

# Report for the Periodic Monitoring of Emissions to Atmosphere

## Asgard Renewables Ltd

### A2 - Edina Engine

Permit No: EPR/AB3097FU  
Installation: Asgard Renewables Cardigan  
Monitoring Dates: 17th August 2023  
Site Address: Unit 2 Crugmore Farm, Penparc, Cardigan, SA43 1RD

|                 |                     |               |                        |        |           |
|-----------------|---------------------|---------------|------------------------|--------|-----------|
| Report Number:  | ES-1418             | Version:      | 1                      | Visit: | 1 in 2023 |
| Date of Report: | 18th September 2023 |               |                        |        |           |
| Report Author:  | Thomas Arden        |               |                        |        |           |
| MCERTS No:      | MM 18 1478          | MCERTS Level: | 2 (TE1, TE2, TE3, TE4) |        |           |
| Approved By:    | Ian Baggley         | Function:     | Training Manager       |        |           |
| MCERTS No:      | MM 05 653           | MCERTS Level: | 2 (TE1, TE2, TE3, TE4) |        |           |

Signed:



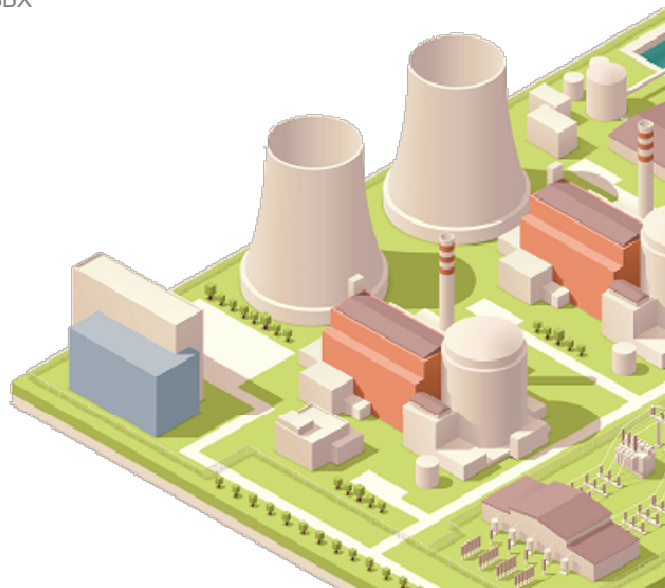
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### YOUR INDUSTRY EXPERTS



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# Executive Summary

## Monitoring Objectives

Envirocare Technical Consultancy were contracted by Asgard Renewables Ltd to carry out emissions monitoring, to determine the compliance of A1 - 2G Engine with the conditions specified in the operators permit (EPR/AB3097FU) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

## Emission Point Identification

| Substances to be Monitored               | A2 - Edina Engine |
|------------------------------------------|-------------------|
| Carbon Monoxide                          | ✓                 |
| Oxides of Nitrogen (as NO <sub>2</sub> ) | ✓                 |
| Total VOC                                | ✓                 |
| Oxygen                                   | ✓                 |
| Sulphur Dioxide                          | ✓                 |
| Water Vapour                             | ✓                 |

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

# Executive Summary

## Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

|                                          |    | Concentration |                |                                  | Reference Conditions                       | Mass Emission |               |                                  | Sampling Date | Sampling Times |
|------------------------------------------|----|---------------|----------------|----------------------------------|--------------------------------------------|---------------|---------------|----------------------------------|---------------|----------------|
| Substance                                |    | Limit (mg/m³) | Result (mg/m³) | Measurement Uncertainty (MU) +/- |                                            | Limit (g/hr)  | Result (g/hr) | Measurement Uncertainty (MU) +/- |               |                |
| Carbon Monoxide                          | R1 | 1400          | 776            | 9.0                              | 273k, 101.3kPa, Dry Gas, 5% O <sub>2</sub> | -             | -             | -                                | 17/08/2023    | 15:11-16:11    |
| Oxides of Nitrogen (as NO <sub>2</sub> ) | R1 | 500           | 573            | 11                               |                                            | -             | -             | -                                | 17/08/2023    | 15:11-16:11    |
| Total VOC                                | R1 | 1000          | 1028           | 14                               |                                            | -             | -             | -                                | 17/08/2023    | 15:11-16:11    |
| Sulphur Dioxide                          | R1 | 350           | 30.3           | 2.35                             |                                            | -             | -             | -                                | 17/09/2023    | 15:11-16:11    |
| Oxygen                                   | R1 | -             | 7.2%           | 0.56                             | As Measured, Dry Gas                       | -             | -             | -                                | 17/08/2023    | 15:11-16:11    |

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 5% O<sub>2</sub>.

