2021
Average Volume Sampled (REF)	m^3	1.3584
3rd Stage of Cascade Impactor (≤ $PM_{2.5}$)		
Filter I.D. Number (3rd Stage)	-	PM3-02561
Start Filter Mass (3rd Stage)	g	0.15206
End Filter Mass (3rd Stage)	g	0.15208
Total Mass	g	0.00002
Total Mass Collected	mg	0.02
Calculated Concentration	mg/m^3	0.01
Balance Uncertainty / LOD	mg/m^3	0.26

$PM_{2.5}$: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Expected Sampling Rate	l/min	30.0
Pre-Sampling Leak Rate	l/min	0.32
Allowable Leak Rate	l/min	0.60
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.3
Allowable MU	%	20.0
MU Acceptable	%	Yes

Silica Gel (Concurrent Water Vapour)	Units	Run 1
Less than 50% Faded	%	Yes

Isokinetic Criterion Compliance	Units	Run 1
Isokinetic Variation	%	104.4
Allowable Isokinetic Range	%	90 - 130
Isokineticity Acceptable	-	Yes

Filter Temperatures	Units	Run 1
Pre-Conditioning Temperature	°C	180
Post-Conditioning Temperature	°C	160
Maximum Filter Temperature	°C	167

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

Cut Size	Units	Run 1
D_{50} Cut Size	µm	2.51
Allowable D_{50} Cut Size	µm	2.25 - 2.75
D_{50} Cut Size Acceptable	-	Yes

$PM_{2.5}$: QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	30.0
Pre-Sampling Leak Rate	l/min	0.28
Allowable Leak Rate	l/min	0.60
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m^3	N/A
Blank Acceptable	-	N/A

Method Deviations

Nature of Deviation (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number 1	
There are no deviations associated with the sampling employed.	wx	

$PM_{2.5}$: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**	**Symbol**	**Units**	**Run 1**
Sampled Volume (Actual)	V_m	2.7813	uV_m	m^3	0.0556
Sampled Gas Temperature	T_m	298.1	uT_m	K	2.00
Sampled Gas Pressure	ρ_m	101.3	$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.00	uH_m	% v/v	1.00
Leak	L	1.07	uL	%	-
Mass of Particulate	m	7.74	um	mg	0.35
Uncollected Mass	UCM	0.02	uUCM	mg	-
Particulate Sizing	PS	10.0	uPS	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.67	≤1%
Sampled Gas Pressure	%	0.49	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	1.07	≤2%
Mass of Particulate	%	-	<5% of ELV
Uncollected Mass	%	-	-
Particulate Sizing	%	10.0	-

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m^3	2.4994	2.28
Leak	L	mg/m^3	0.035	1.00
Mass of Particulate	L_r	mg	7.740	0.74
Uncollected Mass	UCM	mg	0.01	0.74
Particulate Sizing	PS	mg	0.33	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m^3	0.147
Leak	mg/m^3	0.0351
Mass of Particulate	mg/m^3	0.2555
Uncollected Mass	mg/m^3	0.0085
Particulate Sizing	mg/m^3	0.3290

	Oxygen Correction Part of MU Budget	
Measured Quantities	**Units**	**Run 1**
O_2 Correction Factor	-	1.84
Stack Gas O_2 Content	% v/v	12.85
MU for O_2 Correction	-	0.11
Overall MU For O_2 Measurement	%	6.13

Parameter	**Units**	**Run 1**
Combined uncertainty	mg/m^3	0.44
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	0.87
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	0.94
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	0.94
Reported Uncertainty	mg/m^3	0.94
Expanded uncertainty (95% confidence)	%	15.2
Expanded uncertainty (95% confidence), with Oxygen Correction	%	16.4
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	16.4
Reported Uncertainty	%	16.4

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	0.67		0.67
Uncertainty	±mg/m³	0.78		0.78
Mass Emission	g/hr	6.1		6.1
Uncertainty	±g/hr	7.1		7.1

