Element, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: Glenn McMorrow (07966 879 182)
E: glenn.mcmorrow@element.com

**Stack Emissions Testing Report Commissioned by**
Enovert

**Installation Name & Address**
Enovert
Tir John Landfill Site
Port Tennant
Swansea
SA1 8LN

EPR Permit: BP3738LS

**Stack Reference**
Flare

**Dates of the Monitoring Campaign**
10th August 2023

**Job Reference Number**
ERE-23296

| Report Written by |
| --- |
| Joshua Cunningham<br>Technician<br>MCERTS Level 1<br>MM 22 1702<br>- |

| Report Approved by |
| --- |
| Darren Price<br>Team Leader<br>MCERTS Level 2<br>MM 03 176<br>TE1 TE2 TE3 TE4 |

| Report Date |
| --- |
| 8th September 2023 |

| Version |
| --- |
| Version 1 |

| Signature of Report Approver |
| --- |
| D Price |

# CONTENTS



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

# Executive Summary

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## MONITORING OBJECTIVES

Enovert, Tir John Landfill Site
Flare
10th August 2023

**Overall Aim of the Monitoring Campaign**

Element were commissioned by Enovert to carry out stack emissions testing on the Flare at Tir John Landfill Site.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

**Special Requirements**

There were no special requirements.

**Target Parameters**

Total VOCs (as Carbon), Oxides of Nitrogen (as $NO_2$), Carbon Monoxide

# Executive Summary



## MONITORING RESULTS

Enovert, Tir John Landfill Site

Flare

10th August 2023

*where MU = Measurement Uncertainty associated with the Result*

| | | Concentration | | | |
|---|---|---|---|---|---|
| **Parameter** | **Units** | **Result** | | **MU +/-** | **Limit** |
| Total VOCs (as Carbon) [1] | $mg/m^3$ | 2.8 | | 0.75 | 10 |
| Oxides of Nitrogen (as $NO_2$) [1] | $mg/m^3$ | 49.5 | | 3.1 | 150 |
| Carbon Monoxide [1] | $mg/m^3$ | 1.2 | | 1.9 | 50 |
| Oxygen | % v/v | **Dry** | 9.9 | 0.32 | |
| Water Vapour | % v/v | 10.5 | | 0.47 | |

[1] Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 3% oxygen.

# Executive Summary



## MONITORING DATE(S) & TIMES

Enovert, Tir John Landfill Site
Flare
10th August 2023

| Parameter | | Units | Concentration | | Sampling Date(s) | Sampling Times | Duration mins |
|---|---|---|---|---|---|---|---|
| Total VOCs (as Carbon) | R1 | $mg/m^3$ | 2.8 | | 10/08/2023 | 14:30 - 15:30 | 60 |
| Oxides of Nitrogen (as $NO_2$) | R1 | $mg/m^3$ | 49.5 | | 10/08/2023 | 14:30 - 15:30 | 60 |
| Carbon Monoxide | R1 | $mg/m^3$ | 1.2 | | 10/08/2023 | 14:30 - 15:30 | 60 |
| Oxygen | R1 | % v/v | 9.9 | | 10/08/2023 | 14:30 - 15:30 | 60 |
| Water Vapour | R1 | % v/v | 10.5 | | 10/08/2024 | 14:30 - 15:30 | 60 |

All results are expressed at the respective reference conditions.

## PROCESS DETAILS

Enovert, Tir John Landfill Site
Flare
10th August 2023

**Standard Operating Conditions**

| Parameter | Value |
|---|---|
| Process Status | Operating |
| Capacity (of 100%) and Tonnes / Hour | 495 m3/hr |
| Continuous or Batch Process | Batch |
| Feedstock (if applicable) | N/A |
| Abatement System | None |
| Abatement System Running Status | N/A |
| Fuel | Landfill Gas |
| Plume Appearance | No visible plume |

# Executive Summary

**(Page 5 of 7)**

## MONITORING & ANALYTICAL METHODS

Enovert, Tir John Landfill Site
Flare
10th August 2023

| | Monitoring | | | | Analysis | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Standard** | **Technical Procedure** | **Sampling Status** | **Testing Lab** | **Analytical Procedure** | **Analytical Technique** | **Analysis Status** | **Analysis Lab** | **Overall Status** | **LOD (Average)** |
| 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 Signal 3010HM | | | | 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 | 0.71 mg/m³ |
| Oxygen | EN 14789 | CAT-TP-21 | MCERTS | EET | Dry Zirconia Cell by Horiba PG-250 | | | | MCERTS | 0.1 % |

## ANALYSIS LABORATORIES

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

| | |
|---|---|
| Element (Stockport Lab - EET) | ISO 17025 Accreditation Number: 4279 |