# Supporting Information

## Appendix 1: General Information

### Operating Information

| Parameter                                    | Process Details   |
|----------------------------------------------|-------------------|
| Process Type                                 | Bio-gas Engine    |
| Continuous or Batch Process                  | Continuous        |
| Operating Status                             | Normal            |
| Feedstock                                    | -                 |
| Normal Load, Throughput or Continuous Rating | 450kw             |
| Abatement System                             | None              |
| Abatement System Status                      | N/A               |
| Process Fuel                                 | Biogas from waste |
| Plume Appearance                             | None visible      |

### Monitoring Deviations

| Parameter      | Run | Deviation                                                          |
|----------------|-----|--------------------------------------------------------------------|
| All Parameters | All | There are no deviations associated with the monitoring undertaken. |

### Monitoring Organisation Staff Details

| Personnel  | Position    | MCERTS Level           | MCERTS Number |
|------------|-------------|------------------------|---------------|
| Mr T Arden | Team Leader | 2 (TE1, TE2, TE3, TE4) | MM 18 1478    |
| Mr J Doyle | Team Leader | Trainee                | MM 22 1757    |

### Monitoring Methods

| Pollutant Species  | Standard    | Technical Procedure | Testing MCERTS | Analysis Laboratory                                                      | Analytical Procedure | Analytical Technique | Analysis MCERTS |
|--------------------|-------------|---------------------|----------------|--------------------------------------------------------------------------|----------------------|----------------------|-----------------|
| Sulphur Dioxide    | BS EN 14791 | ETC-SE-14           | Yes            | RPS                                                                      | C27(U)               | IC                   | Yes             |
| Carbon Monoxide    | BS EN 15058 | ETC-SE-10 (a/b)     | Yes            | NDIR by Horiba PG-250 or PG350E                                          |                      |                      |                 |
| Oxides of Nitrogen | BS EN 14792 | ETC-SE-10 (a/b)     | Yes            | Chemiluminescence by Horiba PG-250 or Horiba PG-350                      |                      |                      |                 |
| Oxygen             | BS EN 14789 | ETC-SE-10 (a/b)     | Yes            | Dry Zirconia Cell by Horiba PG-250 or Dry Paramagnetic by Horiba PG-350E |                      |                      |                 |
| Total VOC          | BS EN 12619 | ETC-SE-04           | Yes            | Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID             |                      |                      |                 |
| Water Vapour       | BS EN 14790 | ETC-SE-11           | Yes            | ENV                                                                      | ETC-SE-11            | Gravimetric          | Yes             |