General Sampling Information

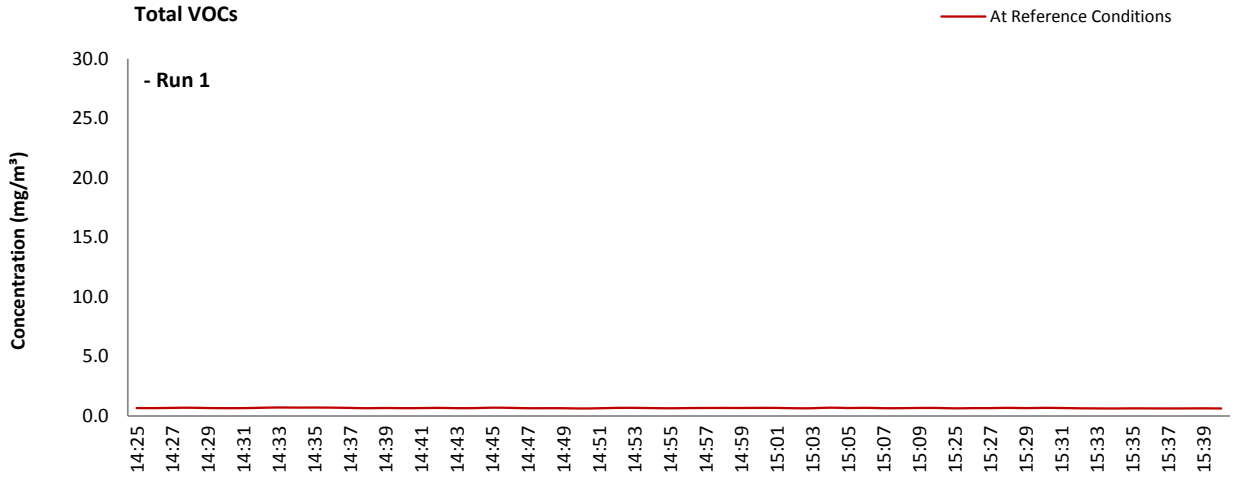
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane in 12% O_2 in N_2 (5 Grade)	
Span Gas Reference Number	CYL 12.0315 in N_2 | CYL 1.0422a in AIR	
Span Gas Expiry Date	02/10/2022 | 27/11/2025	
Span Gas Start Pressure (bar)	100 | 100	
Gas Cylinder Concentration (ppm)	75.94 | 79.82	
Span Gas Set Point (ppm)	78.16	This is the blended concentration of both propane cylinders
Span Gas Uncertainty (%)	2 | 2	
Zero Gas Type	12% O_2 in N_2 (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	C1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	14:25 - 15:10, 15:25 - 15:40
Sampling Dates	-	25/03/2021
Instrument Range	ppm	100
Span Gas Value	ppm	78.2

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.30
	Zero Down Sampling Line (Post)	ppm	0.30
	Zero Drift	ppm	0.00
	Allowable Zero Drift	± ppm	3.91
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	77.60
	Span Down Sampling Line (Post)	ppm	76.70
	Span Drift	ppm	-0.90
	Allowable Span Drift	± ppm	3.91
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	13 - 14

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	30.0		mg/m³ (REF)
Allowable MU	15.0		%
Measured concentration	0.37		mg/m³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m³
Cal gas conc.	78.2		ppm
Conversion	1.61		ppm to mg/m³
MCERTS Range [B]	15.0		mg/m³
Lower of [A] or [B]	15.0		mg/m³
Cal gas conc.	125.5		mg/m³

Performance characteristics	RUN 1		Units
Response time	45		seconds
Number of readings in measurement	60		-
Repeatability at zero	2.00		% full scale
Repeatability at span level	0.00		% full scale
Deviation from linearity	0.31		% of value
Zero drift	0.00		% full scale
Span drift	-1.16		% full scale
Volume or pressure flow dependence	1.60		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	1.40		% full scale/10K
Combined interference	0.45		% range
Dependence on voltage	0.50		% full scale/10V
Losses in the line (leak)	0.77		% of value
Uncertainty of calibration gas	2.83		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.00		mg/m³
Lack of fit	0.03		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.01		mg/m³
Ambient temperature dependence	0.20		mg/m³
Combined interference (from MCERTS Certificate)	0.04		mg/m³
Dependence on voltage	0.06		mg/m³
Losses in the line (leak)	0.00		mg/m³
Uncertainty of calibration gas	0.01		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	0.37		mg/m³
Combined uncertainty			0.22		mg/m³
Expanded uncertainty	k =	1.96	0.43		mg/m³
Uncertainty corrected to std conds. (O_2)			0.78		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	117.02		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.43		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	117.06		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.99		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	15.3		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	227		227
Uncertainty	±mg/m³	9.7		9.7
Mass Emission	g/hr	2078		2078
Uncertainty	±g/hr	133		133