## SUMMARY OF SAMPLING DEVIATIONS

| Parameter | Run | Deviation |
|---|---|---|
| All | All | There are no deviations associated with the sampling employed. |

## SUITABILITY OF SAMPLING LOCATION

### Duct Characteristics

| Parameter | Units | Value |
|---|---|---|
| Type | - | Circular |
| Depth | m | 1.80 |
| Width | m | - |
| Area | m² | 2.55 |
| Port Depth | cm | N/A Mast Used |
| Orientation of Duct | - | Vertical |
| Number of Ports | - | N/A Mast Used |
| Sample Port Size | - | N/A Mast Used |

### Location of Sampling Platform

| General Platform Information | Value |
|---|---|
| Permanent / Temporary Platform | On Ground |
| Inside / Outside | Outside |

### 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) | N/A |
| Platform has vertical base boards (approx. 0.25m high) | N/A |
| Platform has chains / self closing gates at top of ladders | N/A |
| 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

Due to the nature of the access into the duct, it is not possible to conduct a full velocity profile, however no particulate phase sampling was required and all gaseous species were considered to be mixed sufficiently for the purposes of these tests. There is also no requirement to undertake a homogeneity test as per EN 15259 and as such the location cannot be compared against that or the criteria within TGN M1. The sampling location used in this instance has been approved for use by the Environment Agency.

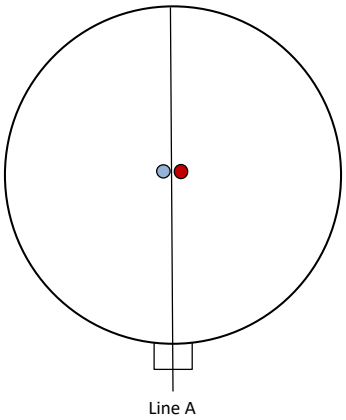
### EN 15259 Homogeneity Test Requirements

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

## PLANT PHOTOS

Photo 1

## 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 | Darren Price | MCERTS Level 2 | MM 03 176 | TE1 TE2 TE3 TE4 |
| Technician | Joshua Cunningham | MCERTS Level 1 | MM 22 1704 | - |

## LIST OF EQUIPMENT

| Extractive Sampling | |
|---|---|
| **Equipment Type** | **Equipment I.D.** |
| Control Box DGM (1) | - |
| Control Box DGM (2) | - |
| Box Thermocouples (1) | - |
| Box Thermocouples (2) | - |
| Umbilical (1) | - |
| Umbilical (2) | - |
| Oven Box (1) | - |
| Oven Box (2) | - |
| Heated Probe (1) | - |
| Heated Probe (2) | - |
| Heated Probe (3) | - |
| S-Pitot (1) | - |
| S-Pitot (2) | - |
| L-Pitot | - |
| Site Balance | CAT 17.82 |
| 500g / 1Kg Check Weights | CAT 17.82 |
| Last Impinger Arm | - |
| Callipers | - |
| Tubes Kit Thermocouple | - |

| Instrumental Analysers | |
|---|---|
| **Equipment Type** | **Equipment I.D.** |
| Horiba PG-250 | CAT 9.26 |
| Horiba PG-250 SRM | - |
| Servomex 5200 MP | - |
| Eco Physics CLD 822Mh | - |
| ABB AO2020-URAS26 | - |
| Testo 350 XL | - |
| Signal 200SM | CAT 4.00168 |
| Gasmet DX4000 | - |
| Gasmet Sampling System | - |
| Signal 3010HM | CAT 8.50 |
| M&C PSS | CAT 12.168 |
| Mass Flow Controller (1) | - |
| Mass Flow Controller (2) | - |
| Mass View (1) | CAT 25.106 |
| Mass View (2) | CAT 25.107 |
| Squirrel 2020 | CAT DL#04 |
| Easylogger EN-EL-12 Bit | - |
| Bioaerosols Temperature Logger | - |
| Electronic Refrigerator | - |

| Miscellaneous Items | |
|---|---|
| **Equipment Type** | **Equipment I.D.** |
| Digital Manometer (1) | - |
| Digital Manometer (2) | - |
| Digital Temperature Meter | CAT 3.294 |
| Stopwatch | - |
| Barometer | - |
| Stack Thermocouple (1) | CAT 4.1676 |
| Stack Thermocouple (2) | - |
| Stack Thermocouple (3) | - |
| 1m Heated Line (1) | - |
| 1m Heated Line (2) | - |
| 1m Heated Line (3) | - |
| 5m Heated Line (1) | - |
| 15m Heated Line (1) | - |
| 20m Heated Line (1) | CAT 20.1023 |
| 20m Heated Line (2) | - |
| Dual Channel Heater Controller | - |
| Single Channel Heater Controller | CAT 20.1023 |
| Laboratory Balance | |
| Tape Measure | CAT 16.144 |