Envirocare: 2522 | RPS Laboratories Ltd (RPS): 0605

## Equipment Checklist

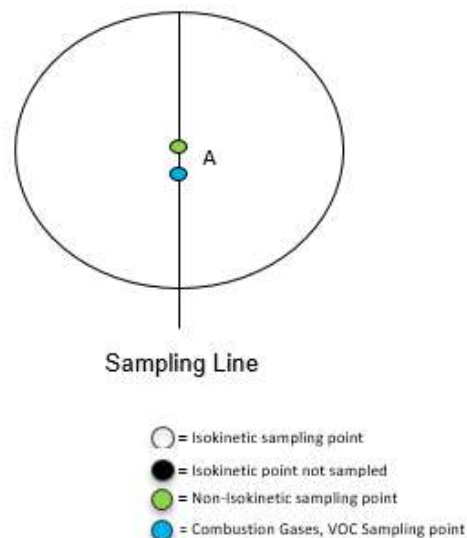
| Extractive Sampling    |                | Instrumental Analysers      |                | Miscellaneous Items           |                |
|------------------------|----------------|-----------------------------|----------------|-------------------------------|----------------|
| Equipment Type         | Equipment I.D. | Equipment Type              | Equipment I.D. | Equipment Type                | Equipment I.D. |
| Control Box DGM        | 8.05(b)        | Horiba PG-250               | -              | Tape Measure                  | 17.02          |
| Box Thermocouples      | -              | Horiba PG-250 SRM           | -              | Bevel Box                     | -              |
| Box Thermocouple In    | -              | Horiba PG-350               | 12.03          | Stopwatch                     | 10.03/10.11    |
| Box Thermocouple Out   | -              | JCT JCC Cooler              | -              | Barometer                     | 11.04          |
| Control Box Timer      | -              | MAK10 Cooler                | -              | Digital Manometer             | 24. a/b        |
| Umbilical              | -              | Horiba PS200 Cooler         | -              | Digital Temperature Meter     | 24. a/b        |
| Oven Box               | -              | M&C PSS Gas Preparation     | 3.42b          | Dual Channel Heat Controller  | -              |
| Heated Probe (1)       | -              | Gasmet DX4000 FTIR          | -              | 1m Heated Line                | -              |
| Heated Probe (2)       | -              | Gasmet Sampling System      | -              | 3m Heated Line                | -              |
| Stack Thermocouple (1) | -              | SK-Thermo FID               | 13.04          | 5m Heated Line                | -              |
| Stack Thermocouple (2) | -              | Bernath 3006 FID            | -              | 10m Heated Line               | -              |
| S-Type Pitot (1)       | -              | Testo 350XL                 | -              | 20m Heated Line               | 5.11           |
| S-Type Pitot (2)       | -              | M&C PSP 4000                | 7.04           | 30m Heated Line               | -              |
| L-Type Pitot           | -              | Easylogger EN-EL-12 Bit     | -              | Impinger Arm Thermocouple (1) | 3.17A          |
| Site Balance           | 18.06          | Hioki 5043 (V)              | -              | Impinger Arm Thermocouple (2) | 3.18A          |
| 500g Check Weight      | 18.06 500g     | Analyser Temperature Logger | -              | Dioxins Kit Thermocouple      | -              |
| 1KG Check Weight       | 18.06 1kg      | -                           | -              | Sample Temperature Logger     | -              |
| Digital Callipers      | 16.01          | -                           | -              | Laboratory Balance            | -              |

## Appendix 2: A2 - Edina Engine Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

| Parameter                   | Units          | Value    |
|-----------------------------|----------------|----------|
| Type                        | -              | Circular |
| Depth                       | m              | -        |
| Width                       | m              | -        |
| Area                        | m <sup>2</sup> | -        |
| Port Depth                  | cm             | 9.0      |
| Orientation of Stack / Duct | -              | Angled   |
| Sampling Port Size          | -              | 1" BSP   |
| Number of Ports             | -              | 1        |

| Manual Sampling Points       | Used / Required |
|------------------------------|-----------------|
| Number of Sampling Lines     | 1 / 1           |
| Number of Sampling Points    | 1 / 1           |
| Instrumental Sampling Points | Used / Required |
| Number of Sampling Lines     | 1 / 1           |
| Number of Sampling Points    | 1 / 1           |

| Platform Type and Location            |              |
|---------------------------------------|--------------|
| Platform Type - Permanent / Temporary | Ground Level |
| Location - Inside / Outside           | Inside       |

| EA Technical Guidance Note M1 Platform Requirements |                                                                                  |     |
|-----------------------------------------------------|----------------------------------------------------------------------------------|-----|
| Load Baring Capacity                                | Load bearing capacity of platform sufficient to fulfil the measurement objective | Yes |
| Position & Work Space                               | Sufficient work area to manipulate probe & operate the measurement instruments   | Yes |
|                                                     | Depth of work area > internal diameter of stack and wall thickness plus 1.5m     | Yes |
|                                                     | Ports on vertical ducts 1.2m to 1.5m above platform floor                        | No  |
|                                                     | Platform has chains / self closing gates at top of ladders                       | Yes |
| Fall Prevention                                     | Platform has adequate drainage to prevent accumulation of free-standing water    | N/A |
|                                                     | Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)                    | N/A |
|                                                     | Gaps between handrails not >0.5m                                                 | N/A |
| Access                                              | Platform has vertical base boards (approx. 0.25m high)                           | N/A |
|                                                     | Access to sampling ports unhindered by obstructions                              | Yes |
|                                                     | Easy & safe access and egress available                                          | Yes |

### Sampling Location / Platform Recommendations

Although the platform does not meet the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, it is adequate for the monitoring specified in the Site Specific Protocol.

