CAULMERT LIMITED

Engineering, Environmental & Planning
Consultancy Services

Bryn Posteg Landfill Site

Potters Waste Management

Annual Monitoring Review

January - December 2017

Prepared by:

Caulmert Limited
InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG
Tel: 01248 672666
Fax: 01248 672601
Email: dianabrookshaw@caulmert.com
Web: www.caulmert.com

Doc ref: 3033-CAU-XX-XX-RP-V-0306.A0-C1

Feburary 2018

APPROVAL RECORD

Site: **Bryn Posteg Landfill Site**

Client: **Potters Waste Management**

Document Title: **Annual Monitoring Review (January – December 2017)**

Document Ref: **3033-CAU-XX-XX-RP-V-0306**

Report Status: **Final**

Project Director: **Andy Stocks**

Project Manager: **Diana Brookshaw**

Caulmert Limited: **Intec, Parc Menai, Bangor, Gwynedd, LL57 4FG**

Tel: **01248 672666**

Author	Sean O'Brien	**Date**	28/02/2018
Reviewer	Diana Brookshaw	**Date**	28/02/2018
Approved	Diana Brookshaw	**Date**	07/03/2018

DISCLAIMER

This report has been prepared by Caulmert Limited with all reasonable skill, care and diligence in accordance with the instruction of the above named client and within the terms and conditions of the Contract with the Client.

The report is for the sole use of the above named Client and Caulmert Limited shall not be held responsible for any use of the report or its content for any purpose other than that for which it was prepared and provided to the Client.

Caulmert Limited accepts no responsibility of whatever nature to any third parties who may have been made aware of or have acted in the knowledge of the report or its contents.

TABLE OF CONTENTS

1. INTRODUCTION 1
1.0 Background 1
1.1 Site Location and Surrounding Land-use 1
1.2 Environmental Context 1
2. LANDFILL GAS 3
2.1 Perimeter Gas Monitoring Results 3
2.2 Trace Gas Monitoring 3
2.3 Engine and Flare Emission Monitoring 3
2.4 Landfill Gas from Capped Surfaces 3
3. GROUNDWATER 4
3.1 Groundwater Levels 4
3.2 Groundwater Quality 4
4. LEACHATE 6
4.1 Leachate Levels 6
4.3 Leachate Quality 6
4.4 Treated Leachate 7
5. SURFACE WATER 9
5.1 Surface Water Quality 9
6. DUST 10
6.1 Monitoring 10
7. ANNUAL PRODUCTION / TREATMENT 11
7.1 Introduction 11
8. PERFORMANCE PARAMETERS 12
8.1 Introduction 12
9. TOPOGRAPHICAL SURVEY 13
10. SUMMARY 14
10.1 Landfill Gas 14
10.2 Groundwater 14
10.3 Leachate 14
10.4 Surface Water 15
10.5 Dust 15

APPENDICES

Appendix 1: Drawing: 2601.EMP.01 - Location of Monitoring Points

Appendix 2: Landfill gas

Appendix 3: Groundwater

Appendix 4: Leachate

Appendix 5: Surface water

Appendix 6: Dust

1. INTRODUCTION

1.0 Background

1.1.1 This report has been compiled in compliance with the Environmental Permit (EP) (formerly PPC Permit) BU7766, Variation Notice Number EPR/BU7766IC/V004 for Bryn Posteg Landfill Site, which requires that the monitoring data collected at the site, is reviewed annually. The data reviewed by this report was collected from 1st January – 31st December 2017.

1.1.2 This report records and reviews monitoring data for landfill gas, leachate, groundwater and surface water and discusses this data in relation to emission limits set in the latest EP variations. The report includes a summary of performance parameters including dust monitoring, topographic survey of the site and production and treatment figures for leachate and gas.

1.1 Site Location and Surrounding Land-use

1.2.2 Bryn Posteg Landfill Site is located approximately 3 km south east of Llanidloes in Powys and is centered at National Grid Reference SN 971 822.

1.2.3 The landfill site was developed from the surface void of a former lead mine. Controlled landfilling has taken place since 1982.

1.2.4 The site is accessed via the B4518, Llanidloes to Tylwch road. The B4518 runs parallel with the western site boundary.

1.2.5 Bryn Posteg is situated amongst predominantly agricultural land. There are seven residential receptors located within approximately 450 m of the waste mass, these are:

- Valley View, 100 m to the north west;
- Rhoswen, 200 m to the east;
- Pant, 250 m to the east;
- Bryn Posteg Farm, 250 to the west;
- Penbryn Du, 300 m to the north
- Maes-Socyn, 350 m to the south-west
- Talcen-Llwydiarth, 450 m to the south-east

1.2 Environmental Context

Geology

1.2.1 According to ground investigations, the site is underlain by clay. The clay is predominantly grey, with various quantities of sand and mudstone gravel. This gravel is interpreted as being the weathering product of the underlying mudstone bedrock.

1.2.2 Geological maps indicated that the region is underlain by strata of the Upper Llandovery Groups of Silurain age. These strata comprise mudstone, slates and sandstones. There are a number of faults through the region, two of which underlie the site. One fault is oriented east-west across the north of the site and the other is oriented south-west to north-east, approximately along the stream on the south side of the site.

Hydrology

1.2.3 The site is within the catchment area of the River Severn. The Afon Dulas runs 3 km north-west of the site. Prior to development of this site the area was partly occupied by marshlands.

1.2.4 Due to the mining activities and later the landfilling activities at the site, the surface water regime around the site has been altered. Surface waters are discharged into the Nant-y-Bradnant to the east of the site and into the unnamed tributary of the Dulas on the western perimeter of the site.

Hydrogeology

1.2.5 The EA Groundwater Vulnerability Sheet No.20 indicates that the strata at the site are classified as a non-aquifer with negligible permeability. Groundwater is controlled by fracture flow within the Llandovery Mudstones.

2. LANDFILL GAS

2.1 Perimeter Gas Monitoring Results

2.1.1 Routine landfill gas (LFG) monitoring around the site perimeter is carried out on a weekly basis at 36 boreholes. Concentrations of methane (CH_4) and carbon dioxide (CO_2) are measured alongside oxygen (O_2), relative pressure and atmospheric pressure on each visit.

2.1.2 CH_4 concentrations exceeded the EP limit of 1.0 %[1] on at least one occasion at every location. Maximum concentrations in the boreholes ranged between 1.1 % (at 4 locations) and 84.6 % in G20.

2.1.3 Of these exceedances, sixteen of the locations where a breach was recorded were only slightly above the compliance limit. Eleven perimeter locations did however contain average methane concentrations at a significant concentration, above 10 %, during 2017.

2.1.4 CO_2 concentrations exceeded the trigger level value of 1.5 % on at least one occasion at 31 monitoring locations. Average concentrations in these boreholes ranged between 0% (G16) and a maximum of 32.1 % in G19. Locations G2, G8, G16, G17 and G32 remained below the trigger limit throughout the review period.

2.1.5 A summary table and time series graphs displaying all landfill gas monitoring data collected during this period are included in Appendix 2.

2.2 Trace Gas Monitoring

2.2.1 Trace gas monitoring was carried out on the 11th January. Monitoring reports are enclosed in Appendix 2.

2.3 Engine and Flare Emission Monitoring

2.3.1 Monitoring of the emissions from the flare and landfill gas engines was carried out on the 10th and 11th January 2018. Monitoring reports are enclosed in Appendix 2. None of the recorded emissions exceeded their respective limits for the flare or the engines.

2.4 Landfill Gas from Capped Surfaces

2.4.1 No surface emissions surveys were undertaken during 2017. A Flame Ionisation Detector (FID) walkover survey and flux box survey of the landfill is due to be carried out in 2018 and will be submitted separately.

[1] All gas concentrations are expressed as % v/v

3. GROUNDWATER

3.1 Groundwater Levels

3.1.1 Groundwater levels are recorded weekly. Levels remained stable throughout the year.

3.2 Groundwater Quality

3.2.1 Groundwater is sampled at locations W1 – W9 as required by Table S4.5 in the EP. W10 was not sampled as it is not currently safe to monitor and is due to be extended to ground level. Groundwater samples are analysed monthly for ammoniacal nitrogen, chloride, cyanide, pH, electrical conductivity and sulphate. In March, June and September, groundwater samples were analysed for the monthly and quarterly suites. In December, samples were also analysed for an additional annual suite. All monitoring data is included in Appendix 3.

3.2.2 Ammoniacal nitrogen concentrations remained below the 2 mg/L EP limit in all groundwater locations throughout 2017, with the exception of W4. Maximum concentrations of 2.49 mg/L, 2.35 mg/L and 3.13 mg/L were detected at W4 during August, October and November respectively.

3.2.3 pH ranged between a minimum of 5.5 in W5, and a maximum of 7.8 in W2. Electrical conductivity ranged between a minimum of 58.8 µS/cm in W6 and a maximum of 890 µS/cm in W1. Sulphate concentrations ranged between <4.4 mg/L in W2, W3 and W6 to 59.8 mg/l=L in W3.

3.2.4 Chloride concentrations were higher than the EP limit of 69 mg/L throughout the review period at W1. The average chloride concentration in W1 was 203 mg/L. Chloride concentration within W1 reduced over the review period to a minimum of 105 mg/L during October.

3.2.5 W1 is situated very close to the B4518 Llanidloes to Tylwch Road. In previous annual reviews it was noted that the groundwater quality within this borehole may be influenced by the application of road salt during the winter months. The chloride concentration within W1 shows no correlation to ammonical nitrogen, but does show strong correlation to sodium concentration. This was investigated in the Caulmert letter report 3033-CAU-XX-XX-CO-V-9101.A0-C1 which was submitted to NRW on the 24th April 2017. The results of this investigation suggest that the chloride concentrations at W1 are not related to landfill, but are instead reflective of a localised source of salt.

3.2.6 No 2, 4 –D, ethyl benzene or xylenes were detected in any of the groundwater monitoring locations.

3.2.7 Mecoprop was detected above the compliance limit at W5 during the second and third quarters with a concentration of 0.11 µg/l. Mecoprop was also detected below the

compliance limit at W5 in the fourth quarter of 2017 and during the third and fourth quarters at W4.

3.2.8 Concentrations of metals cadmium, nickel and zinc remained below their respective EP limits in all locations, throughout the review period.

3.2.9 In December, a full annual suite was undertaken, including a hazardous substances suite. Three parameters were detected in the groundwater and are detailed below in Table 1. No volatile organic compounds (VOCs) or semi volatile organic compounds (SVOCs) were detected. Full annual suite results are included in Appendix 3.

Table 1: Annual Groundwater Hazardous substances suite – detected parameters

Parameter	Unit	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9
EH >C16 - C24	ug/l	<40	101	<20	<40	<10	<10	<10	<10	<10
EH >C24 - C40	ug/l	<40	337	58	<40	<10	<10	<10	<10	<10
EH >C6 - C40	ug/l	<40	438	58	<40	<10	<10	<10	<10	<10

.

4. LEACHATE

4.1 Leachate Levels

4.2.1 Leachate levels are measured monthly at LCP1 (Sump 1), LCP2 (Sump 2), LCP3 (Sump 3), LCP7 (Sump 4), LCP8 (Sump 5), RMLP9C (Sump 9c) and RMLP9D (Sump 9d). LC6, RMLP9A and RMLP9B are sealed to improve the gas management on site. Level data and time series graphs are presented in Appendix 4.

4.2.2 Leachate levels in LCP1 remained below the 1 m EP limit throughout 2017.

4.2.3 Leachate levels in LCP2 and LCP3 were above the compliance limit for the first quarter of 2017. For the remainder of the year LCP2 was compliant and LCP3 was compliant between May and December. Average values for leachate above the base were 0.7 m and 1.0 m respectively.

4.2.4 LCP7 and LCP8 leachate levels were highest during the first quarter with maximums of 1.05 m and 1.65 m respectively, this is significantly lower than the previous year maximums which were 8.66 m and 6.89 m. From May onwards LCP7 and LCP8 were below the permitted limit of 1m above base.

4.2.5 RMLP9C and RMLP9D had the most elevated leachate levels in 2017 with levels around 10 m above base in both sumps for the first 3 months of the year. Levels in RMLP9C range between 10.01 m and 10.11 m in the first quarter and in RMLP9D levels were between 10.06 m and 10.36 m. From April onwards leachate levels in these sumps comply with the 1m permitted limit. These levels have been under review as part of ongoing improvement measures to increase leachate extraction rates. More efficient extraction and removal of leachate from site via tanker facilitated a reduction in levels across the site during 2017.

4.3 Leachate Quality

4.3.1 Leachate was analysed monthly for pH and ammoniacal nitrogen at LCP1 (Sump 1), LCP2 (Sump 2), LCP3 (Sump 3), LCP7 (Sump 4), LCP8 (Sump 5), RMLP9C (Sump 9c) and RMLP9D (Sump 9d). Samples from these locations were previously referred to as Leachate 1 – 7 respectively. In this report, and all future reports, the leachate results will be referred to as they are presented in the Permit.

4.3.2 LCP3 was sampled once during 2017. RMLP9C was sampled on 5 occasions, and RMLP9D was sampled on 7 occasions in 2017. Treated leachate (final discharge) was tested monthly for pH, ammoniacal nitrogen, sulphate, suspended solids, COD, and a TPH range (C6 – C40).

4.3.3 Highest ammoniacal nitrogen concentrations were detected in LCP2 during 2017, as in 2016. Concentrations in this sump ranged between 21.7 mg/L and 3690 mg/L.

4.3.4 Ammoniacal nitrogen concentrations at LCP7 (average concentration of 1210 mg/L) and LCP8 (average concentration of 1490 mg/L) followed a similar trend, increasing towards June 2017 then decreasing slightly towards the end of the year.

4.3.5 pH in the leachate ranged between a minimum of 5.2 in RMLP9D to a maximum of 8.2 in LCP2.

4.3.6 Landfill leachate was also analysed for a larger hazardous substances annual suite in December. 9 parameters were detected in the leachate chambers and are presented in Table 2 below. This is significantly less than in 2016 when 31 were detected.

Table 2: Landfill Leachate Hazardous substances suite – detected parameters

Sample Matrix	Unit	LCP1	LCP2	LCP7	LCP8
Lead , Total as Pb	mg/L	<0.006	0.182	0.007	<0.006
Nickel, Total as Ni	mg/L	0.022	0.334	0.125	0.155
Zinc, Total as Zn	mg/L	0.225	2.24	0.2	0.12
Mecoprop	ug/L	2.32	77.1	25.8	38.4
EH >C6 - C40	ug/L	977	2740	1320	555
EH >C8 - C10	ug/L	59	235	177	<100
EH >C16 - C24	ug/L	<40	271	201	140
EH >C24 - C40	ug/L	50	871	342	177
EH >C10 - C16	ug/L	868	1370	595	238

4.4 Treated Leachate

4.4.1 Approximately 28,844 m^3 of leachate was discharged, under discharge consent to Severn Trent for further treatment between the 1st of January and the 31st of December 2017.

4.4.2 Additionally to the leachate processed on site at the leachate treatment plant, 6975 m^3 of leachate was tankered off site during 2017 to maximize extraction from the site and lower leachate levels.

4.4.3 Potters Waste Management undertake daily in-situ testing of treated leachate in order to assess its suitability for discharge. Treated leachate is not discharged if compliance level exceedances are recorded. A summary of this data is included in Table 4 below as requested by NRW:

Table 3: Treated leachate daily monitoring summary (January - December 2017)

DATE	pH (METER)	pH (STRIP)	Ammoniacal Nitrogen (mg/l)	Dissolved Oxygen (mg/l)	Temperature (°C)
Min	5.5	10.0	6.9	0.9	10.1
Max	8.3	150.0	6.9	9.6	20.5
Average	7.2	70.3	6.9	4.6	15.6
Count	62	62	62	62	62

4.4.4 Several exceedances were recorded during the review period within the treated leachate. Concentrations of ammoniacal nitrogen did not exceeded the EP limit of 150 mg/L in 2017.

This is a significant improvement on the quality of treated leachate from 2016, when six ammoniacal nitrogen concentration exceedances were recorded.

4.4.5 The concentration of suspended solids within the treated leachate exceeded the EP limit between May and August with a maximum of 7650 mg/L. The average for the year was 1087 mg/l, this is above the limit of 500 mg/L. Suspended solids concentrations have increased on average when compared to 2016 (1470 mg/L average), however the total number of exceedances has decreased. There were four exceedances for suspended solids during 2017, as opposed to nine exceedances during 2016.

4.4.6 COD concentrations ranged between 374 mg/L in December and a maximum of 2660 mg/L in January 2017. Average concentrations were 1196 mg/L which is slightly above the limit of 1000 mg/L and significantly lower than the 2016 average of 2071 mg/L. There were also only four months in which an exceedance was detected during 2017, as opposed to the eleven exceedances of 2016. The DAF is currently operational and is expected to continue improving the COD concentration in the treated leachate.

4.4.7 Concentrations of TPH were detected on all of the monitoring rounds, exceeding the compliance limit of 'nil'. Concentrations ranged between 301 µg/L and 6100 µg/L. Average TPH concentration during 2017 was 2068.8 mg/L. This is significantly higher than that detected in 2016 (986 mg/L).

4.4.8 A biomass boiler and heat exchange system was commissioned at Bryn Posteg during 2017, which aids in maintaining the temperature of the leachate treatment lagoon within the optimum range for the biological treatment process. With the exception of TPH, this has improved the quality of the treated leachate, particularly during the winter months.

4.4.9 During June and December the Final Discharge was analysed for a 6 monthly suite. December samples were also analysed for additional hazardous substances. Table 4 below displays the detected parameters.

Table 4: Treated Leachate Hazardous substances suite – detected parameters

Parameter	Units	June	December
Cyanide	mg/L	0.85	<0.009
Dicamba	µg/L	<5.00	0.32
EH >C6 - C40	µg/L	2220	301
EH >C10 - C16	µg/L	2220	232
EH >C16 - C24	µg/L	<100	69
Mercury	mg/L	0.00019	<0.0001
Chloromethane	µg/L	22	<20.0
Bromomethane	µg/L	17.2	<20.0

5. SURFACE WATER

5.1 Surface Water Quality

5.1.1 Surface water samples were collected at SW1 (P1) and SW2 (P2) during the review period. Surface water monitoring data and time series graphs are included in Appendix 5.

5.1.2 Concentrations of ammoniacal nitrogen do not exceed the compliance limit of 0.25 mg/L in SW1 in 2017. In SW2 concentrations of ammoniacal nitrogen reach a maximum of 0.83mg/L in December 2017. Ammoniacal nitrogen in SW2 is compliant for 75% of the year, with an average concentration of 0.2 mg/L.

5.1.3 Suspended solids concentration exceeded the trigger limit on average in SW2 at 230 mg/L, this is higher than the previous year where the maximum was 180 mg/L. An average of 53 mg/l is noted at SW2, which is slightly above the limit of 50 mg/L. However in SW1 the concentrations did not exceed the permitted limit of 50 mg/L.

5.1.4 The pH remained within the EP limit range of 6 – 9 at SW1 and SW2 throughout the review.

5.1.5 No hazardous substances were detected in the surface water locations as part of the suites in June and December. This is a notable decrease compared to three substances detected in 2016.

6. DUST

6.1 Monitoring

6.1.1 Dust monitoring at the site was carried out on 3 occasions in 2017. The results are summarized below:

Table 5: Dust Monitoring Results

Dust	Concentration (mg/m^2/day)
Period	**17/05/2017 – 30/05/2017**
BP 1	26
BP 2	41
BP 3	31
Period	**27/06/2017 -31/07/2017**
BP 1	46
BP 2	69
BP 3	37
Period	**12/11/2017 – 16/12/2017**
BP 1	<10
BP 2	<10
BP 3	23

6.1.2 Dust concentrations remained below the EP limit of 200 mg/m^2/day at all locations during 2017.

7. ANNUAL PRODUCTION / TREATMENT

7.1 Introduction

7.1.1 Annual production/treatment at Bryn Posteg during the period 1st January to 31st December 20167is reported in accordance with Table S5.2 in the EP, see Table 7 below:

Table 6: Annual Production/Treatment

Annual production/treatment	
Leachate:	**Cubic metres/year:**
Disposed of off-site (sewer);	28,844
Disposed of to any offsite effluent treatment plant;	6975
Recirculated into the waste mass.	Nil
Surface water and/or groundwater:	**Cubic metres/year:**
Disposed of off-site;	Nil
Disposed of to any onsite effluent treatment plant.	Nil
Landfill gas:	**Normalised cubic metres/year:**
Combustion in flares;	0.15 million*
Combustion in gas engines;	4.8 million*
Other methods of gas utilisation.	Nil

* estimated

8. PERFORMANCE PARAMETERS

8.1 Introduction

8.1.1 Performance parameters are reported in line with requirements in the EP. Data is presented in Table 7 below, which is a reproduction of Table S5.3 in the permit.

Table 7: Performance Parameters

Parameter	Frequency of assessment	Annual total	Unit
Energy Used (including for leachate treatment)	Annually	130*	MWh of Electricity

* estimated

8.1.2 It should be noted that 8793 MWh of energy was exported from the site during the same time period.

9. TOPOGRAPHICAL SURVEY

9.0.1 An investigation into the current landfill form is ongoing in relation to the Statutory Notice R61 dated 18th January 2018. An updated Stability Risk Assessment will be submitted separately to include a current topographical survey, restoration profiles and remaining void figures.

10. SUMMARY

10.1 Landfill Gas

10.1.1 Methane concentrations exceeded the EP limit of 1.0 %[1] on at least one occasion all monitoring locations.

10.1.2 CO_2 concentrations exceeded the trigger level value of 1.5 % on at least one occasion at all monitoring locations.

10.1.3 Landfill gas concentration detected in the perimeter boreholes in this review period are similar to those detected in 2016.

10.2 Groundwater

10.2.1 Groundwater levels remained stable throughout the review period in all locations.

10.2.2 The EP limit for chloride was exceeded in location W1 throughout the review period. It is likely that this locations is influenced by road salt, used on the B4518 during the winter months, which would explain the seasonality seen in the results.

10.2.3 Three parameters from the bi-annual suite were detected in the groundwater in low concentrations.

10.3 Leachate

10.3.1 Leachate levels in LCP1 remained below the 1 m EP limit throughout the review. Leachate levels in LCP2 and LCP3 were above the compliance limit for the first quarter of 2017. For the remainder of the year LCP2 was compliant and LCP3 was compliant between May and December. LCP7 leachate levels were above the compliance limit in February alone, while LCP8 levels were in exceedance of the compliance limit for January through April.

10.3.2 RMLP9C and RMLP9D were above the leachate level compliance limit during the first quarter of 2017, then decreased to below the compliance limit for the remainder of 2017.

10.3.3 Highest ammoniacal nitrogen concentrations were detected in LCP2 during 2017. Nine parameters were detected in the annual hazardous substances suite.

10.3.4 In the final discharge (treated leachate) quality data, exceedances of the EP limits for suspended solids, COD and TPH were recorded. Treated leachate is not discharged if EP limit exceedances are recorded. A total of eight parameters from the hazardous substances suite were detected during 2017.

10.3.5 Approximately 28,844 m^3 of treated leachate was discharged to sewer (under discharge consent) and 6975 m^3 of leachate was tankered off site for treatment.

10.4 Surface Water

10.4.1 Concentrations of all parameters remained below their respective EP limits in the monthly and quarterly analysis, except ammoniacal nitrogen and suspended solids.

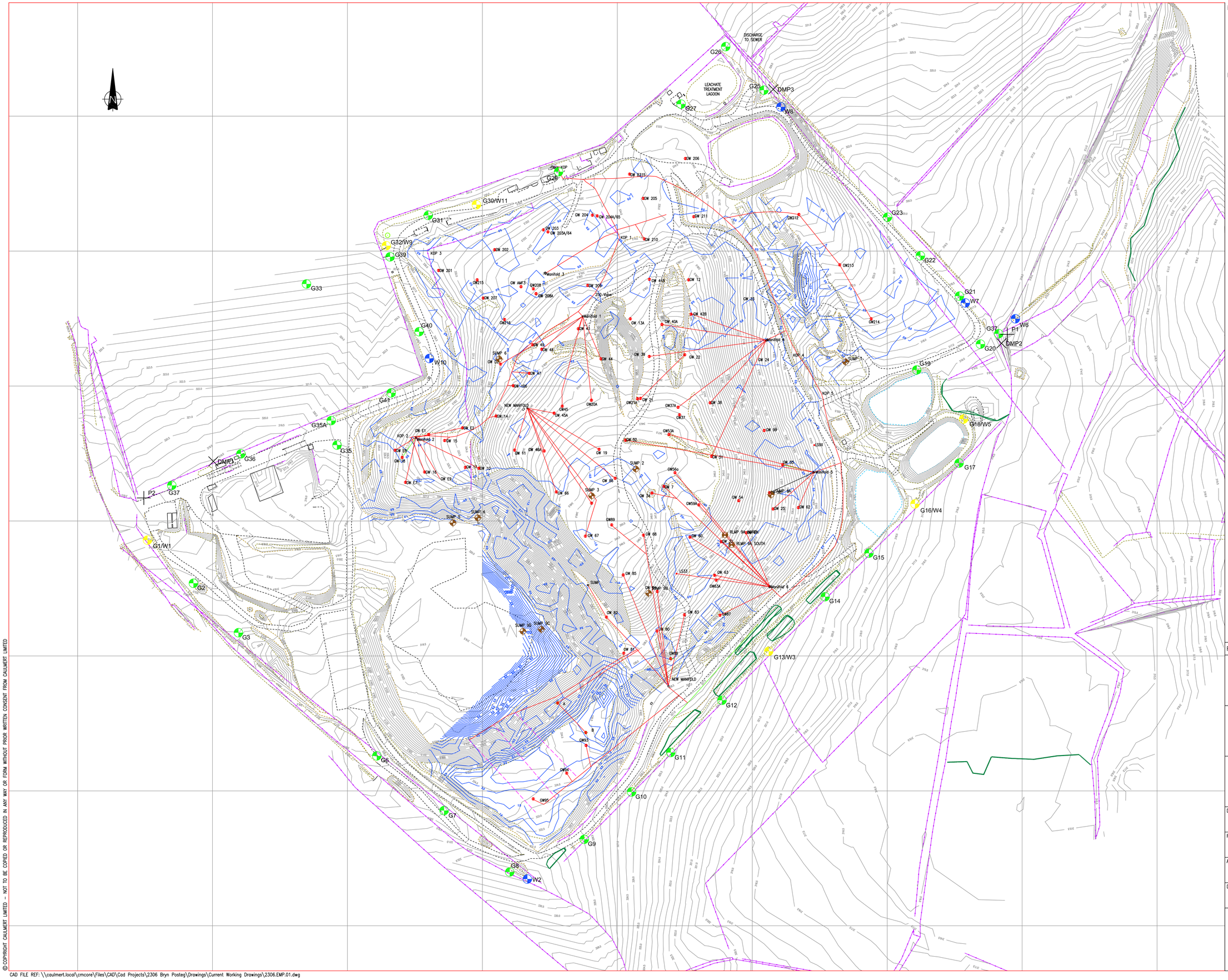
10.4.2 Ammoniacal nitrogen concentration did not exceeded the EP limit during 2017 at SW1, however three slight exceedances were detected at SW2. Suspended solids concentrations exceeded the EP limit on six occasions in SW2 alone.

10.4.3 No hazardous substances were detected in SW1 or SW2 as part of the annual suite in December.

10.5 Dust

10.5.1 Dust concentrations remained below the EP limit at all locations during 2017.

Appendix 1



NOTES

1. SURVEY INFORMATION PROVIDED BY POTTERS WASTE MANAGEMENT. SURVEY DATED 12.01.2016
2. ALL LEVELS IN METRES ABOVE ORDNANCE DATUM.
3. DO NOT SCALE FROM THIS DRAWING

LEGEND

- IN WASTE GAS WELL
- GAS MONITORING BOREHOLE
- GROUNDWATER MONITORING BOREHOLE
- GAS MONITORING BOREHOLE WITH GROUNDWATER MONITORING BOREHOLE
- EXISTING LEACHATE COLLECTION POINT
- IN WASTE GAS WELL
- APPROXIMATE POSITION OF SURFACE WATER MONITORING POINT
- APPROXIMATE POSITION OF DUST MONITORING POINT

SURFACE WATER MONITORING POINTS

P1 NANT-Y-BRADNANT

P2 AFON DULAS

DUST MONITORING POINTS

DMP1 VALLEY VIEW

DMP2 RHOSWEN AND PANT

DMP3 PENBRYNDU

REV	MODIFICATIONS	BY	RE	AP	DATE

POTTERS WASTE MANAGEMENT

BRYN POSTEG LANDFILL SITE

ENVIRONMENTAL MONITORING PLAN

DRAWN BY: RWG	DATE: 12.02.2016	
REVIEWED BY: JMC	SCALE @ A1: 1:1250	
AUTHORISED BY: JMC	ISSUE: P	REVISION: P1
DRAWING NUMBER: 2601.EMP.01		

Caulmert
Engineering, Environmental and Planning

CAD FILE REF: \\caulmert.local\cmcore\Files\CAD\Cad Projects\2306 Bryn Posteg\Drawings\Current Working Drawings\2306.EMP.01.dwg

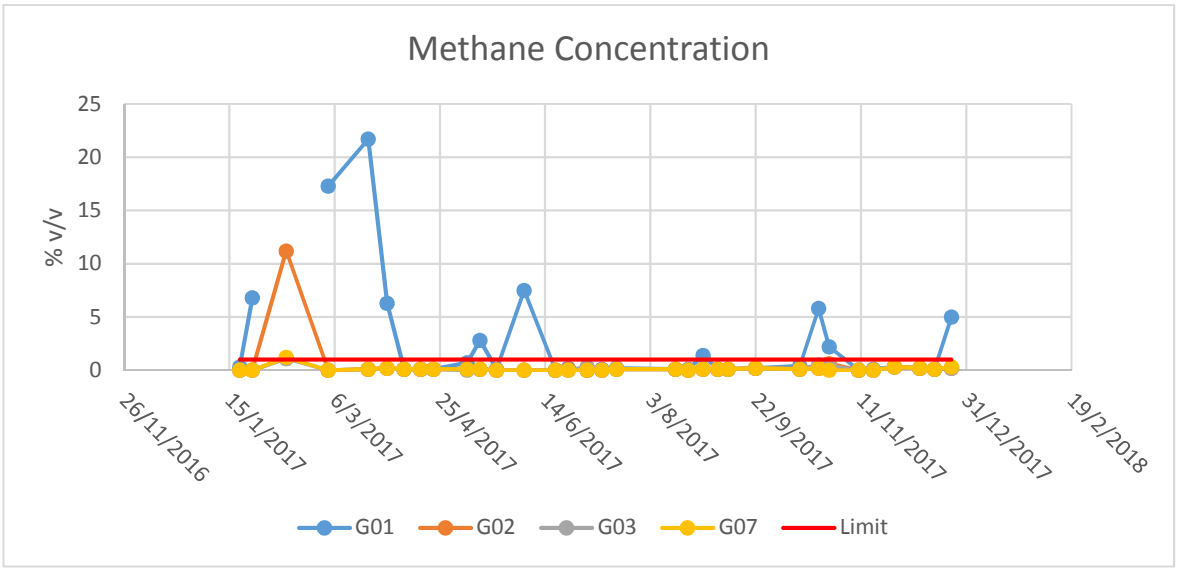
Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG Company Registered No: 06716319

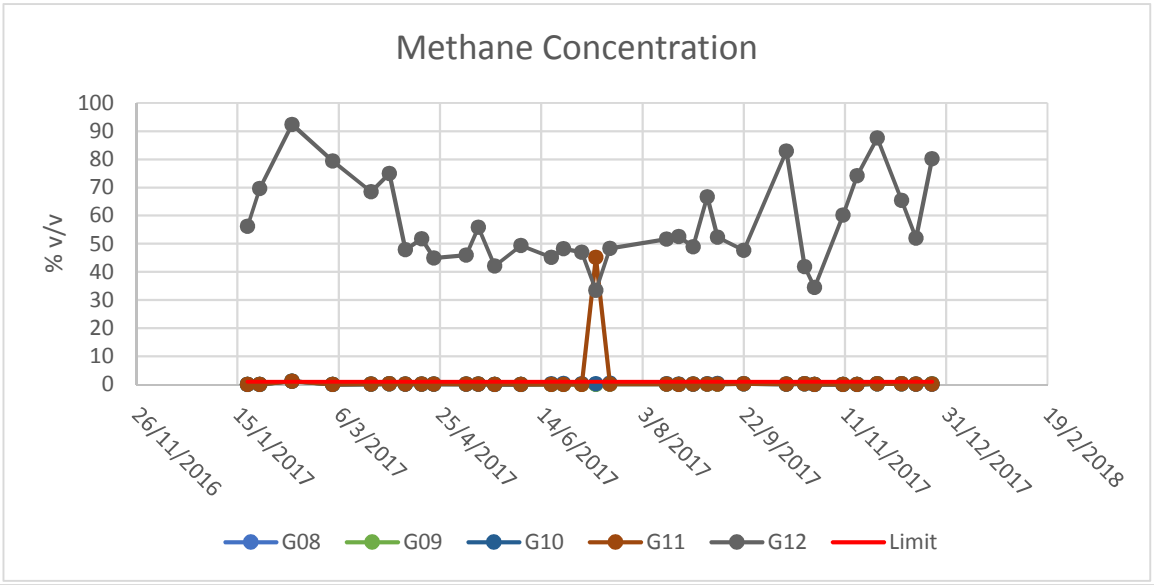
Appendix 2

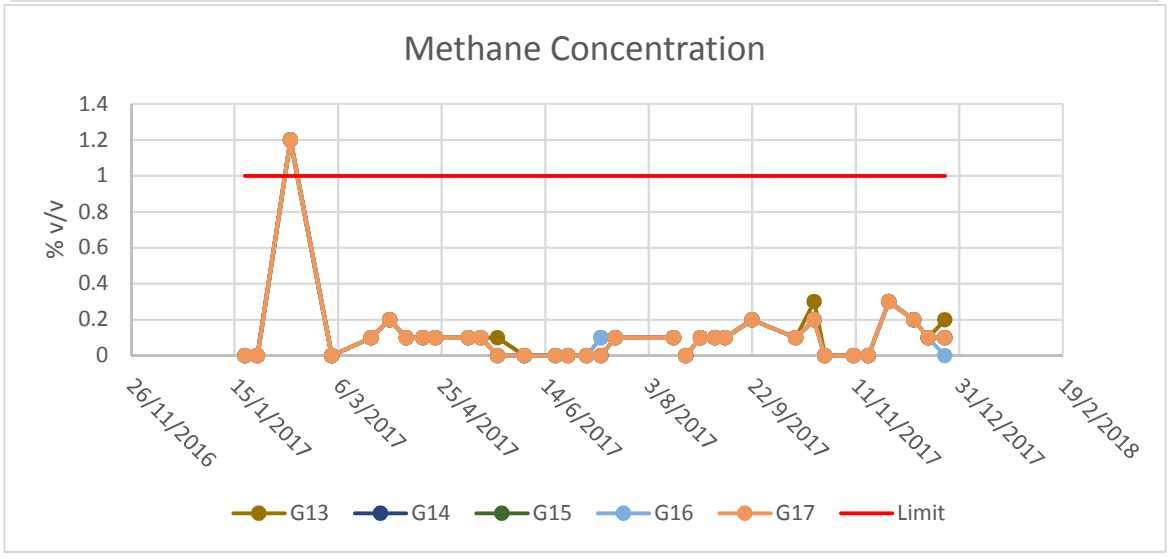
APPENDIX 2 – LANDFILL GAS

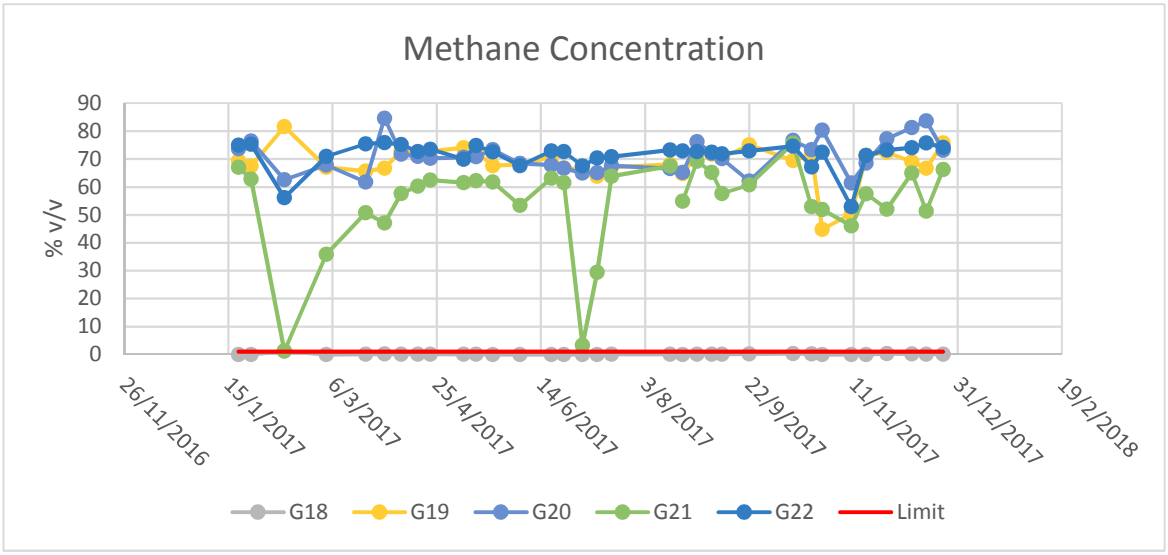
Table 1: Landfill Gas monitoring data (% v/v) – Exceedances highlighted yellow

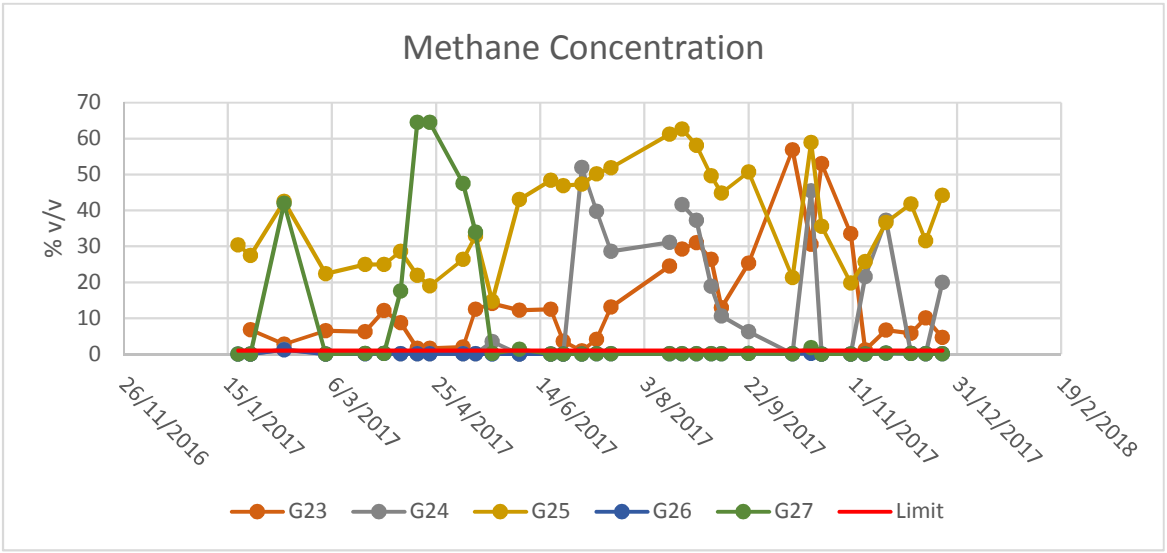
	Methane (% v/v)			Carbon Dioxide (% v/v)			Oxygen (%v/v)			
ID	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Count
G01	0.0	21.7	2.5	0.0	4.0	1.1	4.7	20.5	17.3	33
G02	0.0	11.2	0.4	0.0	1.2	0.2	20.0	22.1	20.7	33
G03	0.0	1.1	0.1	0.1	3.2	1.3	13.6	21.0	18.2	33
G07	0.0	1.2	0.1	0.0	3.6	1.6	12.8	22.0	19.5	33
G08	0.0	1.2	0.1	0.0	1.7	0.3	14.2	21.8	19.7	34
G09	0.0	1.2	0.1	0.0	0.9	0.1	20.5	22.2	21.1	33
G10	0.0	1.2	0.2	0.0	8.9	3.5	13.0	21.6	18.0	34
G11	0.0	45.2	1.5	0.0	3.5	0.9	7.7	22.9	20.2	33
G12	33.4	92.4	57.6	2.6	4.9	3.6	0.2	11.2	5.6	33
G13	0.0	1.2	0.1	0.0	2.6	0.2	19.0	22.6	21.1	33
G14	0.0	1.2	0.1	1.1	4.0	2.5	16.0	20.7	18.4	34
G15	0.0	1.2	0.1	0.4	6.5	1.8	6.2	20.4	17.6	33
G16	0.0	1.2	0.1	0.0	0.1	0.0	20.6	22.8	21.4	33
G17	0.0	1.2	0.1	0.0	0.7	0.1	20.6	22.7	21.4	33
G18	0.0	1.2	0.1	0.0	1.8	0.1	20.4	22.8	21.3	33
G19	44.8	81.6	68.7	23.0	38.3	32.1	0.2	6.6	0.8	33
G20	61.4	84.6	71.0	8.2	39.2	26.9	0.1	7.4	1.0	33
G21	1.2	75.6	54.5	0.0	25.4	14.8	0.1	21.2	2.3	33
G22	52.9	75.9	71.6	16.6	31.3	23.3	0.1	5.7	0.4	33
G23	0.9	56.9	14.8	4.8	21.1	9.8	0.1	8.6	0.8	32
G24	0.0	52.0	12.0	0.0	24.4	5.2	5.1	22.1	16.7	33
G25	14.7	62.7	38.2	6.8	22.3	15.0	0.2	11.7	2.0	34
G26	0.0	1.2	0.1	0.6	4.2	2.3	15.4	20.8	18.8	33
G27	0.0	64.5	8.1	0.0	31.6	5.5	1.0	22.7	17.6	34
G29	0.0	7.1	1.3	0.0	8.1	1.8	1.8	23.1	16.9	33
G30	0.0	19.0	5.2	0.0	3.9	1.6	10.6	22.7	17.8	33
G31	0.0	21.9	2.4	1.0	9.8	3.8	5.3	21.6	17.0	33
G32	0.0	1.1	0.1	0.0	1.3	0.3	20.0	22.7	21.2	33
G35	0.0	74.3	47.1	0.0	37.1	22.4	0.1	21.6	6.1	34
G36	0.0	39.5	3.4	0.1	7.7	1.5	5.2	22.2	18.6	34
G37	0.0	1.1	0.1	0.1	3.6	1.7	15.6	21.5	20.3	32
G38	18.1	73.9	55.2	16.4	35.5	29.3	0.1	8.0	0.8	34
G39	0.0	1.1	0.1	0.0	5.4	1.1	14.8	22.7	20.2	33
G40	0.0	69.5	19.3	0.0	33.5	14.1	0.1	22.3	9.3	33
G41	0.0	36.4	4.1	0.0	28.7	6.7	0.3	22.1	9.9	34
G42	0.0	1.1	0.1	0.0	3.4	0.4	18.1	22.9	21.2	31

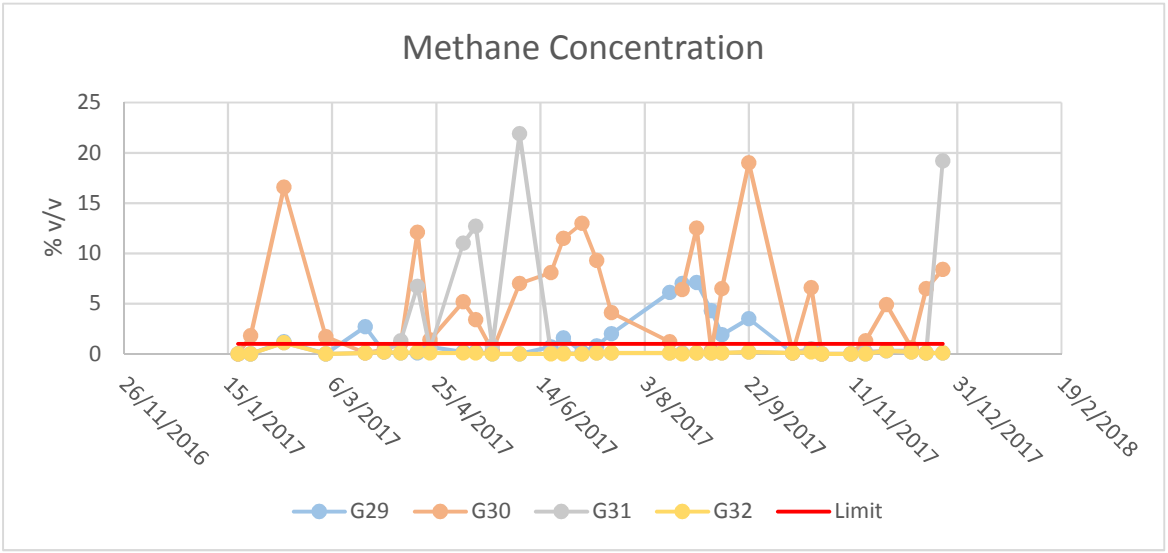

Methane Concentration
% v/v
25
20
15
10
5
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G01
G02
G03
G07
Limit