## METHODS & TECHNICAL PROCEDURES USED

| Parameter | Standard | Technical Procedure |
|---|---|---|
| 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 |

## WATER VAPOUR: RESULTS SUMMARY

Enovert, Tir John Landfill Site

Flare

### Sample Runs

| Parameter | Units | Run 1 | | Mean |
|---|---|---|---|---|
| Concentration | % v/v | 10.5 | | 10.5 |
| Uncertainty | ±% v/v | 0.47 | | 0.47 |

### General Sampling Information

| Parameter | Value |
|---|---|
| Standard | EN 14790 |
| Technical Procedure | CAT-TP-05 |

## WATER VAPOUR: SAMPLING DETAILS

### Sample Runs

| Parameter | Units | Run 1 |
|---|---|---|
| Sampling Times | - | 14:30 - 15:30 |
| Sampling Dates | - | 10/08/2024 |
| Sampling Device | - | MFC / MV |
| Duration | mins | 60 |
| Volume Sampled (STP, Dry) | $m^3$ | 0.3131 |
| Volume Sampled (STP, Wet) | $m^3$ | 0.3497 |
| Sample Flow Rate | l/min | 5.05 |
| Liquid Trap Start Mass | g | 2501.4 |
| Liquid Trap End Mass | g | 2521.7 |
| Silica Trap Start Mass | g | 931.4 |
| Silica Trap End Mass | g | 940.5 |
| Total Mass Of Water Vapour | g | 29.4 |
| Calculated Water Vapour | % v/v | 10.48 |

**Where:** MFC stands for Mass Flow Controller, MV stands for Mass View Flowmeter

## WATER VAPOUR: QUALITY ASSURANCE

### Sample Runs

| Leak Test Results | Units | Run 1 |
|---|---|---|
| Mean Sampling Rate | l/min | 5.0 |
| Pre-Sampling Leak Rate | l/min | 0.08 |
| Post-Sampling Leak Rate | l/min | 0.08 |
| Allowable Leak Rate | l/min | 0.10 |
| Leak Test Acceptable | - | Yes |

| Water Droplets | Units | Run 1 |
|---|---|---|
| Are Water Droplets Present | - | No |

| Measurement Uncertainty | Units | Run 1 |
|---|---|---|
| Measurement Uncertainty (MU) | % | 4.5 |
| Allowable MU | % | 20.0 |
| MU Acceptable | % | Yes |

| Silica Gel | Units | Run 1 |
|---|---|---|
| Less than 50% Faded | % | Yes |

| Test Conditions | Units | Run 1 |
|---|---|---|
| Ambient Temperature Recorded? | - | No |

### Method Deviations

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

## WATER VAPOUR: MEASUREMENT UNCERTAINTY CALCULATIONS

| | Value | | | Standard uncertainty | | | |
|---|---|---|---|---|---|---|---|
| **Measured Quantities** | **Symbol** | **Run 1** | | **Symbol** | **Units** | **Run 1** | |
| Sampled Volume (STP) | $V_m$ | 0.3131 | | $uV_m$ | $m^3$ | 0.0063 | |
| Repeatability of Weighing | $R_w$ | 29.40 | | $uR_w$ | g | 0.12 | |
| Reading of Balance | $R_b$ | 29.40 | | $uR_b$ | g | 0.15 | |
| Leak | L | 1.58 | | | % | - | |

| | Uncertainty as a Percentage | | | |
|---|---|---|---|---|
| **Measured Quantities** | **Units** | **Run 1** | | **Requirement of Standard** |
| Sampled Volume (STP) | % | 2.00 | | ≤2% |
| Repeatability of Weighing | % | 0.41 | | No Requirement |
| Reading of Balance | % | 0.50 | | No Requirement |
| Leak | % | 1.58 | | ≤2% |

| | Uncertainty in Measurement Units | | | | Sensitivity Coefficient | |
|---|---|---|---|---|---|---|
| **Measured Quantities** | **Symbol** | **Units** | **Run 1** | | **Run 1** | |
| Sampled Volume (STP) | $V_m$ | $m^3$ | 0.3131 | | 33.46 | |
| Repeatability of Weighing | $R_w$ | g | 29.40 | | 0.36 | |
| Reading of Balance | $R_b$ | g | 29.40 | | 0.36 | |
| Leak | L | % v/v | 0.10 | | 1.00 | |