## Instrumental Gas Analyser Calibrations

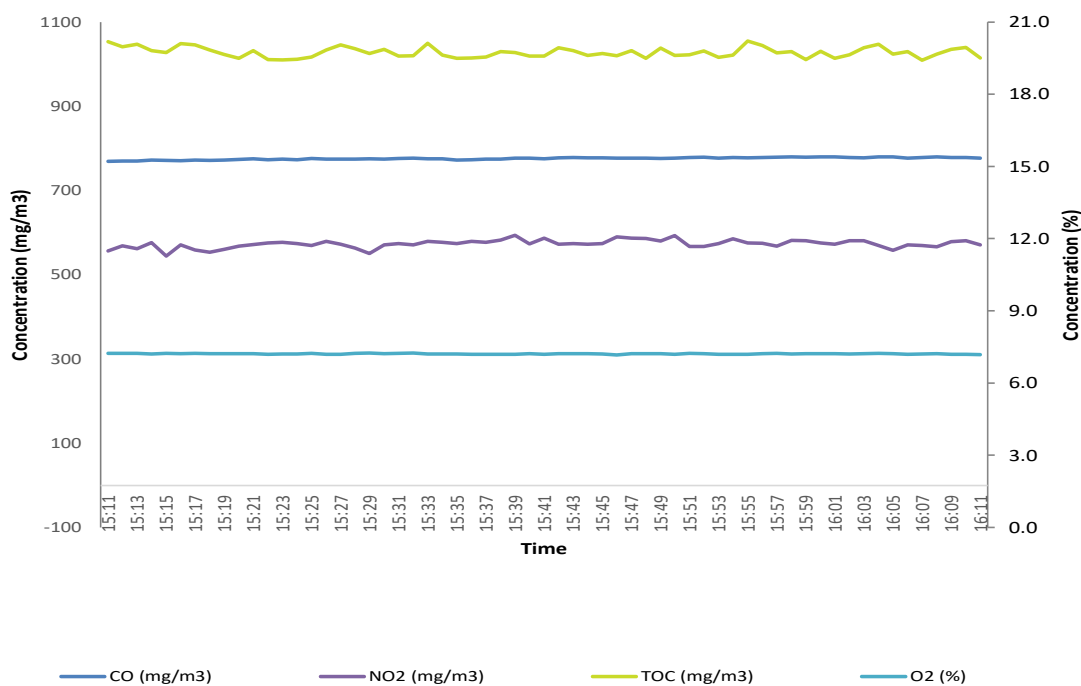
| Date       | Operators | Combustion Gas Analyser | Flame Ionisation Detector |
|------------|-----------|-------------------------|---------------------------|
| 17/08/2023 | TA/MK     | ETC-S12.03              | ETC-S13.04                |

| Calibration Gas   | Certified Concentration | Analyser Range | T90 Time | Analyser Span | Pre-sample Cal |      | Post-sample Cal |      | Zero Drift (%) | Span Drift (%) | Drift Acceptable |
|-------------------|-------------------------|----------------|----------|---------------|----------------|------|-----------------|------|----------------|----------------|------------------|
|                   |                         |                |          |               | Zero           | Span | Zero            | Span |                |                |                  |
| Carbon Monoxide   | 161ppm                  | 200ppm         | 67       | 161           | 0.00           | 161  | 0.30            | 158  | 0.19           | -2.05          | Yes              |
| Nitrogen Monoxide | 201.9ppm                | 250ppm         | 67       | 202           | 0.00           | 202  | 0.40            | 198  | 0.20           | -2.03          | Yes              |
| Propane           | 81ppm                   | 100ppm         | 65       | 81.0          | -0.10          | 81.0 | -1.50           | 82.0 | -1.85          | 3.09           | Yes              |
| Oxygen            | 20.77%                  | 25%            | 57       | 20.8          | -0.08          | 20.8 | -0.22           | 20.4 | -1.06          | -0.72          | Yes              |