General Sampling Information

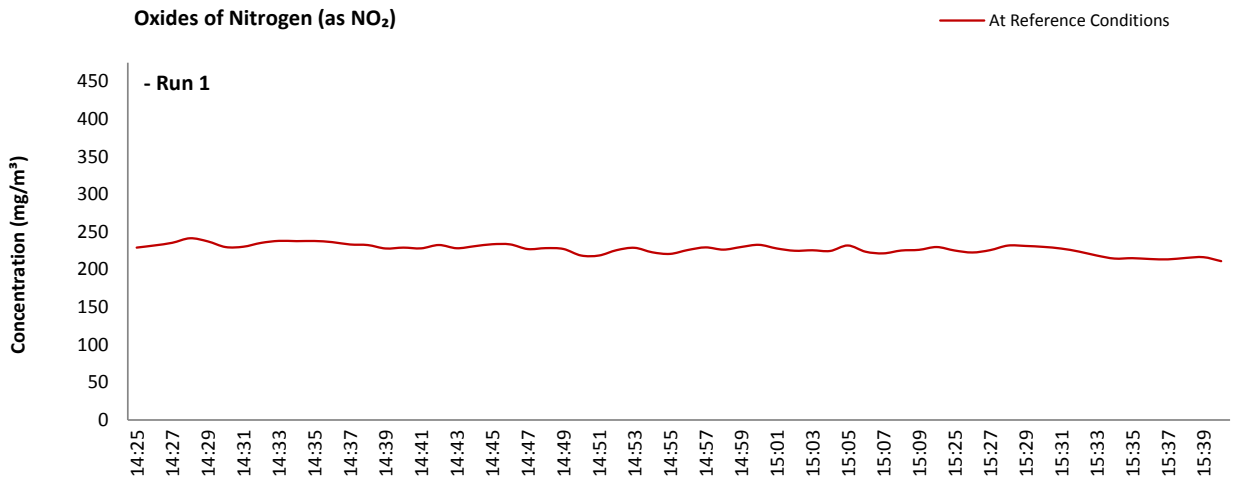
Parameter	Value	
Standard	EN 14792	
Technical Procedure	CAT-TP-21	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	28/08/2020 - 96.5%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	CYL 12.0315	
Span Gas Expiry Date	02/10/2022	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	389.2	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	C1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO_2): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	14:25 - 15:10, 15:25 - 15:40
Sampling Dates	-	25/03/2021
Instrument Range	ppm	250
Span Gas Value	ppm	231.4

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	0.70
CAL 1	Zero Drift	ppm	0.70
CAL 1	Zero Drift	%	0.30
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	231.40
CAL 1	Span at Analyser (Post)	ppm	230.20
CAL 1	Span Drift	ppm	-1.20
CAL 1	Zero Adj. Span Drift	%	0.82
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	13 - 14

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	475.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	125.61		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	250.0		ppm
Range Used [A]	513.1		mg/m³
Cal gas conc.	231.4		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	125.0		mg/m³
Lower of [A] or [B]	125.0		mg/m³
Cal gas conc.	475.0		mg/m³