| | Uncertainty in Result | | |
|---|---|---|---|
| **Measured Quantities** | **Units** | **Run 1** | |
| Sampled Volume (STP) | % v/v | 0.210 | |
| Repeatability of Weighing | % v/v | 0.043 | |
| Reading of Balance | % v/v | 0.052 | |
| Leak | % v/v | 0.096 | |

| **Parameter** | **Units** | **Run 1** |
|---|---|---|
| Combined uncertainty | % v/v | 0.24 |
| Expanded uncertainty (95% confidence) | % v/v | 0.47 |
| Expanded uncertainty (95% confidence), estimated with Method Deviations | % v/v | 0.47 |
| Uncertainty if Water Droplets are present | % v/v | N/A |
| Reported Uncertainty | % v/v | 0.47 |
| Expanded uncertainty (95% confidence) | % | 4.5 |
| Expanded uncertainty (95% confidence), estimated with Method Deviations | % | 4.5 |
| Uncertainty if Water Droplets are present | % | N/A |
| Reported Uncertainty | % | 4.5 |

## TOTAL VOCs (as CARBON): RESULTS SUMMARY

Enovert, Tir John Landfill Site
Flare

### Sample Runs

| Parameter | Units | Run 1 | | Mean |
|---|---|---|---|---|
| Concentration | mg/m³ | 2.8 | | 2.8 |
| Uncertainty | ±mg/m³ | 0.75 | | 0.75 |

### General Sampling Information

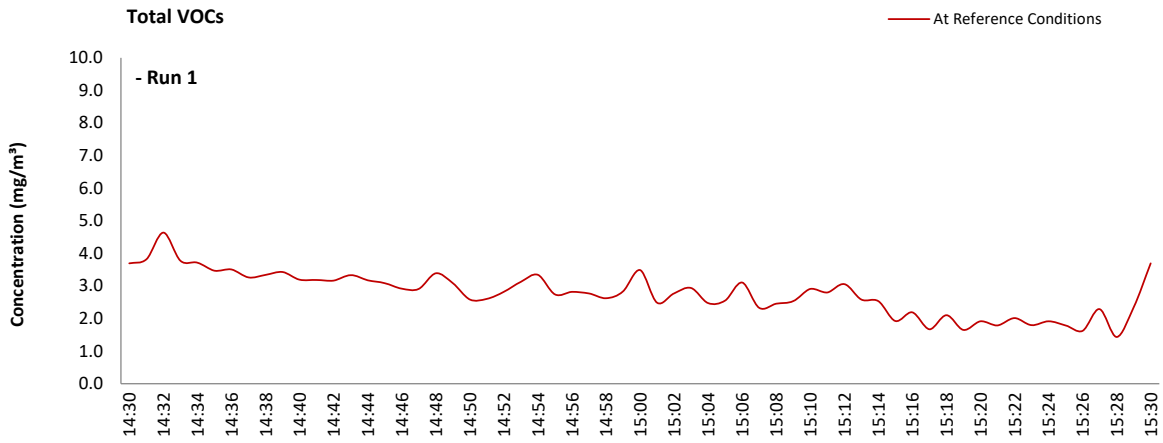
| Parameter | Value | |
|---|---|---|
| Standard | EN 12619:2013 | |
| Technical Procedure | CAT-TP-20 | |
| Probe Material | Stainless Steel | |
| Filtration Type / Size | 0.1µm Glass Fibre | |
| Heated Head Filter Used | Yes | |
| Heated Line Temperature | 180°C | |
| Span Gas Type | Propane In Synthetic Air (5 Grade) | |
| Span Gas Reference Number | 12.0470 | |
| Span Gas Expiry Date | 21/09/2024 | |
| Span Gas Start Pressure (bar) | 50 | |
| Gas Cylinder Concentration (ppm) | 8.5 | |
| Span Gas Set Point (ppm) | 8.50 | |
| Span Gas Uncertainty (%) | 2 | |
| Zero Gas Type | Synthetic Air (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 | A1 | |

### Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 3% 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 | - | 14:30 - 15:30 |
| Sampling Dates | - | 10/08/2023 |
| Instrument Range | ppm | 100 |
| Span Gas Value | ppm | 8.5 |