## Instrumental Gas Analyser Results

| Substance                                | Run | Corrected Concentration |      |      | Units             | Basis                              | O <sub>2</sub> Correction |
|------------------------------------------|-----|-------------------------|------|------|-------------------|------------------------------------|---------------------------|
|                                          |     | Average                 | Max  | Min  |                   |                                    |                           |
| Carbon Monoxide                          | 1   | 776                     | 780  | 769  | mg/m <sup>3</sup> | -                                  | 5%                        |
| Oxides of Nitrogen (as NO <sub>2</sub> ) | 1   | 573                     | 594  | 544  | mg/m <sup>3</sup> | NO <sub>x</sub> as NO <sub>2</sub> | 5%                        |
| Total VOC                                | 1   | 1028                    | 1055 | 1009 | mg/m <sup>3</sup> | VOC as C                           | 5%                        |
| Oxygen                                   | 1   | 7.2                     | 7.2  | 7.2  | %                 | -                                  | -                         |

## Instrumental Gas Analyser Chart - Run 1



## Sulphur Dioxide - Run 1 Calculations

| Sampling Details           |          |                    |
|----------------------------|----------|--------------------|
| Meter Box Number           | 8.05 (b) | -                  |
| Gas Meter Coefficient      | 0.956    | -                  |
| Pitot Coefficient          | -        | -                  |
| Stack Gas Molecular Weight | 30.2     | g/mole             |
| Static Pressure in Stack   |          | cmH <sub>2</sub> O |

| Analysis Details            |         |                    |
|-----------------------------|---------|--------------------|
| Collection Media            | H2O2    |                    |
| 1st Collector Reference     | Imp A&B |                    |
| 1st Collector Concentration | 2756.6  | µg                 |
| 2nd Collector Reference     | Imp C   |                    |
| 2nd Collector Concentration | 7.656   | µg                 |
| Blank Concentration         | < 0.19  | mg/Nm <sup>3</sup> |
| Has breakthrough occurred?  | No      | -                  |

| Isokineticity Details         |      |     |
|-------------------------------|------|-----|
| Nozzle Diameter               | -    | mm  |
| Average Gas Meter Temperature | 25.0 | °C  |
| Average Stack Temperature     | 500  | °C  |
| Average Stack Velocity        | -    | m/s |
| Isokineticity                 | -    | %   |

| Date       | Operators |
|------------|-----------|
| 17/09/2023 | TA/JD     |

| Parameter           | Before | After | Unit  |
|---------------------|--------|-------|-------|
| Barometric Pressure | 1019   | 1019  | mbar  |
| Ambient Temperature | 19.0   | 20.0  | °C    |
| Leak Check          | 0.01   | 0.01  | L/min |
| Time                | 15:11  | 16:11 | -     |

| Emissions Calculations         |         |                    |
|--------------------------------|---------|--------------------|
| Total Sampling Time            | 60.0    | min                |
| Gas Meter Difference           | 120.0   | L                  |
| Corrected Gas Meter Volume     | 114.7   | L                  |
| Mean Sampling Rate             | 1.9     | L/min              |
| Gas Meter Volume (STP Dry)     | 0.106   | Nm <sup>3</sup>    |
| Gas Meter Volume (REF)         | 0.091   | Nm <sup>3</sup>    |
| Stack Gas Water Vapour Content | 10.4    | % v/v              |
| Stack Gas Oxygen Content       | 7.2     | % v/v              |
| Emission Limit Value           | 350     | mg/Nm <sup>3</sup> |
| Concentration (REF)            | 30.3    | mg/Nm <sup>3</sup> |
| Mass Emissions (REF)           | #DIV/0! | g/hr               |

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 5% O<sub>2</sub>.