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	0.39		% of value
Zero drift	0.30		% full scale
Span drift	-0.82		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.18		% full scale/10K
Combined interference	0.60		% range
Dependence on voltage	0.40		% full scale/10V
Converter efficiency	96.5		%
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.05		mg/m³
Lack of fit	0.28		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.11		mg/m³
Ambient temperature dependence	0.03		mg/m³
Combined interference (from MCERTS Certificate)	0.43		mg/m³
Dependence on voltage	0.05		mg/m³
Converter efficiency	0.13		mg/m³
Losses in the line (leak)	0.00		mg/m³
Uncertainty of calibration gas blending	1.02		mg/m³
Uncertainty of calibration gas	1.45		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	125.61		mg/m³
Combined uncertainty			1.90		mg/m³
Expanded uncertainty	k =	1.96	3.73		mg/m³
Uncertainty corrected to std conds. (O_2)			6.75		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.97		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	0.79		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	10.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.24		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.35		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	10.4		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	15.9		15.9
Uncertainty	±mg/m³	2.3		2.3
Mass Emission	g/hr	145		145
Uncertainty	±g/hr	22.3		22.3

General Sampling Information

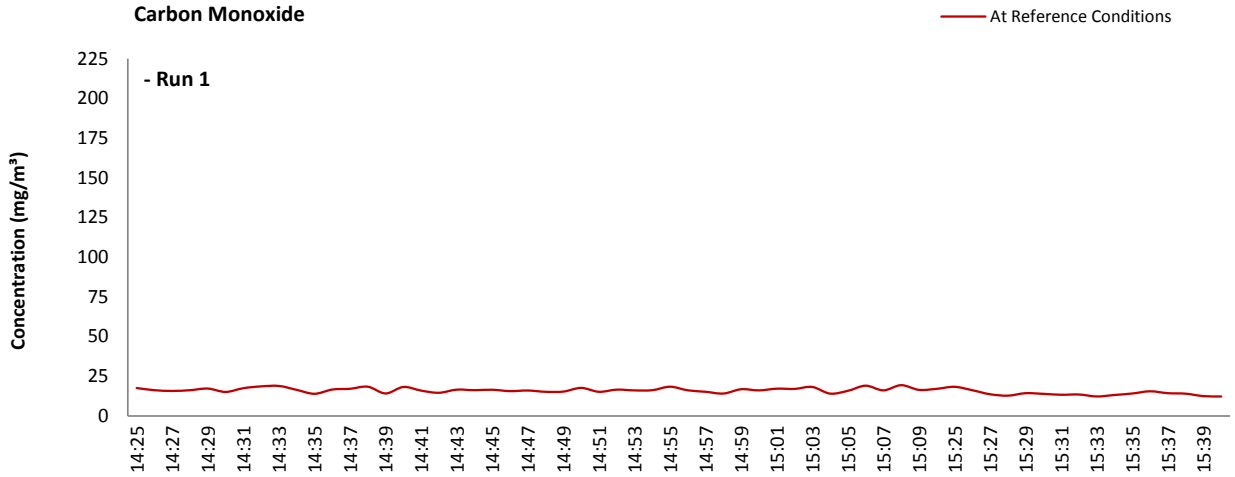
Parameter	Value	
Standard	EN 15058	
Technical Procedure	CAT-TP-21	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	CYL 12.0315	
Span Gas Expiry Date	02/10/2022	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	392	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	C1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 6% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	14:25 - 15:10, 15:25 - 15:40
Sampling Dates	-	25/03/2021
Instrument Range	ppm	200
Span Gas Value	ppm	180.1

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	0.50
CAL 1	Zero Drift	ppm	0.50
CAL 1	Zero Drift	%	0.28
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	180.10
CAL 1	Span at Analyser (Post)	ppm	173.40
CAL 1	Span Drift	ppm	-6.70
CAL 1	Zero Adj. Span Drift	%	4.00
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	13 - 14

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	225.0		mg/m³ (REF)
Allowable MU	6.0		%
Measured concentration	8.78		mg/m³ (STP, dry)
Range Used	200.0		ppm
Range Used [A]	249.8		mg/m³
Cal gas conc.	180.1		ppm
Conversion	1.25		ppm to mg/m³
MCERTS Range [B]	95.0		mg/m³
Lower of [A] or [B]	95.0		mg/m³
Cal gas conc.	225.0		mg/m³