### Quality Assurance

| | Zero Drift | Units | Run 1 |
|---|---|---|---|
| CAL 1 | Zero Down Sampling Line (Pre) | ppm | 0.00 |
| | Zero Down Sampling Line (Post) | ppm | 0.30 |
| | Zero Drift | ppm | 0.30 |
| | Zero Drift | % | 3.53 |
| | Drift Correction Applied | 2-5% | Yes |
| | Allowable Zero Drift | ± ppm | 0.43 |
| | Zero Drift Acceptable | - | #REF! |

| | Span Drift | Units | Run 1 |
|---|---|---|---|
| CAL 1 | Span Down Sampling Line (Pre) | ppm | 8.50 |
| | Span Down Sampling Line (Post) | ppm | 8.20 |
| | Span Drift | ppm | -0.30 |
| | Span Drift | % | -3.53 |
| | Drift Correction Applied | 2-5% | Yes |
| | Allowable Span Drift | ± ppm | 0.43 |
| | Span Drift Acceptable | - | Yes |

| Test Conditions | Units | Run 1 |
|---|---|---|
| Run Ambient Temperature Range | °C | 22 - 26 |

### 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 | 10.0 | | mg/m³ (REF) |
| Allowable MU | 15.0 | | % |
| Measured concentration | 1.71 | | mg/m³ (STP, dry) |
| Range Used | 100.0 | | ppm |
| Range Used [A] | 160.6 | | mg/m³ |
| Cal gas conc. | 8.5 | | 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. | 13.7 | | mg/m³ |

| Performance characteristics | RUN 1 | | Units |
|---|---|---|---|
| Response time | 15 | | seconds |
| Number of readings in measurement | 60 | | - |
| Repeatability at zero | 0.15 | | % full scale |
| Repeatability at span level | 0.80 | | % full scale |
| Deviation from linearity | 0.10 | | % of value |
| Zero drift | 0.00 | | % full scale |
| Span drift | 0.00 | | % full scale |
| Volume or pressure flow dependence | 2.00 | | % of full scale |
| Atmospheric pressure dependence | 0.80 | | % of value/kPa |
| Ambient temperature dependence | 1.00 | | % full scale/10K |
| Combined interference | 1.20 | | % range |
| Dependence on voltage | 0.10 | | % full scale/10V |
| Losses in the line (leak) | 1.18 | | % 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 | 0.10 | | mg/m³ |
| Lack of fit | 0.01 | | mg/m³ |
| Drift | 0.00 | | mg/m³ |
| Volume or pressure flow dependence | 0.00 | | mg/m³ |
| Atmospheric pressure dependence | 0.03 | | mg/m³ |
| Ambient temperature dependence | 0.14 | | mg/m³ |
| Combined interference (from MCERTS Certificate) | 0.10 | | mg/m³ |
| Dependence on voltage | 0.01 | | mg/m³ |
| Losses in the line (leak) | 0.01 | | mg/m³ |
| Uncertainty of calibration gas | 0.02 | | mg/m³ |

| | | | RUN 1 | | Units |
|---|---|---|---|---|---|
| **Measurement uncertainty** | | **Result** | 1.71 | | mg/m³ |
| Combined uncertainty | | | 0.23 | | mg/m³ |
| Expanded uncertainty | k = | 1.96 | 0.46 | | mg/m³ |
| Uncertainty corrected to std conds. ($O_2$) | | | 0.75 | | mg/m³ (REF) |

| | RUN 1 | | Units |
|---|---|---|---|
| Expanded uncertainty (no $O_2$) - at 95% Confidence | 26.88 | | % of Value |
| Expanded uncertainty (no $O_2$) - at 95% Confidence | 4.60 | | % 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 | 27.08 | | % of Value |
| Expanded uncertainty (with $O_2$) - at 95% Confidence | 8.14 | | % 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

Enovert, Tir John Landfill Site
Flare

### Sample Runs

| Parameter | Units | Run 1 | | Mean |
|---|---|---|---|---|
| Concentration | mg/m³ | 49.5 | | 49.5 |
| Uncertainty | ±mg/m³ | 3.1 | | 3.1 |