## Uncertainty

### Uncertainty of Carbon Monoxide by Horiba Gas Analyser - Run 1

| Parameter                  | Value | Unit              |
|----------------------------|-------|-------------------|
| Emission Limit Value (ELV) | 1400  | mg/m <sup>3</sup> |
| Reading                    | 620.6 | ppm               |
| Span Gas Certified Value   | 161   | ppm               |
| Range                      | 200   | ppm               |

| Cal Gas |
|---------|
| CO      |

| Source of Uncertainty                                                             | Uncertainty Criteria | Probability Distribution | Divisor | Source Uncertainty u | Combined Uncertainty u <sup>2</sup> |
|-----------------------------------------------------------------------------------|----------------------|--------------------------|---------|----------------------|-------------------------------------|
| Zero Drift/Lower limit of detection (ppm)                                         | 0.10                 | Rectangular              | 1.73    | 0.06                 | 0.003                               |
| Span Drift (ppm)                                                                  | 3.0                  | Rectangular              | 1.73    | 1.73                 | 3.00                                |
| Linearity (% of value)                                                            | 0.46                 | Rectangular              | 1.73    | 1.65                 | 2.72                                |
| Setting Gas Divider (% of value)                                                  | 0.35                 | Normal                   | 1.00    | 2.17                 | 4.72                                |
| Interference (% of value)                                                         | -0.48                | Rectangular              | 1.73    | -1.72                | 2.96                                |
| Standard deviation of repeatability at zero point (% of range)                    | 0.10                 | Rectangular              | -       | 0.20                 | 0.04                                |
| Standard deviation of repeatability at span point (% of range)                    | 0.20                 | Rectangular              | -       | 0.40                 | 0.16                                |
| <b>Total</b>                                                                      |                      |                          |         |                      | 13.60                               |
| <b>Combined Standard Uncertainty [(sum u<sup>2</sup>)<sup>0.5</sup>]</b>          |                      |                          |         |                      | 3.69                                |
| <b>Expanded Total Uncertainty (ppm) (95% confidence)</b>                          |                      |                          |         |                      | 7.2                                 |
| <b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>       |                      |                          |         |                      | 1                                   |
| <b>Expanded Total Uncertainty (mg/m<sup>3</sup>) (95% confidence)</b>             |                      |                          |         |                      | 9.0                                 |
| <b>Expanded Total Uncertainty as a % of emission limit value (95% confidence)</b> |                      |                          |         |                      | 0.6                                 |

### Uncertainty of Oxides of Nitrogen by Horiba Gas Analyser - Run 1

| Parameter                  | Value | Unit              |
|----------------------------|-------|-------------------|
| Emission Limit Value (ELV) | 500   | mg/m <sup>3</sup> |
| Reading                    | 279.2 | ppm               |
| Span Gas Certified Value   | 202   | ppm               |
| Range                      | 250   | ppm               |

| Cal Gas |
|---------|
| NO      |

| Source of Uncertainty                                                             | Uncertainty Criteria | Probability Distribution | Divisor | Source Uncertainty u | Combined Uncertainty u <sup>2</sup> |
|-----------------------------------------------------------------------------------|----------------------|--------------------------|---------|----------------------|-------------------------------------|
| Zero Drift/Lower limit of detection (ppm)                                         | 0.00                 | Rectangular              | 1.73    | 0.000                | 0.000                               |
| Span Drift (ppm)                                                                  | 3.70                 | Rectangular              | 1.73    | 2.14                 | 4.56                                |
| Linearity (% of value)                                                            | 0.76                 | Rectangular              | 1.73    | 1.23                 | 1.50                                |
| Setting Gas Divider (% of value)                                                  | 0.35                 | Normal                   | 1.00    | 0.98                 | 0.95                                |
| Interference (% of value)                                                         | 0.63                 | Rectangular              | 1.73    | 1.02                 | 1.03                                |
| Standard deviation of repeatability at zero point (% of range)                    | 0.00                 | Rectangular              | -       | 0.000                | 0.000                               |
| Standard deviation of repeatability at span point (% of range)                    | 0.10                 | Rectangular              | -       | 0.25                 | 0.06                                |
| <b>Total</b>                                                                      |                      |                          |         |                      | 8.11                                |
| <b>Combined Standard Uncertainty [(sum u<sup>2</sup>)<sup>0.5</sup>]</b>          |                      |                          |         |                      | 2.85                                |
| <b>Expanded Total Uncertainty (ppm) (95% confidence)</b>                          |                      |                          |         |                      | 5.6                                 |
| <b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>       |                      |                          |         |                      | 2.0                                 |
| <b>Expanded Total Uncertainty (mg/m<sup>3</sup>) (95% confidence)</b>             |                      |                          |         |                      | 11.5                                |
| <b>Expanded Total Uncertainty as a % of emission limit value (95% confidence)</b> |                      |                          |         |                      | 2.3                                 |