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	0.45		% of value
Zero drift	0.28		% full scale
Span drift	0.00		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.05		% full scale/10K
Combined interference	0.73		% range
Dependence on voltage	0.40		% full scale/10V
Losses in the line (leak)	1.17		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.05		mg/m³
Lack of fit	0.25		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.08		mg/m³
Ambient temperature dependence	0.01		mg/m³
Combined interference (from MCERTS Certificate)	0.40		mg/m³
Dependence on voltage	0.05		mg/m³
Losses in the line (leak)	0.06		mg/m³
Uncertainty of calibration gas blending	0.07		mg/m³
Uncertainty of calibration gas	0.10		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	8.78		mg/m³
Combined uncertainty			0.64		mg/m³
Expanded uncertainty	k =	1.96	1.25		mg/m³
Uncertainty corrected to std conds. (O_2)			2.26		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	14.26		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	0.56		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	6.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	14.58		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.20		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	6.7		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 6% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Blazers Fuels Ltd, Ruthin
Biomass CHP Plant Exhaust

Sample Runs

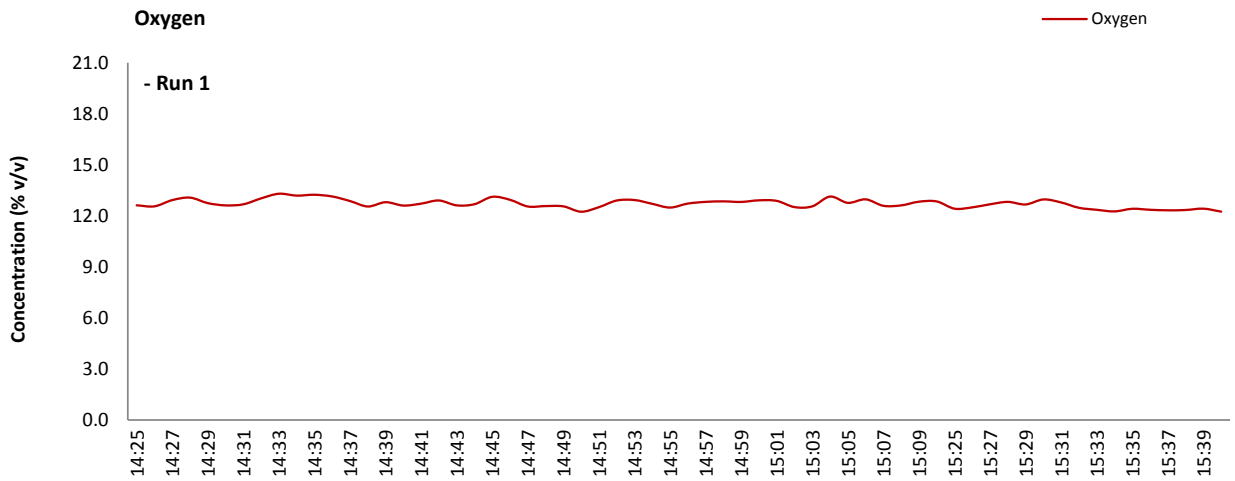
Parameter	Units	Run 1		Mean
Concentration	% v/v	12.7		12.7
Uncertainty	±% v/v	0.39		0.39

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	CAT-TP-21	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 11.0455	
Span Gas Expiry Date	20/01/2026	
Span Gas Start Pressure (bar)	100	
Gas Cylinder Concentration (% v/v)	21.28	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	C1	

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	14:25 - 15:10, 15:25 - 15:40
Sampling Dates	-	25/03/2021
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	10.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	% v/v	0.00
CAL 1	Zero at Analyser (Post)	% v/v	0.09
CAL 1	Zero Drift	% v/v	0.09
CAL 1	Zero Drift	%	0.85
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	% v/v	10.57
CAL 1	Span at Analyser (Post)	% v/v	10.59
CAL 1	Span Drift	% v/v	0.02
CAL 1	Zero Adj. Span Drift	%	0.70
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	13 - 14

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	12.71		%vol
Range Used	25.0		%vol
Cal gas conc.	21.3		%vol