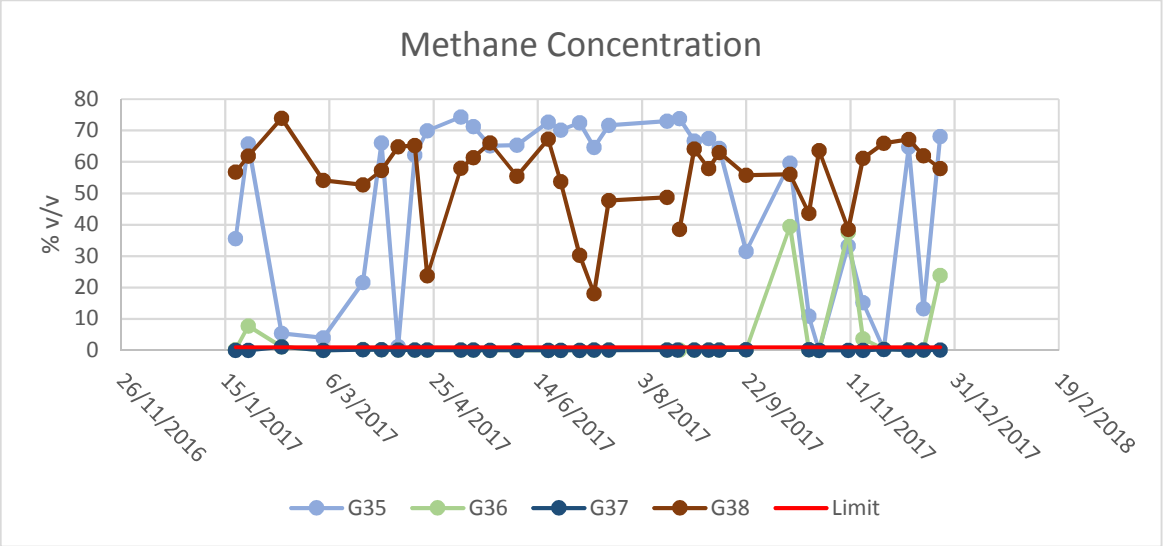

Methane Concentration
% v/v
100
90
80
70
60
50
40
30
20
10
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G08
G09
G10
G11
G12
Limit

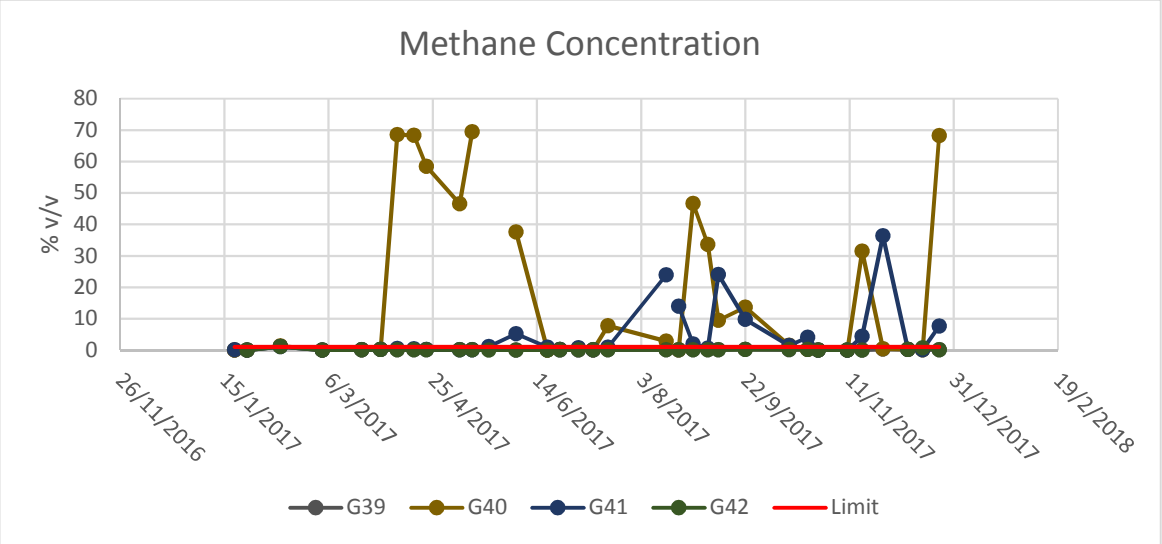

Methane Concentration
% v/v
1.4
1.2
1
0.8
0.6
0.4
0.2
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G13
G14
G15
G16
G17
Limit

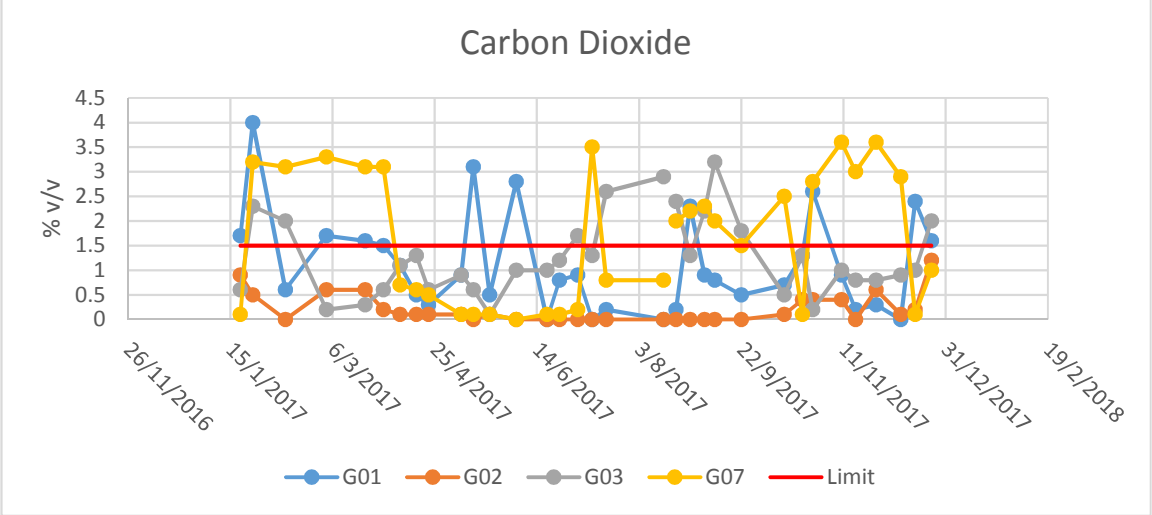

Methane Concentration
% v/v
90
80
70
60
50
40
30
20
10
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G18
G19
G20
G21
G22
Limit

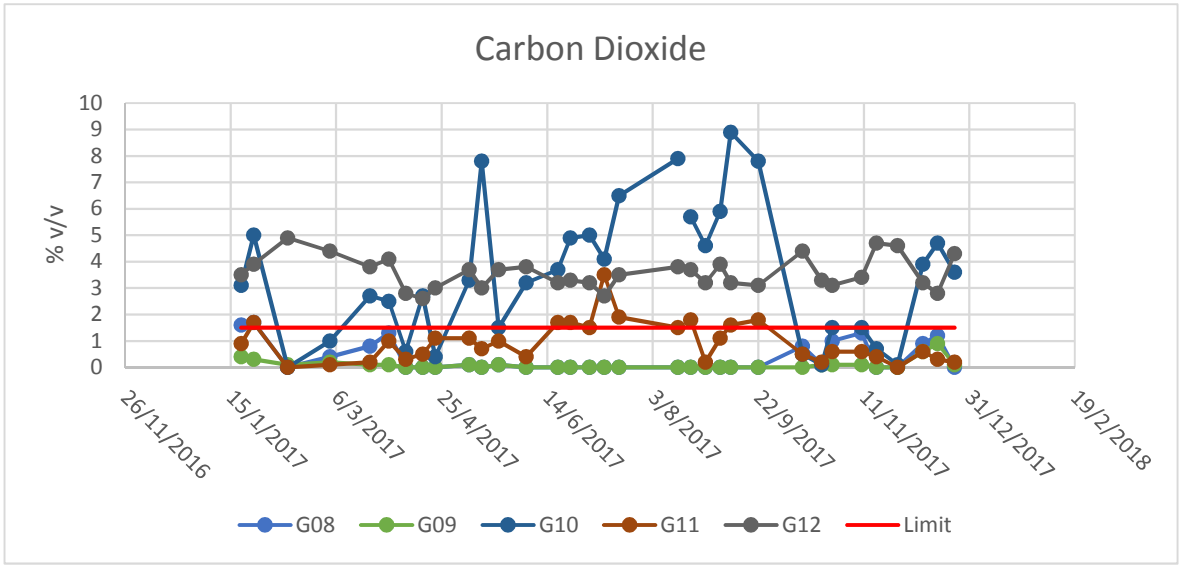

Methane Concentration
% v/v
70
60
50
40
30
20
10
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G23
G24
G25
G26
G27
Limit

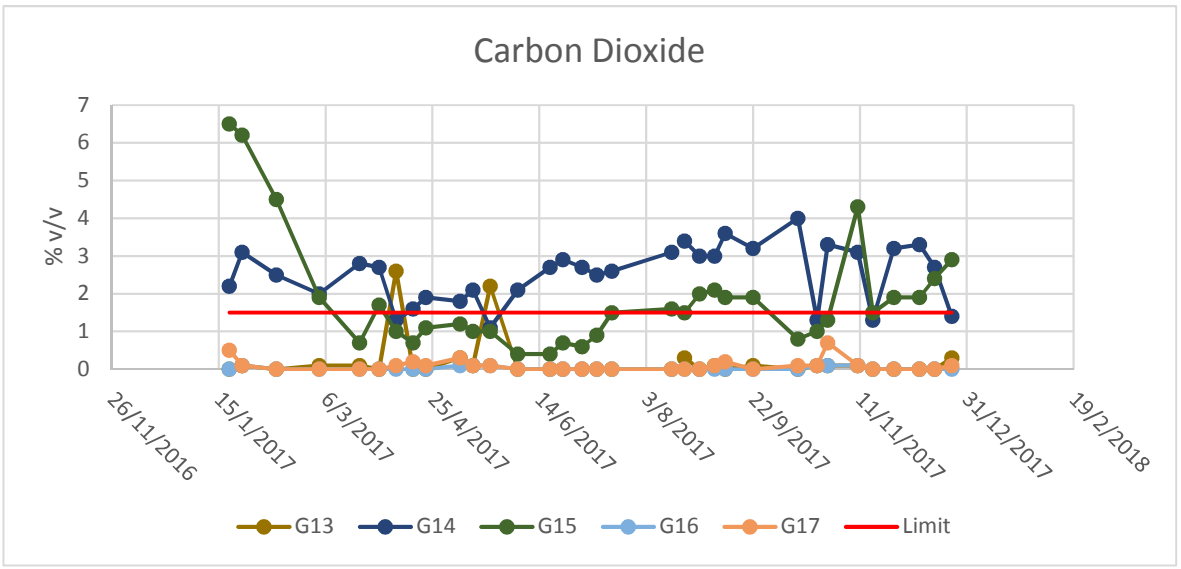

Methane Concentration
% v/v
25
20
15
10
5
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G29
G30
G31
G32
Limit

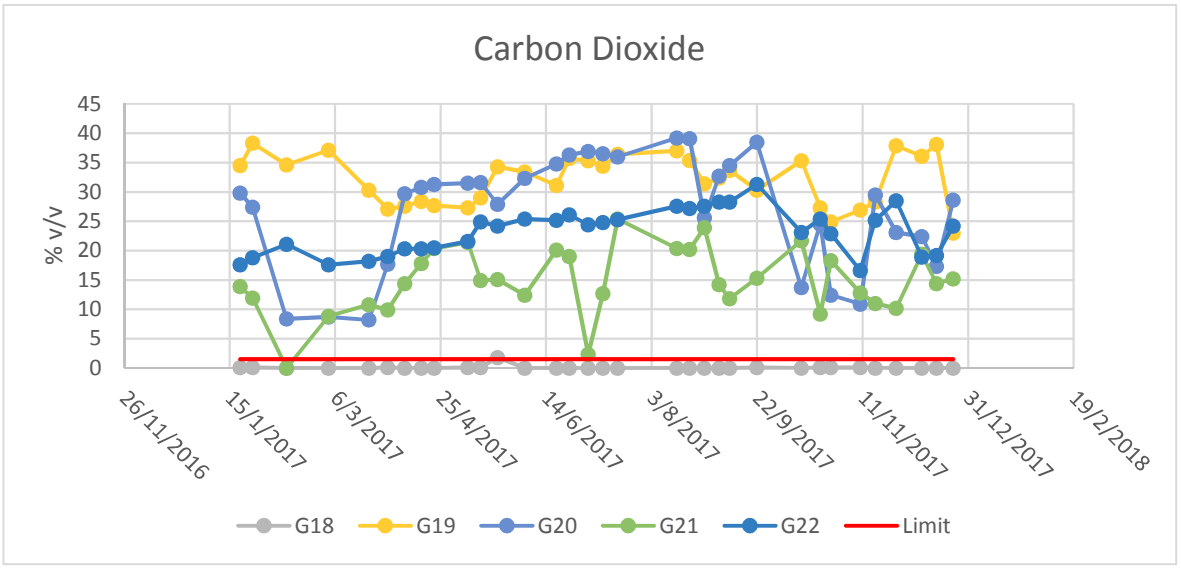

Methane Concentration
% v/v
80
70
60
50
40
30
20
10
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G35
G36
G37
G38
Limit

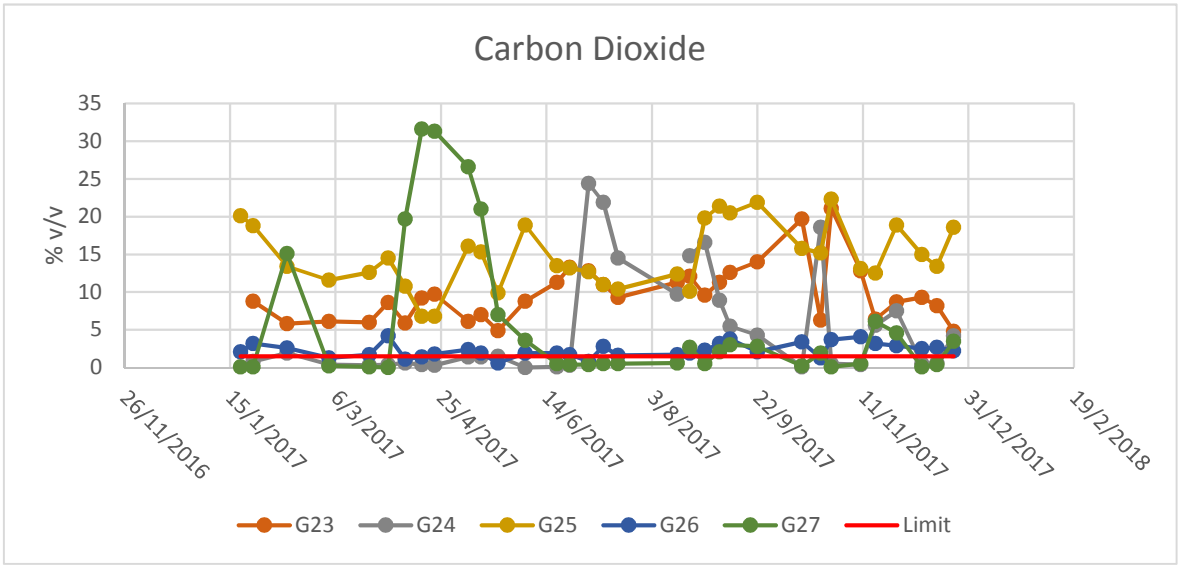

Methane Concentration
% v/v
80
70
60
50
40
30
20
10
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G39
G40
G41
G42
Limit

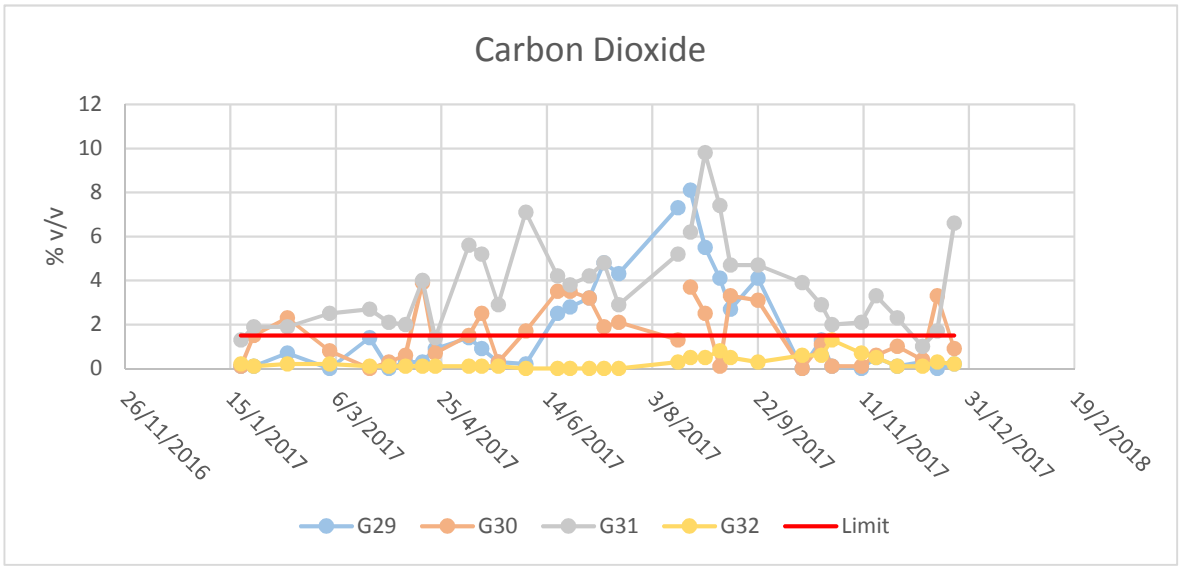

Carbon Dioxide
% v/v
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G01
G02
G03
G07
Limit

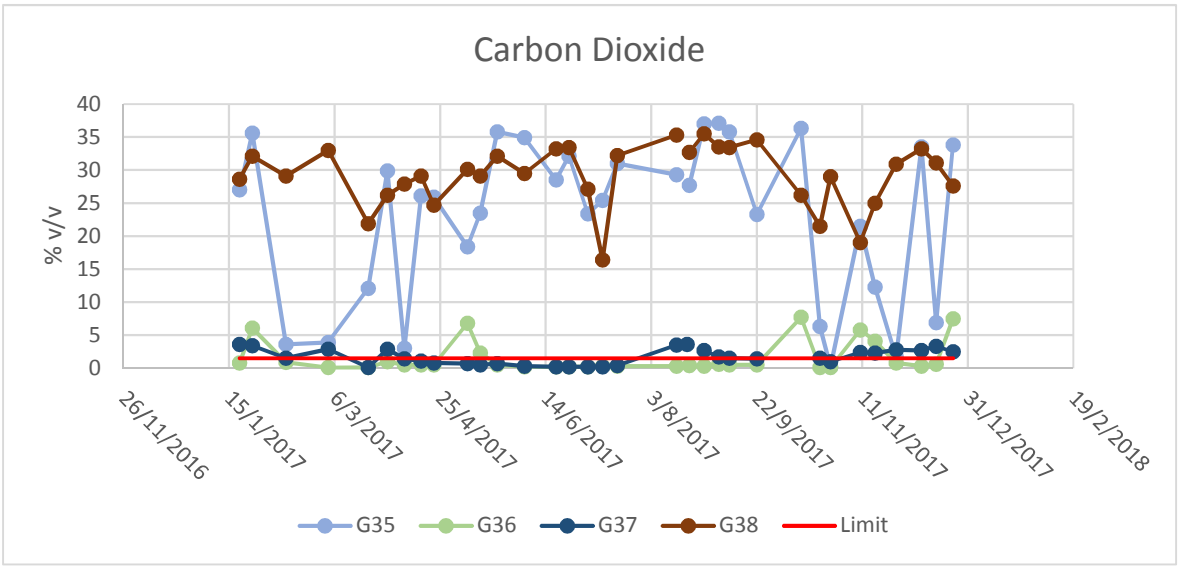

Carbon Dioxide
% v/v
10
9
8
7
6
5
4
3
2
1
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G08
G09
G10
G11
G12
Limit

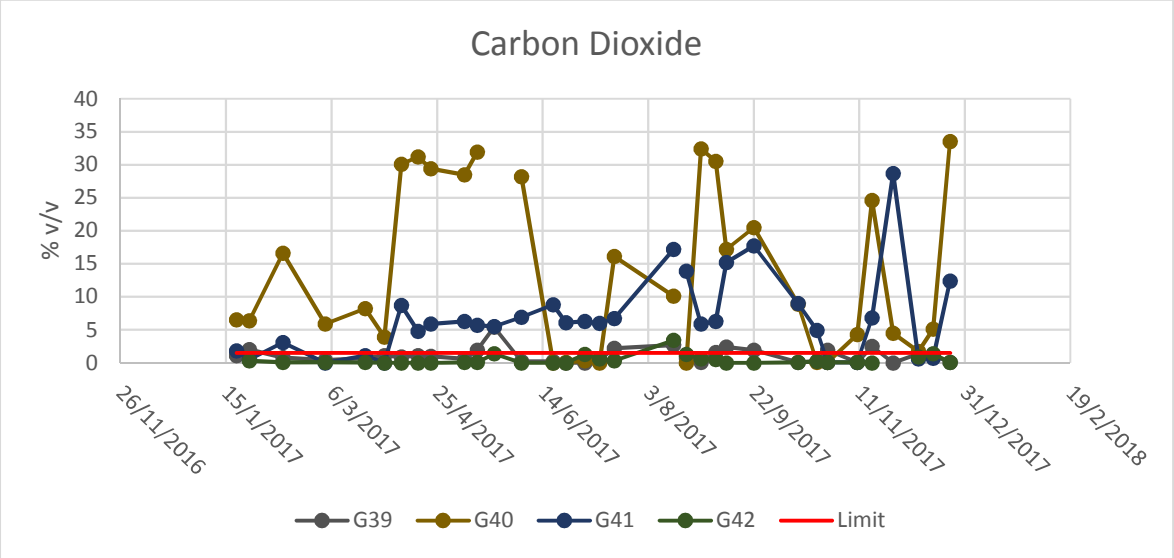

Carbon Dioxide
% v/v
7
6
5
4
3
2
1
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G13
G14
G15
G16
G17
Limit


Carbon Dioxide
% v/v
45
40
35
30
25
20
15
10
5
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G18
G19
G20
G21
G22
Limit


Carbon Dioxide
% v/v
35
30
25
20
15
10
5
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G23
G24
G25
G26
G27
Limit


Carbon Dioxide
% v/v
12
10
8
6
4
2
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G29
G30
G31
G32
Limit


Carbon Dioxide
% v/v
40
35
30
25
20
15
10
5
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G35
G36
G37
G38
Limit


Carbon Dioxide
% v/v
40
35
30
25
20
15
10
5
0
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
G39
G40
G41
G42
Limit

Concept Reference: 708572

Customer Reference: P3334

Tube (Tenax/Carbon/Molecular Sieve) Analysed as Tube (Tenax/Carbon/Molecular Sieve)

Trace Landfill Gas Suite

				Concept Reference	**708572 018**	**708572 021**	**708572 022**
				Customer Sample Reference	**ECL/18/0086**	**ECL/18/0089**	**ECL/18/0090**
				Test Sample	**AR**	**AR**	**AR**
				Volume l	**0.238**		
				Date Sampled	**11-JAN-2018**	**11-JAN-2018**	**11-JAN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
1 Pentene	GC/MS (TD SIR)	10	ng	U	(68) **46**	(68) **30**	(68) **23**
	Calc	Calc	mg/m3	N	**0.19**		
	Calc	Calc	ppm	N	**0.067**		
1,1-Dichloroethane	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.010		
1,1-Dichloroethylene	GC/MS (TD SIR)	10	ng	U	**280**	**240**	<10
	Calc	Calc	mg/m3	N	**1.2**		
	Calc	Calc	ppm	N	**0.30**		
1,2-Dichloroethane	GC/MS (TD SIR)	10	ng	N	(175) **1600**	<10	<10
	Calc	Calc	mg/m3	N	**6.7**		
	Calc	Calc	ppm	N	**1.7**		
1,2-Dichloroethylene	GC/MS (TD SIR)	30	ng	U	<30	<30	**300**
	Calc	Calc	mg/m3	N	<0.13		
	Calc	Calc	ppm	N	<0.032		
1,3-Butadiene	GC/MS (TD SIR)	10	ng	U	(68) <10	(68) <10	(68) **82**
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.019		
1,4 epoxy 1,3-butadiene	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.015		
1-Propanethiol	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.013		
2-butoxyethanol	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.0087		
Benzene	GC/MS (TD SIR)	10	ng	U	(175) **5900**	(175) **2100**	<10
	Calc	Calc	mg/m3	N	**25**		
	Calc	Calc	ppm	N	**7.8**		
Butyric acid	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.012		
Carbon disulphide	GC/MS (TD SIR)	10	ng	N	**440**	<10	<10
	Calc	Calc	mg/m3	N	**1.8**		
	Calc	Calc	ppm	N	**0.59**		
Carbon tetrachloride	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.0067		
Chloroethane	GC/MS (TD SIR)	30	ng	N	<30	<30	<30
	Calc	Calc	mg/m3	N	<0.13		
	Calc	Calc	ppm	N	<0.048		
Dichloromethane	GC/MS (TD SIR)	10	ng	N	(175) **5300**	<10	<10
	Calc	Calc	mg/m3	N	**22**		
	Calc	Calc	ppm	N	**6.4**		
Dimethyl disulphide	GC/MS (TD SIR)	10	ng	N	**320**	<10	<10
	Calc	Calc	mg/m3	N	**1.3**		
	Calc	Calc	ppm	N	**0.35**		
Dimethyl sulphide	GC/MS (TD SIR)	10	ng	U	**750**	**12**	**21**
	Calc	Calc	mg/m3	N	**3.2**		
	Calc	Calc	ppm	N	**1.2**		
Ethyl butyrate	GC/MS (TD SIR)	25	ng	N	<25	<25	<25
	Calc	Calc	mg/m3	N	<0.11		
	Calc	Calc	ppm	N	<0.022		
Ethyl Mercaptan	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.017		
Hydrogen sulphide	GC/MS (TD SIR)	60	ng	N	<60	<60	<60

Concept Reference: 708572
Customer Reference: P3334

Tube (Tenax/Carbon/Molecular Sieve) Analysed as Tube (Tenax/Carbon/Molecular Sieve)

Trace Landfill Gas Suite

				Concept Reference	**708572 018**	**708572 021**	**708572 022**
				Customer Sample Reference	**ECL/18/0086**	**ECL/18/0089**	**ECL/18/0090**
				Test Sample	**AR**	**AR**	**AR**
				Volume l	**0.238**		
				Date Sampled	**11-JAN-2018**	**11-JAN-2018**	**11-JAN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
	Calc	Calc	mg/m3	N	<0.25		
	Calc	Calc	ppm	N	<0.18		
Methyl Mercaptan	GC/MS (TD SIR)	30	ng	N	<30	<30	<30
	Calc	Calc	mg/m3	N	<0.13		
	Calc	Calc	ppm	N	<0.064		
N-Butyl Mercaptan	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.011		
Styrene	GC/MS (TD SIR)	10	ng	N	**260**	<10	<10
	Calc	Calc	mg/m3	N	**1.1**		
	Calc	Calc	ppm	N	**0.26**		
Toluene	GC/MS (TD SIR)	10	ng	N	(27) **12000**	**31**	<10
	Calc	Calc	mg/m3	N	**50**		
	Calc	Calc	ppm	N	**13**		
Trichloroethylene	GC/MS (TD SIR)	10	ng	U	**730**	**250**	<10
	Calc	Calc	mg/m3	N	**3.1**		
	Calc	Calc	ppm	N	**0.57**		
Vinyl chloride monomer	GC/MS (TD SIR)	10	ng	U	(68) <10	(68) <10	(68) <10
	Calc	Calc	mg/m3	N	<0.042		
	Calc	Calc	ppm	N	<0.016		

Concept Reference: 708572
Customer Reference: P3334

Tube (Charcoal) Analysed as Tube (Charcoal 226-01)

Siloxanes

				Concept Reference	**708572 025**	**708572 026**
				Customer Sample Reference	**ECL/18/0093**	**ECL/18/0094**
				Test Sample	**AR**	**AR**
				Date Sampled	**11-JAN-2018**	**11-JAN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Decamethylcyclopentasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Decamethyltetrasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Hexamethylcyclotrisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Hexamethyldisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Octamethylcyclotetrasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Octamethyltrisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1

Index to symbols used in Supplement to 708572-1

Value	Description
AR	As Received
27	Result should be considered as a minimum due to detector saturation.
13	Results have been blank corrected.
175	Results should be viewed with caution due to being outside of the instrument calibration range
68	Outside scope of UKAS accreditation
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited
C	Calculation

Notes

Supplemental report issued to include air concentration units for Sample 018 as this was missing from the original report.
The results for 1 Pentene, 1,3-Butadiene & Vinyl Chloride Monomer are outside the scope of our UKAS accreditation as the standards expired on the 13/01/18.

EMISSIONS MONITORING SURVEY

Prepared for:

Potters Waste
Brynposteg Landfill Site
Llandidloes
SY18 6JJ

Permit Number	**: TP3736SQ**
Variation Number	**: ...**
Installation	**: Engine 1 & 2**
Visit Details	**: Annual Compliance**
Job Number	**: P3334**
Report Number	**: R001**
Report Issue Date	**: 31st January 2018**
Survey Dates	**: 10th & 11th January 2018**

Prepared by:

Environmental Compliance Limited
Unit G1
Main Avenue
Treforest Industrial Estate
Pontypridd
CF37 5BF.
Tel: 01443 841760
Fax: 01443 841761

Report Issue:		**FINAL**	
Report Prepared by:		**Report Reviewed & Approved by** **MCERTS Level Two** **Technical Endorsements TE1, TE2, TE3 & TE4**	
Name:	Mike Mullett	***Name:***	Sam Brookes
		MCERTS No:	MM 06 755
		Signature:	
Date:	29/01/2018	***Date:***	31/01/2018

This report is not to be used for contractual or engineering purposes unless this approval sheet is signed where indicated by the approver and the report is designated "FINAL".

2499

This report has been prepared by Environmental Compliance Limited (ECL) in their professional capacity as Environmental Consultants. The contents of the report reflect the conditions that prevailed and the information available or supplied at the time of its preparation. The report, and the information contained therein, is provided by ECL solely for use and reliance by the Client in performance of ECLs duties and liabilities under its contract with the Client. Until ECL has received payment in full as detailed in the quotation or contract the contents of this report remain the legal property of ECL. The contents of the report do not, in any way, purport to include any manner of legal advice or opinion.

This report should not be reproduced, (except in full) without the written approval of the laboratory.

Should the Client wish to release this report to a Third Party for the party's reliance, Environmental Compliance Ltd may, at its discretion, agree to such release provided that:

- Environmental Compliance Ltd gives written agreement prior to such release and ECL has received payment in full for all works/services undertaken;
- By release of the report to the Third Party, that Third Party does not acquire any rights, contractual or otherwise, whatsoever against Environmental Compliance Ltd and, accordingly, Environmental Compliance Ltd assume no duties, liabilities or obligations to that Third Party;
- Environmental Compliance Ltd accepts no responsibility for any loss or damage incurred by the Client or for any conflict of Environmental Compliance Ltd interests arising out of the Clients' release of this report to the Third Party.

In the event that a report is revised and re-issued, the client shall ensure that any earlier versions of the report, and any copies thereof, are void and such copies should be marked with the words "superseded and revised".

Opinions and Interpretation expressed within this report are outside the scope of the UKAS accreditation.

MCERTS requirements mean that comparison of results with emissions limit values is not permitted within this report.

TABLE OF CONTENTS

Section	Description	Page Number
	Document Control Sheet	
PART 1	EXECUTIVE SUMMARY	4
1	MONITORING OBJECTIVES	4
1.1	Monitoring Results	5
1.2	Operating Information	7
2	MONITORING DEVIATIONS	8
PART 2	SUPPORTING INFORMATION	9
3	SAMPLING STAFF DETAILS	9
4	SAMPLING PROTOCOLS / METHODOLOGIES	10
5	SAMPLE POINT DESCRIPTIONS	14
	EQUIPMENT IDs	16
	FIGURES	18
	TABLES	21
	VELOCITY TRAVERSE PROFILES	28
	FIELD CALIBRATION AND SAMPLING DATA	31
	LABORATORY ANALYSIS RESULTS	42
	UNCERTAINTY CALCULATIONS	47

PART 1 - EXECUTIVE SUMMARY

1 Monitoring Objectives

Environmental Compliance Ltd (ECL) was commissioned by **Potters Waste** to undertake an emission monitoring survey at their **Brynposteg Landfill site**. This report presents the findings of the study.

The monitoring at this installation was carried out in accordance with our quotation reference **DHFB/P3334/Q001**, for compliance check monitoring of emissions to air. The substances requested for monitoring at each emissions point are listed below:

Substances to be monitored	Emission Point Identification	
	Ref No:	Ref No:
	Engine 1	Engine 2
Velocity / Flowrate	● U	● U
Oxides of Nitrogen (as NO_2)	● U	● U
Sulphur Dioxide	● U	● U
Carbon Monoxide	● U	● U
Oxygen	● U	● U
Carbon Dioxide	● U	● U
Total Organic Carbon (TVOC)	● U	● U
Non-methane VOCs	● U	● U

● Denotes the substances to be monitored.

U **Denotes UKAS accreditation is held for monitoring that substance, but does not mean that it has been claimed which will depend on whether the testing could be completed in accordance with the Standard Reference Method.**

Special Requirements: *"Normal operating conditions."*

1.1 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty %	Reference Conditions 273 K, 101.3 kPa	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Tick if non-conforming test (see Sections 2 & 5)	Operating Status
Engine 1	Volumetric Flowrate	...	4.45007	m^3/sec	4	Stack Conditions	10/01/2018	12:28 – 12:38	BS EN 16911-1:2013 & MID	NU	✔	Normal
	Volumetric Flowrate	...	1.10789	m^3/sec	8	Dry & 5% O_2				NU	✔	
	TVOC as Carbon	1750	1639.12	mgC/m^3	3			12:51 – 13:50	BS EN 12619:2013	NU	✔	
	Oxides of Nitrogen (as NO_2)	441.18	439.21	mg/m^3	3			12:30 – 13:29	BS EN 14792: 2017	UKAS / MCERTS	✔	
	Carbon Monoxide	1500	1062.54	mg/m^3	4				BS EN 15058: 2017	UKAS / MCERTS	✔	
	Oxygen (Zirconia Cell)	...	7.18	%	6	Dry			BS EN 14789: 2017	UKAS / MCERTS	✔	
	Carbon Dioxide	1448.7	11.51	%	3	Dry			ISO 12039:2001	UKAS / MCERTS	✔	
	Non-Methane VOC $	150	0.73	mg/m^3	20	Dry & 5% O_2		13:56 – 14:36	CEN/TS 13649:2014	NU	✔	
	Sulphur Dioxide $	...	72.11	mg/m^3	13			12:43 – 13:43	BS EN 14791:2017	NU	✔	

The volumetric flowrate shown above is that from the initial pitot traverse.
Any other flow measurements made during isokinetic sampling and/ or repeat traverses are shown later in the tables section.

For additional Notes see page 6.

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty %	Reference Conditions 273 K, 101.3 kPa	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Tick if non-conforming test (see Sections 2 & 5)	Operating Status
Engine 2	Volumetric Flowrate	...	4.62948	m^3/sec	5	Stack Conditions	10/01/2018	15:00 – 15:20	BS EN 16911-1:2013 & MID	UKAS / MCERTS		Normal
	Volumetric Flowrate	...	1.18792	m^3/sec	9	Dry & 5% O_2				UKAS / MCERTS		
	TVOC as Carbon	1750	1648.33	mgC/m^3	3			15:33 – 16:32	BS EN 12619:2013	UKAS / MCERTS		
	Oxides of Nitrogen (as NO_2)	441.18	430.48	mg/m^3	3			16:23 – 17:22	BS EN 14792: 2017	UKAS / MCERTS		
	Carbon Monoxide	1500	1061.30	mg/m^3	4				BS EN 15058: 2017	UKAS / MCERTS		
	Oxygen (Zirconia Cell)	...	8.08	%	6	Dry			BS EN 14789: 2017	UKAS / MCERTS		
	Carbon Dioxide	1448.7	10.24	%	3	Dry			ISO 12039:2001	UKAS / MCERTS		
	Non-Methane VOC $	150	0.20	mg/m^3	18	Dry & 5% O_2		16:23 – 17:23	CEN/TS 13649:2014	NU	✓	
	Sulphur Dioxide $	...	93.72	mg/m^3	13			15:14 – 16:14	BS EN 14791:2017	UKAS / MCERTS		

The volumetric flowrate shown above is that from the initial pitot traverse.
Any other flow measurements made during isokinetic sampling and/ or repeat traverses are shown later in the tables section.

Notes

The uncertainty figures presented in Table 1.1 for NO_x, CO, SO_2, O_2 & TVOC are "measurement uncertainty" figures, which do not take into account the variability of the measured sample values. The "uncertainty of measurement results" figures, which do include this contribution, are presented in the appendices of the report for these determinands.

Emission Limit Value	The emission limit value is that stated in the permit and will be expressed as a concentration or a mass emission.
Periodic Monitoring Result	The result given is expressed in the same terms and units as the emission limit value.
Uncertainty	The uncertainty associated with the quoted result is at the 95% confidence interval. The Uncertainty results **DO NOT** take into account the effect of the sample location limitations.
Reference Conditions	All results are expressed at 273 K and 101.3kPa. The oxygen and moisture corrections are stated.
Monitoring Method Reference	The method stated is in accordance with the Environment Agency Technical Guidance Note M2, or other method approved by the Environment Agency.
Accreditation for use of Method	**The details indicate the accreditation for the use of the complete monitoring method, e.g. MCERTs, UKAS. If use of the method is not accredited " NA" is stated.**
Operating Status	The details indicate the feedstock and the loading rate of the plant during monitoring.
$	Chemical Analysis on sample reagents was performed by an External Laboratory as detailed in Section 4
NU	UKAS Accreditation Held but UKAS Accreditation cannot be claimed for the test as sampling did not comply with the Standard Reference Method (SRM), see section 2 & 5
NA	**Method is NOT UKAS Accredited.**

1.2 Operating Information

Emission Point Reference	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results					
							Parameter	Date	Time	CEMS Results	Periodic Monitoring Results	Units
Engine 1	Continuous	Dependent on gas supply	Landfill Gas	N/A	N/A	85%	...	...	...	NP	...	...
Engine 2	Continuous		Landfill Gas	N/A	N/A	100%	...	...	...	NP	...	...

Notes:

Process Type	State whether the process is a continuous or batch process.
Process Duration	If a batch process, state the duration, frequency and details of the portion of the batch sampled. If continuous state "NA"
Fuel	If applicable, state the fuel type If not applicable state "NA"
Feedstock	State the feedstock type
Abatement	State the type and whether operational during monitoring. If not applicable state "NA"
Load	State the normal load, throughput or rating of the plant
CEMS Data	Enter this data for each CEM installed if it is has been provided by operator otherwise state “NP” (NOT PROVIDED)

2 Monitoring Deviations

The objective of the survey was to measure the concentrations of pollutants from the processes / locations as detailed in Section 1. This survey meets the requirements of the site's **PPC Permit Number: TP3736SQ** where UKAS and MCERTS accreditation has and could be claimed for the testing in the monitoring results table.

There was a modification to the sampling procedures (TPDs) listed in Section 4 as follows:

- **Non Methane VOC –** ECL/TPD/84 is specifically for the monitoring of dry ambient gas. Testing of the flare stack required the modification of the TPD, to cool and dry the sample gas prior to passing it through the capture media (sorbent tube). Due to the high stack temperature, and the modifications required to facilitate sampling, all Non-Methane VOC tests are non-conforming and UKAS/MCERTS accreditation has not been claimed.

There were no substance deviations from the original and agreed emissions monitoring schedule.

Non-conforming tests are as follows:

- All extractive tests and the volumetric flowrate tests on Gas Engine 1 are non-conforming as they were sampled on the stack exit. Please note that no alternative sample location is currently available.
- In order to facilitate sampling, a sample extension line (un-heated PTFE line) was used from the back of the filtered probe to the impinger train during the wet chemistry SO2 test on Gas Engine 1. Consequently, the moisture test is not in compliance with ECL/TPD/082 and not accredited.
- Analytical laboratory Concept Life Sciences (CLS) do not hold UKAS accreditation for the analysis of total NMVOCs. Consequently, all Non-Methane VOC tests are non-conforming and UKAS/MCERTS accreditation has not been claimed.

The Uncertainty of the reported concentrations for these pollutant results DOES NOT take into account the effect of non-conformities or sample location limitations.

Homogeneity tests have not been completed for pollutants at the following locations:

- Gas Engine 1 - Not applicable to this location as the duct area is $< 1 m^2$.
- Gas Engine 2 - Not applicable to this location as the duct area is $< 1 m^2$.

PART 2 – SUPPORTING INFORMATION

3 SAMPLING STAFF DETAILS

Site Sampling Team

Names of Site Team	Dates on Site	MCERTS No.	LEVEL	Technical Endorsements
Sam Brookes	10-11/01/2018	MM 06 775	2	TE1, TE2, TE3, TE4
Peter Brockway		MM 17 1459	Trainee	...

Report Reviewer

Name	MCERTS No.	LEVEL	Technical Endorsements
Sam Brookes	MM 06 775	2	TE1, TE2, TE3, TE4

Technical Endorsement Key:-

TE1 – Isokinetic Particulates, Temperature & Velocity Profiles, Oxygen.
TE2 – Isokinetic Extractive Pollutants:- Metals, Dioxin & Furans, PAHs, PCBs, HCl, HF.
TE3 – Non-Isokinetic Extractive Pollutants:- Speciated VOCs, HF, HCl, Cyanide.
TE4 – Continuous Analysers (Combustion Gases):- TVOC, CO, NOx, SO2.

4 SAMPLING PROTOCOLS / METHODOLOGIES

Any required modifications to the Technical Procedure Documents (TPDs) specified below will be detailed in section 2 of this report.

Stand alone velocity measurements and those made to support isokinetic sampling are conducted using BS EN 16911-1:2013 & MID.

Pressure, Temperature and Velocity

Testing was carried out using a sampling system in accordance with **BS EN ISO 16911-1:2013 & MID** and In-house technical procedure **ECL/TPD/022A.**

Temperature was recorded using a thermocouple and digital temperature reader.

Velocity and pressure were recorded using an "L" pitot and digital manometer, data being recorded in Pascals.

Water Vapour

Testing was carried out using a Universal Stack Sampling system in accordance with **BS EN 14790:2017** and In-house technical procedure **ECL/TPD/082**.

In this method the stack gases are filtered (in-stack unheated filter or out-stack heated filter) to remove particulate matter. The gases are then passed through a **heated probe** and then to a cooled moisture trapping unit. All unheated parts of the sample train (outside the sample port) which come into contact with stack gas are weighed pre and post sampling in order to determine the weight gain.

After each test, a visual inspection of the last impinger is made to confirm that at least 50% of the silica gel column has not changed colour. This indicates satisfactory collection of water vapour.

Combustion Gases (NO_x, CO & CO_2)

Measurements of combustion gases were carried out using an MCERTS Certified **Horiba PG 250** stack gas analyser. Continuous monitoring of emissions was undertaken over each test period recording minute averaged data (one measurement every 60 seconds). The measurement techniques for each determinand are as follows:

Determinand	Technique	SRM
• NO_x	Chemiluminescence	BS EN 14792: 2017
• CO	Non-dispersive infrared	BS EN 15058: 2017
• CO_2	Non-dispersive infrared	ISO 12039:2001

The analyser was set up with reference to the manufacturer's operator handbook and the in-house technical procedure **ECL/TPD/033c**. The analyser was calibrated on site using certified gases which are traceable to ISO 17025 (with uncertainty < 2%). Zero measurements were performed using Nitrogen. The analyser was calibrated directly into the sample inlet and then checked through the entire sampling system (including sampling probe, heated & unheated gas transport lines and gas drying/ conditioning system).

Data is presented graphically in the Figures Section, and the minute averaged data is given in the Tables Section.

Oxygen

Measurements of Oxygen were carried out using a Testo 350XL electrochemical cell combustion gas analyser which has been validated to meet the performance requirements of **BS EN 14789:2017** Continuous monitoring of emissions was undertaken over each test period recording minute averaged data.

The analyser was set up with reference to the manufacturer's operator handbook and the in-house technical procedure **ECL/TPD/086**. The analyser was calibrated on-site using certified gases which are traceable to ISO 17025 (with uncertainty < 2%), (for emissions streams where oxygen is above 15%, dry ambient air can be used to calibrate the analyser). Zero measurements were performed using Nitrogen. The analyser was calibrated directly into the sample inlet (which is up-stream of the built-in chiller system) and then checked through the entire sampling system (including sampling probe, short heated/ unheated gas transport lines and external gas conditioning systems as required).

TVOC as Carbon

Testing was carried out using an MCERTS Certified Signal 3030PM FID and heated gas sample line, with reference to the manufacturer's operation handbook, **BS EN 12619:2013** and in-house technical procedure **ECL/TPD/032A**.

The analyser was calibrated on site using certified propane span gases, (made up in synthetic air) which are traceable to ISO 17025 standard (with uncertainty $<2\%$).

Zero measurements were performed using synthetic air zero gas, with TVOC content less than 0.2 mg/m^3 (or purity greater than 99.998%).

The analyser was calibrated directly into the sample inlet and then checked through the entire sampling system (including sampling probe, heated filter and heated gas transport lines). Data was corrected by molecular weight to TVOCs as total carbon.

Data was recorded as minute averages over each test period. The data is presented in the Figures Section and the minute averaged data is detailed in the Tables Section**.**

Sulphur Dioxide

Testing was carried out non-isokinetically using a Universal Stack Sampling system in accordance with **BS EN 14791:2017** and In-house technical procedure **ECL/TPD/039**. Non-isokinetic sampling can only take place if there are no droplets present in the stack gas.

In this method the stack gases are filtered to remove particulate matter then the gases are passed through a series of impingers. The first three impingers each contain 140ml of 3% Hydrogen Peroxide (3% H_2O_2). The fourth impinger is left empty and the final impinger contains a measured quantity of silica gel.

The first three impingers containing the 3% Hydrogen Peroxide are analysed for concentrations of Sulphur Dioxide by IC (Ion Chromatography).