# Uncertainty of Total VOC by FID - Run1

| Parameter                  | Value  | Unit  |
|----------------------------|--------|-------|
| Emission Limit Value (ELV) | 1000   | mg/m³ |
| Reading                    | 639.33 | ppm   |
| Span Gas Certified Value   | 81.0   | ppm   |
| Range                      | 100    | ppm   |

| Cal Gas                       |
|-------------------------------|
| C <sub>3</sub> H <sub>8</sub> |

| Source of Uncertainty                                                             | Uncertainty Criteria | Probability Distribution | Divisor | Source Uncertainty u | Combined Uncertainty u² |
|-----------------------------------------------------------------------------------|----------------------|--------------------------|---------|----------------------|-------------------------|
| Zero Drift/Lower limit of detection (ppm)                                         | 1.40                 | Rectangular              | 1.73    | 0.81                 | 0.653                   |
| Span Drift (ppm)                                                                  | -1.00                | Rectangular              | 1.73    | -0.58                | 0.333                   |
| Linearity (% of value)                                                            | 0.19                 | Rectangular              | 1.73    | 0.70                 | 0.49                    |
| Setting Gas Divider (% of value)                                                  | 0.35                 | Normal                   | 1.00    | 2.24                 | 5.01                    |
| Noise (ppm)                                                                       | 0.10                 | Rectangular              | 1.73    | 0.06                 | 0.003                   |
| Temperature Drift (% of value)                                                    | 1.0                  | Rectangular              | 1.73    | 3.69                 | 13.63                   |
| Standard deviation of repeatability at zero point (% of range)                    | 0.20                 | Rectangular              | -       | 0.20                 | 0.04                    |
| Standard deviation of repeatability at span point (% of range)                    | 0.20                 | Rectangular              | -       | 0.20                 | 0.04                    |
| <b>Total</b>                                                                      |                      |                          |         |                      | 20.19                   |
| <b>Combined Standard Uncertainty [(sum u²)<sup>0.5</sup>]</b>                     |                      |                          |         |                      | 4.49                    |
| <b>Expanded Total Uncertainty (ppm) (95% confidence)</b>                          |                      |                          |         |                      | 8.81                    |
| <b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>       |                      |                          |         |                      | 1                       |
| <b>Expanded Total Uncertainty (mg/m³) (95% confidence)</b>                        |                      |                          |         |                      | 14.2                    |
| <b>Expanded Total Uncertainty as a % of emission limit value (95% confidence)</b> |                      |                          |         |                      | 1.4                     |

# Uncertainty of Oxygen by Horiba Gas Analyser - Run 1

| Parameter                | Value | Unit |
|--------------------------|-------|------|
| Reading                  | 7.2   | %    |
| Span Gas Certified Value | 20.8  | %    |
| Range                    | 25.0  | %    |