### General Sampling Information

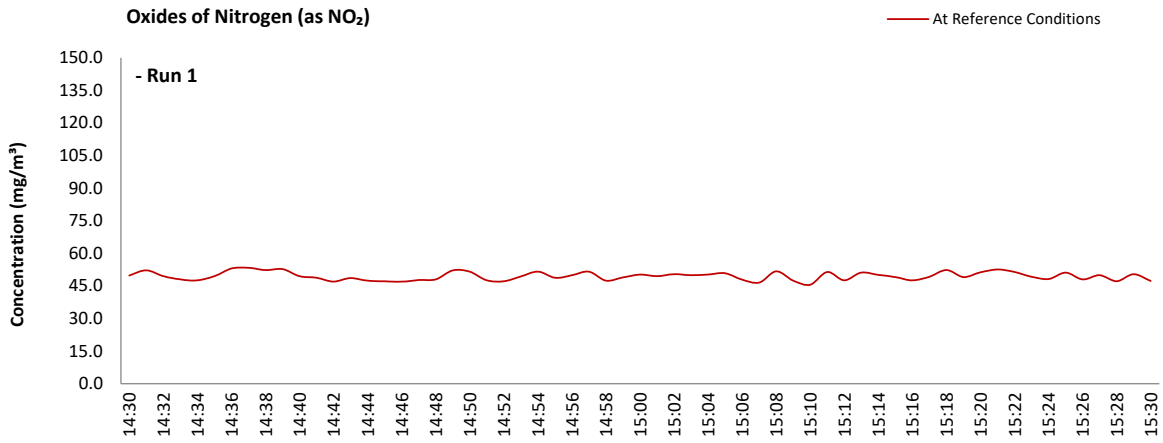
| Parameter | Value | |
|---|---|---|
| Standard | EN 14792 | |
| Technical Procedure | CAT-TP-21 | |
| Probe Material | Stainless Steel | |
| Filtration Type / Size | 0.1µm Glass Fibre | |
| Heated Head Filter Used | Yes | |
| Heated Line Temperature | 180°C | |
| Date & Result of Last Converter Check | 13/10/2022 - 95.5% | |
| Span Gas Type | Nitrogen Monoxide | |
| Span Gas Reference Number | 12.0493 | |
| Span Gas Expiry Date | 11/01/2025 | |
| Span Gas Start Pressure (bar) | 180 | |
| Gas Cylinder Concentration (ppm) | 89.6 | |
| 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 | A1 | |

### Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 3% 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 | - | 14:30 - 15:30 |
| Sampling Dates | - | 10/08/2023 |
| Instrument Range | ppm | 250 |
| Span Gas Value | ppm | 89.6 |

### Quality Assurance

| Conditioning Unit Temperature | Units | Run 1 |
|---|---|---|
| Average Temperature | °C | 3.7 |
| 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 | % | 0.33 |
| 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 | 89.60 |
| CAL 1 | Span at Analyser (Post) | ppm | 85.50 |
| CAL 1 | Span Drift | ppm | -4.10 |
| CAL 1 | Zero Adj. Span Drift | % | 4.24 |
| 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 | 22 - 26 |

### 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 | 150.0 | | mg/m³ (REF) |
| Allowable MU | 10.0 | | % |
| Measured concentration | 30.47 | | mg/m³ (STP, dry) |
| Ratio NO / $NO_2$ | 5 | | % |
| Range Used | 250.0 | | ppm |
| Range Used [A] | 513.1 | | mg/m³ |
| Cal gas conc. | 89.6 | | 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. | 183.9 | | 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 | 0.36 | | % of value |
| Zero drift | -0.33 | | % 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 | 0.18 | | % full scale/10K |
| Combined interference | 0.60 | | % range |
| Dependence on voltage | 0.40 | | % full scale/10V |
| Converter efficiency | 95.5 | | % |
| Losses in the line (leak) | 1.23 | | % 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 | 0.26 | | 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 | 0.04 | | mg/m³ |
| Losses in the line (leak) | 0.22 | | mg/m³ |
| Uncertainty of calibration gas blending | 0.25 | | mg/m³ |
| Uncertainty of calibration gas | 0.35 | | mg/m³ |

| | | | RUN 1 | | Units |
|---|---|---|---|---|---|
| **Measurement uncertainty** | | **Result** | 30.47 | | mg/m³ |
| Combined uncertainty | | | 0.83 | | mg/m³ |
| Expanded uncertainty | k = | 1.96 | 1.63 | | mg/m³ |
| Uncertainty corrected to std conds. ($O_2$) | | | 2.65 | | mg/m³ (REF) |

| | RUN 1 | | Units |
|---|---|---|---|
| Expanded uncertainty (no $O_2$) - at 95% Confidence | 5.35 | | % of Value |
| Expanded uncertainty (no $O_2$) - at 95% Confidence | 1.09 | | % 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 | 6.26 | | % of Value |
| Expanded uncertainty (with $O_2$) - at 95% Confidence | 3.70 | | % at ELV |
| Overall Allowable uncertainty (with $O_2$) - at 95% Confidence | 10.5 | | % 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

Enovert, Tir John Landfill Site
Flare

### Sample Runs

| Parameter | Units | Run 1 | | Mean |
|---|---|---|---|---|
| Concentration | mg/m³ | 1.2 | | 1.2 |
| Uncertainty | ±mg/m³ | 1.9 | | 1.9 |