Concept Life Sciences Ltd (CLS) who are situated in Manchester carried out the analysis of the samples. **CLS** is UKAS accredited for this analysis. In addition to the survey samples, appropriate field blanks and efficiency checks are submitted as part of the technical procedure.

Non-Methane VOC

Non-continuous sampling for **Non-Methaane VOC** was carried out in accordance with **CEN/TS 13649:2014** and In-house technical procedure **ECL/TPD/084.** In this method a metered volume of stack gas is extracted through a standard charcoal sorbent tube.

Concept Life Sciences Ltd (CLS) who are situated in Manchester carried out the analysis of the samples. **CLS** are **not UKAS accredited** for this analysis. In addition to the survey samples, appropriate field blanks and efficiency checks are submitted as part of the technical procedure.

Due to restrictions set out in CEN/TS 13649:2014, MCERTS/UKAS accreditation can only be claimed when the target parameters are organic compounds, the sorbent tube used is a standard charcoal tube/ thermal desorption tube and when laboratory analysis is UKAS accredited and carried out by GC. If other tubes are used, or if analysis is by other means than GC, then usually only UKAS accreditation can be claimed, as long as the laboratory analysis is UKAS accredited. (MCERTS accreditation may still be claimed if prior approval is given for the modifications by the Environment Agency – details will be given in section 2 of this report).

Laboratory analysis cannot be UKAS accredited for "Total VOC" or "TOP 10 compounds".

For the subcontract laboratory to claim UKAS accreditation for analysis, the internal recovery of a spiking compound (desorption efficiency from tube) needs to be above 80%. If it falls below 80% this will be noted on the analysis certificate.

If greater than 5% of the total amount of any of the target species is found in the back up portion of the sorbent tube, this will be noted on the analysis certificate.

5 SAMPLE POINT DESCRIPTIONS

The homogeneity test is applicable to combustion processes. This includes but is not restricted to, those regulated under the Waste Incineration Directive (**WID**) and the Large Combustion Plant Directive (**LCPD**).

Homogeneity testing has not been completed at these locations in accordance with the mandatory requirements of the regulatory authority.

The test is not usually required for stacks with sampling plane areas of $<1m^2$ (below 1.13m in diameter for circular ducts).

The sample locations that were monitored are detailed below:-

Landfill Gas Engine 1

The exhaust diameter is 0.3m and sampling was performed from the exit of the duct approximately 1.25m above the Engine Room roof.

As a result of the sampling point being on the exit of the duct and immediately after a bend it does not currently meet the requirements detailed in *Technical Guidance Note (Monitoring) M1"Sampling requirements for stack-emission monitoring" Environment Agency,* and BS EN 13284-1. The sampling probes were inserted down into the duct exit and positioned at a central location within the ducting.

Access to the sample location was attained by means of temporary scaffolding complete with an in date scafftag accessed from outside the engine one control building. The scaffolding provided 1.8m of width back from the stack exit to facilitate sampling.

A 240V power supply was available inside the engine one control room building directly below the sampling location.

All tests are non-conforming as they had to be conducted on the stack exit.

In addition and in order to facilitate sampling, a sample extension line (un-heated PTFE line) was used from the back of the filtered probe to the impinger train during the wet chemistry SO2 test. Consequently, the moisture test is not in compliance with ECL/TPD/082 and not accredited.

The Uncertainty of the reported concentrations for these pollutant results DOES NOT take into account the effect of these non-conformities or sample location limitations.

Landfill Gas Engine 2

The sampling platform does not currently meet the requirements detailed in *Technical Guidance Note (Monitoring) M1"Sampling requirements for stack-emission monitoring" Environment Agency,* and BS EN 13284-1 due to a lack of space however both ports could be accessed in this survey and no isokinetic tests were required.

The stack diameter is 0.4m and the sample platform width back from the sample port is only 0.4m.

Two sample ports are located on the stack at 90 degrees to each other and are located on the same plane.

These sample ports are located at a height of approximately 1.15m from the working sample platform.

Access to the sample location was attained by means of temporary scaffolding complete with an in date scafftag accessed from outside the engine two control building.

A 240V power supply was available inside the engine two control room building directly below the sampling location.

The Uncertainty of the reported concentrations for these pollutant results DOES NOT take into account the effect of non-conformities or sample location limitations.

EQUIPMENT IDs
(Pre site checklist from SSP)

Potters Waste
Permit No : TP3736SQ
Variation No : ...
Report Ref : P3334 : R001

Installation Name : Engine 1 & 2
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

PRE SITE EQUIPMENT CHECKLIST/ EQUIPMENT USED

(Completed before departure to site and when on site in full)

Equipment	Equip. Type	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:
MST console/pump	E001	U001							
MST Nozzle set									
MST "S" Type Pitot									
MST Probe									
MST Hot Box		978							
MST Impinger Arm		401							
		660							
Barometer		627							
Site Balance		088							
Site Check weights		276							
		277							
Horiba	E002	511							
Heated Probe / Filter		920							
Chiller		972							
Sonimix / MFC									
Heated Line		1013	1014						
FID	E003	269							
Heated Line		517	518						
Heated Probe / Filter		919							
Testo	E004	350							
FTIR	E005								
Heated Probe / Filter									
Heated Line									
Stackmite	E006								
"L" Type Pitot		489							
Digital Manometer		421							
Stack Thermocouple		866							
Thermocouple Reader		1112							
Nozzle Set									
Workhorse Pumps	E007								
Low Flow Pumps									
Tube Thermocouple		1041							

Quantity of Ice Required / Used for Survey	6	Bags (2kg bags)

FIGURES

Figure 1: Engine 1 TVOCs

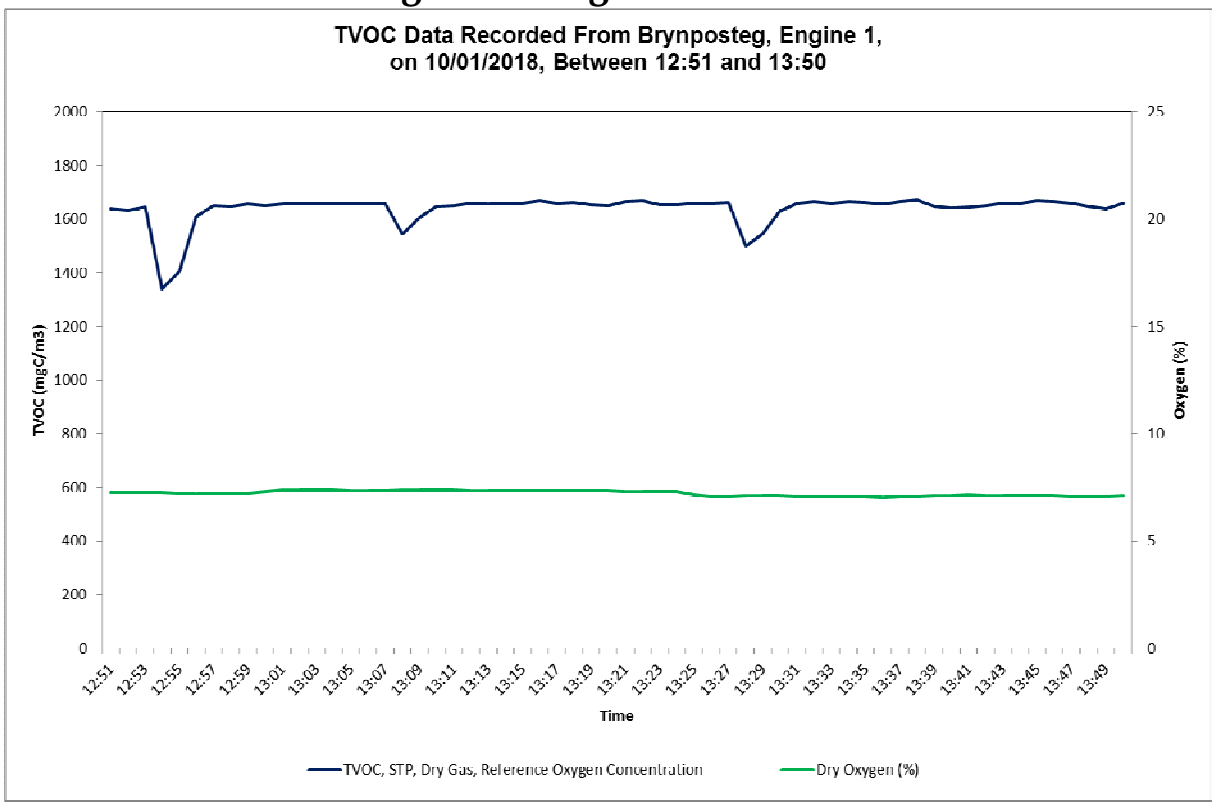


Figure 2: Engine 1 Combustion Gases

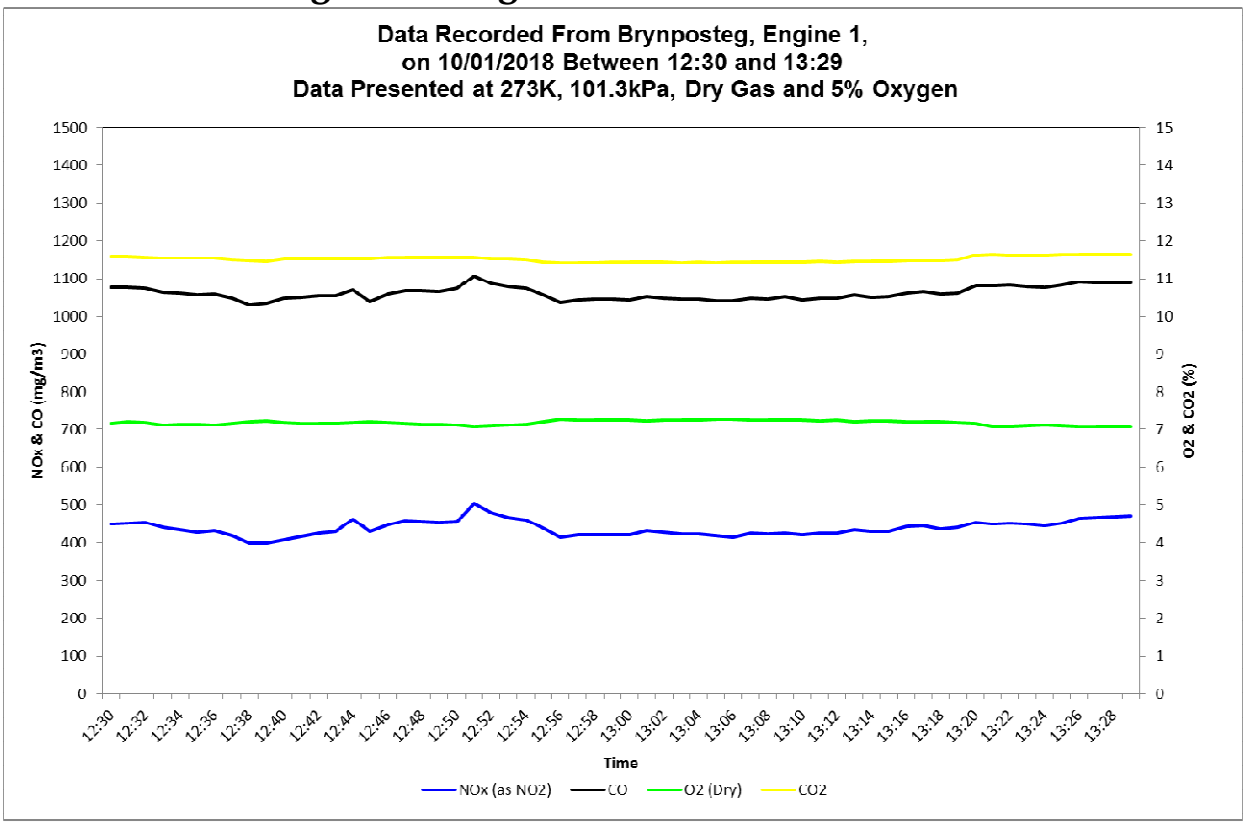


Figure 3: Engine 2 TVOCs

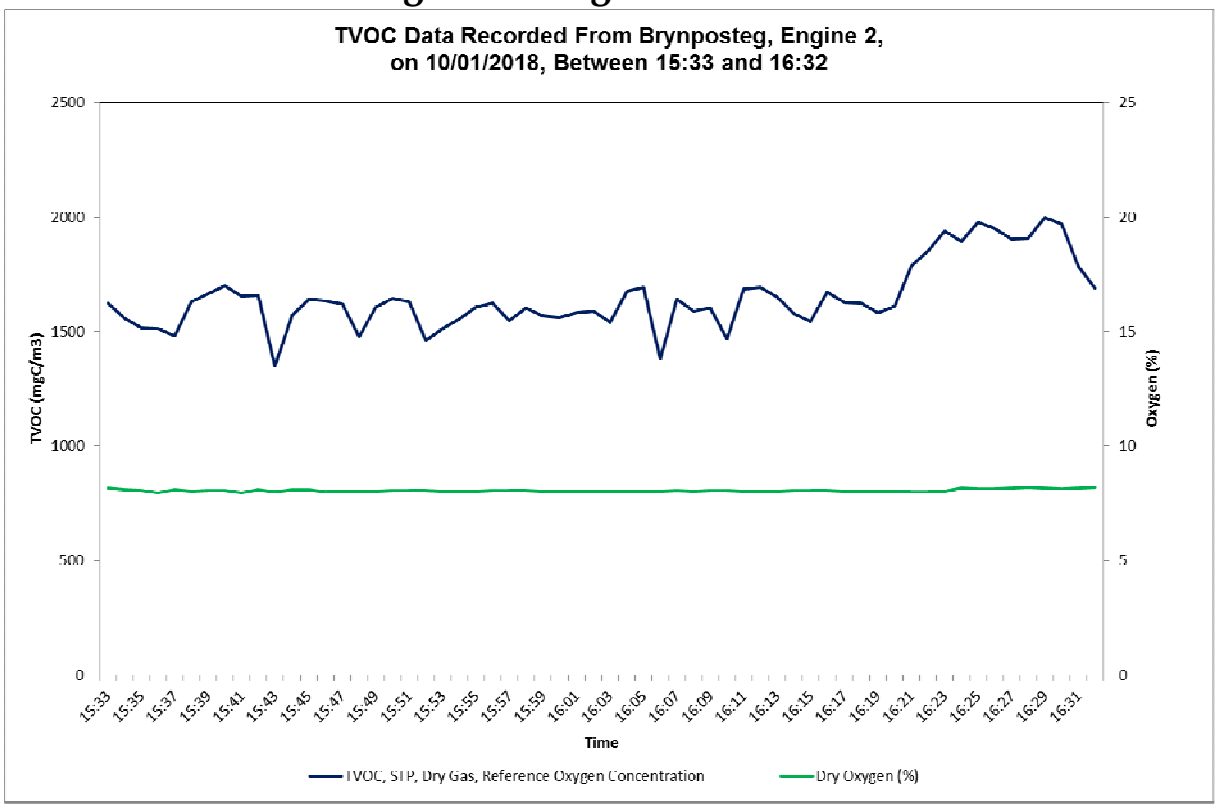
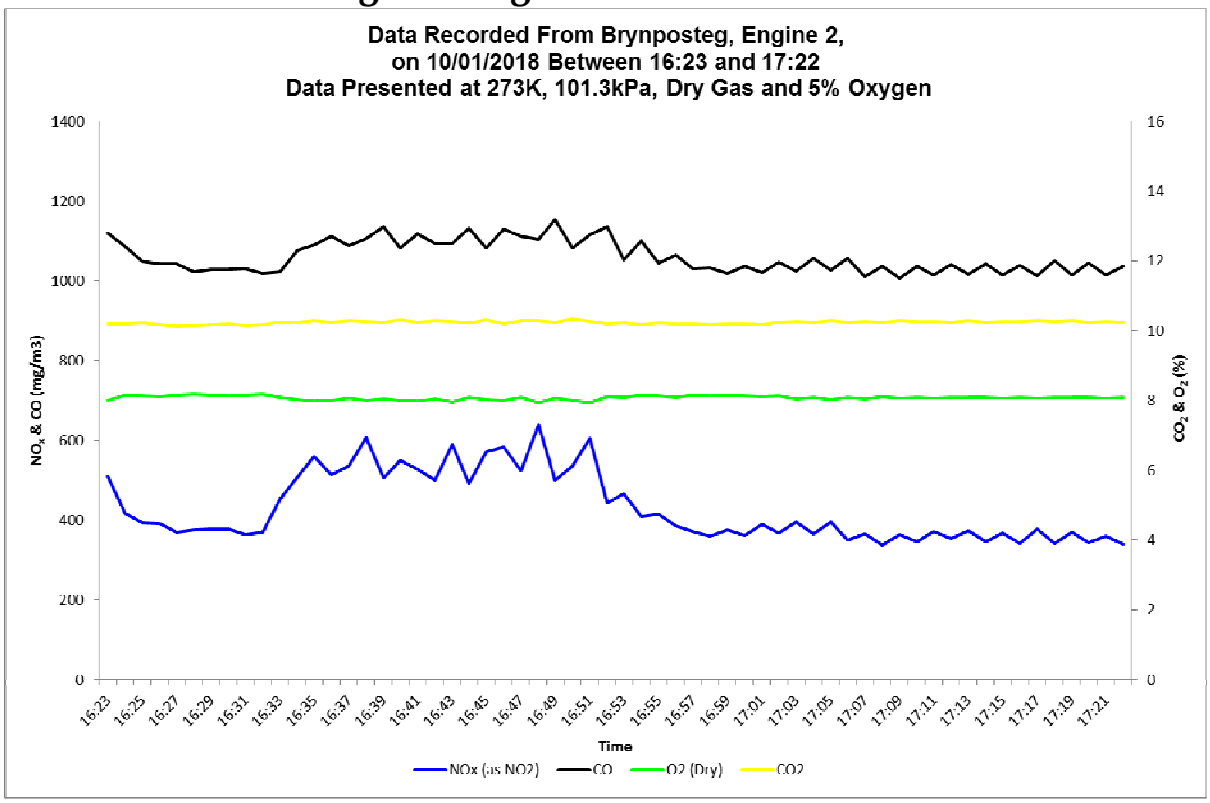


Figure: Engine 2 Combustion Gases



TABLES

Table 1 – TVOC

Data Recorded Engine 1

Sample Period: 12:51 – 13:50 on the 10th January 2018

Volumetric Flowrate (Reference Conditions) = 1.10789 **m^3/sec ***

	Average	Emission Rate
	mg/m^3	**Kg/hr**
TVOC (as carbon)*	**1639.12**	**6.537**

*** Reference Conditions (273K, 101.3 kPa, 5% Oxygen & Dry Gas)**

Table 2 – Gases

Data Recorded from Engine 1

Sample Period: 12:30 – 13:29 on the 10th January 2018

Volumetric Flowrate (Reference Conditions) = 1.10789 **m^3/sec ***

	Average	Emission Rate
	mg/m^3	**Kg/hr**
Oxides of Nitrogen (as NO_2) *	**439.21**	**1.752**
Carbon Monoxide *	**1062.54**	**4.238**
Carbon Dioxide (%) **	**11.51**	**...**
Oxygen (%) **	**7.18**	**...**

*** Reference Conditions (273K, 101.3 kPa, 5% Oxygen & Dry Gas)**
**** Dry Gas**

Potters Waste
Permit No : TP3736SQ
Variation No : ...
Report Ref : P3334 : R001

Installation Name : Engine 1 & 2
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

Table 3 – SO_2

Data Recorded from Engine 1 - Landfill

Emission Parameter	Units	One - SO2	Blank
Stack Diameter	metres	0.40	
Area of Sample Plane	m^2	0.126	
Moisture Content	%	13.25	
Oxygen Content	%	7.23	
Stack Temperature	°C	505	
Gas Velocity (as Measured)	m/sec	62.96	
Gas Velocity (Reference Conditions)	m/sec*	15.68	
Volumetric Flowrate (as Measured)	m^3/sec	7.91	
Volumetric Flowrate (Reference Conditions)	m^3/sec*	1.97	
Dry Gas Molecular Weight	g/gmole	30.13540327	
Sample Date	...	10/01/2018	
Sample Period	...	12:43 - 13:43	
Sample Volume (reference Conditions)	m^3*	0.339	0.339
Sample Reference	ECL/18/	0070 & 0071	0072
Mass of Sulphur Dioxide Collected	mg	24.42	0.14
Concentration of Sulphur Dioxide	mg/m^3*	**72.11**	0.41
Emission Rate of Sulphur Dioxide	kg/hr	0.51	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	99	...

*Reference Conditions (273K, 101.3kPa, 5% Oxygen, Dry Gas)

Table 4 – Non-Methane TVOCs

Potters Waste

Brynposteg Landfill Engine 1

Emission Parameter	Units	Value		
Stack Diameter	mm	300		
Area of Sample Plane	m^2	0.071		
Moisture Content	%	10.15		
Expanded Uncertainty of Moisture (%Relative)	%	14.57		
Measured Oxygen (Dry)	%Vol	7.19		
Meter Temperature	°C	10.33		
StackTemperature	°C	509.17		
Sample Date	...	10/01/2018		
Sample Period	...	13:56 - 14:56		
Sample Volume (as Measured)	m^3	0.10		
Sample Volume (reference Conditions)	m^3*	0.081		
Sample Tube Results		One		Blank
Sample Reference ECL/18/80	Units	Concentration*	Uncertainty	Concentration
Concentration of Non Methane VOCs	mg/m^3	0.73	19.97%	0.012

*Reference Conditions: 273 K, 101.3 kPa, 5% Oxygen & Dry Gas

Table 5 – TVOC

Data Recorded from Engine 2
Sample Period: 15:33 - 16:32 on the 10th January 2018

Volumetric Flowrate (Reference Conditions) = 1.18792 **m³/sec ***

	Average	Emission Rate
	mg/m³	Kg/hr
TVOC (as carbon)*	1648.33	6.59

*** Reference Conditions (273K, 101.3 kPa, 5% Oxygen & Dry Gas)**

Table 6 – Gases

Data Recorded from Engine 2
Sample Period: 16:23 – 17:22 on the 10th January 2018

Volumetric Flowrate (Reference Conditions) = 1.18792 **m³/sec ***

	Average	Emission Rate
	mg/m³	Kg/hr
Oxides of Nitrogen (as NO_2) *	430.48	1.841
Carbon Monoxide *	1061.30	4.539
Carbon Dioxide (%) **	10.24	...
Oxygen (%) **	8.08	...

*** Reference Conditions (273K, 101.3 kPa, 5% Oxygen & Dry Gas)**
**** Dry Gas**

Table 7 – SO_2

Data Recorded from Engine 2 - Landfill

Emission Parameter	Units	One - SO2	Blank
Stack Diameter	metres	0.40	
Area of Sample Plane	m^2	0.126	
Moisture Content	%	10.31	
Oxygen Content	%	8.07	
Stack Temperature	°C	459	
Gas Velocity (as Measured)	m/sec	36.82	
Gas Velocity (Reference Conditions)	m/sec*	9.45	
Volumetric Flowrate (as Measured)	m^3/sec	4.63	
Volumetric Flowrate (Reference Conditions)	m^3/sec*	1.19	
Dry Gas Molecular Weight	g/gmole	29.95981639	
Sample Date	...	10/01/2018	
Sample Period	...	15:14 - 16:14	
Sample Volume (reference Conditions)	m^3*	0.265	0.265
Sample Reference	ECL/18/	0073 & 0074	0075
Mass of Sulphur Dioxide Collected	mg	24.84	0.15
Concentration of Sulphur Dioxide	mg/m^3*	**93.72**	0.58
Emission Rate of Sulphur Dioxide	kg/hr	0.40	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	100	...

***Reference Conditions (273K, 101.3kPa, 5% Oxygen, Dry Gas)**

Table 8 – Non-Methane TVOCs

Potters Waste
Brynposteg Landfill Engine 2

Emission Parameter	Units	Value		
Stack Diameter	mm	400		
Area of Sample Plane	m^2	0.126		
Moisture Content	%	6.60		
Expanded Uncertainty of Moisture (%Relative)	%	16.73		
Measured Oxygen (Dry)	%Vol	8.08		
Meter Temperature	°C	10.17		
StackTemperature	°C	460.00		
Sample Date	...	10/01/2018		
Sample Period	...	16:23 - 17:23		
Sample Volume (as Measured)	m^3	0.099		
Sample Volume (reference Conditions)	m^3*	0.073		
Sample Tube Results		One - NMVOC		Blank
Sample Reference ECL/18/81	Units	Concentration*	Uncertainty	Concentration
Concentration of Non Methane VOC	mg/m^3	0.20	18.30%	0.014

***Reference Conditions: 273 K, 101.3 kPa, 5% Oxygen & Dry Gas**

VELOCITY TRAVERSE PROFILES

Environmental Compliance Limited

Potters Waste		**Installation Name**	**: Engine 1 & 2**
Permit No	**: TP3736SQ**	**Visit Details**	**: Annual Compliance**
Variation No	**: ...**	**Survey Dates**	**: 10th & 11th January 2018**
Report Ref	**: P3334 : R001**	**Report Issue Date**	**: 31st January 2018**

Environmental Compliance Limited	Traverse Data Profoma	Date of Measurement	10/01/2018

Company	Potters Waste	Stack Diameter Port A (mm)	300	Average Stack Diameter (mm)	300	Pitot tube coefficient	0.99
Site	Brynposteg	Stack Diameter Port B (mm)		Port Length (mm)	0	Pitot Id	489
Location	Landfill	Duct Length Port A (mm)		Average Duct Length (mm) L		Stack Thermocouple ID	866
Stack	Engine 1	Duct Length Port B (mm)		Duct width (mm) B		Stack Temp Reader ID	1112
Job No	P3334	Duct Length Port C (mm)		Barometric Pressure. (mb)	964	Manometer ID	421
Operators	SEB + PB	Duct Length Port D (mm)		Ave Static Press. (mm H_20)	34.25	Barometer ID	627

Static Pressure Readings (Pascals)			
Port A	Port B	Port C	Port D
336.00			

Pre - Traverse Checks Carried Out	Time	Pass/ Fail
Pre - Traverse PITOT Visual Inspection	12:28:00	Pass
Pre - Traverse PITOT Leak Check	12:30:00	Pass

Smooth Walls

Port/ Point	Distance to Point (mm)	Time	Temperature Readings (°C) 1	2	3	(ΔP) Pitot Readings (Pa) 1	2	3	Average Temp. (°C)	Average (ΔP) (Pa)	Swirl Test ° From Reference
A1	150	12:32:00	508.0	508.0	508.0	872.0	866.0	867.0	508.0	868.3	0
Blockage Check @ A1 (L-Type Pitot Only)		n/a	508.0	509.0	509.0	872.0	870.0	869.0	508.0	868.3	Total
			Mean		508.7	Mean		870.3	508.0	868.3	Max
			Difference <5% from Initial ?		0.09	Difference <5% from Initial ?		0.23	508.0	868.3	Min
									508.0	868.3	Average

Post - Traverse Checks Carried Out	Time	Pass/ Fail
Post - Traverse Visual Inspection	12:36:00	Pass
Post - Traverse PITOT Leak Check	12:38:00	Pass

Stagnation Check (S-type Pitot Only)	Time	Reading
Static Pressure Via Positive Leg (Pa)	.	.
Static Pressure Via Negative Leg (Pa)	.	.
Difference (Pa) < 10Pa ?		#VALUE!

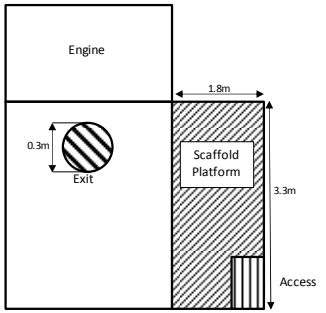
Average temp (K)	781.000

Suitability of Sampling Position	Actual Stack Conditions
Highest:lowest flow pressure ratio < 9:1?	1:1
Maximum deviation of flow from axis < 15° ?	0
X-sectional area for stacks = πr2	0.07 m^2
X-sectional area for ducts = L x B	m^2
Suitability of Position for Sampling	no - but no alternative

Stack Moisture	13.25	%	Gas Velocity (as Measured) Adjusted for Smooth Walls	62.95555	m/sec
Measured Oxygen	7.23	%	Gas Velocity (Reference Conditions) Adjusted for Smooth Walls	15.67342	m/sec*
Measured Carbon Dioxide	11.54	%	Volumetric Flowrate (as Measured) Adjusted for Smooth Walls	4.45007	m^3/sec
Dry Gas Molecular Weight	30.13560	g/g mole	Volumetric Flowrate (Ref Cond) Adjusted for Smooth Walls	1.10789	m^3/sec*

*Reference Conditions: 273K, 101.3kPa, 5% Oxygen, Dry Gas NOTE: Velocity / volume flowrate calculations exclude contributions from the measurement point(s) where swirl >15°

Diagram/ Description of Cross Section of Stack/Duct



Notes
Including expected or actual deviations from procedures / non-conformities

Sample in exit

Not possible to measure swirl

Compliance With Positional Requirements?

Height of sample ports from Platform	**1.25m**
Number of sample ports	**n/a**
Width of platform (port back to handrail)	**1.8m**

Nearest downstream disturbance	Exit	0m
Nearest upstream disturbance	Bend	0.5m
Disturbances are classed as bends, fans or diameter variations		

Environmental Compliance Limited

Potters Waste
Permit No : TP3736SQ
Variation No : ...
Report Ref : P3334 : R001

Installation Name : Engine 1 & 2
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

Environmental Compliance Limited	Traverse Data Profoma	Date of Measurement	10/01/2018

Company	Potters Waste	Stack Diameter Port A (mm)	400	Average Stack Diameter (mm)	400	Pitot tube coefficient	0.99
Site	Brynposteg	Stack Diameter Port B (mm)	400	Port Length (mm)	90	Pitot Id	489
Location	Landfill	Duct Length Port A (mm)		Average Duct Length (mm) L		Stack Thermocouple ID	866
Stack	Engine 2	Duct Length Port B (mm)		Duct width (mm) B		Stack Temp Reader ID	1112
Job No	P3334	Duct Length Port C (mm)		Barometric Pressure. (mb)	964	Manometer ID	421
Operators	SEB + PB	Duct Length Port D (mm)		Ave Static Press. (mm H_20)	-7.65	Barometer ID	627

Pre - Traverse Checks Carried Out	Time	Pass/ Fail
Pre - Traverse PITOT Visual Inspection	15:00:00	Pass
Pre - Traverse PITOT Leak Check	15:02:00	Pass

Smooth Walls

Static Pressure Readings (Pascals)			
Port A	Port B	Port C	Port D
-75.00	-75.00		

Port/ Point	Distance to Point (mm)	Time	Temperature Readings (^{O}C) 1	2	3	(ΔP) Pitot Readings (Pa) 1	2	3	Average Temp. (^{O}C)	Average (ΔP) (Pa)	Swirl Test ^{O} From Reference
A1	59	15:05:00	459.0	460.0	459.0	325.0	330.0	321.0	459.3	325.3	5
A2	341	15:07:00	460.0	460.0	460.0	300.0	304.0	318.0	460.0	307.3	10
B1	59	15:10:00	458.0	458.0	458.0	320.0	324.0	331.0	458.0	325.0	10
B2	341	15:12:00	459.0	459.0	460.0	306.0	314.0	324.0	459.3	314.7	10
Blockage Check @ A1 (L-Type Pitot Only)		15:16:00	459.0	459.0	459.0	330.0	326.0	329.0	1836.7	1272.3	Total
			Mean		459.0	Mean		328.3	460.0	325.3	Max
			Difference <5% from Initial ?		-0.05	Difference <5% from Initial ?		0.92	458.0	307.3	Min
									459.2	318.1	Average

Post - Traverse Checks Carried Out	Time	Pass/ Fail
Post - Traverse Visual Inspection	15:18:00	Pass
Post - Traverse PITOT Leak Check	15:20:00	Pass

Stagnation Check (S-type Pitot Only)	Time	Reading
Static Pressure Via Positive Leg (Pa)	.	.
Static Pressure Via Negative Leg (Pa)	.	.
Difference (Pa) < 10Pa ?		#VALUE!

Average temp (K)	732.167

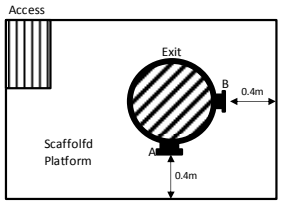
Suitability of Sampling Position	Actual Stack Conditions
Highest:lowest flow pressure ratio < 9:1?	1.08:1
Maximum deviation of flow from axis < 15^O ?	10
X-sectional area for stacks = πr2	0.13 m^2
X-sectional area for ducts = L x B	m^2
Suitability of Position for Sampling	OK

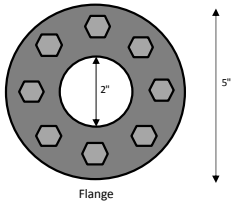
Stack Moisture	10.31	%	Gas Velocity (as Measured) Adjusted for Smooth Walls	36.84027	m/sec
Measured Oxygen	8.07	%	Gas Velocity (Reference Conditions) Adjusted for Smooth Walls	9.45320	m/sec*
Measured Carbon Dioxide	10.23	%	Volumetric Flowrate (as Measured) Adjusted for Smooth Walls	4.62948	m^3/sec
Dry Gas Molecular Weight	29.95960	g/g mole	Volumetric Flowrate (Ref Cond) Adjusted for Smooth Walls	1.18792	m^3/sec*

*Reference Conditions: 273K, 101.3kPa, 5% Oxygen, Dry Gas

NOTE: Velocity / volume flowrate calculations exclude contributions from the measurement point(s) where swirl > 15°

Diagram/ Description of Cross Section of Stack/Duct





Notes
Including expected or actual deviations from procedures / non-conformities

100% load

Narrow platfrom but both ports can be reached

Compliance With Positional Requirements?

Height of sample ports from Platform	**1.15m**
Number of sample ports	**5**
Width of platform (port back to handrail)	**0.4m**

Nearest downstream disturbance	exit	2.0m
Nearest upstream disturbance	bend	1.5m
Disturbances are classed as bends, fans or diameter variations		

FIELD CALIBRATION AND SAMPLING DATA

Potters Waste
Permit No : TP3736SQ
Variation No : ...
Report Ref : P3334 : R001

Installation Name : Engine 1 & 2
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

Engine 1 - Combustion Gases

	Horiba PG 250 Measurement Ranges:			
	NO as NO_2	CO	O_2	CO_2
Units	1025 mg/m³	2500 mg/m³	25 %Vol	20 %Vol
Zero Values (Direct)				
Mean Initial Direct Zero	0.30	0.00	-0.01	0.00
Mean Confirmation Direct Zero	0.28	0.24	-0.03	0.00
Difference in Direct Zero	0.02	0.24	0.02	0.00
Repeatability at Zero	4.10	2.50	0.20	0.20
<2 x Repeatability at Zero?	YES	YES	YES	YES
Pre Zero Values (System)				
Mean Pre Test Zero	0.24	-0.03	-0.03	0.00
% of Measurement Range?	0.02%	0.00%	-0.13%	0.00%
Detection Limit (LOD)	0.16	0.12	0.20	0.00
Applied Span:				
	NO	CO	O_2	CO_2
Actual Applied Span Concentration	526.44	1271.25	14.84	17.73
Pre Test System Zero Values				
Mean Pre Test System Zero	0.24	-0.03	-0.03	0.00
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.05%	0.00%	0.22%	0.00%
Post Test Zero Values				
Mean Post Test Zero	1.06	1.53	-0.04	0.02
% of Certified Range?	0.10%	0.06%	-0.16%	0.10%
Zero Drift ≤ ± 5% of Applied Span?	0.15%	0.12%	0.20%	0.11%
Pre Test System Span Values				
Mean Pre Test System Span	520.19	1262.67	14.86	17.63
Difference ≤ ± 2% of Span Value (5% for SO_2)?	1.19%	0.67%	0.13%	0.55%
Post Test Span Values				
Mean Post Test Span	508.92	1222.29	14.67	17.58
Span Drift ≤ ± 5% Span Value?	3.33%	3.85%	1.12%	0.83%
	3.33%	3.85%	1.12%	0.83%
	See Note 2	See Note 2	See Note 3	See Note 3

NOTE 1: Data Invalid! Contact Quality Manager!
NOTE 2: Correct test data for drift!
NOTE 3: No drift correction required.

NB: NOx and CO data drift corrected prior to calculation of periodic monitoring results

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 1 - TVOCs Calibrations Summary

TVOC - FIELD DATA SHEET

Client	Potters Waste			Barometric Pressure mb	964	
Site	Brynposteg			Barometer ID	ECL/ID/ 627	
Date	10/01/2018			Analyser ID	ECL/ID/ 269	
Location	Landfill			Sonimix/ MFC ID	ECL/ID/	
Stack ID	Engine 1			Heated Line/ Controller ID	ECL/ID/ 517 + 518	
Stack Temp °C	923			Heated Line Set Temp °C	180	YES
Ambient Temp (sampling)	1 = 11	2 = 13	3 = 15	Heated Line Length	10	m
Ambient Temp (sampling)	4 = 17	5 = 16	6 = 15	Heated Probe Filter ID	ECL/ID/ 919	
Job No	P3334			Heated Filter Set Temp °C	180	YES
Operators	SEB + PB			Logger ID	926	

Calibration Gas Details

Calibration Gas	Gas Bottle ID	Gas Value	Uncertainty of Gas (k=2)
Zero Gas (Synthetic Air)	Gas/ 1771	...	...
Hydrogen / Helium	Gas/ 1869	...	...
Propane (In Air)	Gas/ 1770	924.8 ppm	1%

	Analyser Range	Span Gas value used
Propane	4000 ppm	924.8 ppm

Analyser Range should be not less than the expected peak emissions.

Span Gas Values should be **either** *approximately the half-hourly ELV* **OR** ***50%*** *to* ***90%*** *of the Selected Analyser Range.*

	Direct Calibration (Rear of Analyser)					
	Zero Cal		Span Gas Cal		Zero Check	
	Start Time	End Time	Start Time	End Time	Start Time	End Time
ZERO /SPAN/ ZERO	11:05	11:10	11:15	11:20	11:22	11:27

NOTE: RESPONSE TIME

Response Time to be carried out at the same time as "Span Check" on system verification (via the sample probe)
Start Time = when gas turned on. 90% Time = when analyser displays 90% of span gas value used. Response must be within 200 seconds.

Pre-Cal Ambient Temp °C		PRE System Verification Check (Down Line)			
		Zero Check		Span Check	
Max	Min	Start Time	End Time	Start Time	End Time
9	8				
ZERO / SPAN		11:29	11:34	11:36	11:41

Response Time SYSTEM Span Gas Cal		
Start Time	90% Time	less than 200s (Y/N)
11:35:00	11:35:12	Y

	Start Time	End Time	Location	Production Details
Sample Period	12:00	14:56	Enigine 1	Normal
Sample Period				
Sample Period				
Sample Period				
Sample Period				
Sample Period				

Post-Cal Ambient Temp °C		POST System Verification Check (Down Line)			
		Zero Check		Span Check	
Max	Min	Start Time	End Time	Start Time	End Time
10	6				
ZERO / SPAN		17:32	17:34	17:37	17:39

Process Details / Comments

Potters Waste
Permit No : TP3736SQ
Variation No : ...
Report Ref : P3334 : R001

Installation Name : Engine 1 & 2
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

Engine 1 - TVOCs Data Sheet

Calibration Summary		TVOC ppm
Analyser Range		4000
Repeatability at Zero		2
Span Gas Concentration Applied		924.8
Zero Gas Concentration Applied		0
Direct Cal	Zero	0.00
	Span	924.8
	Zero	-0.12
Difference (Zero)		0.1249
< 2 × Repeatability @ Zero?		YES
Pre Test (System)	Zero	0.00
	Span	926.9
Difference (Zero)		0.0000
< 2% Relative to Direct Span		YES
Difference (Span)		2.0927
< 2% Relative to Direct Span		YES
Post Test (System)	Zero	2.92
	Span	908.9
Difference (Zero)		2.9152
Zero Drift < 2% of Applied Span?		YES
Difference (Span)		17.9600
Span Drift < 2% of Applied Span?		YES
Zero and Span Drift < 5% of Applied Span?		YES

Engine 1 - SO2 Field Data Sheet

Environmental Compliance Limited	NON ISOKINETIC SAMPLING PROFORMA	Date of Measurement	10/01/2018
ECL/TPD/ 39	Time taken to change Ports? 0	Start Time	12:43
		Test Duration	60 mins
		End Time	13:43

Client	Potters Waste	Stack Profile	Circular	Console id	U001	Barometer id	627
Site	Brynposteg	Stack Area (m^2)	0.13	Pump id	U001	Nozzle Id	n/a
Location	Landfill	Barometric Pressure (mb)	964	Probe id	Sinter probe	Nozzle size	n/a
Stack ID	Engine 1	Static Pres. (mm H_20)	33.6	DGM Yd	0.9764	Filter Id	Sinter in-stack
Test No.	One - SO2	Pitot coefficient	n/a	ΔH@	38.2	Pitot ID	n/a
Job No	P3334	Probe Heater Setting (^OC)	N/A	Impinger Id	660	Hot Box ID	N/A
ECL Site Staff	SEB + PB	Hot Box Setting (^OC)	N/A	Balance Id	88		

Required Sample Flowrate l/min	Suggested ΔH Entered Below
3	1
6	3
10	10
15	25
25	50
Initial ΔH	3
Reference Oxygen Percentage	5

	Sample	Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total
Start Volume	2850830.0						
Final Volume	2851268.0						
Total Volume	438.0	0.0	0.0	0.0	0.0	0.0	438.0
Leak Check	First	Second	Third	Fourth	Fifth		
Leak rate l/min	0				0		
Vaccum "Hg	12				12		
Time of Check	12:40				13:48		
Set Rate l/min	6				7.3		
Leak <2%?	YES				YES		

Dry O_2 (Atmospheric)	7.23
Dry Carbon Dioxide %	11.54
Dry Carbon Monoxide ppm	

Traverse Point	A1	A1	A1	A1	A1	A1			Total
Time/Point (mins)	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60			
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)	3.00	3.00	3.00	3.00	3.00	3.00			3.00
Meter (Tm in)	9.00	10.00	10.00	11.00	11.00	10.00			10.17
Meter (Tm out)	8.00	8.00	9.00	9.00	9.00	9.00			8.67
Stack Temp (Ts)	505.00	505.00	506.00	505.00	505.00	505.00			505.17
Impinger T Outlet	8.00	8.00	9.00	9.00	9.00	10.00			8.83
Vaccum (" Hg)	10.00	10.00	11.00	11.00	11.00	11.00			10.67

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Impinger 1	3% H2O2
SOL/	3362
Start Weight (g)	729.3
End Weight (g)	767.2
Total weight (g)	37.9
Impinger 2	3%H2O2
SOL/	3362
Start Weight (g)	748.3
End Weight (g)	750.9
Total weight (g)	2.6
Impinger3	3%H2O2
SOL/	3362
Start Weight (g)	760.6
End Weight (g)	762.3
Total weight (g)	1.7
Impinger 4	Empty
SOL/	...
Start Weight (g)	490.5
End Weight (g)	491.2
Total weight (g)	0.7
Impinger 5	Silica
SOL/	...
Start Weight (g)	904.3
End Weight (g)	909.7
Total weight (g)	5.4
Impinger 6	
SOL/	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Impinger 7	
SOL/	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Impinger 8	
SOL/	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Total (g)	48.30
Silica <50% used at End of Test? Y/N	YES

Rinse Solutions used	
Solution	SOL NO
DI Water	3356
Acetone	...
3%H2O2	3362

If moisture was not measured see detailed notes below.

Additional Moisture Weighings	
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

If moisture was not measured and gas was dried before entering the gas meter, impinger weights must be included to produce the moisture concentration used in the isokinetic calculations. If the gas was not dried before it entered the gas meter then impinger weights may be included to produce a nominal 0.1% moisture value.

Environmental Compliance Limited

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 1 - Non-methane TVOCs Field Data Sheet

Environmental Compliance Limited	SAMPLE TUBE DATA SAMPLING PROFORMA

Client	Potters Waste	◉ Circular ○ Rectangular ○ Elipse		Pump ID	n/a
Site	Brynposteg	Stack Diameter (mm)	300	Meter ID	U001
Location	Landfill			MST Probe ID	Sinter in-stack
Stack ID	Engine 1	Stack Area (m^2)	0.071	MST Probe Heating Temp (C)	180
Test No	One	Barometric Pressure (mb)	964	DGM Yd or ml/count	0.9746
Job No	P3334	Stack Thermocouple ID	866	MST Hot Box ID	978
ECL Site Staff	SEB + PB	Tube Thermocouple ID	1041	MST Hot Box Heating Temp (C)	180
Barometer ID	627	Meter Thermocouple ID	U001	Workhorse Set Sample Rate (%)	n/a
		In-Stack Sinter Used (Y/N)	Y	MST Delta H Sampling Rate	0.5 - 1

Date of Test	10/01/2018
Sample Start Time	13:56
Sample End Time	14:56
Duration	60
Measured O2	7.19
O2 Uncertainty %Vol	0.43

Meter Units ○ ml ◉ litres

	Sample	Leak 1	Time (start/ end) (minimum 1 minute)	Leak 2	Time (start/ end) (minimum 1 minute)	Total
Start Volume	2851334.2	2851324.2	13:53:00	2851449.2	14:58:00	
Final Volume	2851440.0	2851324.2	13:54:00	2851449.2	14:59:00	
Total Volume	104.6	0.0		0.0		104.6
Sample Train Internal Volume	1.2447	Litres				

Impinger 1	Empty
Start Weight (g)	526.7
End Weight (g)	534.6
Total weight (g)	7.9

Sample Point	A1	A1	A1	A1
Time/ point (mins)	0-10	10 -- 20	20-30	30-40
Tube Temp ^{O}C	11	11	12	13
Stack Temp ^{O}C	507	508	510	510
Meter Temp In ^{O}C	10	10	11	11
Meter Temp Out ^{O}C	10	10	10	10

Impinger 2	Empty
Start Weight (g)	617.8
End Weight (g)	618.4
Total weight (g)	0.6

Sample Point	A1	A1		
Time/ point (mins)	40-50	50-60		
Tube Temp ^{O}C	14	15		
Stack Temp ^{O}C	510	510		
Meter Temp In ^{O}C	11	11		
Meter Temp Out ^{O}C	10	10		

Impinger3	Silica
Start Weight (g)	761.4
End Weight (g)	761.6
Total weight (g)	0.2

Sample Point				
Time/ point (mins)				
Tube Temp ^{O}C				
Stack Temp ^{O}C				
Meter Temp In ^{O}C				
Meter Temp Out ^{O}C				

Silica	(IF USED)
<50% Spent at end Y/N?	YES
Sample train upstream of sorbent tube condensation free for entire sample (Y/N)	no

NB: Non-conforming test due to high temperature and moisture, see Section 2 "Monitoring Deviations".