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.04		% full scale
Repeatability at span level	0.04		% full scale
Deviation from linearity	0.04		% of value
Zero drift	0.85		% full scale
Span drift	-0.70		% full scale
Volume or pressure flow dependence	0.20		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	-0.07		% full scale/10K
Combined interference	0.56		% range
Dependence on voltage	0.02		% full scale/10V
Losses in the line (leak)	0.80		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.01		%vol
Lack of fit	0.01		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.02		%vol
Ambient temperature dependence	-0.01		%vol
Combined interference (from MCERTS Certificate)	0.08		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.06		%vol
Uncertainty of calibration gas	0.15		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	12.71		%vol
Combined uncertainty			0.20		%vol
Expanded uncertainty	k =	1.96	0.39		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.03		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client

APPENDIX C

Environmental Management System Information

NBFP000 List of Controlled Documents Status Updated 21.05.21

No:	Document Reference:	Document Name:	Issue date	Review Date	Version	Owner
Controlled Documents						
1	NBEP001	Accident Management Plan (AMP)	April 2021	March 2022	V1.0	Newbridge Energy Limited
2	NBEP002	Air Quality Monitoring Assessments	Monitoring exercise from 2021 on File	Due annually from date of permit issue or the date when the generator is first put into operation, whichever is later (permit issued.		Newbridge Energy Limited
3	NBEP003	Annual Management Review Record	April 2021	March 2022	V1.0	Newbridge Energy Limited
4	NBEP004	Audit Schedule – To be established by new compliance manager when in post				
5	NBEP005	Closure and Decommissioning Plan	April 2021	March 2022	V1.0	Newbridge Energy Limited
6	NBEP006	Complaints Procedure	March 2021	March 2020	V1.0	Newbridge Energy Limited
7	NBEP007	Critical Spares List	March 2021	March 2022	V1.0	Newbridge Energy Limited
8	NBEP008	Daily Site Inspections – See NBEF016				
9	NBEP009	Document Control Process	April 2021	March 2022	V1.0	Newbridge Energy Limited
10	NBEP010	Drainage maintenance plan – included in general ppm plan if needed				

		and daily environmental checks.				
11	NBEP011	Engine Sample Point Methodology	From MCERTS contractor	Issued for annual exercise		Newbridge Energy Limited
12	NBEP012 – EMP-02	Environmental Policy	29.11.2019	March 2022	V2	Newbridge Energy Limited
13	NBEP013	Incident and Non-Conformance Reporting Procedures	March 2021	March 2022	V1.0	Newbridge Energy Limited
14	NBEP014	Instrument Calibration Schedule	ongoing	ongoing	V1.0	Newbridge Energy Limited
15	NBEP015	Laboratory Procedures – no internal laboratory procedures carried out				
16	NBEP016	Legal Register	April 2021	March 2022	V1.0	Newbridge Energy Limited
17	NBEP017	Maintenance Schedule and Procedures			V1.0	Newbridge Energy Limited
18	NBEP018	Odour Management Plan (OMP)	April 2021	March 2022	V1.0	Newbridge Energy Limited
19	NBEP019	P&ID Documents File	Combustor in v 02. All other documents in v. 01	March 2022	V1 and V2	Newbridge Energy Limited
20	NBEP020	Pest Control Procedure	April 2021	March 2022	V1.0	Newbridge Energy Limited
21	NBEP021	Process Description, Monitoring and Controls	April 2021	March 2022	V1.0	Newbridge Energy Limited
22	NBEP022	Qualitative Environmental Risk Assessment	April 2021	March 2022	V1.0	Newbridge Energy Limited