### General Sampling Information

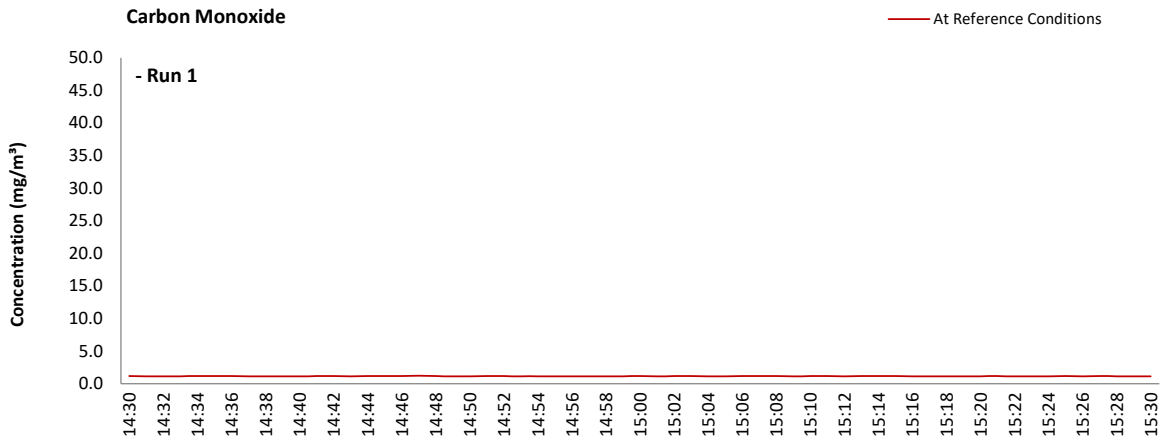
| Parameter | Value | |
|---|---|---|
| Standard | EN 15058 | |
| Technical Procedure | CAT-TP-21 | |
| Probe Material | Stainless Steel | |
| Filtration Type / Size | 0.1µm Glass Fibre | |
| Heated Head Filter Used | Yes | |
| Heated Line Temperature | 180°C | |
| Span Gas Type | Carbon Monoxide | |
| Span Gas Reference Number | 12.0498 | |
| Span Gas Expiry Date | 11/01/2025 | |
| Span Gas Start Pressure (bar) | 180 | |
| Gas Cylinder Concentration (ppm) | 149.1 | |
| 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 | A1 | |

### Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 3% oxygen.

## CARBON MONOXIDE: DATA TREND

**Graphical Trend of Data**



## CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

### Sampling Details

| Parameter | Units | Run 1 |
|---|---|---|
| Sampling Times | - | 14:30 - 15:30 |
| Sampling Dates | - | 10/08/2023 |
| Instrument Range | ppm | 2000 |
| Span Gas Value | ppm | 149.1 |

### Quality Assurance

| Conditioning Unit Temperature | Units | Run 1 |
|---|---|---|
| Average Temperature | °C | 3.7 |
| Allowable Temperature | < °C | 4.0 |
| Temperature Acceptable | - | Yes |

| | Zero Drift | Units | Run 1 |
|---|---|---|---|
| CAL 1 | Zero at Analyser (Pre) | ppm | 1.00 |
| | Zero at Analyser (Post) | ppm | -1.50 |
| | Zero Drift | ppm | -2.50 |
| | Zero Drift | % | 1.65 |
| | 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 | 151.80 |
| | Span at Analyser (Post) | ppm | 148.00 |
| | Span Drift | ppm | -3.80 |
| | Zero Adj. Span Drift | % | 0.87 |
| | 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 | 22 - 26 |

### 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 | 50.0 | | mg/m³ (REF) |
| Allowable MU | 6.0 | | % |
| Measured concentration | 0.71 | | mg/m³ (STP, dry) |
| Range Used | 2000.0 | | ppm |
| Range Used [A] | 2498.4 | | mg/m³ |
| Cal gas conc. | 149.1 | | 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. | 186.3 | | 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 | 0.36 | | % of value |
| Zero drift | -1.65 | | % full scale |
| Span drift | -0.87 | | % 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) | 0.07 | | % 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 | 0.20 | | 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) | 0.00 | | mg/m³ |
| Uncertainty of calibration gas blending | 0.01 | | mg/m³ |
| Uncertainty of calibration gas | 0.01 | | mg/m³ |

| Measurement uncertainty | | Result | RUN 1 | | Units |
|---|---|---|---|---|---|
| Combined uncertainty | | | 0.71 | | mg/m³ |
| Expanded uncertainty | k = | 1.96 | 0.61 | | mg/m³ |
| Uncertainty corrected to std conds. ($O_2$) | | | 1.19 | | mg/m³ |
| | | | 1.93 | | mg/m³ (REF) |

| | RUN 1 | | Units |
|---|---|---|---|
| Expanded uncertainty (no $O_2$) - at 95% Confidence | 166.71 | | % of Value |
| Expanded uncertainty (no $O_2$) - at 95% Confidence | 2.37 | | % 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 | 166.74 | | % of Value |
| Expanded uncertainty (with $O_2$) - at 95% Confidence | 5.04 | | % at ELV |
| Overall Allowable uncertainty (with $O_2$) - at 95% Confidence | 6.8 | | % 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