Potters Waste			Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ		Visit Details	: Annual Compliance
Variation No	: ...		Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334	: R001	Report Issue Date	: 31st January 2018

Engine 2 - Combustion Gases

	Horiba PG 250 Measurement Ranges:			
	NO as NO_2	CO	O_2	CO_2
Units	1025 mg/m^3	2500 mg/m^3	25 %Vol	20 %Vol
	Zero Values (Direct)			
Mean Initial Direct Zero	0.30	0.00	-0.01	0.00
Mean Confirmation Direct Zero	0.28	0.24	-0.03	0.00
Difference in Direct Zero	0.02	0.24	0.02	0.00
Repeatability at Zero	4.10	2.50	0.20	0.20
<2 x Repeatability at Zero?	YES	YES	YES	YES
	Pre Zero Values (System)			
Mean Pre Test Zero	0.24	-0.03	-0.03	0.00
% of Measurement Range?	0.02%	0.00%	-0.13%	0.00%
Detection Limit (LOD)	0.16	0.12	0.20	0.00
	Applied Span:			
	NO	CO	O_2	CO_2
Actual Applied Span Concentration	526.44	1271.25	14.84	17.73
	Pre Test System Zero Values			
Mean Pre Test System Zero	0.24	-0.03	-0.03	0.00
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.05%	0.00%	0.22%	0.00%
	Post Test Zero Values			
Mean Post Test Zero	1.06	1.53	-0.04	0.02
% of Certified Range?	0.10%	0.06%	-0.16%	0.10%
Zero Drift ≤ ± 5% of Applied Span?	0.15%	0.12%	0.20%	0.11%
	Pre Test System Span Values			
Mean Pre Test System Span	520.19	1262.67	14.86	17.63
Difference ≤ ± 2% of Span Value (5% for SO_2)?	1.19%	0.67%	0.13%	0.55%
	Post Test Span Values			
Mean Post Test Span	508.92	1222.29	14.67	17.58
Span Drift ≤ ± 5% Span Value?	3.33%	3.85%	1.12%	0.83%
	3.33%	3.85%	1.12%	0.83%
	See Note 2	See Note 2	See Note 3	See Note 3

NOTE 1: Data Invalid! Contact Quality Manager!
NOTE 2: Correct test data for drift!
NOTE 3: No drift correction required.

NB: NOx and CO data drift corrected prior to calculation of periodic monitoring results

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 2 - TVOCs Calibrations Summary

TVOC - FIELD DATA SHEET

Client	Potters Waste			Barometric Pressure mb	964
Site	Brynposteg			Barometer ID	ECL/ID/ 627
Date	10/01/2018			Analyser ID	ECL/ID/ 269
Location	Landfill			Sonimix/ MFC ID	ECL/ID/
Stack ID	Engine 2			Heated Line/ Controller ID	ECL/ID/ 517 + 518
Stack Temp °C	923			Heated Line Set Temp °C	180 YES
Ambient Temp (sampling)	1 = 11	2 = 13	3 = 15	Heated Line Length	10 m
Ambient Temp (sampling)	4 = 17	5 = 16	6 = 15	Heated Probe Filter ID	ECL/ID/ 919
Job No	P3334			Heated Filter Set Temp °C	180 YES
Operators	SEB + PB			Logger ID	926

Calibration Gas Details

Calibration Gas	Gas Bottle ID	Gas Value	Uncertainty of Gas (k=2)
Zero Gas (Synthetic Air)	Gas/ 1771	...	...
Hydrogen / Helium	Gas/ 1869	...	...
Propane (In Air)	Gas/ 1770	924.8 ppm	1%

	Analyser Range	Span Gas value used
Propane	4000 ppm	924.8 ppm

Analyser Range should be not less than the expected peak emissions.

Span Gas Values should be **either** *approximately the half-hourly ELV* **OR** ***50%*** *to* ***90%*** *of the Selected Analyser Range.*

	Direct Calibration (Rear of Analyser)					
	Zero Cal		Span Gas Cal		Zero Check	
	Start Time	End Time	Start Time	End Time	Start Time	End Time
ZERO /SPAN/ ZERO	11:05	11:10	11:15	11:20	11:22	11:27

NOTE: RESPONSE TIME

Response Time to be carried out at the same time as "Span Check" on system verification (via the sample probe)
Start Time = when gas turned on. 90% Time = when analyser displays 90% of span gas value used. Response must be within 200 seconds.

Pre-Cal Ambient Temp °C		PRE System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
		Start Time	End Time	Start Time	End Time
9	8				
ZERO / SPAN		11:29	11:34	11:36	11:41

Response Time SYSTEM Span Gas Cal		
Start Time	90% Time	less than 200s (Y/N)
11:35:00	11:35:12	Y

	Start Time	End Time	Location	Production Details
Sample Period	15:30	17:25	Enigine 2	Normal
Sample Period				
Sample Period				
Sample Period				
Sample Period				
Sample Period				

Post-Cal Ambient Temp °C		POST System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
		Start Time	End Time	Start Time	End Time
10	6				
ZERO / SPAN		17:32	17:34	17:37	17:39

Process Details / Comments

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 1 - TVOCs data Sheet

Calibration Summary		TVOC ppm
Analyser Range		**4000**
Repeatability at Zero		2
Span Gas Concentration Applied		**924.8**
Zero Gas Concentration Applied		0
Direct Cal	Zero	0.00
	Span	924.8
	Zero	-0.12
Difference (Zero)		0.1249
< 2 × Repeatability @ Zero?		**YES**
Pre Test (System)	Zero	0.00
	Span	926.9
Difference (Zero)		0.0000
< 2% Relative to Direct Span		YES
Difference (Span)		2.0927
< 2% Relative to Direct Span		**YES**
Post Test (System)	Zero	2.92
	Span	908.9
Difference (Zero)		2.9152
Zero Drift < 2% of Applied Span?		YES
Difference (Span)		17.9600
Span Drift < 2% of Applied Span?		**YES**
Zero and Span Drift < 5% of Applied Span?		**YES**

Environmental Compliance Limited

Potters Waste			Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ		Visit Details	: Annual Compliance
Variation No	: ...		Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334	: R001	Report Issue Date	: 31st January 2018

Engine 2 - SO2 Field Data Sheet

Environmental Compliance Limited	NON ISOKINETIC SAMPLING PROFORMA	Date of Measurement	10/01/2018

If moisture was not measured see detailed notes below.

ECL/TPD/	39	Time taken to change Ports?	0	Start Time	15:14
End Time	16:14	Test Duration	60 mins		

Client	Potters Waste	Stack Profile	Circular	Console id	U001	Barometer id	627
Site	Brynposteg	Stack Area (m^2)	0.13	Pump id	U001	Nozzle Id	n/a
Location	Landfill	Barometric Pressure (mb)	964	Probe id	Sinter probe	Nozzle size	n/a
Stack ID	Engine 2	Static Pres. (mm H_20)	-7.645259939	DGM Yd	0.9746	Filter Id	Sinter in-stack
Test No.	One - SO2	Pitot coefficient	n/a	ΔH@	38.2	Pitot ID	n/a
Job No	P3334	Probe Heater Setting (^OC)	n/a	Impinger Id	660	Hot Box ID	978
ECL Site Staff	SEB + PB	Hot Box Setting (^OC)	120	Balance Id	88		

Required Sample Flowrate l/min	Suggested ΔH Entered Below
3	1
6	3
10	10
15	25
25	50
Initial ΔH	3
Reference Oxygen Percentage	5

	Sample	Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total
Start Volume	2851723.4						
Final Volume	2852090.6						
Total Volume	367.2	0.0	0.0	0.0	0.0	0.0	367.2

Leak Check	First	Second	Third	Fourth	Fifth
Leak rate l/min	0				0
Vaccum "Hg	8				13
Time of Check	15:10				16:19
Set Rate l/min	6				6.12
Leak <2%?	YES				YES

Dry O_2 Atmospheric)	8.07
Dry Carbon Dioxide %	10.23
Dry Carbon Monoxide ppm	

Traverse Point	A1	A1	A1	A1	A1	A1			Total
Time/Point (mins)	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60			
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)	3.00	3.00	3.00	3.00	3.00	3.00			3.00
Meter (Tm in)	12.00	12.00	11.00	11.00	10.00	10.00			11.00
Meter (Tm out)	11.00	11.00	10.00	10.00	9.00	9.00			10.00
Stack Temp (Ts)	458.00	460.00	459.00	460.00	460.00	459.00			459.33
Impinger T Outlet	10.00	10.00	10.00	11.00	10.00	9.00			10.00
Vaccum (" Hg)	12.00	12.00	12.00	12.00	12.00	12.00			12.00

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Impinger 1	3% H2O2
SOL/	3362
Start Weight (g)	731.4
End Weight (g)	756.7
Total weight (g)	25.3

Impinger 2	3% H2O2
SOL/	3362
Start Weight (g)	751.8
End Weight (g)	840.6
Total weight (g)	88.8

Impinger3	3% H2O2
SOL/	3362
Start Weight (g)	765.8
End Weight (g)	679.4
Total weight (g)	-86.4

Impinger 4	Empty
SOL/	...
Start Weight (g)	491.3
End Weight (g)	491.7
Total weight (g)	0.4

Impinger 5	Silica
SOL/	...
Start Weight (g)	909.7
End Weight (g)	911.9
Total weight (g)	2.2

Impinger 6	
SOL/	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Impinger 7	
SOL/	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Impinger 8	
SOL/	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Total (g)	30.30

Silica <50% used at End of Test? Y/N	YES

Rinse Solutions used	
Solution	SOL NO
DI Water	3356
Acetone	...
3% H2O2	3362

Additional Moisture Weighings

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

If moisture was not measured and gas was dried before entering the gas meter, impinger weights must be included to produce the moisture concentration used in the isokinetic calculations. If the gas was not dried before it entered the gas meter then impinger weights may be included to produce a nominal 0.1% moisture value.

Environmental Compliance Limited

Potters Waste
Permit No : TP3736SQ
Variation No : ...
Report Ref : P3334 : R001

Installation Name : Engine 1 & 2
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

Engine 2 - Non-methane TVOCs Field Data Sheet

Environmental Compliance Limited	SAMPLE TUBE DATA SAMPLING PROFORMA

Client	Potters Waste	◉ Circular ○Rectangular ○Elipse		Pump ID	n/a
Site	Brynposteg	Stack Diameter (mm)	400	Meter ID	U001
Location	Landfill			MST Probe ID	n/a
Stack ID	Engine 2	Stack Area (m^2)	0.126	MST Probe Heating Temp (C)	Sinter in-stack
Test No	One - NMVOC	Barometric Pressure (mb)	964	DGM Yd or ml/count	0.9746
Job No	P3334	Stack Thermocouple ID	866	MST Hot Box ID	978
ECL Site Staff	SEB + PB	Tube Thermocouple ID	1041	MST Hot Box Heating Temp (C)	180
Barometer ID	627	Meter Thermocouple ID	U001	Workhorse Set Sample Rate (%)	n/a
		In-Stack Sinter Used (Y/N)	Y	MST Delta H Sampling Rate	0.5 - 1

Date of Test	10/01/2018
Sample Start Time	16:23
Sample End Time	17:23
Duration	60
Measured O2	8.08
O2 Uncertainty %Vol	0.48

Meter Units ○ ml ◉ litres

	Sample	Leak 1	Time (start/ end) (minimum 1 minute)	Leak 2	Time (start/ end) (minimum 1 minute)	Total
Start Volume	2852118.0	2852117.0	16:21:00	2852222.2	17:26:00	
Final Volume	2852221.0	2852117.0	16:22:00	2852222.2	17:27:00	
Total Volume	101.8	0.0		0.0		101.8
Sample Train Internal Volume	1.2447	Litres				

Impinger 1	Empty
Start Weight (g)	526.7
End Weight (g)	529.7
Total weight (g)	3

Sample Point	A1	A1	A1	A1
Time/ point (mins)	0-10	10--20	20-30	30-40
Tube Temp ^{O}C	17	16	16	17
Stack Temp ^{O}C	460	460	460	460
Meter Temp In ^{O}C	9	10	10	11
Meter Temp Out ^{O}C	9	10	10	11

Impinger 2	Empty
Start Weight (g)	618.4
End Weight (g)	618.9
Total weight (g)	0.5

Sample Point	A1	A1		
Time/ point (mins)	40-50	50-60		
Tube Temp ^{O}C	17	18		
Stack Temp ^{O}C	460	460		
Meter Temp In ^{O}C	11	10		
Meter Temp Out ^{O}C	11	10		

Impinger3	Silica
Start Weight (g)	761.6
End Weight (g)	763.4
Total weight (g)	1.8

Sample Point				
Time/ point (mins)				
Tube Temp ^{O}C				
Stack Temp ^{O}C				
Meter Temp In ^{O}C				
Meter Temp Out ^{O}C				

Silica	(IF USED)
<50% Spent at end Y/N?	Yes
Sample train upstream of sorbent tube condensation free for entire sample (Y/N)	no

LABORATORY ANALYSIS RESULTS

CONCEPT LIFE SCIENCES

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Combrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2404

Report Number: 708572-1

Date of Report: 24-Jan-2018

Customer: Environmental Compliance Ltd
Unit G1
Main Avenue
Treforest Industrial Estate
Pontypridd
CF37 5BF

Customer Contact: Mr Sam Brookes

Customer Job Reference: P3334
Customer Purchase Order: E7497
Date Job Received at Concept: 15-Jan-2018
Date Analysis Started: 15-Jan-2018
Date Analysis Completed: 24-Jan-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked and authorised by :
Kathryn Gleaves
Customer Service Advisor

Issued by :
Emma Spear
Customer Service Advisor

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Concept Reference: 708572
Customer Reference: P3334

Impinger(peroxide) Analysed as Impinger(peroxide)
Sulphur Dioxide & Volume

Concept Reference					708572 001	708572 002	708572 003	708572 004	708572 005
Customer Sample Reference					ECL/18/0070	ECL/18/0071	ECL/18/0072	ECL/18/0073	ECL/18/0074
Test Sample					AR	AR	AR	AR	AR
Date Sampled					10-JAN-2018	10-JAN-2018	10-JAN-2018	10-JAN-2018	10-JAN-2018
Determinand	Method	LOD	Units	Symbol					
Sulphur Dioxide	IC	0.05	mg/l	U	[13] 54	[13] 0.54	[13] 0.48	[13] 55	[13] 0.69
Volume	Vol	1	ml	U	450	230	300	450	160

Concept Reference: 708572
Customer Reference: P3334

Impinger(peroxide) Analysed as Impinger(peroxide)
Sulphur Dioxide & Volume

Concept Reference					708572 006	708572 007	708572 008	708572 009
Customer Sample Reference					ECL/18/0075	ECL/18/0076	ECL/18/0077	ECL/18/0078
Test Sample					AR	AR	AR	AR
Date Sampled					10-JAN-2018	11-JAN-2018	11-JAN-2018	11-JAN-2018
Determinand	Method	LOD	Units	Symbol				
Sulphur Dioxide	IC	0.05	mg/l	U	[13] 0.43	[13] 0.76	[13] 0.38	[13] 0.76
Volume	Vol	1	ml	U	360	420	220	280

Concept Reference: 708572
Customer Reference: P3334

Tube (Charcoal 226-09) Analysed as Tube (Charcoal 226-09)
VOC (Total)

Concept Reference					708572 011	708572 012	708572 013	708572 014	708572 015
Customer Sample Reference					ECL/18/0080	ECL/18/0081	ECL/18/0082	ECL/18/0083	ECL/18/0084
Test Sample					AR	AR	AR	AR	AR
Date Sampled					10-JAN-2018	10-JAN-2018	10-JAN-2018	11-JAN-2018	11-JAN-2018
Determinand	Method	LOD	Units	Symbol					
Volatile Organic Compounds (Total)	GC/MS	1	µg	N	69	16	<1	3	<1

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Concept Reference: 708572
Customer Reference: P3334

Tube (Tenax/Carbon/Molecular Sieve) — Analysed as Tube (Tenax/Carbon/Molecular Sieve)
Trace Landfill Gas Suite

				Concept Reference	708572 018	708572 021	708572 022
				Customer Sample Reference	ECL/18/0088	ECL/18/0089	ECL/18/0090
				Test Sample	AR	AR	AR
				Date Sampled	11-JAN-2018	11-JAN-2018	11-JAN-2018
Determinand	Method	LOD	Units	Symbol			
I Pentene	GC/MS (TD SIR)	10	ng	U	[68] 46	[68] 30	[68] 23
1,1-Dichloroethane	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
1,1-Dichloroethylene	GC/MS (TD SIR)	10	ng	U	280	240	<10
1,2-Dichloroethane	GC/MS (TD SIR)	10	ng	N	[175] 1600	<10	<10
1,2-Dichloroethylene	GC/MS (TD SIR)	30	ng	U	<30	<30	300
1,3-Butadiene	GC/MS (TD SIR)	10	ng	U	[68] <10	[68] <10	[68] 82
1,4 epoxy 1,3-butadiene	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
1-Propanethiol	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
2-butoxyethanol	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
Benzene	GC/MS (TD SIR)	10	ng	U	[175] 5800	[175] 2100	<10
Butyric acid	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
Carbon disulphide	GC/MS (TD SIR)	10	ng	N	440	<10	<10
Carbon tetrachloride	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
Chloroethane	GC/MS (TD SIR)	30	ng	N	<30	<30	<30
Dichloromethane	GC/MS (TD SIR)	10	ng	N	[175] 6800	<10	<10
Dimethyl disulphide	GC/MS (TD SIR)	10	ng	N	320	<10	<10
Dimethyl sulphide	GC/MS (TD SIR)	10	ng	U	750	12	21
Ethyl butyrate	GC/MS (TD SIR)	25	ng	N	<25	<25	<25
Ethyl Mercaptan	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
Hydrogen sulphide	GC/MS (TD SIR)	60	ng	N	<60	<60	<60
Methyl Mercaptan	GC/MS (TD SIR)	30	ng	N	<30	<30	<30
N-Butyl Mercaptan	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
Styrene	GC/MS (TD SIR)	10	ng	N	280	<10	<10
Toluene	GC/MS (TD SIR)	10	ng	N	[27] 12000	31	<10
Trichloroethylene	GC/MS (TD SIR)	10	ng	U	730	250	<10
Vinyl chloride monomer	GC/MS (TD SIR)	10	ng	U	[68] <10	[68] <10	[68] <10

Concept Reference: 708572
Customer Reference: P3334

Tube (Charcoal) — Analysed as Tube (Charcoal 226-01)
Siloxanes

				Concept Reference	708572 025	708572 026
				Customer Sample Reference	ECL/18/0095	ECL/18/0094
				Test Sample	AR	AR
				Date Sampled	11-JAN-2018	11-JAN-2018
Determinand	Method	LOD	Units	Symbol		
Decamethylcyclopentasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Decamethyltetrasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Hexamethylcyclotrisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Hexamethyldisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Octamethylcyclotetrasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Octamethyltrisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1

Index to symbols used in 708572-1

Value	Description
AR	As Received
27	Result should be considered as a minimum due to detector saturation.
13	Results have been blank corrected.
68	Outside scope of UKAS accreditation
175	Results should be viewed with caution due to being outside of the instrument calibration range
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Notes

The results for 1 Pentene, 1,3-Butadiene & Vinyl Chloride Monomer are outside the scope of our UKAS accreditation as the standards expired on the 13/01/18.

UNCERTAINTY CALCULATIONS

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 1 - Volumetric Flowrate Uncertainty

Measurement Uncertainty Calculations - Velocity at Stack Conditions

Contribution From	Standard u/c (Pa)	
Pitot Calibration Uncertainty Contribution	4.34	A
Manometer Calibration Uncertainty Contribution	4.341666667	B
Variation in Actual Pitot reading at sample points	3.00	C
Combined u/c (Pa) =	**Combined u/c (Pa)**	
SQRT $(A/\sqrt{3})^2 + (B/\sqrt{3})^2 + (C/\sqrt{3})^2$	3.95	
Expanded Uncertainty of Flow Measurements Pa	**7.89**	
	Standard u/c (K)	
Temperature Calibration (K)	3.91	D
Variation in Actual Temp reading at sample points	0.00	E
Combined u/c of Temp (K)	**Combined u/c (K)**	
SQRT $((D/\sqrt{3^2}) + (E/\sqrt{3})^2)$	2.25	
Expanded Uncertainty of Temp Measurements (K)	**4.51**	
Measured Average Velocity (m/s) at Stack Conds	63.27	
Maximum Average Velocity (m/s) at Stack Conds	63.74	
Standard Uncertainty Velocity at Stack Conditions (%)	0.74	
Expanded Uncertainty Velocity (at Stack Conditions)	**1.49 (%)**	

Measurement Uncertainty Calculations - Flowrate at Stack Conditions

Contribution From	Standard u/c (m^2)
Area (m2)	0.00071
Measured Average Flowrate (m^3/s) at Stack Conds	4.47
Maximum Average Flowrate (m^3/s) at Stack Conds	4.55
Standard Uncertainty Flowrate (m^3/s) at Stack Conditions (%)	1.75
Expanded Uncertainty Flowrate (m^3/s) at Stack Conditions	**3.50 (%)**

Measurement Uncertainty Calculations - Flowrate at STP & Wet Gas

Contribution From	Standard u/c (%)
Temperature Calibration (K)	0.5
Barometer Calibration	0.5
Measured Average Flowrate (m^3/s) at STP Wet	1.49
Maximum Average Flowrate (m^3/s) at STP Wet	1.52
Standard Uncertainty Flowrate (m^3/s) at STP Wet	1.93
Expanded Uncertainty Flowrate (m^3/s) at STP Wet	**3.86 (%)**

Measurement Uncertainty Calculations - Flowrate at STP & Dry Gas

Contribution From	Standard u/c (%)
Moisture Uncertainty (% v/v)	0.24
Measured Average Flowrate (m^3/s) at STP Dry	1.29
Maximum Average Flowrate (m^3/s) at STP Dry	1.32
Standard Uncertainty Flowrate (m^3/s) at STP Dry	2.21
Expanded Uncertainty Flowrate (m^3/s) at STP Dry	**4.42 (%)**

Measurement Uncertainty Calculations - Flowrate at STP, Dry Gas & Ref Oxygen

Contribution From	Standard u/c (%)
Oxygen Uncertainty (% v/v)	0.217
Measured Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	1.11
Maximum Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	1.15
Standard Uncertainty Flowrate (m^3/s) at STP Dry & Ref Oxygen	3.82
Expanded Uncertainty Flowrate (m^3/s) at STP Dry & Ref O_2	**7.64 (%)**

Potters Waste		**Installation Name**	**: Engine 1 & 2**
Permit No	**: TP3736SQ**	**Visit Details**	**: Annual Compliance**
Variation No	**: ...**	**Survey Dates**	**: 10th & 11th January 2018**
Report Ref	**: P3334 : R001**	**Report Issue Date**	**: 31st January 2018**

Engine 1 Combustion Gases Uncertainty of Measurement

Uncertainty of Measurement Results - Calculations Part 1

Horiba PG 250 Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Minimum Certified Range (R_i) NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit[1]	u_{lof}	Rectangular	$\sqrt{3}$	0.40	0.40	0.13	0.60
Span drift[2]	$u_{d,s}$			0.27	0.29	0.029	0.24
Losses / leakage in the sample system[4]	u_{loss}			5.00	9.03	0.080	0.49
Temperature dependant span drift[5]	u_t			0.18	0.050	0.070	0.040

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,\max} - x_{i,adj})^2 + (x_{i,\min} - x_{i,adj})(x_{i,\max} - x_{i,adj}) + (x_{i,\min} - x_{i,adj})^2}{3}}$, when $|(x_{i,\max} - x_{i,adj})| = |(x_{i,\min} - x_{i,adj})|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Horiba PG 250 Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.29	0.22	0.019	0.069
Span drift	$u_{d,s}$			0.20	0.16	0.0041	0.028
Temperature dependant span drift	u_t			1.41	0.30	0.11	0.0092
Interferents	u_i			0.87	1.59	0.081	...

Uncertainty of Measurement Results - Calculations Part 2

Horiba PG 250 Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Losses / leakage in the sample system	u_{loss}	10/01/18 12:30 - 13:29	21.97	94.85	0.0057	0.056
Standard Error of Measured Value	u_{SE}	10/01/18 12:30 - 13:29	2.23	1.79	0.0078	0.0099

Effect on Uncertainty Caused by Oxygen $uCorr^n_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})x(20.9\% - O_{2,measured})} x\, Uncertainty\ of\ O_2\ Measurement =$ 0.025

$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} =$ 2.2131 $uf_{o_2} = \frac{uCorr^n_{o_2}}{f_{o_2}} x100 =$ 1.15 %

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

$u_{combined} = \sqrt{\sum (uf_{o_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$\therefore u(x_i) = C_i u_i$ where $C_i = \frac{\partial f}{\partial x_i}$

Uncertainty of Measurement Results - Calculations Part 3

Horiba PG 250 Uncertainty	Date & Time	NOx (as NO2) 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Measured Concentration	10/01/18 12:30 - 13:29	439.21	1062.54	7.18	11.51
Expanded Uncertainty as Percentage of Measured Concentration		10%	18%	4%	2%

Combined Standard Uncertainty $u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_t^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2 + u_v^2 + u_{syn}^2}$

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Where the uncertainty of Moisture is taken as the standard error of the time averaged value used to correct to Dry Conditions
7 If no value for uncertainty is presented above, the uncertainty is considered to be >100%

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 1 - Combustion Gases Measurement Uncertainty

Measurement Uncertainty Calculations Part 1

Horiba PG 250 Performance Characteristics	Standard Uncertainty (% of Range)	Distributiuon	Minimum Certified Range (R_i) NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit[1]	u_{lof}	Rectangular (Divisor = √3)	0.40	0.40	0.13	0.60
Span drift[2]	$u_{d,s}$	Rectangular (Divisor = √3)	0.27	0.29	0.029	0.24
Repeatability Standard Deviation (span)[3]	u_r	Normal (Divisor = 1)	4.95	23.31	0.42	0.14
Losses / leakage in the sample system[4]	u_{loss}	Rectangular (Divisor = √3)	5.00	9.03	0.080	0.49
Temperature dependant span drift[5]	u_t	Rectangular (Divisor = √3)	0.18	0.050	0.070	0.040
Interferents[1]	u_i	Rectangular (Divisor = √3)	1.20	2.90	0.56	0.010
Uncertainty of Reference Gas[6]	u_{ref}	Rectangular (Divisor = √3)	9.12	22.02	0.15	0.31

Note:

$$when\ \left|(x_{i,\max} - x_{i,adj})\right| = \left|(x_{i,\min} - x_{i,adj})\right|, then\ u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Expressed as standard uncertainty in units of measurement i.e. mg/m³ / %Vol inc additional uncertainty of 2% for gas blending
7 Data not available so not included

Measurement Uncertainty Calculations Part 2

Horiba PG 250 Performance Characteristics	Uncertainty	Value of Standard Uncertainty	NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.29	0.22	0.019	0.07
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.20	0.16	0.0041	0.0280
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	4.95	23.31	0.42	0.14
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	3.61	4.95	0.012	0.06
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.26	0.055	0.020	0.009
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.87	1.59	0.081	0.01
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	5.26	12.71	0.086	0.18
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	8.14	27.05	0.43	0.25
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	16.27	54.11	0.87	0.49
Applied Span Concentration			526.44	1271.25	14.84	17.73
Measured Span Concentration, STP Dry Gas			514.55	1242.48	14.77	17.61
Expanded measurement uncertainty as % of Applied Span			3%	4%	6%	3%

Potters Waste			Installation Name	: Engine 1 & 2	
Permit No	: TP3736SQ		Visit Details	: Annual Compliance	
Variation No	: ...		Survey Dates	: 10th & 11th January 2018	
Report Ref	: P3334	: R001	Report Issue Date	: 31st January 2018	

Engine 1 - TVOCs Uncertainty of Measurement

Engine 1 - TVOC - Uncertainty of Measurement Results - Calculations Part 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Min Certified Range	
				O_2 0 - 25 %Vol	TVOC 0 - 15 mgC/m^3
Lack of fit[1]	u_{lof}	Rectangular	$\sqrt{3}$	0.13	0.73
Span drift[2]	$u_{d,s}$			0.029	0.35
Losses / leakage in the sample system[4]	u_{loss}			1.00	0.23
Temperature dependant span drift[5]	u_t			0.070	0.30
Interferents[1]	u_i			0.56	4.39
Effect of Voltage Fluctuation[7]	u_v			...	1.80
Effect of Oxygen Synergism[7]	u_{syn}			...	

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,\max} - x_{i,adj})^2 + (x_{i,\min} - x_{i,adj})(x_{i,\max} - x_{i,adj}) + (x_{i,\min} - x_{i,adj})^2}{3}}$, when $\left|(x_{i,\max} - x_{i,adj})\right| = \left|(x_{i,\min} - x_{i,adj})\right|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	O_2 0 - 25 %Vol	TVOC 0 - 15 mgC/m^3
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.019	0.064
Span drift	$u_{d,s}$			0.0041	0.031
Temperature dependant span drift	u_t			0.053	0.14
Interferents	u_i			0.081	0.38
Effect of Voltage Fluctuation (See Note)	u_v			...	0.16

Engine 1 - TVOC - Uncertainty of Measurement Results - Calculations Part 2

Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	O_2 0 - 25 %Vol	TVOC 0 - 15 mgC/m^3
Losses / leakage in the sample system	u_{loss}	10/01/18 12:51 - 13:50	0.072	3.71
Standard Error of Measured Value	u_{SE}	10/01/18 12:51 - 13:50	0.015	5.63

Effect on Uncertainty Caused by Oxygen $uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times$ Uncertainty of O_2 Meas = 0.03

$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} =$ 1.1624

$uf_{O_2} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 =$ 2.19 %

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

$$u_{combined} = \sqrt{\sum (uf_{o_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$$

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$\therefore u(x_i) = C_i u_i$ where $C_i = \frac{\partial f}{\partial x}$

Engine 1 - TVOC - Uncertainty of Measurement Results - Calculations Part 3

Uncertainty	Date & Time	O_2 0 - 25 %Vol	*TVOC 0 - 15 mgC/m^3
Measured Concentration	10/01/18 12:51 - 13:50	7.22	1639.12
Expanded Uncertainty as Percentage of Measured Concentration		3 %	2 %

Combined Standard Uncertainty $u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_t^2 + u_{loss}^2 + u_i^2 + u_i^2 + u_{ref}^2 + u_v^2 + u_{syn}^2}$

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the applied span concentration
5 Expressed as a percentage of the certified range per one degree centigrade
6 Where the uncertainty of moisture is taken from the manual extract test calculations.
7 Expressed as a percentage of the certified range
8 Where no uncertainty is presented above, the uncertainty is > 100%

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 1 - TVOCs Measurement Uncertainty

Engine 1 - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Min Certified Ranges TVOC 0 - 15 mgC/m³
Lack of fit(1)	u_{lof}	Rectangular (Divisor = √3)	0.73
Span drift(2)	$u_{d,s}$	Rectangular (Divisor = √3)	0.35
Repeatability Standard Deviation (span)(3)	u_r	Normal (Divisor = 1)	82.16
Losses / leakage in the sample system(4)	u_{loss}	Rectangular (Divisor = √3)	13.95
Temperature dependant span drift(5)	u_t	Rectangular (Divisor = √3)	0.30
Interferents(1)	u_i	Rectangular (Divisor = √3)	4.39
Uncertainty of Reference Gas(6)	u_{ref}	Rectangular (Divisor = √3)	25.74
Effect of Voltage Fluctuation(7)	u_v	Rectangular (Divisor = √3)	1.80
Effect of Oxygen Synergism(7)	u_{syn}	Rectangular (Divisor = √3)	4.60

Note:

$$when\ \left|(x_{i,\max} - x_{i,adj})\right| = \left|(x_{i,\min} - x_{i,adj})\right|, then\ \ u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$$

1 Expressed as a percentage of the certified range
2 Expressed as maximum drift per 24hr period as percentage of the certified range
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Expressed as standard uncertainty in units of measurement i.e. mg/m³ / %Vol taking account of an additional uncertainty of 2% for gas blending
7 Expressed as a percentage of the certified range

Engine 1 - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 2

Performance Characteristics	Uncertainty	Value of Standard Uncertainty	*TVOC 0 - 15 mgC/m³
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.064
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.031
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	12.32
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	1.21
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.052
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.38
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	14.86
Effect of Voltage Fluctuation	u_v	$u(x_i) = \frac{u_v \times R_i}{\sqrt{3}} =$	0.16
Effect of Oxygen Synergism	u_{syn}	$u(x_i) = \frac{u_{syn} \times R_i}{\sqrt{3}} =$	0.40
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	19.35
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	38.71
Applied Span Concentration			1486.15
Measured Span Concentration, STP Dry Gas			1480.90
Expanded measurement uncertainty as % of Applied Span			3 %

* Signal 3030 FID

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 1 - SO2 Uncertainty

Site: Brynposteg
Location: Engine 1

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K=2 Filter mg	Solution mg	Standard Uncertainty Filter mg	Solution mg	Combined Uncertainty mg
One - SO2								
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
Sulphur Dioxide	...	24.42	24.42	...	3.18	...	1.59	1.59
...	...	...	...	...	...	...	...	...
...								
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...

	One - SO2			Standard Uncertainty @ 95%		
Sampled Volume (V_m)	0.44	m^3	uV_m	0.001	m^3	
Meter Correction Factor (Yd)	0.98	...		...	...	
Meter Temperature (T_m)	282.42	k	uT_m	1.5	k	
Average Differential Pressure (ΔH)	3.00	mmH_2O	uΔH	0.25	mmH_2O	
Barometric Pressure (ρ_b)	723.06	mmHg	$u\rho_b$	3.8	mmHg	
ΔH + ρs (ρ_m)	96.43	kPa		...	...	
Oxygen content ($O_{2,m}$)	7.23	% by volume	$uO_{2,m} = \sigma/\sqrt{n}$	0.0146		% by volume
Moisture Content (H_2O)	13.25	% by volume	uH_2O	0.48		% by volume

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\partial f}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standard uncertainty and i is the index identifying the contributing factor e.g. i = uV_m, uT_m etc.

Where results are required at wet conditions, the following correction factor is used to convert the data from the dry gas meter:

One - SO2:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = \quad 1.00$$

Uncertainty in correction factor to STP due to measured ΔH uncertainty component (uΔH), measured stack pressure uncertainty component (up_b) & measured temperature of dry gas uncertainty component ($uT_{m\ Dry}$)

One - SO2:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = \quad 0.898$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.90	0.90	0.0000913	0.0000228
up_b	0.90	0.89	0.00124	0.00466
uT_m	0.90	0.89	0.00318	0.00477
H_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00604$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uV_{std}) & volume uncertainty component (uV_m)

One - SO2:

$$V_{std} = V_{measured} \times f_s = \quad 0.393$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty (m^3)
Effect of uV_{std}	0.40	0.39	0.44	0.00265
Effect of uV_m	0.39	0.39	0.90	0.000898

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.00141$$

Uncertainty of Oxygen Correction Factor (%):-

One - SO2:

$$f_{o_2} = \frac{20.9\% - O_{2,\,ref}}{20.9\% - O_{2,\,measured}} = \quad 1.16$$

$$uCorr^n{}_{o_2} = \frac{20.9\% - O_{2,\,ref}}{(20.9\% - O_{2,\,measured}) x (20.9\% - O_{2,\,measured})} x\, Uncertainty\ of\ O_2\ Measurement = \quad 0.0255$$

$$uf_{o_2} = \frac{uCorr^n{}_{o_2}}{f_{o_2}} x100 = \quad 2.19\ \%$$

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Uncertainty in final measurement @ reference conditions due to mass uncertainty component (uM)

Determinand	one:			
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	uM mg/Nm^3
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	76.88	67.49	2.96	4.69
...	...	...	...	...

Uncertainty in final measurement @ reference conditions due to uncertainty component arrising from leak and/or loss (assumed 2% max) in the sample system (uL)

Determinand	one:
	uL mg/Nm^3
...	...
...	...
Sulphur Dioxide	0.83
...	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	one:			
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	uVstp mg/Nm^3
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	72.45	71.93	183.48	0.26
...	...	...	...	...

Combined Uncertainty excluding oxygen contribution

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{stp})^2}$$

Determinand	one:			
	Combined Uncertainty mg/Nm^3	Expanded Uncertainty mg/Nm^3	Measured Concentration mg/Nm^3	Percent of Measured Concentration
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	4.77	9.55	72.19	13.22
...	...	...	...	...

Combined Uncertainty including oxygen contribution

$$u_{combined} = \sqrt{\sum (uf_{o_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$$

Determinand	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corrn Factor	Overall Measurement Uncertainty inc O_2 Corr^n factor (Ucombined)
...	...	...	...
...	...	...	...
Sulphur Dioxide	13.22	2.19	13.40
...	...	...	...

Potters Waste			Installation Name	: Engine 1 & 2	
Permit No	: TP3736SQ		Visit Details	: Annual Compliance	
Variation No	: ...		Survey Dates	: 10th & 11th January 2018	
Report Ref	: P3334	: R001	Report Issue Date	: 31st January 2018	

Engine 1 - Non-methane TVOCs Uncertainty

Site: Potters Waste, Brynposteg
Location: Landfill, Stack ID:Engine 1

					Standard Uncertainty @ 95%		
Sampled Volume	V_m	0.10456	m^3		uV_m	0.000	m^3
Meter Correction Factor or ml/count	Yd	0.9746	...		...	...	...
Meter Temperature	T_m	283.33	k		uT_m	1.5	k
Barometric Pressure	ρ_b	964.00	mBar			10.0	mBar
Oxygen content	$O_{2,m}$	7.19	%Vol		$uO_{2,m}$	0.43	%Vol
Moisture	H_2O	10.15	%Vol		uH_2O	1.48	%Vol

Tubes					
Determinand	Recovered Mass		Standard Uncertainty		
Engine 1	59.00	µg	uM	5.90	µg

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\sigma J}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standa
and i is the index identifying the contributing factor e.g. i = uV_m, uT_m etc.

Where results are required at wet conditions, the following correction factor is used to convert the data fro
meter:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = \quad 1.00$$

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (upb), measured temperature of dry gas uncertainty component (uT_m) & measured moisture (uH_2O) where required

$$f_s = \frac{273}{T_m} \times \frac{\rho}{101.3} = \quad 0.92$$

	Maximum	Minimum	Sensitivity	ufstp
$u\rho_b$	0.47	0.46	0.000484	0.00484
uT_m	0.92	0.91	0.00324	0.00485
uH_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00634$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uVstd) & volume uncertainty component (uVm)

$$V_{std} = V_{measured} \times f_s = \quad 0.0934$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty m^3
Effect of uf_s	0.0941	0.0928	0.10	0.000646
Effect of uV_m	0.0934	0.0934	0.89	8.936E-06

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.00952$$

Uncertainty of correction factor to reference conditions (excluding oxygen contribution) & Uncertainty in final measurement @ reference conditions due to uncertainty component arrising from leak and/or loss (assumed 2% max) in the sample system (uL)

$$uL = \frac{Conc \times \frac{2}{100}}{\sqrt{3}}$$

	Tubes uL mg/Nm^3	Condensate uL mg/Nm^3
Engine 1	0.00729	...

$$Conc = \frac{M_{\text{Recovered}}}{V_m \times f_s \times f_{O_2}}$$

Uncertainty in final measurement @ Reference Conditions due to $uM_{Recovered}$

Charcoal Tube Results				
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	Standard Uncertainty mg/Nm^3
Non Methane VOCs	0.66	0.60	10.70	0.0316
Condensate Results				
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	Standard Uncertainty mg/Nm^3
Non Methane VOCs				

Uncertainty in final measurement @ Reference Conditions due to uV_{STD}

Charcoal Tube Results				
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	Standard Uncertainty mg/Nm^3
Non Methane VOCs	0.70	0.57	6.83	0.0650

Combined Uncertainty (excluding Oxygen contribution)

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{stp})^2}$$

Charcoal Tubes: Determinand	Combined Uncertainty mg/Nm^3	Expanded Uncertainty mg/Nm^3	Measured Concentration mg/Nm^3	Percent of Measured Concentration
Non Methane VOCs	0.0726	0.15	0.73	19.85

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 2 - Volumetric Flowrate Uncertainty

Measurement Uncertainty Calculations - Velocity at Stack Conditions

Contribution From	Standard u/c (Pa)	
Pitot Calibration Uncertainty Contribution	1.59	A
Manometer Calibration Uncertainty Contribution	1.590416667	B
Variation in Actual Pitot reading at sample points	7.00	C
Combined u/c (Pa) =	**Combined u/c (Pa)**	
SQRT $(A/\sqrt{3})^2 + (B/\sqrt{3})^2 + (C/\sqrt{3})^2$	4.24	
Expanded Uncertainty of Flow Measurements Pa	**8.49**	
	Standard u/c (K)	
Temperature Calibration (K)	3.66	D
Variation in Actual Temp reading at sample points	0.25	E
Combined u/c of Temp (K)	**Combined u/c (K)**	
SQRT $((D/\sqrt{3^2}) + (E/\sqrt{3})^2)$	2.12	
Expanded Uncertainty of Temp Measurements (K)	**4.24**	
Measured Average Velocity (m/s) at Stack Conds	37.01	
Maximum Average Velocity (m/s) at Stack Conds	37.60	
Standard Uncertainty Velocity at Stack Conditions (%)	1.62	
Expanded Uncertainty Velocity (at Stack Conditions)	**3.24 (%)**	

Measurement Uncertainty Calculations - Flowrate at Stack Conditions

Contribution From	Standard u/c (m^2)
Area (m2)	0.00126
Measured Average Flowrate (m^3/s) at Stack Conds	4.65
Maximum Average Flowrate (m^3/s) at Stack Conds	4.77
Standard Uncertainty Flowrate (m^3/s) at Stack Conditions (%)	2.63
Expanded Uncertainty Flowrate (m^3/s) at Stack Conditions	**5.27 (%)**

Measurement Uncertainty Calculations - Flowrate at STP & Wet Gas

Contribution From	Standard u/c (%)
Temperature Calibration (K)	0.5
Barometer Calibration	0.5
Measured Average Flowrate (m^3/s) at STP Wet	1.65
Maximum Average Flowrate (m^3/s) at STP Wet	1.70
Standard Uncertainty Flowrate (m^3/s) at STP Wet	2.83
Expanded Uncertainty Flowrate (m^3/s) at STP Wet	**5.65 (%)**

Measurement Uncertainty Calculations - Flowrate at STP & Dry Gas

Contribution From	Standard u/c (%)
Moisture Uncertainty (% v/v)	0.25
Measured Average Flowrate (m^3/s) at STP Dry	1.48
Maximum Average Flowrate (m^3/s) at STP Dry	1.53
Standard Uncertainty Flowrate (m^3/s) at STP Dry	3.11
Expanded Uncertainty Flowrate (m^3/s) at STP Dry	**6.22 (%)**

Measurement Uncertainty Calculations - Flowrate at STP, Dry Gas & Ref Oxygen

Contribution From	Standard u/c (%)
Oxygen Uncertainty (% v/v)	0.179
Measured Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	1.12
Maximum Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	1.17
Standard Uncertainty Flowrate (m^3/s) at STP Dry & Ref Oxygen	4.64
Expanded Uncertainty Flowrate (m^3/s) at STP Dry & Ref O_2	**9.28 (%)**

Potters Waste		**Installation Name**	**: Engine 1 & 2**
Permit No	**: TP3736SQ**	**Visit Details**	**: Annual Compliance**
Variation No	**: ...**	**Survey Dates**	**: 10th & 11th January 2018**
Report Ref	**: P3334 : R001**	**Report Issue Date**	**: 31st January 2018**

Engine 2 - Combustion Gases Uncertainty of Measurement

Uncertainty of Measurement Results - Calculations Part 1

Horiba PG 250 Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Minimum Certified Range (R_i) NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit[1]	u_{lof}	Rectangular	$\sqrt{3}$	0.40	0.40	0.13	0.60
Span drift[2]	$u_{d,s}$			0.27	0.29	0.029	0.24
Losses / leakage in the sample system[4]	u_{loss}			5.00	9.03	0.080	0.49
Temperature dependant span drift[5]	u_t			0.18	0.050	0.070	0.040

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,\max} - x_{i,adj})^2 + (x_{i,\min} - x_{i,adj})(x_{i,\max} - x_{i,adj}) + (x_{i,\min} - x_{i,adj})^2}{3}}$, when $|(x_{i,\max} - x_{i,adj})| = |(x_{i,\min} - x_{i,adj})|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Horiba PG 250 Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.29	0.22	0.019	0.069
Span drift	$u_{d,s}$			0.20	0.16	0.0041	0.028
Temperature dependant span drift	u_t			1.41	0.30	0.11	0.0092
Interferents	u_i			0.87	1.59	0.081	...