| Cal Gas        |
|----------------|
| O <sub>2</sub> |

| Source of Uncertainty                                                       | Uncertainty Criteria | Probability Distribution | Divisor | Source Uncertainty u | Combined Uncertainty u² |
|-----------------------------------------------------------------------------|----------------------|--------------------------|---------|----------------------|-------------------------|
| Zero Drift/Lower limit of detection (%vol)                                  | 0.32                 | Rectangular              | 1.73    | 0.18                 | 0.034                   |
| Span Drift (%vol)                                                           | 0.37                 | Rectangular              | 1.73    | 0.21                 | 0.046                   |
| Linearity (% of value)                                                      | 0.24                 | Rectangular              | 1.73    | 0.01                 | 0.00010                 |
| Setting Gas Divider (% of value)                                            | 0.35                 | Normal                   | 1.00    | 0.03                 | 0.0006                  |
| Interference (% of value)                                                   | 0.00                 | Rectangular              | 1.73    | 0.000                | 0.000                   |
| Standard deviation of repeatability at zero point (% of range)              | 0.02                 | Rectangular              | -       | 0.005                | 0.00003                 |
| Standard deviation of repeatability at span point (% of range)              | 0.02                 | Rectangular              | -       | 0.005                | 0.00003                 |
| <b>Total</b>                                                                |                      |                          |         |                      | 0.081                   |
| <b>Combined Standard Uncertainty [(sum u²)<sup>0.5</sup>]</b>               |                      |                          |         |                      | 0.28                    |
| <b>Expanded Total Uncertainty (%) (95% confidence)</b>                      |                      |                          |         |                      | 0.56                    |
| <b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b> |                      |                          |         |                      | 7.7                     |

# Uncertainty of Sulphur Dioxide - Run 1

| Parameter                  | Value | Unit  |
|----------------------------|-------|-------|
| Emission Limit Value (ELV) | 350   | mg/m³ |
| Mean Sampling Rate         | 1.9   | L/min |
| Leak Rate                  | 0.01  | L/min |
| Barometric Pressure        | 1019  | mbar  |
| Average Stack Temperature  | 500   | °C    |
| Sampled Stack Gas Volume   | 120   | L     |

| Parameter                   | Value    | Unit  |
|-----------------------------|----------|-------|
| Mean Emission Concentration | 30.3     | mg/m³ |
| Monitoring Duration         | 60       | min   |
| Console ID                  | 8.05 (b) | -     |
| Temperature Uncertainty     | 0.24     | °C    |
| Gas Meter Uncertainty       | 0.37     | %     |
| Barometer Uncertainty       | 1.0      | mbar  |

| Source of Uncertainty                                                             | ASD* | BS EN 14791              |            | Certified Value | Units | % Actual Value | Source Uncertainty u | Combined Uncertainty u² |
|-----------------------------------------------------------------------------------|------|--------------------------|------------|-----------------|-------|----------------|----------------------|-------------------------|
|                                                                                   |      | Uncertainty Criteria     | Max. Value |                 |       |                |                      |                         |
| Analysis Procedure                                                                | Std  | <2.5% of measured value  | -          | 7.7             | %     | 3.9            | 1.19                 | 1.42                    |
| Leak Rate                                                                         | Rect | <2% of sampling rate     | 0.04       | 0.01            | L/min | 0.52           | 0.0916               | 0.0084                  |
| Time                                                                              | Std  | 1sec in 1hour = 0.028%   | 2.0        | 1.0             | sec   | 0.03           | 0.0084               | 0.000071                |
| Gasmeter Volume                                                                   | Std  | <2.5% volume of gas      | 3.0        | 0.44            | L     | 0.37           | 0.11                 | 0.013                   |
| Temperature                                                                       | Std  | <1% absolute temperature | 5.0        | 0.24            | °C    | 0.05           | 0.015                | 0.00021                 |
| Pressure                                                                          | Std  | <1% absolute pressure    | 10.2       | 1.0             | mbar  | 0.10           | 0.030                | 0.00089                 |
| <b>Total</b>                                                                      |      |                          |            |                 |       |                |                      | 1.44                    |
| <b>Combined Standard Uncertainty [(sum u²)<sup>0.5</sup>]</b>                     |      |                          |            |                 |       |                |                      | 1.20                    |
| <b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>       |      |                          |            |                 |       |                |                      | 7.8                     |
| <b>Expanded Total Uncertainty (mg/m³) (95% confidence)</b>                        |      |                          |            |                 |       |                |                      | 2.35                    |
| <b>Expanded Total Uncertainty as a % of emission limit value (95% confidence)</b> |      |                          |            |                 |       |                |                      | 0.67                    |

| Document Version Number | Record of change within different version numbers  |
|-------------------------|----------------------------------------------------|
| V1                      | Original version of the document issued to client. |