Enovert, Tir John Landfill Site
Flare

### Sample Runs

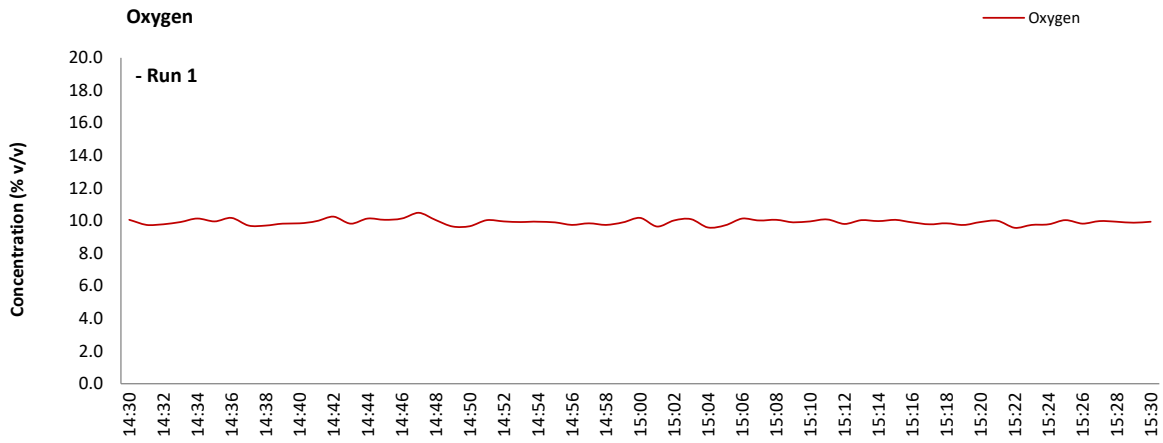
| Parameter | Units | Run 1 | | Mean |
|---|---|---|---|---|
| Concentration | % v/v | 9.9 | | 9.9 |
| Uncertainty | ±% v/v | 0.32 | | 0.32 |

### General Sampling Information

| Parameter | Value | |
|---|---|---|
| Standard | EN 14789 | |
| Technical Procedure | CAT-TP-21 | |
| 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 | 12.047 | |
| Span Gas Expiry Date | 21/09/2024 | |
| Span Gas Start Pressure (bar) | 50 | |
| Gas Cylinder Concentration (% v/v) | 7.8 | |
| 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 | A1 | |

## OXYGEN: DATA TREND

**Graphical Trend of Data**



## OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

### Sampling Details

| Parameter | Units | Run 1 |
|---|---|---|
| Sampling Times | - | 14:30 - 15:30 |
| Sampling Dates | - | 10/08/2023 |
| Instrument Range | % v/v | 25.0 |
| Span Gas Value | % v/v | 7.8 |

### Quality Assurance

| Conditioning Unit Temperature | Units | Run 1 |
|---|---|---|
| Average Temperature | °C | 3.7 |
| Allowable Temperature | < °C | 4.0 |
| Temperature Acceptable | - | Yes |

| | Zero Drift | Units | Run 1 |
|---|---|---|---|
| CAL 1 | Zero at Analyser (Pre) | % v/v | 0.05 |
| | Zero at Analyser (Post) | % v/v | 0.08 |
| | Zero Drift | % v/v | 0.03 |
| | Zero Drift | % | 0.38 |
| | 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 | 7.98 |
| | Span at Analyser (Post) | % v/v | 7.96 |
| | Span Drift | % v/v | -0.02 |
| | Zero Adj. Span Drift | % | 0.64 |
| | 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 | 22 - 26 |

### 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 | 9.92 | | %vol |
| Range Used | 25.0 | | %vol |
| Cal gas conc. | 7.8 | | %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 | 0.10 | | % of value |
| Zero drift | 0.38 | | % full scale |
| Span drift | -0.64 | | % 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) | 0.00 | | % 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) | 0.00 | | %vol |
| Uncertainty of calibration gas | 0.11 | | %vol |

| | | | RUN 1 | | Units |
|---|---|---|---|---|---|
| **Measurement uncertainty** | | **Result** | 9.92 | | %vol |
| Combined uncertainty | | | 0.16 | | %vol |
| Expanded uncertainty | k = | 1.96 | 0.32 | | %vol |

| | RUN 1 | | Units |
|---|---|---|---|
| Expanded uncertainty (no $O_2$) - at 95% Confidence | 3.25 | | % 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 HISTORY

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