Uncertainty of Measurement Results - Calculations Part 2

Horiba PG 250 Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Losses / leakage in the sample system	u_{loss}	10/01/18 16:23 - 17:22	21.98	92.34	0.0065	0.050
Standard Error of Measured Value	u_{SE}	10/01/18 16:23 - 17:22	8.98	4.07	0.0079	0.0059

Effect on Uncertainty Caused by Oxygen $uCorr^n_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} x\, Uncertainty\ of\ O_2\ Measurement =$ 0.029

$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} =$ 1.9681 $uf_{o_2} = \frac{uCorr^n_{o_2}}{f_{o_2}} x100 =$ 1.47 %

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

$u_{combined} = \sqrt{\sum (uf_{o_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$\therefore u(x_i) = C_i u_i$ where $C_i = \frac{\partial f}{\partial x_i}$

Uncertainty of Measurement Results - Calculations Part 3

Horiba PG 250 Uncertainty	Date & Time	NOx (as NO2) 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Measured Concentration	10/01/18 16:23 - 17:22	430.48	1061.30	8.08	10.24
Expanded Uncertainty as Percentage of Measured Concentration		11%	18%	4%	2%

Combined Standard Uncertainty $u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2 + u_v^2 + u_{syn}^2}$

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Where the uncertainty of Moisture is taken as the standard error of the time averaged value used to correct to Dry Conditions
7 If no value for uncertainty is presented above, the uncertainty is considered to be >100%

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 2 - Combustion Gases Measurement Uncertainty

Measurement Uncertainty Calculations Part 1

Horiba PG 250 Performance Characteristics	Standard Uncertainty (% of Range)	Distributiuon	Minimum Certified Range (R_i)			
			NO 0 - 125 mg/m^3	CO 0 - 95 mg/m^3	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit[1]	u_{lof}	Rectangular (Divisor = √3)	0.40	0.40	0.13	0.60
Span drift[2]	$u_{d,s}$	Rectangular (Divisor = √3)	0.27	0.29	0.029	0.24
Repeatability Standard Deviation (span)[3]	u_r	Normal (Divisor = 1)	4.95	23.31	0.42	0.14
Losses / leakage in the sample system[4]	u_{loss}	Rectangular (Divisor = √3)	5.00	9.03	0.080	0.49
Temperature dependant span drift[5]	u_t	Rectangular (Divisor = √3)	0.18	0.050	0.070	0.040
Interferents[1]	u_i	Rectangular (Divisor = √3)	1.20	2.90	0.56	0.010
Uncertainty of Reference Gas[6]	u_{ref}	Rectangular (Divisor = √3)	9.12	22.02	0.15	0.31

Note:

$$when\ \left|(x_{i,\max} - x_{i,adj})\right| = \left|(x_{i,\min} - x_{i,adj})\right|, then\ u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Expressed as standard uncertainty in units of measurement i.e. mg/m^3 / %Vol inc additional uncertainty of 2% for gas blending
7 Data not available so not included

Measurement Uncertainty Calculations Part 2

Horiba PG 250 Performance Characteristics	Uncertainty	Value of Standard Uncertainty	NO 0 - 125 mg/m^3	CO 0 - 95 mg/m^3	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.29	0.22	0.019	0.07
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.20	0.16	0.0041	0.0280
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	4.95	23.31	0.42	0.14
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	3.61	4.95	0.012	0.06
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.26	0.055	0.020	0.009
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.87	1.59	0.081	0.01
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	5.26	12.71	0.086	0.18
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	8.14	27.05	0.43	0.25
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	16.27	54.11	0.87	0.49
Applied Span Concentration			526.44	1271.25	14.84	17.73
Measured Span Concentration, STP Dry Gas			514.55	1242.48	14.77	17.61
Expanded measurement uncertainty as % of Applied Span			3%	4%	6%	3%

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 2 - TVOCs Uncertainty of Measurement

Engine 2 - TVOC - Uncertainty of Measurement Results - Calculations Part 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Min Certified Range O_2 0 - 25 %Vol	Min Certified Range TVOC 0 - 15 mgC/m³
Lack of fit[1]	u_{lof}	Rectangular	$\sqrt{3}$	0.13	0.73
Span drift[2]	$u_{d,s}$			0.029	0.35
Losses / leakage in the sample system[4]	u_{loss}			1.00	0.23
Temperature dependant span drift[5]	u_t			0.070	0.30
Interferents[1]	u_i			0.56	4.39
Effect of Voltage Fluctuation[7]	u_v			...	1.80
Effect of Oxygen Synergism[7]	u_{syn}			...	

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,\max} - x_{i,adj})^2 + (x_{i,\min} - x_{i,adj})(x_{i,\max} - x_{i,adj}) + (x_{i,\min} - x_{i,adj})^2}{3}}$, when $|(x_{i,\max} - x_{i,adj})| = |(x_{i,\min} - x_{i,adj})|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	O_2 0 - 25 %Vol	TVOC 0 - 15 mgC/m³
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.019	0.064
Span drift	$u_{d,s}$			0.0041	0.031
Temperature dependant span drift	u_t			0.053	0.14
Interferents	u_i			0.081	0.38
Effect of Voltage Fluctuation (See Note)	u_v			...	0.16

Engine 2 - TVOC - Uncertainty of Measurement Results - Calculations Part 2

Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	O_2 0 - 25 %Vol	TVOC 0 - 15 mgC/m³
Losses / leakage in the sample system	u_{loss}	10/01/18 15:33 - 16:32	0.081	3.73
Standard Error of Measured Value	u_{SE}	10/01/18 15:33 - 16:32	0.0069	13.55

Effect on Uncertainty Caused by Oxygen

$$uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})*(20.9\% - O_{2,measured})} \text{ x Uncertainty of } O_2 \text{ Meas} = 0.03$$

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.2377$$

$$uf_{O_2} = \frac{uCorr_{O_2}}{f_{O_2}} x100 = 2.34 \%$$

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

$$u_{combined} = \sqrt{\sum (uf_{O_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$$

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$\therefore\ u(x_i) = C_i u_i$ where $C_i = \frac{\partial f}{\partial x_i}$

Engine 2 - TVOC - Uncertainty of Measurement Results - Calculations Part 3

Uncertainty	Date & Time	O_2 0 - 25 %Vol	*TVOC 0 - 15 mgC/m³
Measured Concentration	10/01/18 15:33 - 16:32	8.05	1648.33
Expanded Uncertainty as Percentage of Measured Concentration		3 %	3 %

Combined Standard Uncertainty $u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_t^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2 + u_v^2 + u_{syn}^2}$

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the applied span concentration
5 Expressed as a percentage of the certified range per one degree centigrade
6 Where the uncertainty of moisture is taken from the manual extract test calculations.
7 Expressed as a percentage of the certified range
8 Where no uncertainty is presented above, the uncertainty is > 100%

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 2 - TVOCs Measurement Uncertainty

Engine 2 - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Min Certified Ranges TVOC 0 - 15 mgC/m^3
Lack of fit[1]	u_{lof}	Rectangular (Divisor = √3)	0.73
Span drift[2]	$u_{d,s}$	Rectangular (Divisor = √3)	0.35
Repeatability Standard Deviation (span)[3]	u_r	Normal (Divisor = 1)	82.16
Losses / leakage in the sample system[4]	u_{loss}	Rectangular (Divisor = √3)	13.95
Temperature dependant span drift[5]	u_t	Rectangular (Divisor = √3)	0.30
Interferents[1]	u_i	Rectangular (Divisor = √3)	4.39
Uncertainty of Reference Gas[6]	u_{ref}	Rectangular (Divisor = √3)	25.74
Effect of Voltage Fluctuation[7]	u_v	Rectangular (Divisor = √3)	1.80
Effect of Oxygen Synergism[7]	u_{syn}	Rectangular (Divisor = √3)	4.60

Note:

$$when\ \left|(x_{i,\max} - x_{i,adj})\right| = \left|(x_{i,\min} - x_{i,adj})\right|, then\ \ u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$$

1 Expressed as a percentage of the certified range
2 Expressed as maximum drift per 24hr period as percentage of the certified range
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Expressed as standard uncertainty in units of measurement i.e. mg/m^3 / %Vol taking account of an additional uncertainty of 2% for gas blending
7 Expressed as a percentage of the certified range

Engine 2 - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 2

Performance Characteristics	Uncertainty	Value of Standard Uncertainty	*TVOC 0 - 15 mgC/m^3
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.064
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.031
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	12.32
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	1.21
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.052
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.38
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	14.86
Effect of Voltage Fluctuation	u_v	$u(x_i) = \frac{u_v \times R_i}{\sqrt{3}} =$	0.16
Effect of Oxygen Synergism	u_{syn}	$u(x_i) = \frac{u_{syn} \times R_i}{\sqrt{3}} =$	0.40
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	19.35
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	38.71
Applied Span Concentration			1486.15
Measured Span Concentration, STP Dry Gas			1480.90
Expanded measurement uncertainty as % of Applied Span			3 %

* Signal 3030 FID

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 2 - SO2 Uncertainty

Site: Brynposteg
Location: Engine 2

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K=2 Filter mg	Solution mg	Standard Uncertainty Filter mg	Solution mg	Combined Uncertainty mg
One - SO2								
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
Sulphur Dioxide	...	24.84	24.84	...	3.23	...	1.61	1.61
...	...	...	...	...	...	...	...	...
...								
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...

	One - SO2		Standard Uncertainty @ 95%			
Sampled Volume (V_m)	0.37	m^3	uV_m	0.001	m^3	
Meter Correction Factor (Yd)	0.97	...		...	...	
Meter Temperature (T_m)	283.50	k	uT_m	1.5	k	
Average Differential Pressure (ΔH)	3.00	mmH_2O	uΔH	0.25	mmH_2O	
Barometric Pressure (ρ_b)	723.06	mmHg	up_b	3.8	mmHg	
ΔH + ρs (ρ_m)	96.43	kPa		...	...	
Oxygen content ($O_{2,m}$)	8.07	% by volume	$uO_{2,m} = \sigma/\sqrt{n}$	0.00823		% by volume
Moisture Content (H_2O)	10.31	% by volume	uH_2O	0.50		% by volume

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\partial f}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standard uncertainty and i is the index identifying the contributing factor e.g. i = uV_m, uT_m etc.

Where results are required at wet conditions, the following correction factor is used to convert the data from the dry gas meter:

One - SO2 :

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = \quad 1.00$$

Uncertainty in correction factor to STP due to measured ΔH uncertainty component (uΔH), measured stack pressure uncertainty component (up_b) & measured temperature of dry gas uncertainty component ($uT_{m\,Dry}$)

One - SO2 :

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = \quad 0.893$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.89	0.89	0.0000908	0.0000227
up_b	0.90	0.89	0.00123	0.00463
uT_m	0.90	0.89	0.00315	0.00473
H_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00595$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uV_{std}) & volume uncertainty component (uV_m)

One - SO2 :

$$V_{std} = V_{measured} \times f_s = \quad 0.328$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty (m^3)
Effect of uV_{std}	0.33	0.33	0.37	0.00219
Effect of uV_m	0.33	0.33	0.89	0.000893

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.00113$$

Uncertainty of Oxygen Correction Factor (%):-

One - SO2 :

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = \quad 1.24$$

$$uCorr^n_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) x (20.9\% - O_{2,measured})} x\, Uncertainty\ of\ O_2\ Measurement = \quad 0.0290$$

$$uf_{o_2} = \frac{uCorr^n_{o_2}}{f_{o_2}} x100 = \quad 2.34\ \%$$

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Uncertainty in final measurement @ reference conditions due to mass uncertainty component (uM)

Determinand	one: Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	uM mg/Nm³
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	99.81	87.63	3.77	6.09
...	...	...	...	...

Uncertainty in final measurement @ reference conditions due to uncertainty component arrising from leak and/or loss (assumed 2% max) in the sample system (uL)

Determinand	one: uL mg/Nm³
...	...
...	...
Sulphur Dioxide	1.08
...	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	one: Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	uVstp mg/Nm³
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	94.04	93.40	285.76	0.32
...	...	...	...	...

Combined Uncertainty excluding oxygen contribution

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{stp})^2}$$

Determinand	one: Combined Uncertainty mg/Nm³	Expanded Uncertainty mg/Nm³	Measured Concentration mg/Nm³	Percent of Measured Concentration
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	6.20	12.39	93.72	13.22
...	...	...	...	...

Combined Uncertainty including oxygen contribution

$$u_{combined} = \sqrt{\sum (uf_{o_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$$

Determinand	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corrn Factor	Overall Measurement Uncertainty inc O_2 Corrⁿ factor (Ucombined)
...	...	...	...
...	...	...	...
Sulphur Dioxide	13.22	2.33	13.43
...	...	...	...

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R001	Report Issue Date	: 31st January 2018

Engine 2 - Non-methane TVOCs Uncertainty

Site: Potters Waste, Brynposteg
Location: Landfill, Stack ID:Engine 2

					Standard Uncertainty @ 95%	
Sampled Volume	V_m	0.10176	m^3	uV_m	0.000	m^3
Meter Correction Factor or ml/count	Yd	0.9746	...	...	...	...
Meter Temperature	T_m	283.17	k	uT_m	1.5	k
Barometric Pressure	ρ_b	964.00	mBar		10.0	mBar
Oxygen content	$O_{2,m}$	8.10	%Vol	$uO_{2,m}$	0.49	%Vol
Moisture	H_2O	4.21	%Vol	uH_2O	0.89	%Vol

Tubes				
Determinand	Recovered Mass		Standard Uncertainty	
Engine 2	15.00	µg	uM	1.50 µg

Potters Waste			Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ		Visit Details	: Annual Compliance
Variation No	: ...		Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334	: R001	Report Issue Date	: 31st January 2018

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\sigma J}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standa
and i is the index identifying the contributing factor e.g. i = uV_m, uT_m etc.

Where results are required at wet conditions, the following correction factor is used to convert the data fro
meter:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = \quad 1.00$$

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (uρb), measured temperature of dry gas uncertainty component (uT_m) & measured moisture (uH_2O) where required

$$f_s = \frac{273}{T_m} \times \frac{\rho}{101.3} = \quad 0.92$$

	Maximum	Minimum	Sensitivity	ufstp
$u\rho_b$	0.47	0.46	0.000485	0.00485
uT_m	0.92	0.91	0.00324	0.00486
uH_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00635$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uVstd) & volume uncertainty component (uVm)

$$V_{std} = V_{measured} \times f_s = \quad 0.0910$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty m^3
Effect of uf_s	0.0916	0.0904	0.0992	0.000630
Effect of uV_m	0.0910	0.0910	0.89	8.942E-06

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.00902$$

Uncertainty of correction factor to reference conditions (excluding oxygen contribution) & Uncertainty in final measurement @ reference conditions due to uncertainty component arrising from leak and/or loss (assumed 2% max) in the sample system (uL)

$$uL = \frac{Conc \times \frac{2}{100}}{\sqrt{3}}$$

	Tubes uL mg/Nm³	Condensate uL mg/Nm³
Engine 2	0.00190	...

$$Conc = \frac{M_{\text{Recovered}}}{V_m \times f_s \times f_{O_2}}$$

Uncertainty in final measurement @ Reference Conditions due to $uM_{Recovered}$

Charcoal Tube Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Non Methane VOC	0.17	0.16	10.99	0.00824
Condensate Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Non Methane VOC				

Uncertainty in final measurement @ Reference Conditions due to uV_{STD}

Charcoal Tube Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Non Methane VOC	0.18	0.15	1.83	0.0165

Combined Uncertainty (excluding Oxygen contribution)

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{stp})^2}$$

Charcoal Tubes: Determinand	Combined Uncertainty mg/Nm³	Expanded Uncertainty mg/Nm³	Measured Concentration mg/Nm³	Percent of Measured Concentration
Non Methane VOC	0.0186	0.0371	0.20	18.15

EMISSIONS MONITORING SURVEY

Prepared for:

Potters Waste
Brynposteg Landfill Site
Llandidloes
SY18 6JJ

Permit Number	**: BU7766IC**
Variation Number	**: EPR/BU7766IC/V004**
Installation	**: Flare Stack**
Visit Details	**: Annual Compliance**
Job Number	**: P3334**
Report Number	**: R002**
Report Issue Date	**: 31st January 2018**
Survey Dates	**: 10th & 11th January 2018**

Prepared by:

Environmental Compliance Limited
Unit G1
Main Avenue
Treforest Industrial Estate
Pontypridd
CF37 5BF.
Tel: 01443 841760
Fax: 01443 841761

Report Issue:		**FINAL**	
Report Prepared by:		**Report Reviewed & Approved by** **MCERTS Level Two** **Technical Endorsements TE1, TE2, TE3 & TE4**	
Name:	Mike Mullett	***Name:***	Sam Brookes
		MCERTS No:	MM 06 755
		Signature:	
Date:	29/01/2018	***Date:***	31/01/2018

This report is not to be used for contractual or engineering purposes unless this approval sheet is signed where indicated by the approver and the report is designated "FINAL".

2499

This report has been prepared by Environmental Compliance Limited (ECL) in their professional capacity as Environmental Consultants. The contents of the report reflect the conditions that prevailed and the information available or supplied at the time of its preparation. The report, and the information contained therein, is provided by ECL solely for use and reliance by the Client in performance of ECLs duties and liabilities under its contract with the Client. Until ECL has received payment in full as detailed in the quotation or contract the contents of this report remain the legal property of ECL. The contents of the report do not, in any way, purport to include any manner of legal advice or opinion.

This report should not be reproduced, (except in full) without the written approval of the laboratory.

Should the Client wish to release this report to a Third Party for the party's reliance, Environmental Compliance Ltd may, at its discretion, agree to such release provided that:

- Environmental Compliance Ltd gives written agreement prior to such release and ECL has received payment in full for all works/services undertaken;
- By release of the report to the Third Party, that Third Party does not acquire any rights, contractual or otherwise, whatsoever against Environmental Compliance Ltd and, accordingly, Environmental Compliance Ltd assume no duties, liabilities or obligations to that Third Party;
- Environmental Compliance Ltd accepts no responsibility for any loss or damage incurred by the Client or for any conflict of Environmental Compliance Ltd interests arising out of the Clients' release of this report to the Third Party.

In the event that a report is revised and re-issued, the client shall ensure that any earlier versions of the report, and any copies thereof, are void and such copies should be marked with the words "superseded and revised".

Opinions and Interpretation expressed within this report are outside the scope of the UKAS accreditation.

MCERTS requirements mean that comparison of results with emissions limit values is not permitted within this report.

TABLE OF CONTENTS

Section	Description	Page Number
	Document Control Sheet	
PART 1	EXECUTIVE SUMMARY	4
1	MONITORING OBJECTIVES	4
1.1	Monitoring Results	5
1.2	Operating Information	6
2	MONITORING DEVIATIONS	7
PART 2	SUPPORTING INFORMATION	8
3	SAMPLING STAFF DETAILS	8
4	SAMPLING PROTOCOLS / METHODOLOGIES	9
5	SAMPLE POINT DESCRIPTIONS	13
	EQUIPMENT IDs	14
	FIGURES	16
	TABLES	18
	VELOCITY TRAVERSE PROFILES	22
	FIELD CALIBRATION AND SAMPLING DATA	24
	LABORATORY ANALYSIS RESULTS	29
	UNCERTAINTY CALCULATIONS	34

PART 1 - EXECUTIVE SUMMARY

1 Monitoring Objectives

Environmental Compliance Ltd (ECL) was commissioned by **Potters Waste** to undertake an emission monitoring survey at their **Brynposteg Landfill site**. This report presents the findings of the study.

The monitoring at this installation was carried out in accordance with our quotation reference **DHFB/P3334/Q001**, for compliance check monitoring of emissions to air. The substances requested for monitoring at each emissions point are listed below:

Substances to be monitored	Emission Point Identification
	Ref No:
	Flare Stack
Velocity / Flowrate	• U
Oxides of Nitrogen (as NO_2)	• U
Sulphur Dioxide	• U
Carbon Monoxide	• U
Oxygen	• U
Carbon Dioxide	• U
Total Organic Carbon (TVOC)	• U
Non-methane VOCs	• U

• Denotes the substances to be monitored.

U **Denotes UKAS accreditation is held for monitoring that substance, but does not mean that it has been claimed which will depend on whether the testing could be completed in accordance with the Standard Reference Method.**

Special Requirements: *"Normal operating conditions"*

1.1 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty %	Reference Conditions 273 K, 101.3 kPa	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Tick if non-conforming test (see Sections 2 & 5)	Operating Status
Flare Stack	Volumetric Flowrate	...	36.16668	m^3/sec	17	Stack Conditions	11/01/2018	10:35 – 10:46	BS EN 16911-1:2013 & MID	UKAS / MCERTS	✓	Normal
	Volumetric Flowrate	...	4.74322	m^3/sec	23	STP Dry 3% O_2				UKAS / MCERTS	✓	
	TVOC as Carbon	10	4.60	mgC/m^3	5			13:38 – 14:37	BS EN 12619:2013	UKAS / MCERTS		
	Oxides of Nitrogen (as NO_2)	150	78.19	mg/m^3	2			13:54 – 14:53	BS EN 14792: 2017	UKAS / MCERTS		
	Carbon Monoxide	50	49.12	mg/m^3	3				BS EN 15058: 2017	UKAS / MCERTS		
	Oxygen (Testo)	...	9.87	%	6	Dry			BS EN 14789: 2017	UKAS / MCERTS		
	Carbon Dioxide (Horiba)	...	8.67	%	3				ISO 12039:2001	UKAS / MCERTS		
	Sulphur Dioxide	...	2.81	mg/m^3	13	STP Dry 3% O_2		13:12 – 14:12	BS 14791:2017	UKAS / MCERTS	✓	
	Non-methane VOCs	5	0.092	mg/m^3	10			14:24 – 15:24	CEN/TS 13649:2014	NU	✓	

Notes

The volumetric flowrate shown above is that from the initial pitot traverse.
Any other flow measurements made during isokinetic sampling and/ or repeat traverses are shown later in the tables section.

The uncertainty figures presented in Table 1.1 for NO_x, CO, O_2, CO_2 & TVOC are "measurement uncertainty" figures, which do not take into account the variability of the measured sample values. The "uncertainty of measurement results" figures, which do include this contribution, are presented in the appendices of the report for these determinands.

Emission Limit Value	The emission limit value is that stated in the permit and will be expressed as a concentration or a mass emission.
Periodic Monitoring Result	The result given is expressed in the same terms and units as the emission limit value.
Uncertainty	The uncertainty associated with the quoted result is at the 95% confidence interval. The Uncertainty results **DO NOT** take into account the effect of the sample location limitations.
Reference Conditions	All results are expressed at 273 K and 101.3kPa. The oxygen and moisture corrections are stated.
Monitoring Method Reference	The method stated is in accordance with the Environment Agency Technical Guidance Note M2, or other method approved by the Environment Agency.
Accreditation for use of Method	**The details indicate the accreditation for the use of the complete monitoring method, e.g. MCERTs, UKAS. If use of the method is not accredited "NA" is stated.**
Operating Status	The details indicate the feedstock and the loading rate of the plant during monitoring.
$	Chemical Analysis on sample reagents was performed by an External Laboratory as detailed in Section 4
NU	UKAS Accreditation Held but UKAS Accreditation cannot be claimed for the test as sampling did not comply with the Standard Reference Method (SRM), see section 2 & 5
NA	**Method is NOT UKAS Accredited.**

1.2 Operating Information

Emission Point Reference	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results					
							Parameter	Date	Time	CEMS Results	Periodic Monitoring Results	Units
Flare Stack	Batch	N/A	Gas	Landfill Gas	None	Normal	...	...	...	NP	...	...

Notes:

Process Type	State whether the process is a continuous or batch process.
Process Duration	If a batch process, state the duration, frequency and details of the portion of the batch sampled. If continuous state "NA"
Fuel	If applicable, state the fuel type If not applicable state "NA"
Feedstock	State the feedstock type
Abatement	State the type and whether operational during monitoring. If not applicable state "NA"
Load	State the normal load, throughput or rating of the plant
CEMS Data	Enter this data for each CEM installed if it is has been provided by operator otherwise state “NP” (NOT PROVIDED)

2 Monitoring Deviations

The objective of the survey was to measure the concentrations of pollutants from the processes / locations as detailed in Section 1. This survey meets the requirements of the site's **PPC Permit Number: BU7766IC** where UKAS and MCERTS accreditation has and could be claimed for the testing in the monitoring results table.

There was a modification to the sampling procedures (TPDs) listed in Section 4:

- **Non Methane VOC –** ECL/TPD/84 is specifically for the monitoring of dry ambient gas. Testing of the flare stack required the modification of the TPD, to cool and dry the sample gas prior to passing it through the capture media (sorbent tube). Due to the high stack temperature, and the modifications required to facilitate sampling, UKAS accreditation has not been claimed for Non-Methane VOCs.

There were no substance deviation from the original and agreed emissions monitoring schedule.

Non-conforming tests are as follows:

- Due to Health & Safety restrictions only a single sampling point was traversed, see also Section 5. Due to the high stack temperatures and the limited access, it was not possible to fully traverse the duct. Consequently, all flowrate measurements are non-conforming.
- Impinger collection efficiency is less than 95% for the Sulphur Dioxide tests. However, please note that there is no ELV in place. If an ELV of 50mg/m3 is used (the same as CO) then the concentration is less than 30% of the ELV and the impinger collection efficiency is not applicable.

The Uncertainty of the reported concentrations for these pollutant results DOES NOT take into account the effect of non-conformities or sample location limitations.

Homogeneity tests have not been completed for pollutants at the following locations:

- Flare stack – Not requested by client

PART 2 – SUPPORTING INFORMATION

3 SAMPLING STAFF DETAILS

Site Sampling Team

Names of Site Team	Dates on Site	MCERTS No.	LEVEL	Technical Endorsements
Sam Brookes	10-11/01/2018	MM 06 775	2	TE1, TE2, TE3, TE4
Peter Brockway		MM 17 1459	Trainee	…

Report Reviewer

Name	MCERTS No.	LEVEL	Technical Endorsements
Sam Brookes	MM 06 775	2	TE1, TE2, TE3, TE4

Technical Endorsement Key:-

TE1 – Isokinetic Particulates, Temperature & Velocity Profiles, Oxygen.
TE2 – Isokinetic Extractive Pollutants:- Metals, Dioxin & Furans, PAHs, PCBs, HCl, HF.
TE3 – Non-Isokinetic Extractive Pollutants:- Speciated VOCs, HF, HCl, Cyanide.
TE4 – Continuous Analysers (Combustion Gases):- TVOC, CO, NOx, SO2.

4 SAMPLING PROTOCOLS / METHODOLOGIES

Any required modifications to the Technical Procedure Documents (TPDs) specified below will be detailed in section 2 of this report.

Stand alone velocity measurements and those made to support isokinetic sampling are conducted using BS EN 16911-1:2013 & MID.

Pressure, Temperature and Velocity

Testing was carried out using a sampling system in accordance with **BS EN ISO 16911-1:2013 & MID** and In-house technical procedure **ECL/TPD/022A.**

Temperature was recorded using a thermocouple and digital temperature reader.

Velocity and pressure were recorded using an "L" type and digital manometer, data being recorded in Pascals.

Water Vapour

Testing was carried out using a Universal Stack Sampling system in accordance with **BS EN 14790:2017** and In-house technical procedure **ECL/TPD/082**.

In this method the stack gases are filtered (in-stack unheated filter or out-stack heated filter) to remove particulate matter. The gases are then passed through a **heated probe** and then to a cooled moisture trapping unit. All unheated parts of the sample train (outside the sample port) which come into contact with stack gas are weighed pre and post sampling in order to determine the weight gain.

After each test, a visual inspection of the last impinger is made to confirm that at least 50% of the silica gel column has not changed colour. This indicates satisfactory collection of water vapour.

Combustion Gases (NO_x, CO & CO_2)

Measurements of combustion gases were carried out using an MCERTS Certified **Horiba PG 250** stack gas analyser. Continuous monitoring of emissions was undertaken over each test period recording minute averaged data (one measurement every 60 seconds). The measurement techniques for each determinand are as follows:

Determinand	Technique	SRM
• NO_x	Chemiluminescence	BS EN 14792: 2017
• CO	Non-dispersive infrared	BS EN 15058: 2017
• CO_2	Non-dispersive infrared	ISO 12039:2001

The analyser was set up with reference to the manufacturer's operator handbook and the in-house technical procedure **ECL/TPD/033c**. The analyser was calibrated on site using certified gases which are traceable to ISO 17025 (with uncertainty < 2%). Zero measurements were performed using Nitrogen. The analyser was calibrated directly into the sample inlet and then checked through the entire sampling system (including sampling probe, heated & unheated gas transport lines and gas drying/ conditioning system).

Data is presented graphically in the Figures Section, and the minute averaged data is given in the Tables Section.

Oxygen

Measurements of Oxygen were carried out using a Testo 350XL electrochemical cell combustion gas analyser which has been validated to meet the performance requirements of **BS EN 14789:2017** Continuous monitoring of emissions was undertaken over each test period recording minute averaged data.

The analyser was set up with reference to the manufacturer's operator handbook and the in-house technical procedure **ECL/TPD/086**. The analyser was calibrated on-site using certified gases which are traceable to ISO 17025 (with uncertainty < 2%). (for emissions streams where oxygen is above 15%, dry ambient air can be used to calibrate the analyser). Zero measurements were performed using Nitrogen. The analyser was calibrated directly into the sample inlet (which is up-stream of the built-in chiller system) and then checked through the entire sampling system (including sampling probe, short heated/ unheated gas transport lines and external gas conditioning systems as required).

TVOC as Carbon

Testing was carried out using an MCERTS Certified Signal 3030PM FID and heated gas sample line, with reference to the manufacturer's operation handbook, **BS EN 12619:2013** and in-house technical procedure **ECL/TPD/032A**.

The analyser was calibrated on site using certified propane span gases, (made up in synthetic air) which are traceable to ISO 17025 standard (with uncertainty $<2\%$).

Zero measurements were performed using synthetic air zero gas, with TVOC content less than 0.2 mg/m^3 (or purity greater than 99.998%).

The analyser was calibrated directly into the sample inlet and then checked through the entire sampling system (including sampling probe, heated filter and heated gas transport lines). Data was corrected by molecular weight to TVOCs as total carbon.

Data was recorded as minute averages over each test period. The data is presented in the Figures Section and the minute averaged data is detailed in the Tables Section**.**

Sulphur Dioxide

Testing was carried out non-isokinetically using a Universal Stack Sampling system in accordance with **BS EN 14791:2017** and In-house technical procedure **ECL/TPD/039**. Non-isokinetic sampling can only take place if there are no droplets present in the stack gas.

In this method the stack gases are filtered to remove particulate matter then the gases are passed through a series of impingers. The first three impingers each contain 140ml of 3% Hydrogen Peroxide (3% H_2O_2). The fourth impinger is left empty and the final impinger contains a measured quantity of silica gel.

The first three impingers containing the 3% Hydrogen Peroxide are analysed for concentrations of Sulphur Dioxide by IC (Ion Chromatography).

Concept Life Sciences Ltd (CLS) who are situated in Manchester carried out the analysis of the samples. **CLS** is UKAS accredited for this analysis. In addition to the survey samples, appropriate field blanks and efficiency checks are submitted as part of the technical procedure.

Non-methane VOCs

Non-continuous sampling for **Non-methane VOCs** was carried out in accordance with **CEN/TS 13649:2014** and In-house technical procedure **ECL/TPD/084.** In this method a metered volume of stack gas is extracted through a standard charcoal sorbent tube/ thermal desorption tube.

Concept Life Sciences Ltd (CLS) who are situated in Manchester carried out the analysis of the samples. **CLS are not UKAS** accredited for this analysis. In addition to the survey samples, appropriate field blanks and efficiency checks are submitted as part of the technical procedure.

Due to restrictions set out in CEN/TS 13649:2014, MCERTS/UKAS accreditation can only be claimed when the target parameters are organic compounds, the sorbent tube used is a standard charcoal tube/ thermal desorption tube and when laboratory analysis is UKAS accredited and carried out by GC. If other tubes are used, or if analysis is by other means than GC, then usually only UKAS accreditation can be claimed, as long as the laboratory analysis is UKAS accredited. (MCERTS accreditation may still be claimed if prior approval is given for the modifications by the Environment Agency – details will be given in section 2 of this report).

Laboratory analysis **cannot** be UKAS accredited for "Total VOC" or "TOP 10 compounds".

For the subcontract laboratory to claim UKAS accreditation for analysis, the internal recovery of a spiking compound (desorption efficiency from tube) needs to be above 80%. If it falls below 80% this will be noted on the analysis certificate.

If greater than 5% of the total amount of any of the target species is found in the back up portion of the sorbent tube, this will be noted on the analysis certificate.

5 SAMPLE POINT DESCRIPTIONS

The homogeneity test is applicable to combustion processes. This includes but is not restricted to, those regulated under the Waste Incineration Directive (**WID**) and the Large Combustion Plant Directive (**LCPD**).

Homogeneity testing has not been completed at this location in accordance with the mandatory requirements of the regulatory authority.

The test is not usually required for stacks with sampling plane areas of $<1m^2$ (below 1.13m in diameter for circular ducts).

The sample location that was monitored is detailed below:-

Flare Stack

As a result of the sampling point being located in close proximity to the exit of the stack the sampling location does not currently meet the requirements detailed in *Technical Guidance Note (Monitoring) M1"Sampling requirements for stack-emission monitoring" Environment Agency, January 2007, Version 4.1,* and BS EN 13284-1 but there is no alternative sampling location.

In addition, due to health and safety considerations, the flare was turned off in order to set up equipment and then turned back on again after the probe had been inserted into the stack and the monitoring team had descended from the sampling platform.

The stack diameter is 2.3m and sampling was performed using one of the four 4-inch flange ports located close to the exit of the stack.

These ports are positioned at a height of 0.3m above the scaffold platform and the distance back from the port is 1m.

Access to the stack was gained by means of three temporary ladders secured to the side of temporary scaffolding complete with an in-date scafftag.

Due to Health & Safety restrictions only a single sampling point was traversed, see also Section 5. Due to the high stack temperatures and the limited access, it was not possible to fully traverse the duct. Furthermore, the velocity that was measured at a single point in the duct was near to the lower limit of detection. Consequently, all flowrate measurements are non-conforming.

The Uncertainty of the reported concentrations for these pollutant results DOES NOT take into account the effect of non-conformities or sample location limitations.

EQUIPMENT IDs
(Pre site checklist from SSP)

Potters Waste
Permit No : BU7766IC
Variation No : EPR/BU7766IC/V004
Report Ref : P3334 : R002

Installation Name : Flare Stack
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

PRE SITE EQUIPMENT CHECKLIST/ EQUIPMENT USED

(Completed before departure to site and when on site in full)

Equipment	Equip. Type	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:
MST console/pump	E001	U001							
MST Nozzle set									
MST "S" Type Pitot									
MST Probe									
MST Hot Box		978							
MST Impinger Arm		401							
		660							
Barometer		627							
Site Balance		088							
Site Check weights		276							
		277							
Horiba	E002	511							
Heated Probe / Filter		920							
Chiller		972							
Sonimix / MFC									
Heated Line		1013	1014						
FID	E003	269							
Heated Line		517	518						
Heated Probe / Filter		919							
Testo	E004	350							
FTIR	E005								
Heated Probe / Filter									
Heated Line									
Stackmite	E006								
"L" Type Pitot		489							
Digital Manometer		421							
Stack Thermocouple		866							
Thermocouple Reader		1112							
Nozzle Set									
Workhorse Pumps	E007								
Low Flow Pumps									
Tube Thermocouple		1041							

Quantity of Ice Required / Used for Survey	6	Bags (2kg bags)

FIGURES

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

Figure 1 – Flare Stack Combustion Gases

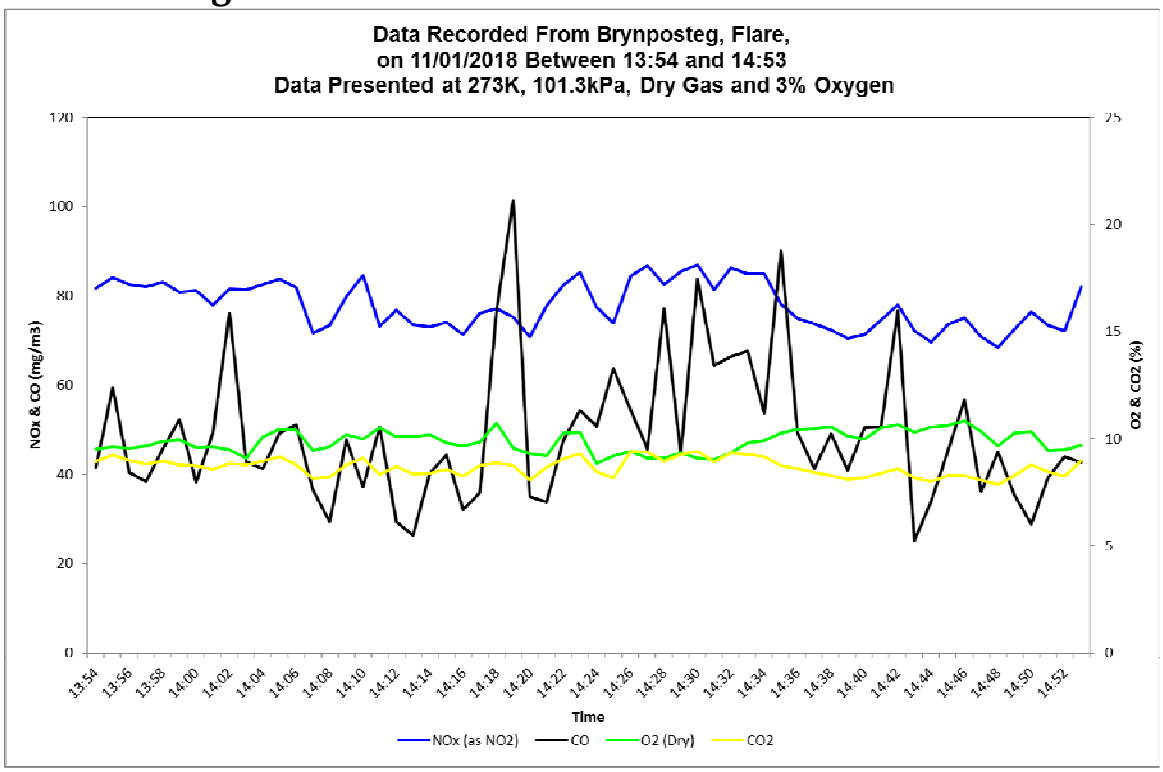
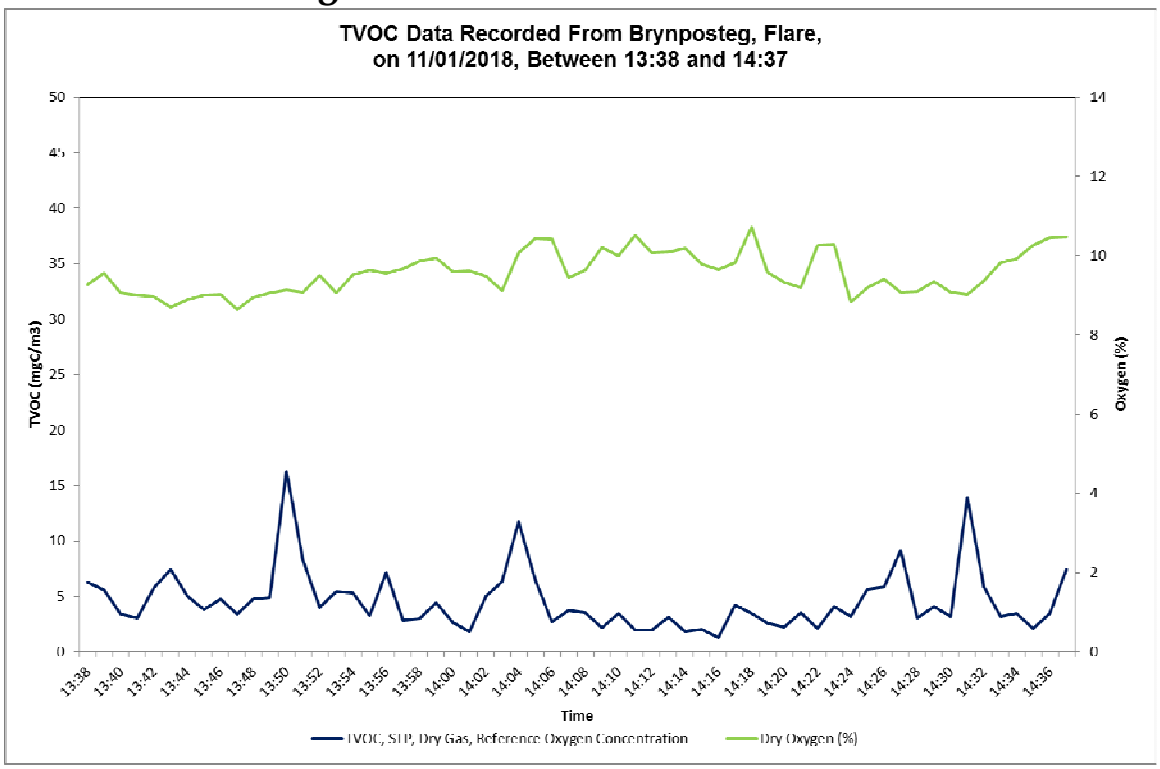


Figure 2 – Flare Stack TVOCs



TABLES

Table 1 – TVOC

Data Recorded from Flare Stack

Sample Period: 13:38 – 14:47 on the 11th January 2018

Volumetric Flowrate (Reference Conditions) = 4.74322 **m³/sec ***

	Average	Emission Rate
	mg/m³	**Kg/hr**
TVOC (as carbon)*	**4.60**	**0.0785**

*** Reference Conditions (273K, 101.3 kPa, 3% Oxygen & Dry Gas)**

Table 2 – Combustion Gases

Data Recorded from Flare Stack

Sample Period: 13:54 – 14:53 on the 11th January 2018

Volumetric Flowrate (Reference Conditions) = 4.74322 **m³/sec ***

	Average	Emission Rate
	mg/m³	**Kg/hr**
Oxides of Nitrogen (as NO_2) *	**78.19**	**1.335**
Carbon Monoxide *	**49.12**	**0.839**
Carbon Dioxide (%) **	**8.67**	**...**
Oxygen (%) **	**9.87**	**...**

*** Reference Conditions (273K, 101.3 kPa, 3% Oxygen & Dry Gas)**
**** Dry Gas**

Potters Waste
Permit No : BU7766IC
Variation No : EPR/BU7766IC/V004
Report Ref : P3334 : R002

Installation Name : Flare Stack
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

Table 3 – SO_2

Data Recorded from Flare - Landfill

Emission Parameter	Units	One	Blank
Stack Diameter	metres	2.30	
Area of Sample Plane	m^2	4.155	
Moisture Content	%	7.55	
Oxygen Content	%	9.40	
Stack Temperature	°C	930	
Gas Velocity (as Measured)	m/sec	8.66	
Gas Velocity (Reference Conditions)	m/sec*	1.14	
Volumetric Flowrate (as Measured)	m^3/sec	35.99	
Volumetric Flowrate (Reference Conditions)	m^3/sec*	4.72	
Dry Gas Molecular Weight	g/gmole	29.82680874	
Sample Date	...	11/01/2018	
Sample Period	...	13:12 - 14:12	
Sample Volume (reference Conditions)	m^3*	0.143	0.143
Sample Reference	ECL/18/	0076 0077	0078
Mass of Sulphur Dioxide Collected	mg	0.40	0.21
Concentration of Sulphur Dioxide	mg/m^3*	**2.81**	1.48
Emission Rate of Sulphur Dioxide	kg/hr	0.05	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	79	...

*Reference Conditions (273K, 101.3kPa, 3% Oxygen, Dry Gas)

NB: No ELV for SO_2, please note if 50mg/m^3 ELV used then the concentration is < 30% ELV and therefore impinger collection efficiency is not applicable.

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

Table 4 – NMVOCs

Potters Waste

Brynposteg Landfill Flare

Emission Parameter	Units	Value		
Stack Diameter	mm	2300		
Area of Sample Plane	m^2	4.155		
Moisture Content	%	9.20		
Expanded Uncertainty of Moisture (%Relative)	%	17.99		
Measured Oxygen (Dry)	%Vol	9.82		
Meter Temperature	°C	13.25		
StackTemperature	°C	925.50		
Sample Date	...	11/01/2018		
Sample Period	...	14:24 - 15:24		
Sample Volume (as Measured)	m^3	0.057		
Sample Volume (reference Conditions)	m^3*	0.033		
Sample Tube Results		One		Blank
Sample Reference ECL/18/83	Units	Concentration*	Uncertainty	Concentration
Concentration of Non Methane VOC	mg/m^3	0.092	9.65%	0.031

*Reference Conditions: 273 K, 101.3 kPa, 3% Oxygen & Dry Gas

VELOCITY TRAVERSE PROFILES

Environmental Compliance Limited

Potters Waste		**Installation Name**	**: Flare Stack**
Permit No	**: BU7766IC**	**Visit Details**	**: Annual Compliance**
Variation No	**: EPR/BU7766IC/V004**	**Survey Dates**	**: 10th & 11th January 2018**
Report Ref	**: P3334 : R002**	**Report Issue Date**	**: 31st January 2018**

Environmental Compliance Limited	Traverse Data Profoma	Date of Measurement	11/01/2018

Company	Potters Waste	Stack Diameter Port A (mm)	2300	Average Stack Diameter (mm)	2300	Pitot tube coefficient	0.98
Site	Brynposteg	Stack Diameter Port B (mm)		Port Length (mm)	90	Pitot Id	489
Location	Landfill	Duct Length Port A (mm)		Average Duct Length (mm) L		Stack Thermocouple ID	866
Stack	Flare	Duct Length Port B (mm)		Duct width (mm) B		Stack Temp Reader ID	1112
Job No	P3334	Duct Length Port C (mm)		Barometric Pressure. (mb)	980	Manometer ID	421
Operators	SEB + PB	Duct Length Port D (mm)		Ave Static Press. (mm H_20)	-0.82	Barometer ID	627

Pre - Traverse Checks Carried Out	Time	Pass/ Fail
Pre - Traverse PITOT Visual Inspection	10:35:00	Pass
Pre - Traverse PITOT Leak Check	10:37:00	Pass

Smooth Walls

Static Pressure Readings (Pascals)			
Port A	Port B	Port C	Port D
-8.00			

Port/ Point	Distance to Point (mm)	Time	Temperature Readings (°C) 1	2	3	(ΔP) Pitot Readings (Pa) 1	2	3	Average Temp. (°C)	Average (ΔP) (Pa)	Swirl Test ° From Reference
A1	1150	10:40:00	923.0	923.0	923.0	10.1	12.9	11.1	923.0	11.4	1
Blockage Check @ A1 (L-Type Pitot Only)		10:42:00	926.0	928.0	928.0	11.2	12.1	11.0	923.0	11.4	Total
			Mean		927.3	Mean		11.4	923.0	11.4	Max
			Difference <5% from Initial ?		0.36	Difference <5% from Initial ?		0.59	923.0	11.4	Min
									923.0	11.4	Average

Post - Traverse Checks Carried Out	Time	Pass/ Fail
Post - Traverse Visual Inspection	10:44:00	Pass
Post - Traverse PITOT Leak Check	10:46:00	Pass

Stagnation Check (S-type Pitot Only)	Time	Reading
Static Pressure Via Positive Leg (Pa)		.
Static Pressure Via Negative Leg (Pa)		.
Difference (Pa) < 10Pa ?		#VALUE!