NBFP000 List of Controlled Documents Status Updated 21.05.21

23	NBEP023	Quantitative H1 Model or air quality impact modelling assessment See original permit application document R2298E-R02-v1 for copy of air quality impact modelling assessment submitted with application.	Copy retained in EMS permitting history file	March 2022		Newbridge Energy Limited
24	NBEP024	Raw Materials Inventory	April 2021	March 2022	V1.0	Newbridge Energy Limited
25	NBEP025	Roles and Responsibilities	April 2021	March 2022	V1.0	Newbridge Energy Limited
26	NBEP026	Sampling Procedures				
27	NBEP027	SCADA Policy	April 2021	March 2022	V1.0	Newbridge Energy Limited
28	NBEP028	Site Condition Report	April 2021	March 2022	V1.0	Newbridge Energy Limited
29	NBEP029	Site Drainage plan	2018/02/WD1 2018/02/WD23	March 2022	C4	Newbridge Energy Limited
30	NBEP030	Site inductions forms – See NBEF003 See SOP on general introduction to permitted site operations				
31	NBEP031	Site Location Plan	March 2021	March 2022	V1.0	Newbridge Energy Limited
32	NBEP032	Site Plan	Feb 2018	March 2022	Revision d	Newbridge Energy Limited
33	NBEP033	Statement of Energy Efficiency				Newbridge Energy Limited
34	NBEP034	Statutory Monitoring and Reporting	April 2021	March 2022	V1.0	Newbridge Energy Limited
35	NBEP035	Technical description of the plant, including process flow diagrams, process controls and description of plant systems and equipment	Copy retained in EMS	March 2022		Newbridge Energy Limited

NBFP000 List of Controlled Documents Status Updated 21.05.21

		See original permit application document R2298E-R02-v1 for copy of technical drawings and technical description of the plant.	permitting history file			
36	NBEP036	Training modules – See Environmental Induction and activity specific SOP's for training materials/content				
37	NBEP037	Training Needs Analysis Template	April 2021	March 2022	V1.0	Newbridge Energy Limited
38	NBEP038	Waste acceptance procedure and pre-acceptance procedures	April 2021	March 2022	V1.0	Newbridge Energy Limited
39	NBEP039	Waste Diversion Plan	April 2021	March 2022	V1.0	Newbridge Energy Limited
40	NBEP040	Waste Storage and Handling Standards	April 2021	March 2022	V1.0	Newbridge Energy Limited
41	NBEP041	Organogram	March 2021	March 2022	V1.0	Newbridge Energy Limited
42	NBEP042	Adverse Events Reporting	April 2021	March 2022	V1.0	Newbridge Energy Limited
43	NBEP043	Site permitted boundary and emissions points plans	April 2021	March 2022	V1.0	Newbridge Energy Limited
Controlled Forms						
1	NBEF001	Document Changes Record	March 2021	March 2022	V1.0	Newbridge Energy Limited
2	NBEF002	Documents Withdrawn from Use	March 2021	March 2022	V1.0	Newbridge Energy Limited
3	NBEF003	Induction Check List	March 2021	March 2022	V1.0	Newbridge Energy Limited
4	NBEF004	Corrective and Preventative Measures Tracking Sheet	March 2021	March 2021	V1.0	Newbridge Energy Limited

5	NBEF005	Maintenance record sheet – See PPM Schedule spreadsheet for records				Newbridge Energy Limited
6	NBEF006	Management Review Record	April 2021	March 2022	V1.0	Newbridge Energy Limited
7	NBEF007	Generic Complaint Form	March 2021	March 2022	V1.0	Newbridge Energy Limited
8	NBEF008	Quarterly Waste Return (EA issued document)	14th June 2019	March 2022	V16.3	Newbridge Energy Limited
9	NBEF009	Record of Rejected Loads	March 2021	March 2022	V1.0	Newbridge Energy Limited
10	NBEF010	Schedule 5 Notification Form	Issued with Permit			Newbridge Energy Limited
11	NBEF011	Training Records Form	24.10.19	March 2022	V1.0	Newbridge Energy Limited
12	NBEF012	Waste Pre-Acceptance Assessment Record Form	April 2021	March 2022	V1.0	Newbridge Energy Limited
13	NBEF013	Accident and Incident Record Form	March 2021	March 2022	V1.0	Newbridge Energy Limited
14	NBEF014	External Complaints Log	March 2021	March 2022	V1.0	Newbridge Energy Limited
15	NBEF015	Odour Sniff Test Record Form	March 2021	March 2022	V1.0	Newbridge Energy Limited
16	NBEF016	Daily Site Inspection Form	March 2021	March 2022	V1.0	Newbridge Energy Limited
17	NBEF017	Air 1 Reporting Form	Issued with permit			Newbridge Energy Limited
18	NBEF018	Waste Transfer Note	March 2021	March 2022	V1.0	Newbridge Energy Limited