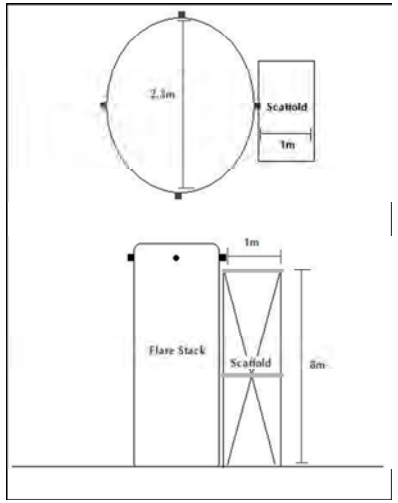
Average temp (K)	1196.000

Suitability of Sampling Position	Actual Stack Conditions
Highest:lowest flow pressure ratio < 9:1?	1.13:1
Maximum deviation of flow from axis <15° ?	1
X-sectional area for stacks= πr2	4.15 m^2
X-sectional area for ducts = L x B	m^2
Suitability of Position for Sampling	OK

Stack Moisture	7.55	%	Gas Velocity (as Measured) Adjusted for Smooth Walls	8.70489	m/sec
Measured Oxygen	9.4	%	Gas Velocity (Reference Conditions) Adjusted for Smooth Walls	1.14164	m/sec*
Measured Carbon Dioxide	9.07	%	Volumetric Flowrate (as Measured) Adjusted for Smooth Walls	36.16668	m^3/sec
Dry Gas Molecular Weight	29.82720	g/g mole	Volumetric Flowrate (Ref Cond) Adjusted for Smooth Walls	4.74322	m^3/sec*

*Reference Conditions: 273K, 101.3kPa, 3% Oxygen, Dry Gas NOTE: Velocity / volume flowrate calculations exclude contributions from the measurement point(s) where swirl >15°

Diagram/ Description of Cross Section of Stack/Duct



Notes
Including expected or actual deviations from procedures / non-conformities

Only one point measured due to access and temperature

Site thermocouple readings 1026C

Compliance With Positional Requirements?

Height of sample ports from Platform	**03.m**
Number of sample ports	**4**
Width of platform (port back to handrail)	**1m**

Nearest downstream disturbance	exit	0.5m
Nearest upstream disturbance	bend	5m
Disturbances are classed as bends, fans or diameter variations		

FIELD CALIBRATION AND SAMPLING DATA

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

Combustion Gases Field Calibration Sheet

	Horiba PG 250 Measurement Ranges:			
	NO as NO_2	CO	O_2	CO_2
Units	1025 mg/m^3	625 mg/m^3	25 %Vol	20 %Vol
	Zero Values (Direct)			
Mean Initial Direct Zero	0.20	-0.59	-0.01	0.02
Mean Confirmation Direct Zero	0.30	-0.44	-0.02	0.02
Difference in Direct Zero	0.10	0.15	0.01	0.00
Repeatability at Zero	4.10	2.50	0.20	0.20
<2 x Repeatability at Zero?	YES	YES	YES	YES
	Pre Zero Values (System)			
Mean Pre Test Zero	-0.20	0.82	-0.01	0.02
% of Measurement Range?	-0.02%	0.13%	-0.04%	0.11%
Detection Limit (LOD)	0.05	0.11	0.20	0.01
	Applied Span:			
	NO	CO	O_2	CO_2
Actual Applied Span Concentration	526.44	252.75	14.84	17.73
	Pre Test System Zero Values			
Mean Pre Test System Zero	-0.20	0.82	-0.01	0.02
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.04%	0.32%	0.07%	0.13%
	Post Test Zero Values			
Mean Post Test Zero	-0.21	0.66	-0.02	0.02
% of Certified Range?	-0.02%	0.11%	-0.09%	0.10%
Zero Drift ≤ ± 5% of Applied Span?	0.08%	0.49%	0.11%	0.00%
	Pre Test System Span Values			
Mean Pre Test System Span	521.25	253.49	14.87	17.67
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.99%	0.29%	0.19%	0.33%
	Post Test Span Values			
Mean Post Test Span	519.94	251.51	14.67	17.74
Span Drift ≤ ± 5% Span Value?	1.24%	0.49%	1.15%	0.04%
	1.24%	0.49%	1.15%	0.04%
	See Note 3	See Note 3	See Note 3	See Note 3

NOTE 1: Data Invalid! Contact Quality Manager!
NOTE 2: Correct test data for drift!
NOTE 3: No drift correction required.

Potters Waste
Permit No : BU7766IC
Variation No : EPR/BU7766IC/V004
Report Ref : P3334 : R002

Installation Name : Flare Stack
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

TVOC - FIELD DATA SHEET

Client	Potters Waste		
Site	Brynposteg		
Date	11/01/2018		
Location	Landfill		
Stack ID	Flare		
Stack Temp °C	1000		
Ambient Temp (sampling)	1= 6	2= 7	3= 8
Ambient Temp (sampling)	4= 8	5= 8	6= 7
Job No	P3334		
Operators	SEB + PB		

Barometric Pressure mb	980	
Barometer ID	ECL/ID/ 627	
Analyser ID	ECL/ID/ 269	
Sonimix/ MFC ID	ECL/ID/	
Heated Line/ Controller ID	ECL/ID/ 517 518	
Heated Line Set Temp °C	180	YES
Heated Line Length	10	m
Heated Probe Filter ID	ECL/ID/ 919	
Heated Filter Set Temp °C	180	YES
Logger ID	926	

Calibration Gas Details

Calibration Gas	Gas Bottle ID	Gas Value	Uncertainty of Gas (k=2)
Zero Gas (Synthetic Air)	Gas/ 1771	...	...
Hydrogen / Helium	Gas/ 1869	...	...
Propane (In Air)	Gas/ 1895	29.91 ppm	1%

	Analyser Range	Span Gas value used
Propane	40 ppm	29.91 ppm

Analyser Range should be not less than the expected peak emissions.

Span Gas Values should be **either** *approximately the half-hourly ELV* **OR** ***50%*** *to* ***90%*** *of the Selected Analyser Range.*

	Direct Calibration (Rear of Analyser)					
	Zero Cal		Span Gas Cal		Zero Check	
	Start Time	End Time	Start Time	End Time	Start Time	End Time
ZERO /SPAN/ ZERO	09:20	09:25	09:21	09:36	09:41	09:46

NOTE: RESPONSE TIME

Response Time to be carried out at the same time as "Span Check" on system verification (via the sample probe)
Start Time = when gas turned on. 90% Time = when analyser displays 90% of span gas value used. Response must be within 200 seconds.

Pre-Cal Ambient Temp °C		PRE System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
6	5	Start Time	End Time	Start Time	End Time
ZERO / SPAN		10:43	10:48	10:50	10:55

Response Time SYSTEM Span Gas Cal		
Start Time	90% Time	less than 200s (Y/N)
10:49:00	10:49:18	Y

	Start Time	End Time	Location	Production Details
Sample Period	10:21	15:07	Flare	Normal
Sample Period				
Sample Period				
Sample Period				
Sample Period				
Sample Period				

Post-Cal Ambient Temp °C		POST System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
7	7	Start Time	End Time	Start Time	End Time
ZERO / SPAN		15:34	15:39	15:41	15:46

Process Details / Comments

Potters Waste
Permit No : BU7766IC
Variation No : EPR/BU7766IC/V004
Report Ref : P3334 : R002

Installation Name : Flare Stack
Visit Details : Annual Compliance
Survey Dates : 10th & 11th January 2018
Report Issue Date : 31st January 2018

TVOCs Field Calibration Sheet

Calibration Summary		TVOC ppm
Analyser Range		40
Repeatability at Zero		0.8
Span Gas Concentration Applied		29.91
Zero Gas Concentration Applied		0
Direct Cal	Zero	0.00
	Span	29.9
	Zero	0.14
Difference (Zero)		0.1425
< 2 × Repeatability @ Zero?		YES
Pre Test (System)	Zero	0.52
	Span	29.9
Difference (Zero)		0.5157
< 2% Relative to Direct Span		YES
Difference (Span)		0.0440
< 2% Relative to Direct Span		YES
Post Test (System)	Zero	0.25
	Span	30.2
Difference (Zero)		0.2620
Zero Drift < 2% of Applied Span?		YES
Difference (Span)		0.3228
Span Drift < 2% of Applied Span?		YES
Zero and Span Drift < 5% of Applied Span?		YES

SO_2 Field Data Sheet

Environmental Compliance Limited	NON ISOKINETIC SAMPLING PROFORMA	Date of Measurement	11/01/2018		
ECL/TPD/	39	Time taken to change Ports?	0		
Start Time	13:12	End Time	14:12	Test Duration	60 mins

Client	Potters Waste	Stack Profile	Circular	Console id	U001	Barometer id	627
Site	Brynposteg	Stack Area (m^2)	4.15	Pump id	U001	Nozzle Id	n/a
Location	Landfill	Barometric Pressure (mb)	980	Probe id	Sinter probe	Nozzle size	n/a
Stack ID	Flare	Static Pres. (mm H_20)	-0.8	DGM Yd	0.9746	Filter Id	Sinter in-stack
Test No.	One	Pitot coefficient	n/a	ΔH@	38.2	Pitot ID	n/a
Job No	P3334	Probe Heater Setting (°C)	n/a	Impinger Id	660	Hot Box ID	978
ECL Site Staff	SEB + PB	Hot Box Setting (°C)	120	Balance Id	88		

Required Sample Flowrate l/min	Suggested ΔH Entered Below
3	1
6	3
10	10
15	25
25	50
Initial ΔH	3
Reference Oxygen Percentage	3

	Sample	Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total
Start Volume	2852245.0						
Final Volume	2852488.0						
Total Volume	243.0	0.0	0.0	0.0	0.0	0.0	243.0
Leak Check	First	Second	Third	Fourth	Fifth		
Leak rate l/min	0				0	Dry O_2 (☐ Atmospheric)	9.40
Vaccum "Hg	8				16	Dry Carbon Dioxide %	9.07
Time of Check	13:10				14:17	Dry Carbon Monoxide ppm	
Set Rate l/min	6				4		
Leak <2%?	YES				YES		

Traverse Point	A1	A1	A1	A1	A1	A1			Total
Time/Point (mins)	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60			
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)	3.00	3.00	3.00	3.00	3.00	3.00			3.00
Meter (Tm in)	7.00	7.00	8.00	8.00	9.00	9.00			8.00
Meter (Tm out)	7.00	7.00	8.00	8.00	9.00	9.00			8.00
Stack Temp (Ts)	923.00	926.00	928.00	930.00	934.00	938.00			929.83
Impinger T Outlet	6.00	6.00	6.00	7.00	7.00	9.00			6.83
Vaccum (" Hg)	14.00	12.00	12.00	12.00	12.00	12.00			12.33

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Traverse Point									Total
Time/Point(mins)									
ΔP (mm H20)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
K factor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ΔH (Orifice)									
Meter (Tm in)									
Meter (Tm out)									
Stack Temp (Ts)									
Impinger T Outlet									
Vaccum (" Hg)									

Impinger 1	3% H2O2	Impinger 2	3% H2O2	Impinger3	3% H2O2	Impinger 4	Empty
SOL/	3362	SOL/	3362	SOL/	3362	SOL/	...
Start Weight (g)	740.5	Start Weight (g)	751.4	Start Weight (g)	772.5	Start Weight (g)	490
End Weight (g)	748	End Weight (g)	753.1	End Weight (g)	773.9	End Weight (g)	491.2
Total weight (g)	7.5	Total weight (g)	1.7	Total weight (g)	1.4	Total weight (g)	1.2

Impinger 5	Silica	Impinger 6		Impinger 7		Impinger 8	
SOL/	...	SOL/		SOL/		SOL/	
Start Weight (g)	909.5	Start Weight (g)		Start Weight (g)		Start Weight (g)	
End Weight (g)	912.3	End Weight (g)		End Weight (g)		End Weight (g)	
Total weight (g)	2.8	Total weight (g)	0	Total weight (g)	0	Total weight (g)	0

Total (g)	14.60
Silica <50% used at End of Test? Y/N	YES

Rinse Solutions used	
Solution	SOL NO
DI Water	3356
Acetone	...

If moisture was not measured see detailed notes below.

Additional Moisture Weighings	
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0
Item Name	
Start Weight (g)	
End Weight (g)	
Total weight (g)	0

If moisture was not measured and gas was dried before entering the gas meter, impinger weights must be included to produce the moisture concentration used in the isokinetic calculations. If the gas was not dried before it entered the gas meter then impinger weights may be included to produce a nominal 0.1% moisture value.

Non-methane TVOCs Field Data Sheet

Environmental Compliance Limited	SAMPLE TUBE DATA SAMPLING PROFORMA

Client	Potters Waste	◉ Circular ○ Rectangular ○ Elipse		Pump ID	n/a
Site	Brynposteg	Stack Diameter (mm)	2300	Meter ID	U001
Location	Landfill			MST Probe ID	n/a
Stack ID	Flare	Stack Area (m^2)	4.155	MST Probe Heating Temp (C)	180
Test No	One	Barometric Pressure (mb)	980	DGM Yd or ml/count	0.9746
Job No	P3334	Stack Thermocouple ID	866	MST Hot Box ID	978
ECL Site Staff	SEB + PB	Tube Thermocouple ID	1041	MST Hot Box Heating Temp (C)	180
Barometer ID	627	Meter Thermocouple ID	U001	Workhorse Set Sample Rate (%)	n/a
		In-Stack Sinter Used (Y/N)	Y	MST Delta H Sampling Rate	0.5

Date of Test	11/01/2018
Sample Start Time	14:24
Sample End Time	15:24
Duration	60
Measured O2	9.82
O2 Uncertainty %Vol	0.59

Meter Units ○ ml ◉ litres	Sample	Leak 1	Time (start/ end) (minimum 1 minute)	Leak 2	Time (start/ end) (minimum 1 minute)	Total
Start Volume	2852464.0	2852454.9	14:21:00	2852532.1	15:30:00	
Final Volume	2852523.8	2852454.9	14:22:00	2852532.1	15:31:00	
Total Volume	58.6	0.0		0.0		58.6
Sample Train Internal Volume	1.2447	Litres				

Sample Point	A1	A1	A1	A1
Time/ point (mins)	0-10	10--20	20-30	30-40
Tube Temp °C	11	11	11	12
Stack Temp °C	917	923	927	929
Meter Temp In °C	16	16	15	15
Meter Temp Out °C	11	11	12	12

Sample Point	A1	A1		
Time/ point (mins)	40-50	50-60		
Tube Temp °C	12	13		
Stack Temp °C	930	927		
Meter Temp In °C	14	14		
Meter Temp Out °C	12	11		

Sample Point				
Time/ point (mins)				
Tube Temp °C				
Stack Temp °C				
Meter Temp In °C				
Meter Temp Out °C				

Impinger 1	Empty	Impinger 2	Empty	Impinger3	Silca
Start Weight (g)	527.7	Start Weight (g)	617.1	Start Weight (g)	760.4
End Weight (g)	529.7	End Weight (g)	618	End Weight (g)	761.9
Total weight (g)	2	Total weight (g)	0.9	Total weight (g)	1.5

Silica	(IF USED)
<50% Spent at end Y/N?	Yes
Sample train upstream of sorbent tube condensation free for entire sample (Y/N)	no

NB: Non-conforming test due to high temperature and moisture, see Section 2 "Monitoring Deviations".

LABORATORY ANALYSIS RESULTS

CONCEPT LIFE SCIENCES

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Combrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2404

Report Number: 708572-1

Date of Report: 24-Jan-2018

Customer: Environmental Compliance Ltd
Unit G1
Main Avenue
Treforest Industrial Estate
Pontypridd
CF37 5BF

Customer Contact: Mr Sam Brookes

Customer Job Reference: P3334
Customer Purchase Order: E7497
Date Job Received at Concept: 15-Jan-2018
Date Analysis Started: 15-Jan-2018
Date Analysis Completed: 24-Jan-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked and authorised by :
Kathryn Gleaves
Customer Service Advisor

Issued by :
Emma Spear
Customer Service Advisor

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

Concept Reference: 708572
Customer Reference: P3334

Impinger(peroxide) Analysed as Impinger(peroxide)
Sulphur Dioxide & Volume

				Concept Reference	708572 001	708572 002	708572 003	708572 004	708572 005
				Customer Sample Reference	ECL/18/0070	ECL/18/0071	ECL/18/0072	ECL/18/0073	ECL/18/0074
				Test Sample	AR	AR	AR	AR	AR
				Date Sampled	10-JAN-2018	10-JAN-2018	10-JAN-2018	10-JAN-2018	10-JAN-2018
Determinand	Method	LOD	Units	Symbol					
Sulphur Dioxide	IC	0.05	mg/l	U	[13] 64	[13] 0.64	[13] 0.48	[13] 66	[13] 0.69
Volume	Vol	1	ml	U	450	230	300	450	180

Concept Reference: 708572
Customer Reference: P3334

Impinger(peroxide) Analysed as Impinger(peroxide)
Sulphur Dioxide & Volume

				Concept Reference	708572 006	708572 007	708572 008	708572 009
				Customer Sample Reference	ECL/18/0075	ECL/18/0076	ECL/18/0077	ECL/18/0078
				Test Sample	AR	AR	AR	AR
				Date Sampled	10-JAN-2018	11-JAN-2018	11-JAN-2018	11-JAN-2018
Determinand	Method	LOD	Units	Symbol				
Sulphur Dioxide	IC	0.05	mg/l	U	[13] 0.43	[13] 0.76	[13] 0.58	[13] 0.76
Volume	Vol	1	ml	U	360	420	220	280

Concept Reference: 708572
Customer Reference: P3334

Tube (Charcoal 226-09) Analysed as Tube (Charcoal 226-09)
VOC (Total)

				Concept Reference	708572 011	708572 012	708572 013	708572 014	708572 015
				Customer Sample Reference	ECL/18/0080	ECL/18/0081	ECL/18/0082	ECL/18/0083	ECL/18/0084
				Test Sample	AR	AR	AR	AR	AR
				Date Sampled	10-JAN-2018	10-JAN-2018	10-JAN-2018	11-JAN-2018	11-JAN-2018
Determinand	Method	LOD	Units	Symbol					
Volatile Organic Compounds (Total)	GC/MS	1	µg	N	59	15	<1	3	<1

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

Concept Reference: 708572
Customer Reference: P3334

Tube (Tenax/Carbon/Molecular Sieve) — Analysed as Tube (Tenax/Carbon/Molecular Sieve)
Trace Landfill Gas Suite

				Concept Reference	708572 018	708572 021	708572 022
				Customer Sample Reference	ECL/18/0088	ECL/18/0089	ECL/18/0090
				Test Sample	AR	AR	AR
				Date Sampled	11-JAN-2018	11-JAN-2018	11-JAN-2018
Determinand	Method	LOD	Units	Symbol			
1 Pentene	GC/MS (TD SIR)	10	ng	U	(68) 48	(68) 30	(68) 23
1,1-Dichloroethane	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
1,1-Dichloroethylene	GC/MS (TD SIR)	10	ng	U	280	240	<10
1,2-Dichloroethane	GC/MS (TD SIR)	10	ng	N	(175) 1600	<10	<10
1,2-Dichloroethylene	GC/MS (TD SIR)	30	ng	U	<30	<30	300
1,3-Butadiene	GC/MS (TD SIR)	10	ng	U	(68) <10	(68) <10	(68) 82
1,4 epoxy 1,3-butadiene	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
1-Propanethiol	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
2-butoxyethanol	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
Benzene	GC/MS (TD SIR)	10	ng	U	(175) 5800	(175) 2100	<10
Butyric acid	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
Carbon disulphide	GC/MS (TD SIR)	10	ng	N	440	<10	<10
Carbon tetrachloride	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
Chloroethane	GC/MS (TD SIR)	30	ng	N	<30	<30	<30
Dichloromethane	GC/MS (TD SIR)	10	ng	N	(175) 6300	<10	<10
Dimethyl disulphide	GC/MS (TD SIR)	10	ng	N	320	<10	<10
Dimethyl sulphide	GC/MS (TD SIR)	10	ng	U	750	12	21
Ethyl butyrate	GC/MS (TD SIR)	25	ng	N	<25	<25	<25
Ethyl Mercaptan	GC/MS (TD SIR)	10	ng	N	<10	<10	<10
Hydrogen sulphide	GC/MS (TD SIR)	60	ng	N	<60	<60	<60
Methyl Mercaptan	GC/MS (TD SIR)	30	ng	N	<30	<30	<30
N-Butyl Mercaptan	GC/MS (TD SIR)	10	ng	U	<10	<10	<10
Styrene	GC/MS (TD SIR)	10	ng	N	280	<10	<10
Toluene	GC/MS (TD SIR)	10	ng	N	(27) 12000	31	<10
Trichloroethylene	GC/MS (TD SIR)	10	ng	U	730	250	<10
Vinyl chloride monomer	GC/MS (TD SIR)	10	ng	U	(68) <10	(68) <10	(68) <10

Concept Reference: 708572
Customer Reference: P3334

Tube (Charcoal) — Analysed as Tube (Charcoal 226-01)
Siloxanes

				Concept Reference	708572 025	708572 026
				Customer Sample Reference	ECL/18/0093	ECL/18/0094
				Test Sample	AR	AR
				Date Sampled	11-JAN-2018	11-JAN-2018
Determinand	Method	LOD	Units	Symbol		
Decamethylcyclopentasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Decamethyltetrasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Hexamethylcyclotrisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Hexamethyldisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Octamethylcyclotetrasiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1
Octamethyltrisiloxane	GC/MS (Solvent Desorption)	1	µg	U	<1	<1

Index to symbols used in 708572-1

Value	Description
AR	As Received
27	Result should be considered as a minimum due to detector saturation.
13	Results have been blank corrected.
68	Outside scope of UKAS accreditation
175	Results should be viewed with caution due to being outside of the instrument calibration range
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

Notes

The results for 1 Pentene, 1,3-Butadiene & Vinyl Chloride Monomer are outside the scope of our UKAS accreditation as the standards expired on the 13/01/18.

UNCERTAINTY CALCULATIONS

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

Volumetric Flowrate Uncertainty

Measurement Uncertainty Calculations - Velocity at Stack Conditions

Contribution From	Standard u/c (Pa)	
Pitot Calibration Uncertainty Contribution	0.06	A
Manometer Calibration Uncertainty Contribution	0.056833333	B
Variation in Actual Pitot reading at sample points	1.40	C
Combined u/c (Pa) =	**Combined u/c (Pa)**	
SQRT $(A/\sqrt{3})^2 + (B/\sqrt{3})^2 + (C/\sqrt{3})^2$	0.81	
Expanded Uncertainty of Flow Measurements Pa	**1.62**	
	Standard u/c (K)	
Temperature Calibration (K)	5.98	D
Variation in Actual Temp reading at sample points	0.00	E
Combined u/c of Temp (K)	**Combined u/c (K)**	
SQRT $((D/\sqrt{3^2}) + (E/\sqrt{3})^2)$	3.45	
Expanded Uncertainty of Temp Measurements (K)	**6.91**	
Measured Average Velocity (m/s) at Stack Conds	8.71	
Maximum Average Velocity (m/s) at Stack Conds	9.33	
Standard Uncertainty Velocity at Stack Conditions (%)	7.19	
Expanded Uncertainty Velocity (at Stack Conditions)	**14.39 (%)**	

Measurement Uncertainty Calculations - Flowrate at Stack Conditions

Contribution From	Standard u/c (m^2)
Area (m2)	0.04155
Measured Average Flowrate (m^3/s) at Stack Conds	36.17
Maximum Average Flowrate (m^3/s) at Stack Conds	39.16
Standard Uncertainty Flowrate (m^3/s) at Stack Conditions (%)	8.27
Expanded Uncertainty Flowrate (m^3/s) at Stack Conditions	**16.53 (%)**

Measurement Uncertainty Calculations - Flowrate at STP & Wet Gas

Contribution From	Standard u/c (%)
Temperature Calibration (K)	0.5
Barometer Calibration	0.5
Measured Average Flowrate (m^3/s) at STP Wet	7.99
Maximum Average Flowrate (m^3/s) at STP Wet	8.66
Standard Uncertainty Flowrate (m^3/s) at STP Wet	8.39
Expanded Uncertainty Flowrate (m^3/s) at STP Wet	**16.78 (%)**

Measurement Uncertainty Calculations - Flowrate at STP & Dry Gas

Contribution From	Standard u/c (%)
Moisture Uncertainty (% v/v)	0.33
Measured Average Flowrate (m^3/s) at STP Dry	7.62
Maximum Average Flowrate (m^3/s) at STP Dry	8.29
Standard Uncertainty Flowrate (m^3/s) at STP Dry	8.76
Expanded Uncertainty Flowrate (m^3/s) at STP Dry	**17.53 (%)**

easurement Uncertainty Calculations - Flowrate at STP, Dry Gas & Ref Oxyge

Contribution From	Standard u/c (%)
Oxygen Uncertainty (% v/v)	0.141
Measured Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	4.91
Maximum Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	5.41
Standard Uncertainty Flowrate (m^3/s) at STP Dry & Ref Oxygen	10.09
Expanded Uncertainty Flowrate (m^3/s) at STP Dry & Ref O_2	**20.17 (%)**

Potters Waste		**Installation Name**	**: Flare Stack**
Permit No	**: BU7766IC**	**Visit Details**	**: Annual Compliance**
Variation No	**: EPR/BU7766IC/V004**	**Survey Dates**	**: 10th & 11th January 2018**
Report Ref	**: P3334 : R002**	**Report Issue Date**	**: 31st January 2018**

Combustion Gases Measurement Uncertainty

Uncertainty of Measurement Results - Calculations Part 1

Horiba PG 250 Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Minimum Certified Range (R_i) NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit[1]	u_{lof}	Rectangular	$\sqrt{3}$	0.40	0.40	0.13	0.60
Span drift[2]	$u_{d,s}$			0.27	0.29	0.029	0.24
Losses / leakage in the sample system[4]	u_{loss}			4.15	0.78	0.11	0.30
Temperature dependant span drift[5]	u_t			0.18	0.050	0.070	0.040

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,\max} - x_{i,adj})^2 + (x_{i,\min} - x_{i,adj})(x_{i,\max} - x_{i,adj}) + (x_{i,\min} - x_{i,adj})^2}{3}}$, when $|(x_{i,\max} - x_{i,adj})| = |(x_{i,\min} - x_{i,adj})|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Horiba PG 250 Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.29	0.22	0.019	0.069
Span drift	$u_{d,s}$			0.20	0.16	0.0041	0.028
Temperature dependant span drift	u_t			0.26	0.055	0.020	0.0092
Interferents	u_i			0.87	1.59	0.081	...

Uncertainty of Measurement Results - Calculations Part 2

Horiba PG 250 Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	NO 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Losses / leakage in the sample system	u_{loss}	11/01/18 13:54 - 14:53	3.24	0.38	0.011	0.026
Standard Error of Measured Value	u_{SE}	11/01/18 13:54 - 14:53	0.42	1.27	0.065	0.053

Effect on Uncertainty Caused by Oxygen $uCorr^n_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})x(20.9\% - O_{2,measured})} x\, Uncertainty\ of\ O_2\ Measurement =$ 0.027

$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} =$ 1.8127 $uf_{o_2} = \frac{uCorr^n_{o_2}}{f_{o_2}} x100 =$ 1.46 %

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

$u_{combined} = \sqrt{\sum (uf_{o_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$\therefore u(x_i) = C_i u_i$ where $C_i = \frac{\partial f}{\partial x_i}$

Uncertainty of Measurement Results - Calculations Part 3

Horiba PG 250 Uncertainty	Date & Time	NOx (as NO2) 0 - 125 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Measured Concentration	11/01/18 13:54 - 14:53	78.19	49.12	9.87	8.67
Expanded Uncertainty as Percentage of Measured Concentration		9%	9%	3%	3%

Combined Standard Uncertainty $u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2 + u_v^2 + u_{syn}^2}$

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Where the uncertainty of Moisture is taken as the standard error of the time averaged value used to correct to Dry Conditions
7 If no value for uncertainty is presented above, the uncertainty is considered to be > 100%

Potters Waste		**Installation Name**	**: Flare Stack**
Permit No	**: BU7766IC**	**Visit Details**	**: Annual Compliance**
Variation No	**: EPR/BU7766IC/V004**	**Survey Dates**	**: 10th & 11th January 2018**
Report Ref	**: P3334 : R002**	**Report Issue Date**	**: 31st January 2018**

Combustion Gases Uncertainty of Measurements

Measurement Uncertainty Calculations Part 1

Horiba PG 250 Performance Characteristics	Standard Uncertainty (% of Range)	Distributiuon	Minimum Certified Range (R_i)										
			NO 0 - 125 mg/m³	NO_2 mg/m³	N_2O mg/m³	SO_2 mg/m³	CO 0 - 95 mg/m³	HCl mg/m³	NH_3 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol	H_2O %Vol	*TOC mgC/m³
Lack of fit[1]	u_{lof}	Rectangular (Divisor = √3)	0.40				0.40			0.13	0.60		
Span drift[2]	$u_{d,s}$	Rectangular (Divisor = √3)	0.27				0.29			0.029	0.24		
Repeatability Standard Deviation (span)[3]	u_r	Normal (Divisor = 1)	0.58				1.16			0.42	0.20		
Losses / leakage in the sample system[4]	u_{loss}	Rectangular (Divisor = √3)	4.15				0.78			0.11	0.30		
Temperature dependant span drift[5]	u_t	Rectangular (Divisor = √3)	0.18				0.050			0.070	0.040		
Interferents[1]	u_i	Rectangular (Divisor = √3)	1.20				2.90			0.56	0.010		
Uncertainty of Reference Gas[6]	u_{ref}	Rectangular (Divisor = √3)	9.12				4.38			0.15	0.31		
Effect of Voltage Fluctuation[7]	u_v	Rectangular (Divisor = √3)	...				...			...	...		
Effect of Sample Gas Flow/ Pressure[7]	u_{sg}	Rectangular (Divisor = √3)	...				...			...	...		

Note:

$$when\ \left|(x_{i,\max} - x_{i,adj})\right| = \left|(x_{i,\min} - x_{i,adj})\right|, then\ u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Expressed as standard uncertainty in units of measurement i.e. mg/m³ / %Vol inc additional uncertainty of 2% for gas blending
7 Data not available so not included

Measurement Uncertainty Calculations Part 2

Horiba PG 250 Performance Characteristics	Uncertainty	Value of Standard Uncertainty	NO 0 - 125 mg/m³	NO_2 mg/m³	N_2O mg/m³	SO_2 0 - 460 mg/m³	CO 0 - 95 mg/m³	HCl mg/m³	NH_3 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol	H_2O %Vol	*TOC mgC/m³
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.29				0.22			0.019	0.07		
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.20				0.16			0.0041	0.0280		
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	0.58				1.16			0.42	0.20		
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	3.00				0.43			0.016	0.03		
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,\max} - x_{adj})^2 + (x_{i,\min} - x_{adj})(x_{i,\max} - x_{adj}) + (x_{i,\min} - x_{adj})^2}{3}}$	0.13				0.027			0.010	0.005		
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.87				1.59			0.081	0.01		
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	5.26				2.53			0.086	0.18		
Effect of Voltage Fluctuation[7]	u_v	$u(x_i) = \frac{u_v \times R_i}{\sqrt{3}} =$	...				...			...	...		
Effect of Sample Gas Flow/ Pressure[7]	u_{sg}	$u(x_i) = \frac{u_{syn} \times R_i}{\sqrt{3}} =$	...				...			...	...		
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	6.16				3.24			0.44	0.28		
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	12.31				6.49			0.87	0.56		
Applied Span Concentration			526.44				252.75			14.84	17.73		
Measured Span Concentration, STP Dry Gas			520.59				252.50			14.79	17.70		
Expanded measurement uncertainty as % of Applied Span			2%				3%			6%	3%		

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

TVOCs Measurement Uncertainty

Flare - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Min Certified Ranges TVOC 0 - 15 mgC/m³
Lack of fit(1)	u_{lof}	Rectangular (Divisor = √3)	0.73
Span drift(2)	$u_{d,s}$	Rectangular (Divisor = √3)	0.35
Repeatability Standard Deviation (span)(3)	u_r	Normal (Divisor = 1)	5.50
Losses / leakage in the sample system(4)	u_{loss}	Rectangular (Divisor = √3)	0.29
Temperature dependant span drift(5)	u_t	Rectangular (Divisor = √3)	0.30
Interferents(1)	u_i	Rectangular (Divisor = √3)	4.39
Uncertainty of Reference Gas(6)	u_{ref}	Rectangular (Divisor = √3)	0.83
Effect of Voltage Fluctuation(7)	u_v	Rectangular (Divisor = √3)	1.80
Effect of Oxygen Synergism(7)	u_{syn}	Rectangular (Divisor = √3)	4.60

Note:

$$when\ \left|(x_{i,\max} - x_{i,adj})\right| = \left|(x_{i,\min} - x_{i,adj})\right|, then\ \ u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$$

1 Expressed as a percentage of the certified range
2 Expressed as maximum drift per 24hr period as percentage of the certified range
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the certified range
5 Expressed as a percentage of the certified range per one degree centigrade
6 Expressed as standard uncertainty in units of measurement i.e. mg/m³ / %Vol taking account of an additional uncertainty of 2% for gas blending
7 Expressed as a percentage of the certified range

Flare - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 2

Performance Characteristics	Uncertainty	Value of Standard Uncertainty	*TVOC 0 - 15 mgC/m³
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.064
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.031
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	0.82
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	0.025
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.026
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.38
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	0.48
Effect of Voltage Fluctuation	u_v	$u(x_i) = \frac{u_v \times R_i}{\sqrt{3}} =$	0.16
Effect of Oxygen Synergism	u_{syn}	$u(x_i) = \frac{u_{syn} \times R_i}{\sqrt{3}} =$	0.40
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	1.12
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	2.23
Applied Span Concentration			48.07
Measured Span Concentration, STP Dry Gas			48.19
Expanded measurement uncertainty as % of Applied Span			5 %

* Signal 3030 FID

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

TVOCs Uncertainty of Measurements

Flare - TVOC - Uncertainty of Measurement Results - Calculations Part 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Min Certified Range O_2 0 - 25 %Vol	Min Certified Range TVOC 0 - 15 mgC/m^3
Lack of fit[1]	u_{lof}	Rectangular	$\sqrt{3}$	0.13	0.73
Span drift[2]	$u_{d,s}$			0.029	0.35
Losses / leakage in the sample system[4]	u_{loss}			1.00	0.15
Temperature dependant span drift[5]	u_t			0.070	0.30
Interferents[1]	u_i			0.56	4.39
Effect of Voltage Fluctuation[7]	u_v			...	1.80
Effect of Oxygen Synergism[7]	u_{syn}			...	

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,\max} - x_{i,adj})^2 + (x_{i,\min} - x_{i,adj})(x_{i,\max} - x_{i,adj}) + (x_{i,\min} - x_{i,adj})^2}{3}}$, when $|(x_{i,\max} - x_{i,adj})| = |(x_{i,\min} - x_{i,adj})|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	O_2 0 - 25 %Vol	TVOC 0 - 15 mgC/m^3
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.019	0.064
Span drift	$u_{d,s}$			0.0041	0.031
Temperature dependant span drift	u_t			0.020	0.052
Interferents	u_i			0.081	0.38
Effect of Voltage Fluctuation (See Note)	u_v			...	0.16

Flare - TVOC - Uncertainty of Measurement Results - Calculations Part 2

Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	O_2 0 - 25 %Vol	TVOC 0 - 15 mgC/m^3
Losses / leakage in the sample system	u_{loss}	11/01/18 13:38 - 14:37	0.096	0.0066
Standard Error of Measured Value	u_{SE}	11/01/18 13:38 - 14:37	0.068	0.21

Effect on Uncertainty Caused by Oxygen $uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times$ Uncertainty of O_2 Meas. = 0.03

$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} =$ 1.5792

$uf_{O_2} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 =$ 1.59 %

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

$$u_{combined} = \sqrt{\sum (uf_{o_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$$

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$\therefore u(x_i) = C_i u_i$ where $C_i = \frac{\partial f}{\partial x_i}$

Flare - TVOC - Uncertainty of Measurement Results - Calculations Part 3

Uncertainty	Date & Time	O_2 0 - 25 %Vol	*TVOC 0 - 15 mgC/m^3
Measured Concentration	11/01/18 13:38 - 14:37	9.57	4.46
Expanded Uncertainty as Percentage of Measured Concentration		3 %	20 %

Combined Standard Uncertainty $u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_t^2 + u_{loss}^2 + u_i^2 + u_i^2 + u_{ref}^2 + u_v^2 + u_{syn}^2}$

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

1 Expressed as a percentage of the certified range
2 Expressed as a percentage of the certified range as maximum drift per 24hr period
3 Expressed as a percentage of the certified range
4 Expressed as a percentage of the applied span concentration
5 Expressed as a percentage of the certified range per one degree centigrade
6 Where the uncertainty of moisture is taken from the manual extract test calculations.
7 Expressed as a percentage of the certified range
8 Where no uncertainty is presented above, the uncertainty is > 100%

Potters Waste		**Installation Name**	**: Flare Stack**
Permit No	**: BU7766IC**	**Visit Details**	**: Annual Compliance**
Variation No	**: EPR/BU7766IC/V004**	**Survey Dates**	**: 10th & 11th January 2018**
Report Ref	**: P3334 : R002**	**Report Issue Date**	**: 31st January 2018**

SO_2 Uncertainty

Site: Brynposteg
Location: Flare

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K=2 Filter mg	LAB Method Uncert (%) K=2 Solution mg	Standard Uncertainty Filter mg	Standard Uncertainty Solution mg	Combined Uncertainty mg
				One				
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
Sulphur Dioxide	...	0.40	0.40	...	0.0524	...	0.0262	0.0262
...	...	...	...	...	...	...	...	...
				...				
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...

	One		Standard Uncertainty @ 95%		
Sampled Volume (V_m)	0.24	**m^3**	**uV_m**	0.001	**m^3**
Meter Correction Factor (Yd)	0.97	**...**		...	**...**
Meter Temperature (T_m)	281.00	**k**	**uT_m**	1.5	**k**
Average Differential Pressure (ΔH)	3.00	**mmH_2O**	**uΔH**	0.25	**mmH_2O**
Barometric Pressure (ρ_b)	735.06	**mmHg**	**up_b**	3.8	**mmHg**
ΔH + ρs (ρ_m)	98.03	**kPa**		...	**...**
Oxygen content ($O_{2,m}$)	9.40	**% by volume**	$uO_{2,m} = \sigma/\sqrt{n}$	0.0639	**% by volume**
Moisture Content (H_2O)	7.55	**% by volume**	**uH_2O**	0.66	**% by volume**

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\partial f}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standard uncertainty and i is the index identifying the contributing factor e.g. i = uV_m, uT_m etc.

Where results are required at wet conditions, the following correction factor is used to convert the data from the dry gas meter:

One:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = \quad 1.00$$

Uncertainty in correction factor to STP due to measured ΔH uncertainty component (uΔH), measured stack pressure uncertainty component (up_b) & measured temperature of dry gas uncertainty component ($uT_{m\ Dry}$)

One:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = \quad 0.916$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.92	0.92	0.0000916	0.0000229
up_b	0.92	0.91	0.00125	0.00467
uT_m	0.92	0.91	0.00326	0.00489
H_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00621$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uV_{std}) & volume uncertainty component (uV_m)

One:

$$V_{std} = V_{measured} \times f_s = \quad 0.223$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty (m^3)
Effect of uV_{std}	0.22	0.22	0.24	0.00151
Effect of uV_m	0.22	0.22	0.92	0.000916

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.000916$$

Uncertainty of Oxygen Correction Factor (%):-

One:

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = \quad 1.56$$

$$uCorr^n_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) x (20.9\% - O_{2,measured})} x\ Uncertainty\ of\ O_2\ Measurement = \quad 0.0244$$

$$uf_{O_2} = \frac{uCorr^n_{O_2}}{f_{O_2}} x100 = \quad 1.57\ \%$$

Uncertainty in final measurement @ reference conditions due to mass uncertainty component (uM)

Determinand	One:			
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	uM mg/Nm^3
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	3.00	2.63	6.99	0.18
...	...	...	...	...

Uncertainty in final measurement @ reference conditions due to uncertainty component arrising from leak and/or loss (assumed 2% max) in the sample system (uL)

Determinand	One:
	uL mg/Nm^3
...	...
...	...
Sulphur Dioxide	0.0325
...	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	One:			
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	uVstp mg/Nm^3
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	2.83	2.81	12.65	0.0116
...	...	...	...	...

Combined Uncertainty excluding oxygen contribution

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{stp})^2}$$

Determinand	One:			
	Combined Uncertainty mg/Nm^3	Expanded Uncertainty mg/Nm^3	Measured Concentration mg/Nm^3	Percent of Measured Concentration
...	...	...	...	...
...	...	...	...	...
Sulphur Dioxide	0.19	0.37	2.82	13.23
...	...	...	...	...

Combined Uncertainty including oxygen contribution

$$u_{combined} = \sqrt{\sum (uf_{o_2})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$$

Determinand	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corrn Factor	Overall Measurement Uncertainty inc O_2 Corr^n factor (Ucombined)
...	...	...	...
...	...	...	...
Sulphur Dioxide	13.23	1.57	13.32
...	...	...	...

Potters Waste		Installation Name	: Flare Stack
Permit No	: BU7766IC	Visit Details	: Annual Compliance
Variation No	: EPR/BU7766IC/V004	Survey Dates	: 10th & 11th January 2018
Report Ref	: P3334 : R002	Report Issue Date	: 31st January 2018

Non-methane VOCs Uncertainty

Site: Potters Waste, Brynposteg
Location: Landfill, Stack ID:Flare

					Standard Uncertainty @ 95%	
Sampled Volume	V_m	0.05856	m^3	uV_m	0.000	m^3
Meter Correction Factor or ml/count	Yd	0.9746	...	...	...	...
Meter Temperature	T_m	286.25	k	uT_m	1.5	k
Barometric Pressure	ρ_b	980.00	mBar		10.0	mBar
Oxygen content	$O_{2,m}$	9.82	%Vol	$uO_{2,m}$	0.59	%Vol
Moisture	H_2O	9.20	%Vol	uH_2O	1.66	%Vol

Tubes				
Determinand	Recovered Mass		Standard Uncertainty	
Flare	3.00	µg	uM	0.30 µg

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\partial J}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standa and i is the index identifying the contributing factor e.g. i = uV_m, uT_m etc.

Where results are required at wet conditions, the following correction factor is used to convert the data fro meter:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = \quad 1.00$$

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (upb), measured temperature of dry gas uncertainty component (uT_m) & measured moisture (uH_2O) where required

$$f_s = \frac{273}{T_m} \times \frac{\rho}{101.3} = \quad 0.92$$

	Maximum	Minimum	Sensitivity	ufstp
$u\rho_b$	0.48	0.47	0.000482	0.00482
uT_m	0.93	0.92	0.00322	0.00483
uH_2O	…	…	…	…

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00626$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uVstd) & volume uncertainty component (uVm)

$$V_{std} = V_{measured} \times f_s = \quad 0.0527$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty m^3
Effect of uf_s	0.0530	0.0523	0.0571	0.000357
Effect of uV_m	0.0527	0.0526	0.90	8.992E-06

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.00300$$

Uncertainty of correction factor to reference conditions (excluding oxygen contribution) & Uncertainty in final measurement @ reference conditions due to uncertainty component arrising from leak and/or loss (assumed 2% max) in the sample system (uL)

$$uL = \frac{Conc \times \frac{2}{100}}{\sqrt{3}}$$

	Tubes uL mg/Nm^3	Condensate uL mg/Nm^3
Flare	0.000658	…

$$Conc = \frac{M_{\text{Recovered}}}{V_m \times f_s \times f_{O_2}}$$

Uncertainty in final measurement @ Reference Conditions due to $uM_{Recovered}$

Charcoal Tube Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Non Methane VOC	0.0598	0.0541	18.99	0.00285
Condensate Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Non Methane VOC				

Uncertainty in final measurement @ Reference Conditions due to uV_{STD}

Charcoal Tube Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Non Methane VOC	0.0604	0.0539	1.09	0.00326

Combined Uncertainty (excluding Oxygen contribution)

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{stp})^2}$$

Charcoal Tubes: Determinand	Combined Uncertainty mg/Nm³	Expanded Uncertainty mg/Nm³	Measured Concentration mg/Nm³	Percent of Measured Concentration
Non Methane VOC	0.00438	0.0088	0.0921	9.52

Appendix 3

APPENDIX 3 – GROUNDWATER

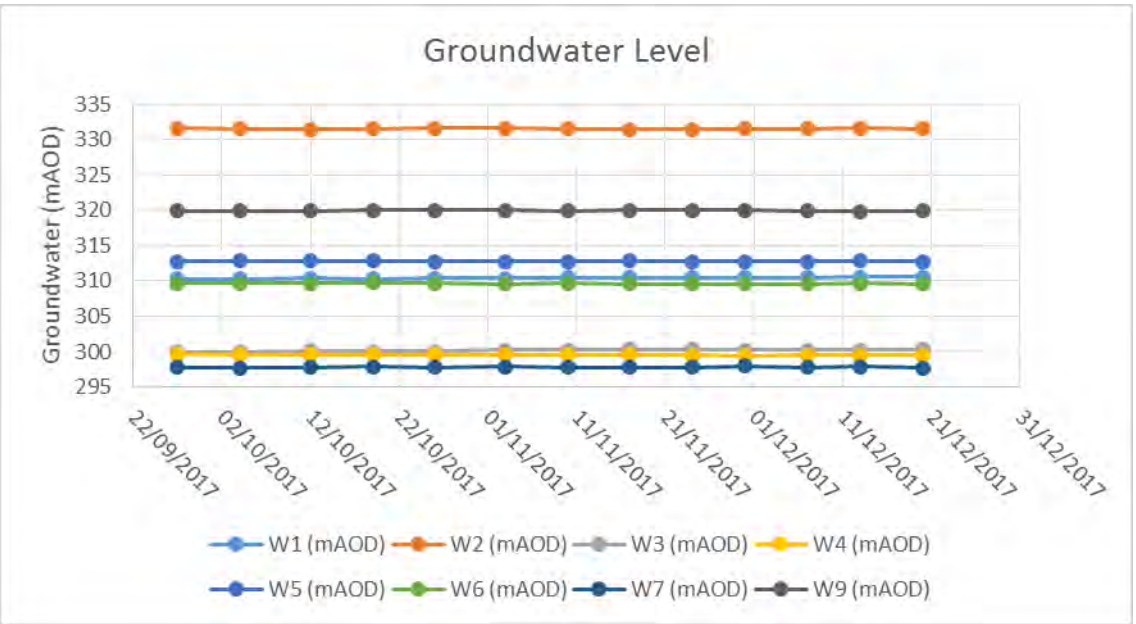
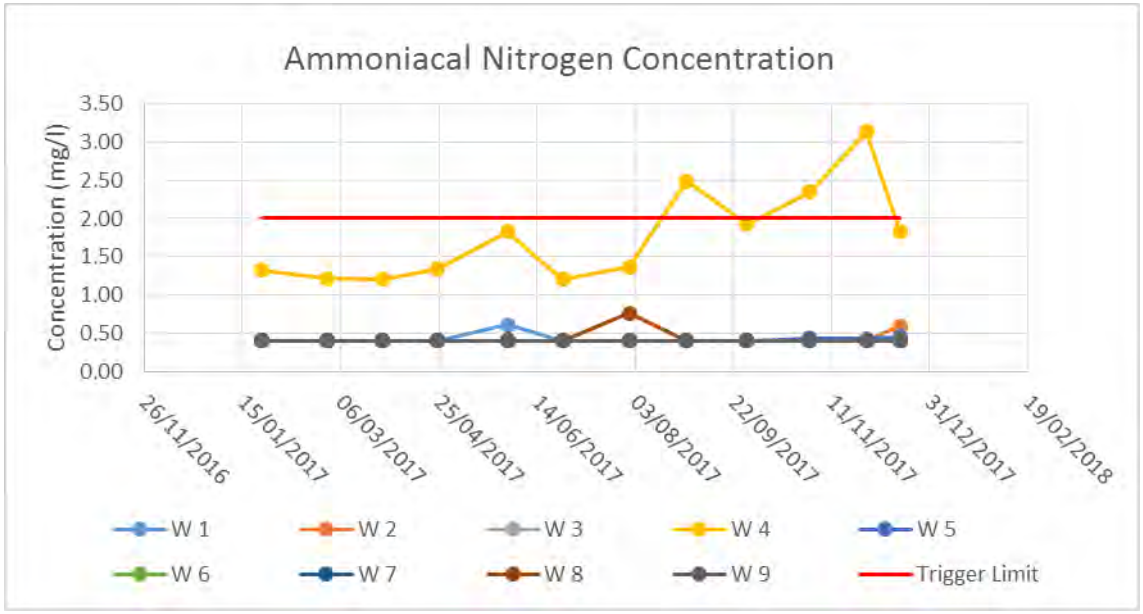
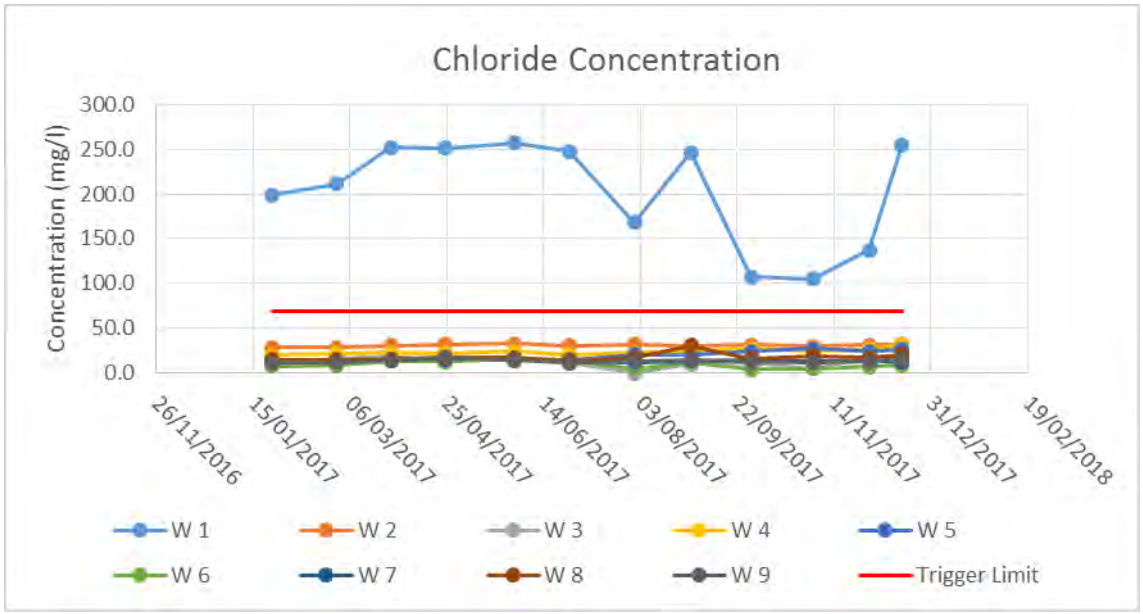


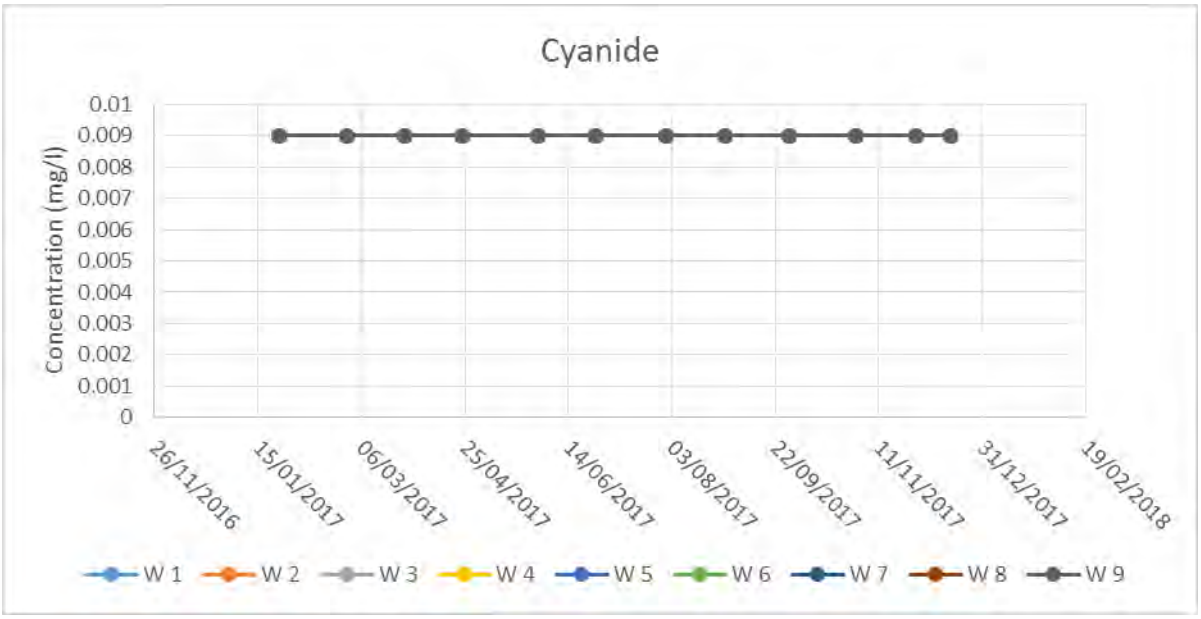
Figure 1 – Weekly level data (measured as metres above ordinance datum)

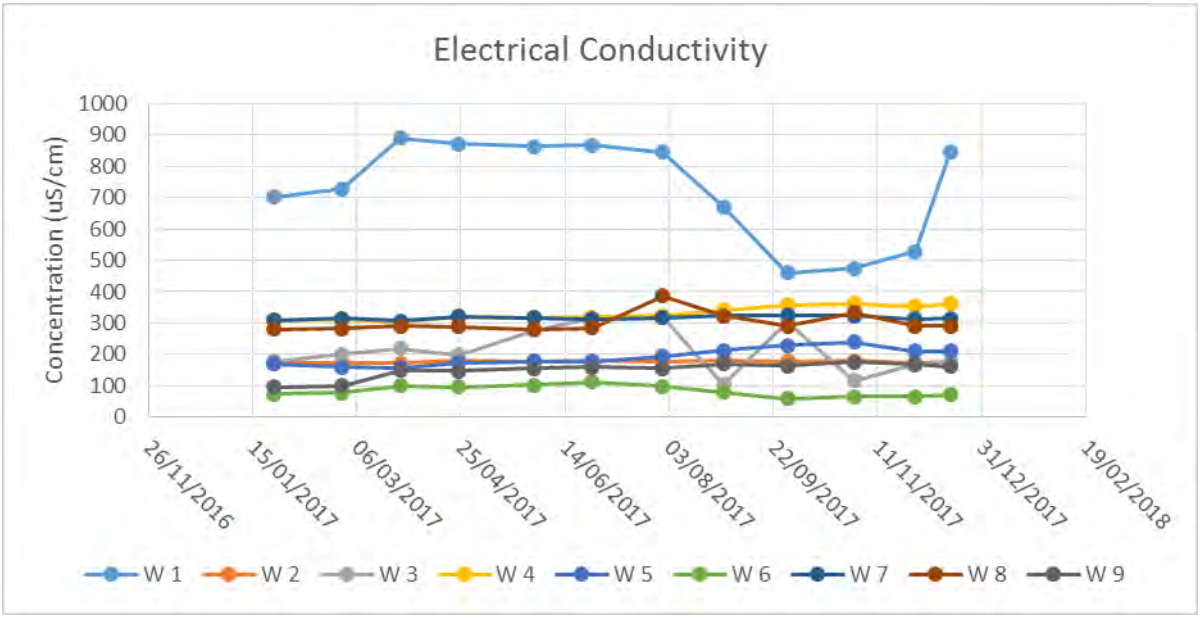
Table 1: Groundwater Monthly monitoring data

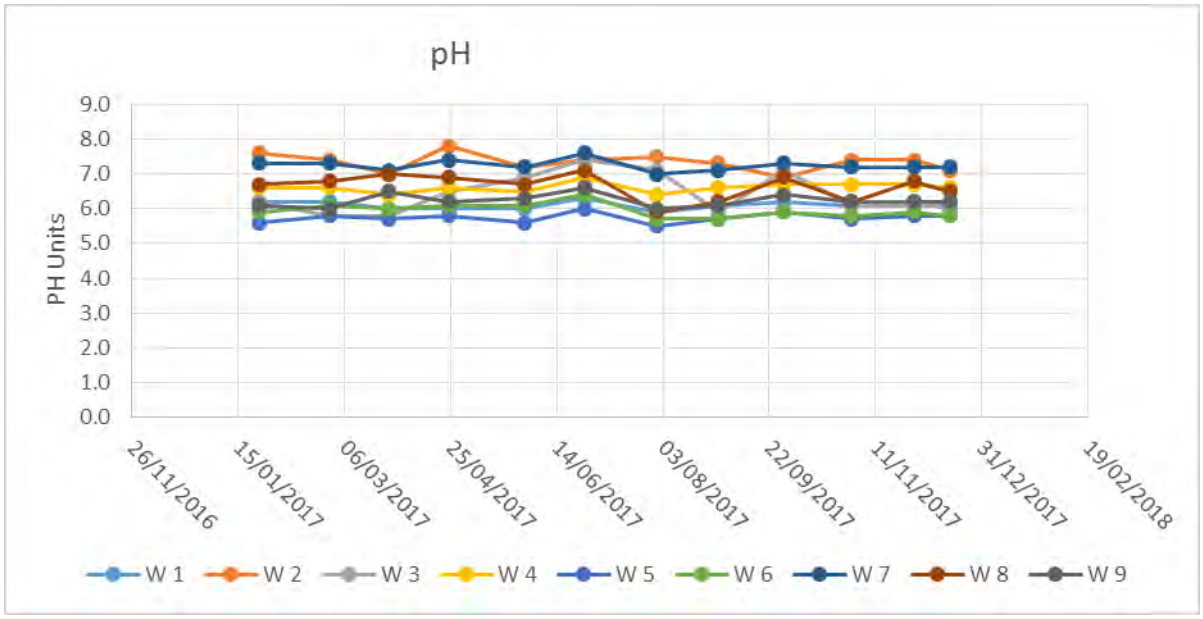
LOCATION	DATE	Ammoniacal Nitrogen	Chloride	Cyanide	Electrical Conductivity	pH	Sulphate
		2	69	-	-	-	-
		mg/l	mg/l	mg/l	µS/cm	pH units	mg/l
W1	MIN	0.41	105.0	0.009	461.00	5.9	5.30
	MAX	0.62	257.0	0.009	890.00	6.3	28.80
	AV	0.43	203.0	0.009	728.83	6.1	16.35
W2	MIN	0.41	28.1	0.009	171.00	6.9	<4.4
	MAX	0.60	32.9	0.009	182.00	7.8	<4.4
	AV	0.43	30.8	0.009	176.25	7.3	<4.4
W3	MIN	0.41	4.7	0.009	105.00	5.8	<4.4
	MAX	0.41	18.8	0.009	319.00	7.4	59.80
	AV	0.41	13.5	0.009	214.83	6.4	28.11
W4	MIN	1.21	20.1	0.009	303.00	6.4	8.20
	MAX	3.13	31.5	0.009	362.00	6.9	31.50
	AV	1.77	23.9	0.009	331.25	6.6	21.17
W5	MIN	0.41	11.5	0.009	157.00	5.5	24.80
	MAX	0.46	27.0	0.009	239.00	6.0	45.70
	AV	0.42	18.7	0.009	192.50	5.7	37.09
W6	MIN	0.41	4.2	0.009	58.80	5.7	<4.4
	MAX	0.41	15.4	0.009	112.00	6.4	6.30
	AV	0.41	9.5	0.009	83.29	6.0	4.57
W7	MIN	0.41	11.8	0.009	307.00	7.0	21.40
	MAX	0.41	16.3	0.009	326.00	7.6	31.70
	AV	0.41	13.7	0.009	316.25	7.2	27.85
W8	MIN	0.41	13.1	0.009	281.00	5.9	18.00
	MAX	0.41	30.7	0.009	386.00	7.1	31.40
	AV	0.41	17.7	0.009	301.58	6.6	23.53
W9	MIN	0.77	11.1	0.009	96.30	6.0	11.60
	MAX	0.41	17.9	0.009	175.00	6.6	27.60
	AV	0.41	13.5	0.009	150.28	6.2	23.33


Ammoniacal Nitrogen Concentration
Concentration (mg/l)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
26/11/2016
15/01/2017
06/03/2017
25/04/2017
14/06/2017
03/08/2017
22/09/2017
11/11/2017
31/12/2017
19/02/2018
W 1
W 2
W 3
W 4
W 5
W 6
W 7
W 8
W 9
Trigger Limit


Chloride Concentration
Concentration (mg/l)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
26/11/2016
15/01/2017
06/03/2017
25/04/2017
14/06/2017
03/08/2017
22/09/2017
11/11/2017
31/12/2017
19/02/2018
W 1
W 2
W 3
W 4
W 5
W 6
W 7
W 8
W 9
Trigger Limit


Cyanide
Concentration (mg/l)
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
26/11/2016
15/01/2017
06/03/2017
25/04/2017
14/06/2017
03/08/2017
22/09/2017
11/11/2017
31/12/2017
19/02/2018
W 1
W 2
W 3
W 4
W 5
W 6
W 7
W 8
W 9


Electrical Conductivity
Concentration (uS/cm)
1000
900
800
700
600
500
400
300
200
100
0
26/11/2016
15/01/2017
06/03/2017
25/04/2017
14/06/2017
03/08/2017
22/09/2017
11/11/2017
31/12/2017
19/02/2018
W 1
W 2
W 3
W 4
W 5
W 6
W 7
W 8
W 9


pH
PH Units
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
26/11/2016
15/01/2017
06/03/2017
25/04/2017
14/06/2017
03/08/2017
22/09/2017
11/11/2017
31/12/2017
19/02/2018
W 1
W 2
W 3
W 4
W 5
W 6
W 7
W 8
W 9

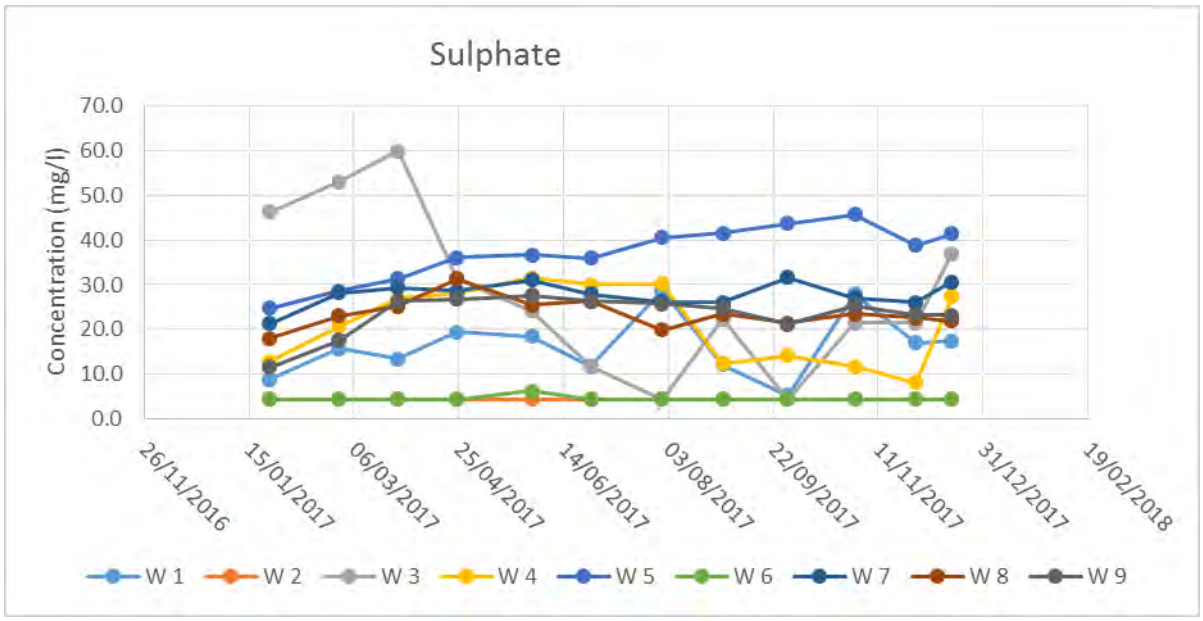

Sulphate
Concentration (mg/l)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
26/11/2016
15/01/2017
06/03/2017
25/04/2017
14/06/2017
03/08/2017
22/09/2017
11/11/2017
31/12/2017
19/02/2018
W 1
W 2
W 3
W 4
W 5
W 6
W 7
W 8
W 9

Table 2: Groundwater Quarterly monitoring data (EP limit exceedances highlighted)

PARAMETER	Unit	EP Limit	Quarter	GW1	GW2	GW3	GW4	GW5
2,4 - D	ug/l	0.1	Q1	<0.10	<0.05	<0.05	<0.10	<0.05
			Q2	<0.05	<0.05	<0.05	<0.10	<0.05
			Q3	<0.50	<0.05	<0.05	<0.05	<0.05
			Q4	<0.05	<0.05	<0.05	<0.05	<0.05
Ammoniacal Nitrogen	mg/l	2	Q1	<0.41	<0.41	<0.41	1.21	<0.41
			Q2	<0.41	<0.41	<0.41	1.21	<0.41
			Q3	<0.41	<0.41	<0.41	1.93	<0.41
			Q4	<0.41	0.6	<0.41	1.84	0.46
Cadmium	mg/l	0.0056	Q1	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
			Q2	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
			Q3	0.0022	<0.0006	<0.0006	<0.0006	<0.0006
			Q4	0.0011	<0.0006	<0.0006	<0.0006	<0.0006
Ethyl Benzene	ug/l	1	Q1	<0.10	<0.10	<0.10	<0.10	<0.10
			Q2	<0.10	<0.10	<0.10	<0.10	<0.10
			Q3	<0.10	<0.10	<0.10	<0.10	<0.10
			Q4	<0.10	<0.10	<0.10	<0.10	<0.10
Mecoprop	ug/l	0.1	Q1	<0.08	<0.04	<0.04	<0.08	<0.04
			Q2	<0.04	<0.04	<0.04	<0.08	<0.04
			Q3	<0.40	<0.04	<0.04	0.06	0.11
			Q4	<0.04	<0.04	<0.04	0.06	0.07
Nickel	mg/l	0.12	Q1	0.009	<0.003	0.010	0.009	0.014
			Q2	0.004	<0.003	0.005	0.009	0.017
			Q3	0.016	<0.003	0.008	0.008	0.020
			Q4	0.006	<0.003	0.005	0.005	0.017
Toluene	ug/l	4	Q1	<0.10	0.2	<0.10	<0.10	<0.10
			Q2	<0.10	0.13	<0.10	<0.10	<0.10
			Q3	<0.10	0.41	0.28	<0.10	<0.10
			Q4	<0.10	0.27	<0.10	<0.10	<0.10
Total Xylenes	ug/l	3	Q1	<0.20	<0.20	<0.20	<0.20	<0.20
			Q2	<0.20	<0.20	<0.20	<0.20	<0.20
			Q3	<0.20	<0.20	<0.20	<0.20	<0.20
			Q4	<0.20	<0.20	<0.20	<0.20	<0.20
Zinc	mg/l	0.85	Q1	0.020	<0.018	0.060	0.040	0.090
			Q2	0.03	<0.018	0.03	0.03	0.1
			Q3	0.08	<0.018	0.05	0.03	0.106
			Q4	0.03	<0.018	0.05	0.07	0.111

PARAMETER	Unit	EP Limit	Quarter	GW6	GW7	GW8	GW9
2,4 - D	ug/l	0.1	Q1	<0.05	<0.05	<0.05	<0.05
			Q2	<0.05	<0.05	<0.05	<0.05
			Q3	<0.05	<0.05	<0.05	<0.05
			Q4	<0.05	<0.05	<0.05	<0.05
Ammoniacal Nitrogen	mg/l	2	Q1	<0.41	<0.41	<0.41	<0.41
			Q2	<0.41	<0.41	<0.41	<0.41
			Q3	<0.41	<0.41	<0.41	<0.41
			Q4	<0.41	<0.41	<0.41	<0.41
Cadmium	mg/l	0.0056	Q1	<0.0006	<0.0006	<0.0006	<0.0006
			Q2	<0.0006	<0.0006	<0.0006	<0.0006
			Q3	<0.0006	<0.0006	<0.0006	<0.0006
			Q4	<0.0006	<0.0006	<0.0006	<0.0006
Ethyl Benzene	ug/l	1	Q1	<0.10	<0.10	<0.10	<0.10
			Q2	<0.10	<0.10	<0.10	<0.10
			Q3	<0.10	<0.10	<0.10	<0.10
			Q4	<0.10	<0.10	<0.10	<0.10
Mecoprop	ug/l	0.1	Q1	<0.04	<0.04	<0.04	<0.04
			Q2	<0.04	<0.04	<0.04	<0.04
			Q3	<0.04	<0.04	<0.04	<0.04
			Q4	<0.04	<0.04	<0.04	<0.04
Nickel	mg/l	0.12	Q1	0.005	<0.003	<0.003	<0.003
			Q2	<0.003	<0.003	<0.003	<0.003
			Q3	0.004	<0.003	0.004	<0.003
			Q4	0.003	<0.003	0.003	<0.003
Toluene	ug/l	4	Q1	<0.10	<0.10	<0.10	<0.10
			Q2	<0.10	<0.10	<0.10	<0.10
			Q3	<0.10	<0.10	<0.10	<0.10
			Q4	<0.10	<0.10	<0.10	<0.10
Total Xylenes	ug/l	3	Q1	<0.20	<0.20	<0.20	<0.20
			Q2	<0.20	<0.20	<0.20	<0.20
			Q3	<0.20	<0.20	<0.20	<0.20
			Q4	<0.20	<0.20	<0.20	<0.20
Zinc	mg/l	0.85	Q1	0.030	<0.018	0.020	0.070
			Q2	0.04	<0.018	0.03	0.02
			Q3	0.07	<0.018	<0.018	0.03
			Q4	0.09	0.03	0.03	0.07

Table 3: Groundwater Quarterly monitoring data (No EP Limits), Quarter 1

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
Acenaphthene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3	mg/l	28.2	42.4	9.8	108	11.4	24	123	106	19.9	118
Anthracene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Antimony Ultra Low Total as Sb	mg/l	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012
Arsenic, Ultra Low Total as As	mg/l	0.0061	0.001	0.0059	0.018	0.0016	0.0098	0.0011	0.0025	<0.0010	<0.0010
Benzene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (a) pyrene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Bicarbonate Alkalinity	mg/l	28	39.2	8.8	102	12	23.2	122	106	19.9	118
Calcium , Total as Ca	mg/l	10.7	9.7	21.8	36.7	11.3	9.31	37.9	36.3	10.8	19.4
Chloride as Cl	mg/l	252	30.8	18.3	22.7	13.8	13.2	14.9	15.6	14.3	11.7
Chromium , Total as Cr	mg/l	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chrysene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Conductivity- Electrical 20C	uS/cm	890	171	218	303	157	99.9	307	290	150	278
Copper, Total as Cu	mg/l	<0.009	<0.009	0.014	<0.009	0.044	<0.009	<0.009	<0.009	<0.009	<0.009
Cyanide, Total as CN	mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Dibenz (a,h) anthracene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Oxygen, Fixed	mg/l	<0.5	1.7	6.5	<0.5	4	10	1.5	1.9	8.5	12.8
Fluoranthene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	0.011	<0.01
Fluorene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno (1,2,3) cd pyrene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Iron , Total as Fe	mg/l	3.03	<0.23	2.63	8	0.66	3.42	0.35	0.86	<0.23	<0.23
Lead , Total as Pb	mg/l	<0.006	<0.006	0.035	<0.006	<0.006	<0.006	0.011	0.007	<0.006	<0.006
m&p Xylene	ug/l	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Magnesium, Total as Mg	mg/l	3.7	1.1	5.9	8.3	2.9	2.1	5.9	8.9	2.9	5.9
Manganese , Total as Mn	mg/l	2.27	0.012	0.596	3.53	0.788	1.04	0.617	0.912	0.03	0.623
Mercury, Total as Hg	mg/l	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Naphthalene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/l	<0.7	<0.7	5.3	<0.7	3.5	0.9	<0.7	<0.7	<0.7	<0.7
o-Xylene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PAH, Total	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	0.037	<0.01
pH	pH units	6	7	5.8	6.4	5.7	6	7.1	7	6.5	7.5
Phenanthrene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	0.011	<0.01
Phenols Mono (Phenol Index)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
Potassium , Total as K	mg/l	1.32	2	2.91	1.82	1.72	0.51	2.43	1.1	0.99	2.43
Pyrene	ug/l	<0.02	<0.01	<0.01	<0.04	<0.04	<0.01	<0.01	<0.01	0.015	<0.01
Selenium Ultra Low Total as Se	mg/l	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Silver , Total as Ag	mg/l	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	0.0007	<0.0007	<0.0007	<0.0007
Sodium , Total as Na	mg/l	137	20.6	8.98	10.2	8.94	5.78	18.2	8.53	10.6	28.7
Sulphate as SO4	mg/l	13.4	<4.4	59.8	26.9	31.3	<4.4	29.4	25.2	26.3	10.1

Table 4: Groundwater Quarterly and Six Monthly monitoring data (No EP Limits), Quarter 2

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Acenaphthene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3	mg/l	45.4	43.2	147	110	14.6	16.4	122	105	26.8
Anthracene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Antimony Ultra Low Total as Sb	mg/l	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012
Arsenic, Ultra Low Total as As	mg/l	0.01	0.0011	0.013	0.016	0.0019	0.0019	0.011	0.002	<0.0010
Benzene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (a) pyrene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Bicarbonate Alkalinity	mg/l	45.4	43.2	147	110	14.6	16.4	122	105	26.8
Calcium , Total as Ca	mg/l	13.3	9.74	39.2	36.6	12.8	9.41	39.7	36	11.6
Chloride as Cl	mg/l	248	30.3	10.9	20.2	14.6	14.2	12.7	13.1	11.1
Chromium , Total as Cr	mg/l	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chrysene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Conductivity- Electrical 20C	uS/cm	867	180	315	319	177	112	312	284	160
Copper, Total as Cu	mg/l	<0.009	<0.009	0.019	<0.009	0.041	<0.009	<0.009	<0.009	<0.009
Cyanide, Total as CN	mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Dibenz (a,h) anthracene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Oxygen, Fixed	mg/l	<0.5	0.9	0.8	0.6	2.4	4.2	<0.5	3	2.5
Ethyl Benzene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno (1,2,3) cd pyrene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Iron , Total as Fe	mg/l	2.58	0.33	3.76	8.82	0.76	0.71	4.1	0.73	<0.23
Lead , Total as Pb	mg/l	<0.006	<0.006	0.099	<0.006	<0.006	<0.006	0.146	0.009	<0.006
m&p Xylene	ug/l	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Magnesium, Total as Mg	mg/l	4.5	1.1	9.3	8.4	3.4	2	6.2	8.9	3.4
Manganese , Total as Mn	mg/l	1.89	0.015	3.18	3.41	1.52	0.189	1.03	0.874	0.039
Mercury, Total as Hg	mg/l	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Naphthalene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/l	<0.7	<0.7	<0.7	<0.7	2.6	1.4	<0.7	<0.7	1.2
o-Xylene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PAH, Total	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
pH	pH units	6.3	7.4	7.4	6.9	6	6.4	7.6	7.1	6.6
Phenanthrene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Phenols Mono (Phenol Index)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium , Total as K	mg/l	1.47	2.33	2.1	2.19	2.03	0.56	2.9	1.21	0.94
Pyrene	ug/l	<0.04	<0.02	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium Ultra Low Total as Se	mg/l	<0.0008	<0.0008	0.0017	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Silver , Total as Ag	mg/l	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007
Sodium , Total as Na	mg/l	139	20	9.09	10.5	9.22	6.44	17.8	8.08	10.4
Sulphate as SO4	mg/l	11.8	<4.4	11.9	30.1	36	<4.4	27.9	26.4	26.4

Table 5: Groundwater Quarterly monitoring data (No EP Limits), Quarter 3

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Acenaphthene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3	mg/l	57.6	42.4	162	136	24	9.6	125	110	33.6
Anthracene	ug/l	<0.41	<0.41	<0.41	1.93	<0.41	<0.41	<0.41	<0.41	<0.41
Antimony Ultra Low Total as Sb	mg/l	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012
Arsenic, Ultra Low Total as As	mg/l	0.042	<0.0010	0.059	0.013	0.0014	0.0034	0.006	0.0019	<0.0010
Benzene	ug/l	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (a) pyrene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Bicarbonate Alkalinity	mg/l	57.6	42.4	162	136	24	9.6	125	110	33.6
Calcium , Total as Ca	mg/l	13.3	9.74	39.2	36.6	12.8	9.41	39.7	36	11.6
Chloride as Cl	mg/l	6.21	10.4	42.3	43.7	17.2	4.4	40.6	39.4	13.4
Chromium , Total as Cr	mg/l	107	31.2	11.4	27.2	24.3	4.2	14.1	16.5	12.8
Chrysene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Conductivity- Electrical 20C	uS/cm	461	177	305	357	230	58.8	326	290	164
Copper, Total as Cu	mg/l	0.059	<0.009	0.036	<0.009	0.037	0.01	<0.009	<0.009	<0.009
Cyanide, Total as CN	mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Dibenz (a,h) anthracene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Oxygen, Fixed	mg/l	<0.5	0.6	4	2.6	<0.5	6.2	2.2	0.6	4.1
Ethyl Benzene	ug/l	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Fluoranthene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno (1,2,3) cd pyrene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Iron , Total as Fe	mg/l	10.9	0.35	10	7.22	0.44	0.63	2.04	0.74	<0.23
Lead , Total as Pb	mg/l	0.025	<0.006	0.278	<0.006	<0.006	<0.006	0.092	<0.006	<0.006
m&p Xylene	ug/l	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Magnesium, Total as Mg	mg/l	1.6	1.2	8.9	9.5	4.3	0.9	6.3	9.4	3.8
Manganese , Total as Mn	mg/l	1.48	0.013	1.83	3.99	2.08	0.114	0.479	0.9	0.062
Mercury, Total as Hg	mg/l	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Naphthalene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/l	<0.7	<0.7	<0.7	<0.7	1.2	1.2	<0.7	<0.7	<0.7
o-Xylene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PAH, Total	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
pH	pH units	6.2	6.9	7.1	6.7	5.9	5.9	7.3	6.9	6.4

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Phenanthrene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Phenols Mono (Phenol Index)	mg/l	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10
Potassium , Total as K	mg/l	1.06	2.04	1.92	2.07	2.25	0.34	2.49	1.11	0.79
Pyrene	ug/l	<0.10	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium Ultra Low Total as Se	mg/l	0.0036	<0.0008	0.0014	<0.0008	0.0011	<0.0008	<0.0008	<0.0008	<0.0008
Silver , Total as Ag	mg/l	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007
Sodium , Total as Na	mg/l	57.1	21.1	8.9	12.4	14	4.4	22.6	9.04	11.2
Sulphate as SO4	mg/l	5.3	<4.4	<4.4	14.1	43.6	<4.4	31.7	21.5	21.2

Table 6: Groundwater Quarterly monitoring data (No EP Limits), Quarter 4

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Acenaphthene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3	mg/l	24.4	42.8	10.4	113	19.6	7.4	125	111	33.2
Anthracene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Antimony Ultra Low Total as Sb	mg/l	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012
Arsenic, Ultra Low Total as As	mg/l	0.0097	<0.0010	0.014	0.02	0.0014	0.0056	0.0013	0.0024	<0.0010
Benzene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (a) pyrene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Bicarbonate Alkalinity	mg/l	24.4	42.8	10.4	113	19.6	7.4	125	111	33.2
Calcium , Total as Ca	mg/l	11.9	10.2	17.6	45	14.7	4.91	40.9	37.9	13.2
Chloride as Cl	mg/l	255	32.1	18.8	31.5	26.3	8.5	12.3	20.3	15.5
Chromium , Total as Cr	mg/l	0.003	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chrysene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Conductivity- Electrical 20C	uS/cm	845	176	178	362	210	70.6	314	290	162
Copper, Total as Cu	mg/l	0.018	<0.009	0.021	<0.009	0.036	0.009	<0.009	<0.009	<0.009
Cyanide, Total as CN	mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Dibenz (a,h) anthracene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Oxygen, Fixed	mg/l	1	2	7.5	<0.5	<0.5	8.8	2.3	1.4	10.3
Ethyl Benzene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno (1,2,3) cd pyrene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Iron , Total as Fe	mg/l	4.48	0.28	3.56	8.96	0.59	1.12	0.42	0.97	<0.23
Lead , Total as Pb	mg/l	0.007	<0.006	0.141	<0.006	<0.006	0.008	0.016	0.008	<0.006
m&p Xylene	ug/l	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Magnesium, Total as Mg	mg/l	3.9	1.1	4.7	9.8	3.7	1	6.3	9.1	3.7
Manganese , Total as Mn	mg/l	1.25	0.014	0.462	4.22	1.94	0.118	0.29	0.941	0.1
Mercury, Total as Hg	mg/l	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010
Naphthalene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/l	<0.7	<0.7	4.1	<0.7	<0.7	1.3	<0.7	<0.7	<0.7
o-Xylene	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PAH, Total	ug/l	<0.04	0.039	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
pH	pH units	6	7.1	6.1	6.6	5.8	5.8	7.2	6.5	6.2

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Phenanthrene	ug/l	<0.04	0.023	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Phenols Mono (Phenol Index)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium , Total as K	mg/l	1.7	2.11	2.23	2.26	2.18	0.4	2.65	1.26	0.85
Pyrene	ug/l	<0.04	0.016	<0.02	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium Ultra Low Total as Se	mg/l	0.0009	<0.0008	0.0023	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Silver , Total as Ag	mg/l	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007
Sodium , Total as Na	mg/l	131	20.9	7.3	14.4	13.5	5.14	19.8	8.78	11.4
Sulphate as SO4	mg/l	17.4	<4.4	36.9	27.3	41.4	<4.4	30.7	21.9	23.2

Table 7: Groundwater Annual Hazardous Substances Suite (No EP Limits) Detected Parameters Highlighted

Parameter	Units	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9
SVOC										
Phenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroethyl)ether	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
3&4-Methylphenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenzofuran	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroisopropyl)ether	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Nitrosodi-n-propylamine	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachloroethane	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrobenzene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isophorone	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitrophenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroethoxy)methane	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dichlorophenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Naphthalene	ug/l	<4.0	<2.0	<4.0	<8.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hexachlorobutadiene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylnaphthalene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4,6-Trichlorophenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4,5-Trichlorophenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chloronaphthalene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dimethylphthalate	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,6-Dinitrotoluene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dinitrotoluene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Diethylphthalate	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Nitrophenol	ug/l	<10.0	<5.0	<10.0	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Chlorophenyl phenyl ether	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Diphenylamine	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0

Parameter	Units	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9
SVOC										
4-Bromophenyl Phenyl Ether	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
di-n-Butylphthalate	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzyl Butyl Phthalate	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)anthracene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-ethylhexyl)phthalate	ug/l	<10.0	<5.0	<10.0	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0
Di-n-octylphthalate	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b)fluoranthene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Indeno(1,2,3-c,d)pyrene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a,h)anthracene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g,h,i)perylene	ug/l	<2.0	<1.0	<2.0	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0

Customer Sample Ref.	units	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9
VOC										
Dichlorodifluoromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichlorofluoromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromochloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Customer Sample Ref.	units	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9
VOC										
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromoethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl Benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
m&p-Xylene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o-Xylene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Styrene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropylbenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Propylbenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorotoluene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3,5-Trimethylbenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chlorotoluene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tert-Butylbenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trimethylbenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
sec-Butylbenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
p-Isopropyltoluene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Butylbenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-chloropropane	ug/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

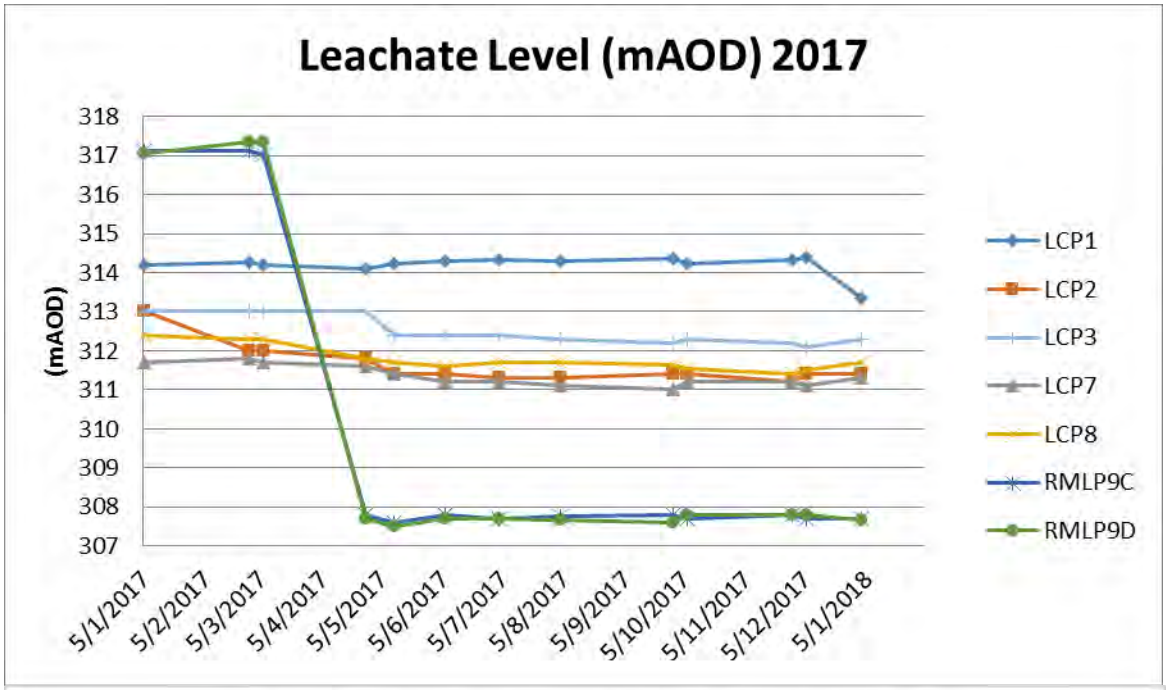
Customer Sample Ref.	units	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9
VOC										
1,2,4-Trichlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Naphthalene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
MTBE	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Appendix 4

APPENDIX 4 – LEACHATE

Table 1 – Monthly leachate level data

	Leachate Head (m)							
	LCP 1	LCP 2	LCP 3	LCP7	LCP8	RMLP9C	RMLP9D	EP Limit
Min	-0.06	0.3	0.6	0.25	0.65	0.6	0.5	1
Max	0.98	2.1	1.5	1.05	1.65	10.11	10.36	1
Average	0.80	0.72	1.01	0.60	1.04	2.90	2.9	1
Count	13	13	13	13	13	13	13	1


Leachate Level (mAOD) 2017
(mAOD)
318
317
316
315
314
313
312
311
310
309
308
307
5/1/2017
5/2/2017
5/3/2017
5/4/2017
5/5/2017
5/6/2017
5/7/2017
5/8/2017
5/9/2017
5/10/2017
5/11/2017
5/12/2017
5/1/2018
LCP1
LCP2
LCP3
LCP7
LCP8
RMLP9C
RMLP9D

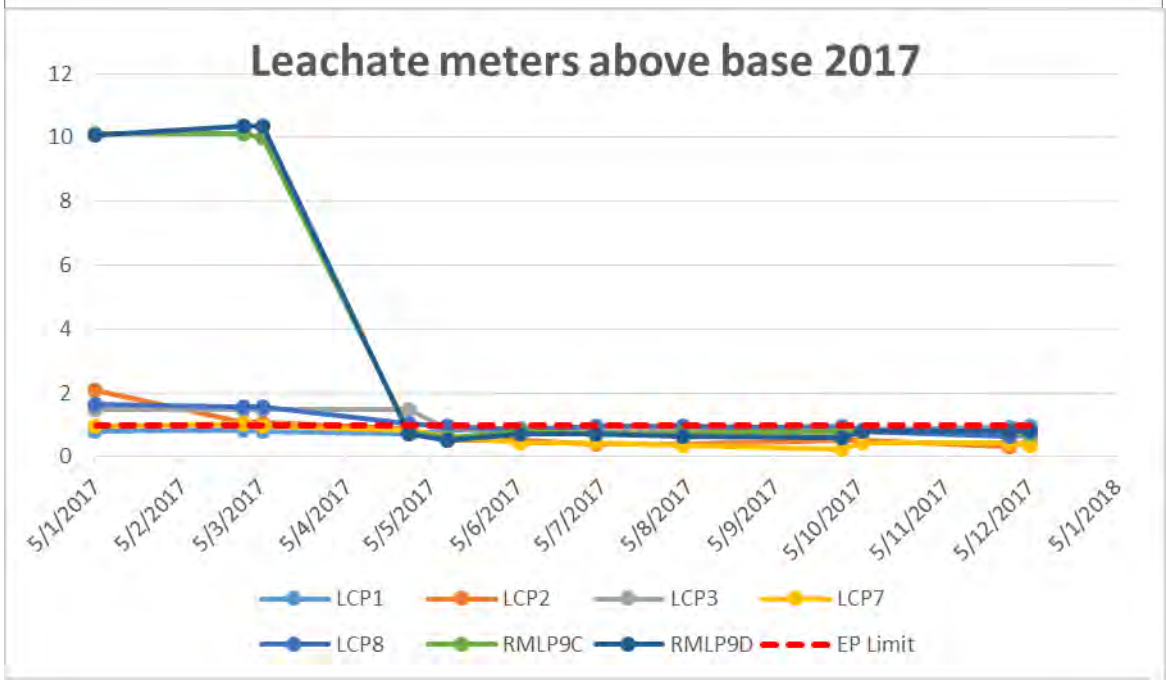
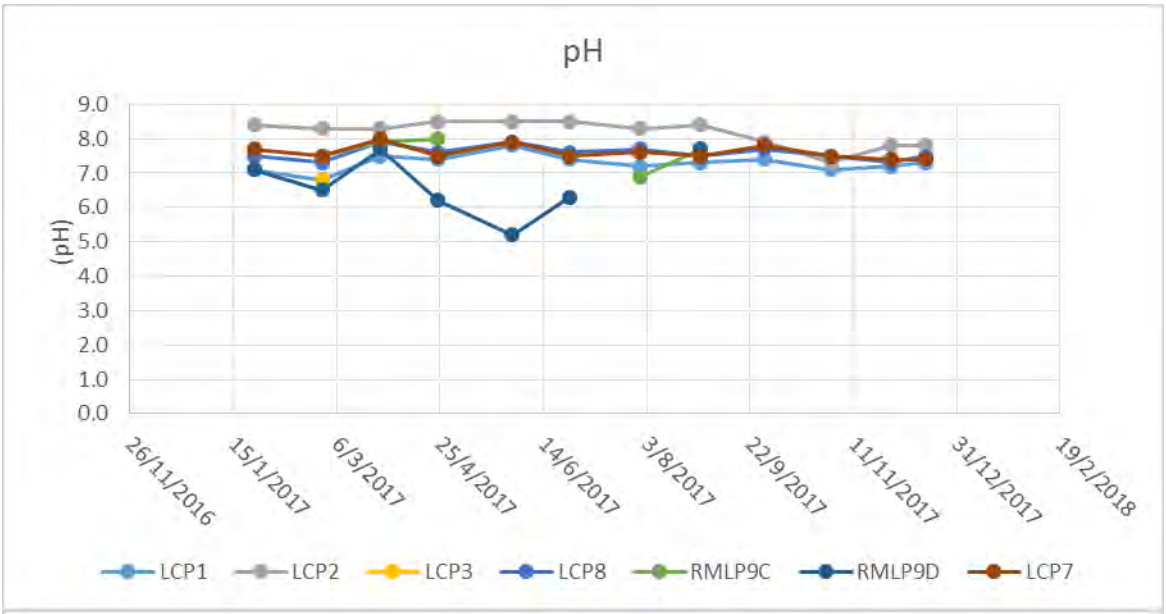