19	NBEF019	Material 'In' and 'Out' Sheet and List of Approved Suppliers	March 2021	Ongoing	Ongoing	Newbridge Energy Limited
20	NBEF020	Detailed Smoke Monitoring Sheet	March 2021	March 2022	V1.0	Newbridge Energy Limited
21	NBEF021	Odour Complaint Form	April 2021	March 2022	V1.0	Newbridge Energy Limited
22	NBEF022	Accident, Incident and Near Miss Record Form	April 2021	March 2022	V1.0	Newbridge Energy Limited

SOP's

No	SOP Title	Issue Date	Review Date	Version	Owner
001	Daily Site Inspections	April 2021	March 2022	V1.0	Newbridge Energy Limited
002	General Introduction to Permitted Site Operations	April 2021	March 2022	V1.0	Newbridge Energy Limited
003	Duty of Care and Pre acceptance Site Checks Newbridge Energy	April 2021	March 2022	V1.0	Newbridge Energy Limited
004	Acceptance of Material to Site	March 2021	March 2022	V1.0	Newbridge Energy Limited
005	Random Waste Checks and Testing of Incoming Material	April 2021	March 2022	V1.0	Newbridge Energy Limited
006	Fuel Blending and Application	April 2021	March 2022	V1.0	Newbridge Energy Limited
007	Accident, Incident and Spill Response	April 2021	March 2022	V1.0	Newbridge Energy Limited
008	Dark Smoke Checks Procedure	April 2021	March 2022	V1.0	Newbridge

					Energy Limited
009	Management of Process Derived Wastes				
010	Daily Odour Checks	April 2021	March 2022	V1.0	Newbridge Energy Limited
011	CHP Plant Biomass Boiler Plant Start-Up following Emergency Stops	May 2021	March 2022	V1.0	Newbridge Energy Limited
012	CHP Plant Biomass Boiler Plant Start-Up following Shutdown	May 2021	March 2022	V1.0	Newbridge Energy Limited
013	CHP Plant Biomass Boiler Plant Emergency Stops	May 2021	March 2022	V1.0	Newbridge Energy Limited
014	CHP Plant Biomass Boiler Planned Plant Shutdown	May 2021	March 2022	V1.0	Newbridge Energy Limited

Reference Documents

No	Reference Document Title	Destination File	Subject Area
1	Site Permit	Planning Documentation and Permits	NRW permit requirements
2	Planning Notice	Planning Documentation and Permits	Planning requirements
3	Permit Application Documents and Email Communication History	Permit Application History	Application documents and email communication. Includes email communication regarding application of

			Regulatory Position Statement 213 with respect to storage of waste wood at the site.
4	App F R2298D-R02-v4 – Original air quality impact modelling assessment submitted to support permit application	Permit Application History	Basis of risk assessment of emissions to atmosphere with respect to air quality impacts.
5	R2298E-R03-v1-Ruthin PO1 – Agreement with NRW ref PO1 of permit - methodology for monitoring of dark smoke	Permit Application History	Agreed methodology for monitoring of dark smoke
6	Manufacturer's Manual	Manufactures' Manual	Referenced in site permit that operator must operate plant according to this.
7	Environmental Permitting Technical Note 5/1(18) Reference document for the incineration / combustion of waste wood Revised: 2018	Guidance Notes	Referenced in site permit as relevant BAT standards for site and that site must operate in accordance with this document.
8	Link to RPS 213 Storage of wood waste prior to use in a Part B incinerator	Guidance Notes	Regulatory position statement that allows up to 125t of wood waste to be stored without a permit - and conditions that must be met for this to apply.
9	Technical Guidance WM3 – Guidance on the Classification and assessment of waste (First Edition V.1.1 GB January 2021)	Guidance Note	Guidance on waste characterisation and classification methodology
10	M4 Technical Guidance Note (Monitoring), Guidelines for Ash Sampling and Analysis, Environment Agency, Version 7, June 2006	Guidance Note	Methodology for sampling and analysis of ash.

Key

Grey – Document not required

Amber – Document still under development