Leachate meters above base 2017
12
10
8
6
4
2
0
5/1/2017
5/2/2017
5/3/2017
5/4/2017
5/5/2017
5/6/2017
5/7/2017
5/8/2017
5/9/2017
5/10/2017
5/11/2017
5/12/2017
5/1/2018
LCP1
LCP2
LCP3
LCP7
LCP8
RMLP9C
RMLP9D
EP Limit

Table 2 – Monthly monitoring data

Location		pH	Ammoniacal Nitrogen
		pH units	mg/l
LCP1	Min	6.8	82.5
	Max	7.8	827.0
	Average	7.3	304.0
	Count	12	12
LCP2	Min	7.3	21.7
	Max	8.5	3690.0
	Average	8.2	2373.9
	Count	12.0	12.0
LCP3	Min	6.8	1.1
	Max	6.8	1.1
	Average	6.8	1.1
	Count	1	1
LCP7	Min	7.4	630.0
	Max	8.0	1210.0
	Average	7.6	999.4
	Count	12	12
LCP8	Min	7.3	225.0
	Max	7.9	1490.0
	Average	7.6	974.7
	Count	12	12
RMLP9C	Min	6.9	87.3
	Max	8.0	391.0
	Average	7.6	209.7
	Count	5	5
RMLP9D	Min	5.2	3.6
	Max	7.7	690.3
	Average	6.7	174.1
	Count	7	7


pH
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
(pH)
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
LCP1
LCP2
LCP3
LCP8
RMLP9C
RMLP9D
LCP7

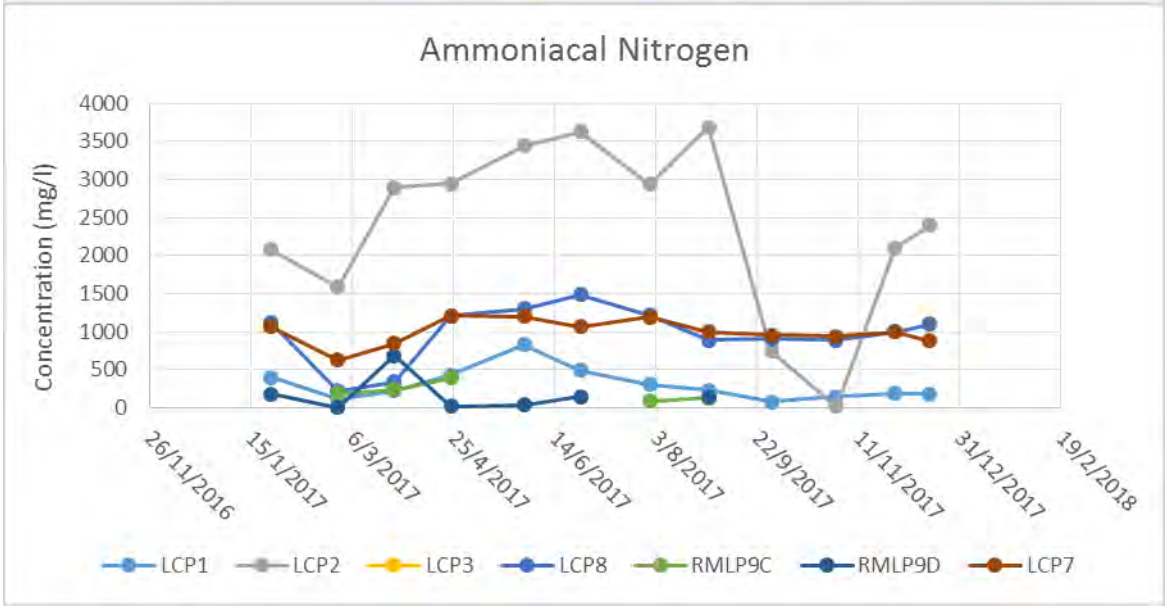

Ammoniacal Nitrogen
4000
3500
3000
2500
2000
1500
1000
500
0
Concentration (mg/l)
26/11/2016
15/1/2017
6/3/2017
25/4/2017
14/6/2017
3/8/2017
22/9/2017
11/11/2017
31/12/2017
19/2/2018
LCP1
LCP2
LCP3
LCP8
RMLP9C
RMLP9D
LCP7

Table 3: Final discharge monthly monitoring data (EP exceedances highlighted)

LOCATION	DATE	pH	Ammoniacal Nitrogen as N	Suspended Solids	COD (1 hr settled)	Total TPH (EH>C6 - C40)	Sulphate as SO4	Dissolved Methane
		pH units	mg/l	mg/l	mg/l	µg/l	mg/l	mg/l
Compliance Limit		**6 - 10**	**150**	**500**	**1000**	**nil**	**1000**	**N/A**
Treated Leachate	**27/01/2017**	7.6	108	356	2660	714	115	0.01
	27/03/2017	7.1	1	18	897	603	203	<0.010
	24/04/2017	6.2	21	90	613	6100	133	<0.010
	30/05/2017	5.2	38	1310	1440	1820	<4.4	<0.010
	27/06/2017	6.3	146	1400	1910	2220	128	<0.010
	31/07/2017	6.2	84	548	962	3510	92	<0.010
	29/08/2017	7.9	148	7650	2460	-	-	-
	29/09/2017	6.0	2	130	513	2090	140	<0.010
	31/10/2017	5.9	11.2	230	518	1950	89.4	<0.010
	29/11/2017	7.1	138	31	815	1380	69.1	<0.010
	16/12/2017	3.2	112	194	374	301	86.2	<0.010
	MIN	3.2	1.2	18.0	374.0	301.0	69.1	0.0
	MAX	7.9	148.0	7650.0	2660.0	6100.0	203.0	0.0
	AVRG	6.2	73.5	1087.0	1196.5	2068.8	117.3	0.0

Table 4: Final discharge six monthly monitoring data, June

Sample Matrix		Treated Leachate
2,3,6 - TBA	ug/l	<5.00
2,4 - D	ug/l	<5.00
2,4 - DB	ug/l	<5.00
2,4,5 - T	ug/l	<5.00
Bromoxynil	ug/l	<5.00
Cadmium , Total as Cd	mg/l	<0.0006
Chromium , Total as Cr	mg/l	0.391
Copper, Total as Cu	mg/l	0.131
Cyanide, Total as CN	mg/l	0.85
Dicamba	ug/l	<5.00
Dichlorprop	ug/l	<5.00
EH >C10 - C16	ug/l	2220
EH >C16 - C24	ug/l	<100
EH >C24 - C40	ug/l	<100
EH >C6 - C40	ug/l	2220
EH >C6 - C8	ug/l	<100
EH >C8 - C10	ug/l	<100
Fenthion	ug/l	<0.192
Hexachlorobenzene	ng/l	<155
Ioxynil	ug/l	<5.00
Lead , Total as Pb	mg/l	0.046
MCPA	ug/l	<5.00
MCPB	ug/l	<5.00
Mecoprop	ug/l	<4.00
Mercury, Total as Hg	mg/l	0.00019
Methane, Dissolved	mg/l	<0.010
Nickel, Total as Ni	mg/l	0.256
Zinc, Total as Zn	mg/l	0.418

Sample Matrix	Units	Treated Leachate
SVOC		
Phenol	ug/l	<200
Bis(2-chloroethyl)ether	ug/l	<200
2-Chlorophenol	ug/l	<200
1,3-Dichlorobenzene	ug/l	<200
1,4-Dichlorobenzene	ug/l	<200
2-Methylphenol	ug/l	<200
3&4-Methylphenol	ug/l	<200
Dibenzofuran	ug/l	<200
1,2-Dichlorobenzene	ug/l	<200
Bis(2-chloroisopropyl)ether	ug/l	<200
n-Nitrosodi-n-propylamine	ug/l	<200
Hexachloroethane	ug/l	<200
Nitrobenzene	ug/l	<200
Isophorone	ug/l	<200
2,4-Dimethylphenol	ug/l	<200
2-Nitrophenol	ug/l	<200
Bis(2-chloroethoxy)methane	ug/l	<200
2,4-Dichlorophenol	ug/l	<200
1,2,4-Trichlorobenzene	ug/l	<200
Naphthalene	ug/l	<400
Hexachlorobutadiene	ug/l	<200
4-Chloro-3-methylphenol	ug/l	<200

Sample Matrix	Units	Treated Leachate
SVOC		
2-Methylnaphthalene	ug/l	<200
2,4,6-Trichlorophenol	ug/l	<200
2,4,5-Trichlorophenol	ug/l	<200
2-Chloronaphthalene	ug/l	<200
Dimethylphthalate	ug/l	<200
2,6-Dinitrotoluene	ug/l	<200
Acenaphthylene	ug/l	<200
Acenaphthene	ug/l	<200
2,4-Dinitrotoluene	ug/l	<200
Diethylphthalate	ug/l	<200
4-Nitrophenol	ug/l	<1000
4-Chlorophenyl phenyl ether	ug/l	<200
Fluorene	ug/l	<200
Diphenylamine	ug/l	<200
4-Bromophenyl Phenyl Ether	ug/l	<200
Hexachlorobenzene	ug/l	<200
Pentachlorophenol	ug/l	<200
Phenanthrene	ug/l	<200
Anthracene	ug/l	<200
di-n-Butylphthalate	ug/l	<200
Fluoranthene	ug/l	<200
Pyrene	ug/l	<200
Benzyl Butyl Phthalate	ug/l	<200
Benzo(a)anthracene	ug/l	<200
Chrysene	ug/l	<200
Bis(2-ethylhexyl)phthalate	ug/l	<1000
Di-n-octylphthalate	ug/l	<200
Benzo(b)fluoranthene	ug/l	<200
Benzo(k)fluoranthene	ug/l	<200
Benzo(a)pyrene	ug/l	<200
Indeno(1,2,3-c,d)pyrene	ug/l	<200
Dibenz(a,h)anthracene	ug/l	<200
Benzo(g,h,i)perylene	ug/l	<200

Sample Matrix	Units	Treated Leachate
VOC		
Dichlorodifluoromethane	ug/l	<10.0
Chloromethane	ug/l	22
Chloroethane	ug/l	<10.0
Bromomethane	ug/l	17.2
Trichlorofluoromethane	ug/l	<10.0
1,1-Dichloroethene	ug/l	<10.0
Dichloromethane	ug/l	<10.0
1,1-Dichloroethane	ug/l	<10.0
cis-1,2-Dichloroethene	ug/l	<10.0
2,2-Dichloropropane	ug/l	<10.0
Chloroform	ug/l	<10.0
Bromochloromethane	ug/l	<10.0
1,1,1-Trichloroethane	ug/l	<10.0
1,1-Dichloropropene	ug/l	<10.0
1,2-Dichloroethane	ug/l	<10.0
Benzene	ug/l	<10.0
1,2-Dichloropropane	ug/l	<10.0
Trichloroethene	ug/l	<10.0

Sample Matrix	Units	Treated Leachate
VOC		
Bromodichloromethane	ug/l	<10.0
Dibromomethane	ug/l	<10.0
cis-1,3-Dichloropropene	ug/l	<10.0
Toluene	ug/l	<10.0
trans-1,3-Dichloropropene	ug/l	<10.0
1,1,2-Trichloroethane	ug/l	<10.0
Carbon Tetrachloride	ug/l	<10.0
Vinyl Chloride	ug/l	<5.0
1,3-Dichloropropane	ug/l	<10.0
Tetrachloroethene	ug/l	<10.0
Dibromochloromethane	ug/l	<10.0
1,2-Dibromoethane	ug/l	<10.0
Chlorobenzene	ug/l	<10.0
1,1,1,2-Tetrachloroethane	ug/l	<10.0
Ethyl Benzene	ug/l	<10.0
m&p-Xylene	ug/l	<10.0
o-Xylene	ug/l	<10.0
Styrene	ug/l	<10.0
Bromoform	ug/l	<10.0
Isopropylbenzene	ug/l	<10.0
trans-1,2-Dichloroethene	ug/l	<10.0
1,1,2,2-Tetrachloroethane	ug/l	<10.0
1,2,3-Trichloropropane	ug/l	<10.0
n-Propylbenzene	ug/l	<10.0
Bromobenzene	ug/l	<10.0
2-Chlorotoluene	ug/l	<10.0
1,3,5-Trimethylbenzene	ug/l	<10.0
4-Chlorotoluene	ug/l	<10.0
tert-Butylbenzene	ug/l	<10.0
1,2,4-Trimethylbenzene	ug/l	<10.0
sec-Butylbenzene	ug/l	<10.0
p-Isopropyltoluene	ug/l	<10.0
1,3-Dichlorobenzene	ug/l	<10.0
1,4-Dichlorobenzene	ug/l	<10.0
n-Butylbenzene	ug/l	<10.0
1,2-Dichlorobenzene	ug/l	<10.0
1,2-Dibromo-3-chloropropane	ug/l	<20.0
1,2,4-Trichlorobenzene	ug/l	<10.0
Hexachlorobutadiene	ug/l	<10.0
Naphthalene	ug/l	<10.0
1,2,3-Trichlorobenzene	ug/l	<10.0
MTBE	ug/l	<10.0

Table 5: Final discharge six monthly monitoring data, December

Sample Matrix	Units	Treated Leachate
2,3,6 - TBA	ug/l	<0.20
2,4 - D	ug/l	<0.20
2,4 - DB	ug/l	<0.20
2,4,5 - T	ug/l	<0.20
Bromoxynil	ug/l	<0.20
Cadmium , Total as Cd	mg/l	0.0014
Chromium , Total as Cr	mg/l	0.068
Copper, Total as Cu	mg/l	0.088
Cyanide, Total as CN	mg/l	<0.009
Dicamba	ug/l	0.32
Dichlorprop	ug/l	<0.20
EH >C10 - C16	ug/l	232
EH >C16 - C24	ug/l	69
EH >C24 - C40	ug/l	<40
EH >C6 - C40	ug/l	301
EH >C6 - C8	ug/l	<40
EH >C8 - C10	ug/l	<40
Fenthion	ug/l	<0.011
Hexachlorobenzene	ng/l	<9
Ioxynil	ug/l	<0.20
Lead , Total as Pb	mg/l	0.011
MCPA	ug/l	<0.20
MCPB	ug/l	<0.20
Mecoprop	ug/l	<0.16
Mercury, Total as Hg	mg/l	<0.00010
Methane, Dissolved	mg/l	<0.010
Nickel, Total as Ni	mg/l	0.063
Zinc, Total as Zn	mg/l	0.556

Sample Matrix	units	Treated Leachate
SVOC		
Phenol	ug/l	<200
Bis(2-chloroethyl)ether	ug/l	<200
2-Chlorophenol	ug/l	<200
1,3-Dichlorobenzene	ug/l	<200
1,4-Dichlorobenzene	ug/l	<200
2-Methylphenol	ug/l	<200
3&4-Methylphenol	ug/l	<200
Dibenzofuran	ug/l	<200
1,2-Dichlorobenzene	ug/l	<200
Bis(2-chloroisopropyl)ether	ug/l	<200
n-Nitrosodi-n-propylamine	ug/l	<200
Hexachloroethane	ug/l	<200
Nitrobenzene	ug/l	<200
Isophorone	ug/l	<200
2,4-Dimethylphenol	ug/l	<200
2-Nitrophenol	ug/l	<200
Bis(2-chloroethoxy)methane	ug/l	<200
2,4-Dichlorophenol	ug/l	<200
1,2,4-Trichlorobenzene	ug/l	<200
Naphthalene	ug/l	<400
Hexachlorobutadiene	ug/l	<200
4-Chloro-3-methylphenol	ug/l	<200
2-Methylnaphthalene	ug/l	<200
2,4,6-Trichlorophenol	ug/l	<200

Sample Matrix	units	Treated Leachate
SVOC		
2,4,5-Trichlorophenol	ug/l	<200
2-Chloronaphthalene	ug/l	<200
Dimethylphthalate	ug/l	<200
2,6-Dinitrotoluene	ug/l	<200
Acenaphthylene	ug/l	<200
Acenaphthene	ug/l	<200
2,4-Dinitrotoluene	ug/l	<200
Diethylphthalate	ug/l	<200
4-Nitrophenol	ug/l	<1000
4-Chlorophenyl phenyl ether	ug/l	<200
Fluorene	ug/l	<200
Diphenylamine	ug/l	<200
4-Bromophenyl Phenyl Ether	ug/l	<200
Hexachlorobenzene	ug/l	<200
Pentachlorophenol	ug/l	<200
Phenanthrene	ug/l	<200
Anthracene	ug/l	<200
di-n-Butylphthalate	ug/l	<200
Fluoranthene	ug/l	<200
Pyrene	ug/l	<200
Benzyl Butyl Phthalate	ug/l	<200
Benzo(a)anthracene	ug/l	<200
Chrysene	ug/l	<200
Bis(2-ethylhexyl)phthalate	ug/l	<1000
Di-n-octylphthalate	ug/l	<200
Benzo(b)fluoranthene	ug/l	<200
Benzo(k)fluoranthene	ug/l	<200
Benzo(a)pyrene	ug/l	<200
Indeno(1,2,3-c,d)pyrene	ug/l	<200
Dibenz(a,h)anthracene	ug/l	<200
Benzo(g,h,i)perylene	ug/l	<200

Sample Matrix	units	Treated Leachate
VOC		
Dichlorodifluoromethane	ug/l	<20.0
Chloromethane	ug/l	<20.0
Chloroethane	ug/l	<20.0
Bromomethane	ug/l	<20.0
Trichlorofluoromethane	ug/l	<20.0
1,1-Dichloroethene	ug/l	<20.0
Dichloromethane	ug/l	<20.0
1,1-Dichloroethane	ug/l	<20.0
cis-1,2-Dichloroethene	ug/l	<20.0
2,2-Dichloropropane	ug/l	<20.0
Chloroform	ug/l	<20.0
Bromochloromethane	ug/l	<20.0
1,1,1-Trichloroethane	ug/l	<20.0
1,1-Dichloropropene	ug/l	<20.0
1,2-Dichloroethane	ug/l	<20.0
Benzene	ug/l	<20.0
1,2-Dichloropropane	ug/l	<20.0
Trichloroethene	ug/l	<20.0
Bromodichloromethane	ug/l	<20.0
Dibromomethane	ug/l	<20.0

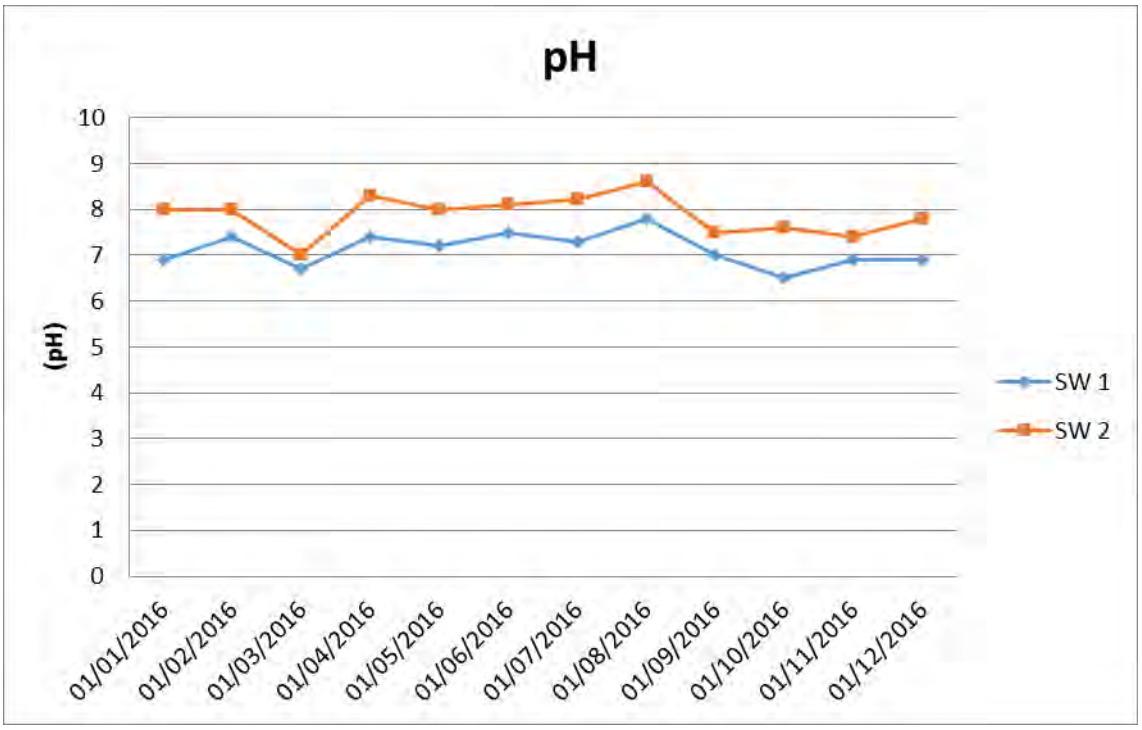
Sample Matrix	units	Treated Leachate
VOC		
cis-1,3-Dichloropropene	ug/l	<20.0
Toluene	ug/l	<20.0
trans-1,3-Dichloropropene	ug/l	<20.0
1,1,2-Trichloroethane	ug/l	<20.0
Carbon Tetrachloride	ug/l	<20.0
Vinyl Chloride	ug/l	<10.0
1,3-Dichloropropane	ug/l	<20.0
Tetrachloroethene	ug/l	<20.0
Dibromochloromethane	ug/l	<20.0
1,2-Dibromoethane	ug/l	<20.0
Chlorobenzene	ug/l	<20.0
1,1,1,2-Tetrachloroethane	ug/l	<20.0
Ethyl Benzene	ug/l	<20.0
m&p-Xylene	ug/l	<20.0
o-Xylene	ug/l	<20.0
Styrene	ug/l	<20.0
Bromoform	ug/l	<20.0
Isopropylbenzene	ug/l	<20.0
trans-1,2-Dichloroethene	ug/l	<20.0
1,1,2,2-Tetrachloroethane	ug/l	<20.0
1,2,3-Trichloropropane	ug/l	<20.0
n-Propylbenzene	ug/l	<20.0
Bromobenzene	ug/l	<20.0
2-Chlorotoluene	ug/l	<20.0
1,3,5-Trimethylbenzene	ug/l	<20.0
4-Chlorotoluene	ug/l	<20.0
tert-Butylbenzene	ug/l	<20.0
1,2,4-Trimethylbenzene	ug/l	<20.0
sec-Butylbenzene	ug/l	<20.0
p-Isopropyltoluene	ug/l	<20.0
1,3-Dichlorobenzene	ug/l	<20.0
1,4-Dichlorobenzene	ug/l	<20.0
n-Butylbenzene	ug/l	<20.0
1,2-Dichlorobenzene	ug/l	<20.0
1,2-Dibromo-3-chloropropane	ug/l	<40.0
1,2,4-Trichlorobenzene	ug/l	<20.0
Hexachlorobutadiene	ug/l	<20.0
Naphthalene	ug/l	<20.0
1,2,3-Trichlorobenzene	ug/l	<20.0
MTBE	ug/l	<20.0

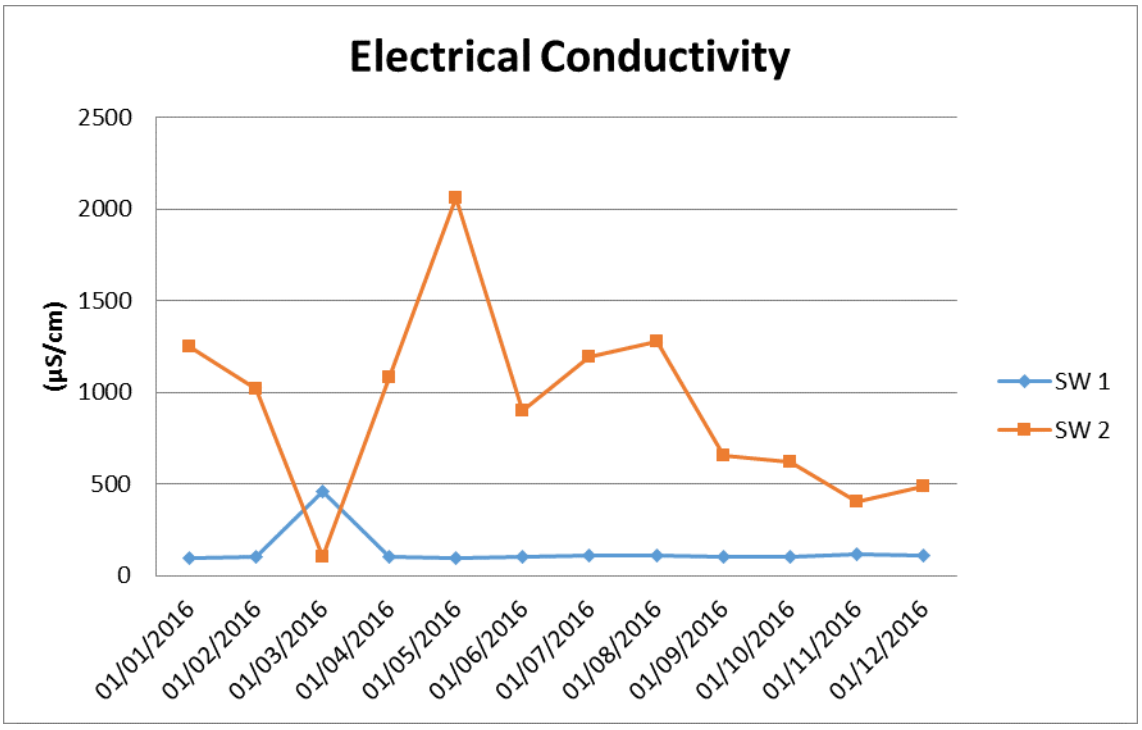
Appendix 5

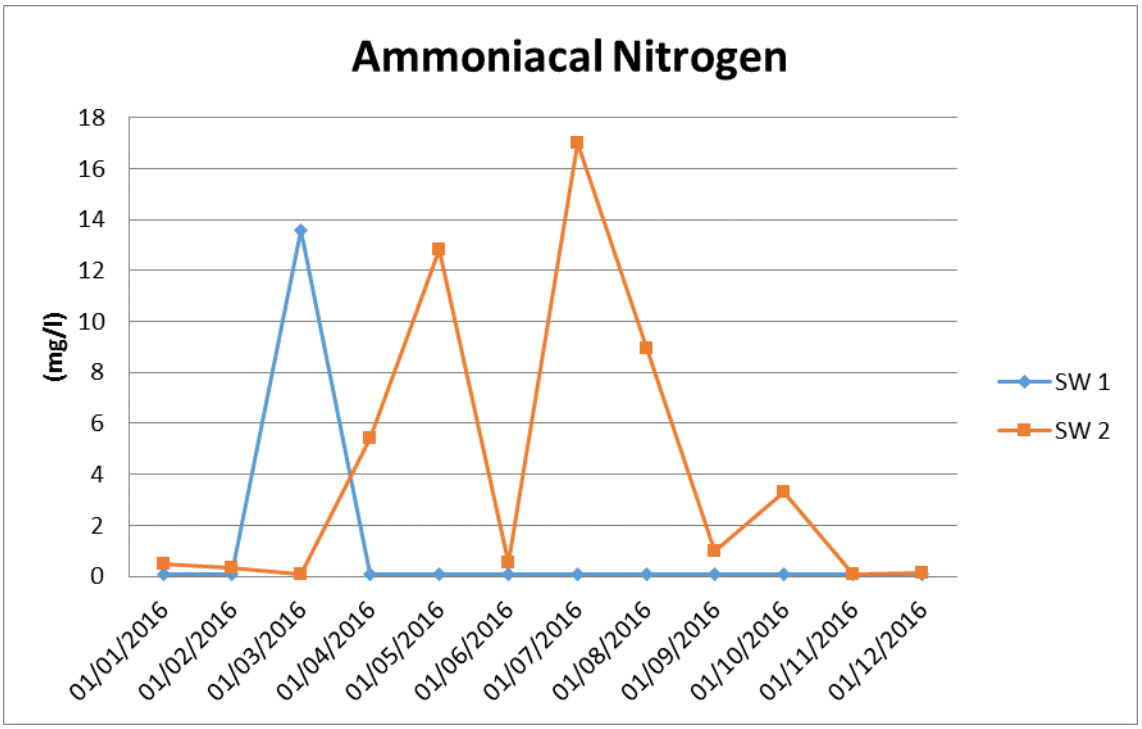
APPENDIX 5 – SURFACE WATER

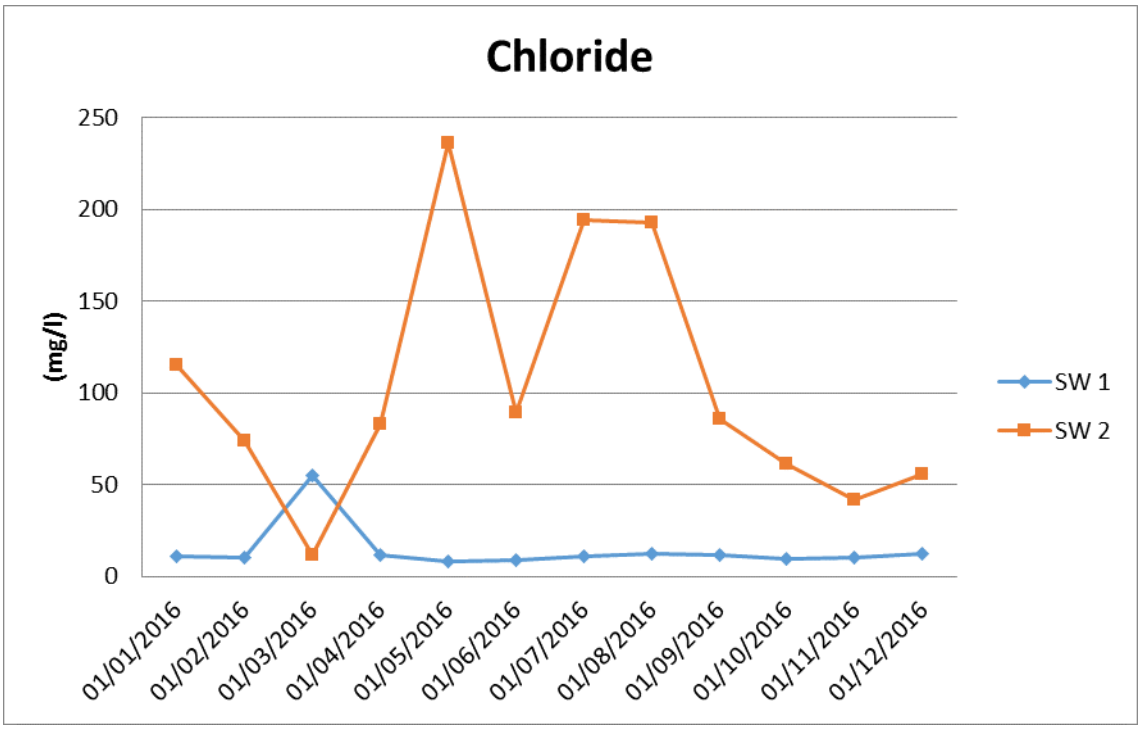
Table 1: Monthly monitoring data

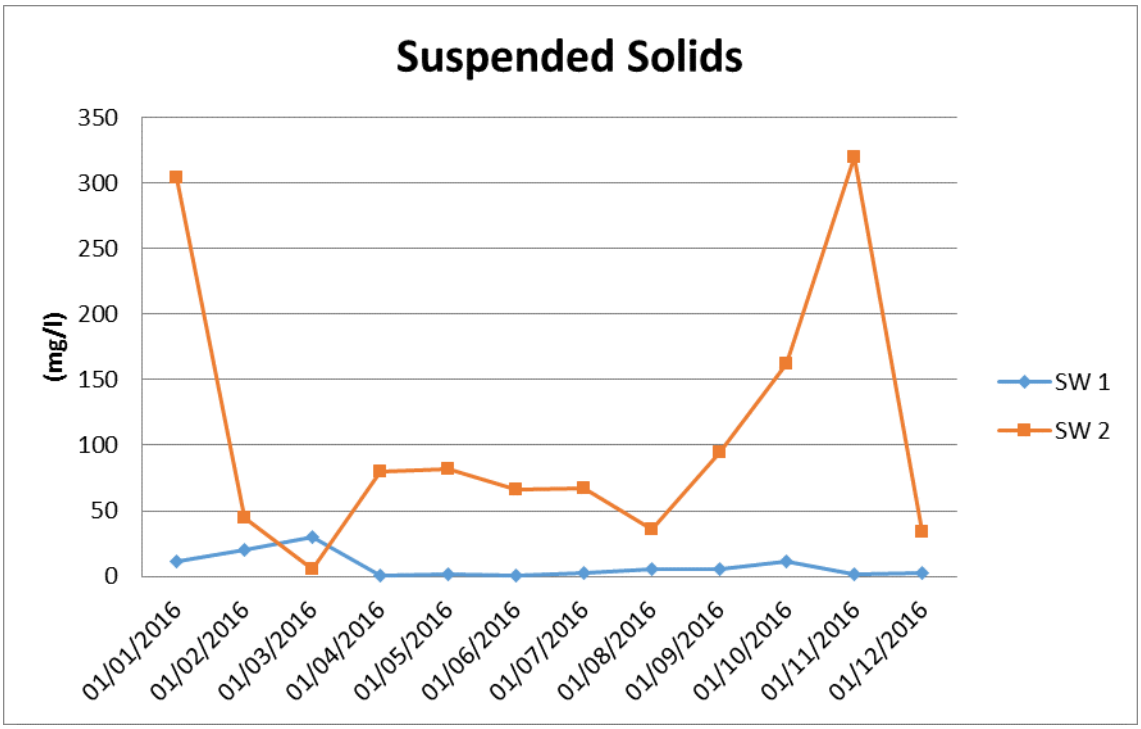
LOCATION		pH	Conductivity-Electrical 20C	Ammoniacal Nitrogen as N (LL)	Chloride as Cl	Total Suspended Solids	BOD + ATU (5 day)	EH >C6 - C40	EH >C6 - C8	EH >C8 - C10	EH >C16 - C24	EH >C24 - C40	EH >C10 - C16
		pH units	µS/cm	mg/l	mg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
EP Limit		6 - 9	N/A	0.25	N/A	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SW 1	Min	6.5	95.4	0.1	7.9	1	1	10	10	10	10	10	10
	Max	7.8	459.0	13.6	55.3	30	10	100	100	100	100	100	100
	Average	7.1	133.7	1.2	14.3	8	2	24	20	20	20	24	20
	Count	12	12	12	12	12	12	12	12	12	12	12	12
SW 2	Min	7.0	101.0	0.1	11.7	5	1	10	10	10	10	10	10
	Max	8.6	2060.0	17.0	236.0	320	21	743	100	100	421	200	122
	Average	7.9	920.8	4.2	103.3	108	5	133	26	26	72	68	37
	Count	12	12	12	12	12	12	12	12	12	12	12	12


pH
10
9
8
7
6
5
4
3
2
1
0
(pH)
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
SW 1
SW 2


Electrical Conductivity
2500
2000
1500
1000
500
0
(µS/cm)
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
SW 1
SW 2


Ammoniacal Nitrogen
(mg/l)
18
16
14
12
10
8
6
4
2
0
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
SW 1
SW 2


Chloride
(mg/l)
250
200
150
100
50
0
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
SW 1
SW 2


Suspended Solids
350
300
250
200
150
100
50
0
(mg/l)
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
SW 1
SW 2

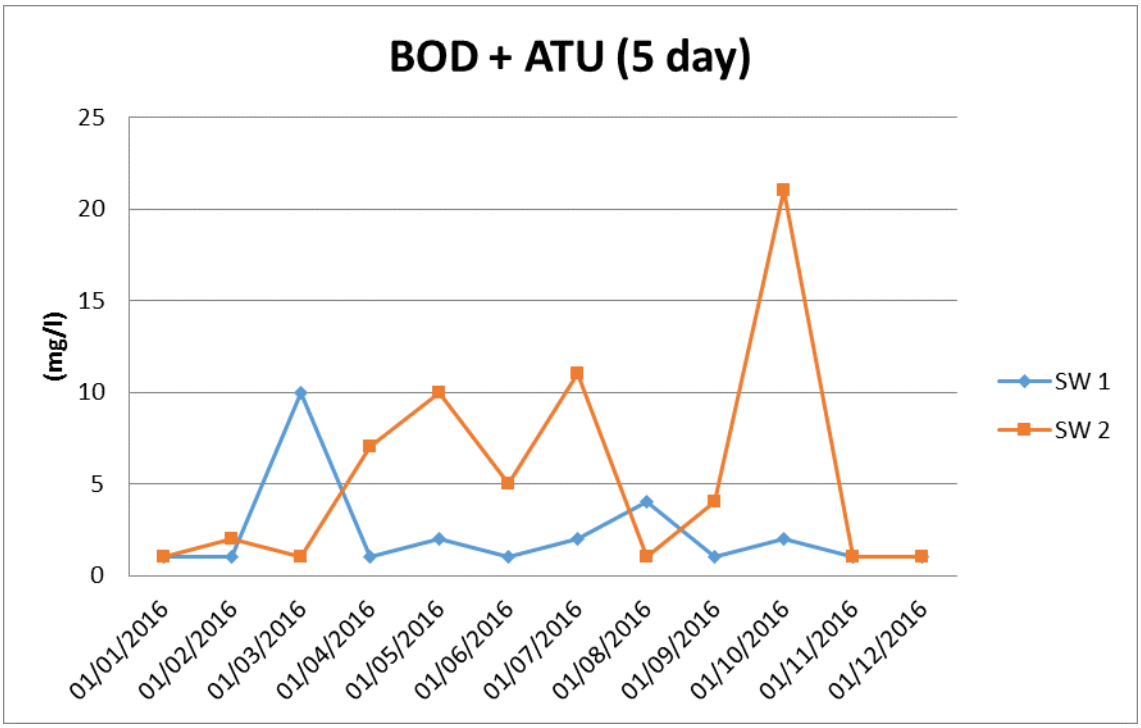

BOD + ATU (5 day)
25
20
15
10
5
0
(mg/l)
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
SW 1
SW 2

Table 2: Six monthly monitoring data, June

Parameters	Units	SW1	SW2
2,3,6 - TBA	ug/l	<0.05	<0.05
2,4 - D	ug/l	0.15	0.11
2,4 - DB	ug/l	<0.05	<0.05
2,4,5 - T	ug/l	0.1	<0.05
Bromoxynil	ug/l	<0.05	<0.05
Cadmium , Total as Cd	mg/l	<0.0006	<0.0006
COD (Total)	mg/l	36	63
Cyanide, Total as CN	mg/l	<0.009	<0.009
Dicamba	ug/l	<0.05	<0.05
Dichlorprop	ug/l	<0.05	<1.00
Dissolved Oxygen, Fixed	mg/l	7.7	4.4
Ioxynil	ug/l	<0.05	<0.05
MCPA	ug/l	<0.05	<0.05
MCPB	ug/l	<0.05	<0.05
Mecoprop	ug/l	<0.04	0.18

Parameter	Units	SW 1	SW 2
SVOC			
Phenol	ug/l	<2.0	<1.0
Bis(2-chloroethyl)ether	ug/l	<2.0	<1.0
2-Chlorophenol	ug/l	<2.0	<1.0
1,3-Dichlorobenzene	ug/l	<2.0	<1.0
1,4-Dichlorobenzene	ug/l	<2.0	<1.0
2-Methylphenol	ug/l	<2.0	<1.0
3&4-Methylphenol	ug/l	<2.0	<1.0
Dibenzofuran	ug/l	<2.0	<1.0
1,2-Dichlorobenzene	ug/l	<2.0	<1.0
Bis(2-chloroisopropyl)ether	ug/l	<2.0	<1.0
n-Nitrosodi-n-propylamine	ug/l	<2.0	<1.0
Hexachloroethane	ug/l	<2.0	<1.0
Nitrobenzene	ug/l	<2.0	<1.0
Isophorone	ug/l	<2.0	<1.0
2,4-Dimethylphenol	ug/l	<2.0	<1.0
2-Nitrophenol	ug/l	<2.0	<1.0
Bis(2-chloroethoxy)methane	ug/l	<2.0	<1.0
2,4-Dichlorophenol	ug/l	<2.0	<1.0
1,2,4-Trichlorobenzene	ug/l	<2.0	<1.0
Naphthalene	ug/l	<4.0	<2.0
Hexachlorobutadiene	ug/l	<2.0	<1.0
4-Chloro-3-methylphenol	ug/l	<2.0	<1.0
2-Methylnaphthalene	ug/l	<2.0	<1.0
2,4,6-Trichlorophenol	ug/l	<2.0	<1.0
2,4,5-Trichlorophenol	ug/l	<2.0	<1.0
2-Chloronaphthalene	ug/l	<2.0	<1.0
Dimethylphthalate	ug/l	<2.0	<1.0
2,6-Dinitrotoluene	ug/l	<2.0	<1.0
Acenaphthylene	ug/l	<2.0	<1.0
Acenaphthene	ug/l	<2.0	<1.0
2,4-Dinitrotoluene	ug/l	<2.0	<1.0
Diethylphthalate	ug/l	<2.0	<1.0
4-Nitrophenol	ug/l	<10.0	<5.0
4-Chlorophenyl phenyl ether	ug/l	<2.0	<1.0
Fluorene	ug/l	<2.0	<1.0
Diphenylamine	ug/l	<2.0	<1.0
4-Bromophenyl Phenyl Ether	ug/l	<2.0	<1.0

Parameter	Units	SW 1	SW 2
SVOC			
Hexachlorobenzene	ug/l	<2.0	<1.0
Pentachlorophenol	ug/l	<2.0	<1.0
Phenanthrene	ug/l	<2.0	<1.0
Anthracene	ug/l	<2.0	<1.0
di-n-Butylphthalate	ug/l	<2.0	<1.0
Fluoranthene	ug/l	<2.0	<1.0
Pyrene	ug/l	<2.0	<1.0
Benzyl Butyl Phthalate	ug/l	<2.0	<1.0
Benzo(a)anthracene	ug/l	<2.0	<1.0
Chrysene	ug/l	<2.0	<1.0
Bis(2-ethylhexyl)phthalate	ug/l	<10.0	<5.0
Di-n-octylphthalate	ug/l	<2.0	<1.0
Benzo(b)fluoranthene	ug/l	<2.0	<1.0
Benzo(k)fluoranthene	ug/l	<2.0	<1.0
Benzo(a)pyrene	ug/l	<2.0	<1.0
Indeno(1,2,3-c,d)pyrene	ug/l	<2.0	<1.0
Dibenz(a,h)anthracene	ug/l	<2.0	<1.0
Benzo(g,h,i)perylene	ug/l	<2.0	<1.0

Parameter	Units	SW 1	SW 2
SVOC			
Phenol	ug/l	<2.0	<1.0
Bis(2-chloroethyl)ether	ug/l	<2.0	<1.0
2-Chlorophenol	ug/l	<2.0	<1.0
1,3-Dichlorobenzene	ug/l	<2.0	<1.0
1,4-Dichlorobenzene	ug/l	<2.0	<1.0
2-Methylphenol	ug/l	<2.0	<1.0
3&4-Methylphenol	ug/l	<2.0	<1.0
Dibenzofuran	ug/l	<2.0	<1.0
1,2-Dichlorobenzene	ug/l	<2.0	<1.0
Bis(2-chloroisopropyl)ether	ug/l	<2.0	<1.0
n-Nitrosodi-n-propylamine	ug/l	<2.0	<1.0
Hexachloroethane	ug/l	<2.0	<1.0
Nitrobenzene	ug/l	<2.0	<1.0
Isophorone	ug/l	<2.0	<1.0
2,4-Dimethylphenol	ug/l	<2.0	<1.0
2-Nitrophenol	ug/l	<2.0	<1.0
Bis(2-chloroethoxy)methane	ug/l	<2.0	<1.0
2,4-Dichlorophenol	ug/l	<2.0	<1.0
1,2,4-Trichlorobenzene	ug/l	<2.0	<1.0
Naphthalene	ug/l	<4.0	<2.0
Hexachlorobutadiene	ug/l	<2.0	<1.0
4-Chloro-3-methylphenol	ug/l	<2.0	<1.0
2-Methylnaphthalene	ug/l	<2.0	<1.0
2,4,6-Trichlorophenol	ug/l	<2.0	<1.0
2,4,5-Trichlorophenol	ug/l	<2.0	<1.0
2-Chloronaphthalene	ug/l	<2.0	<1.0
Dimethylphthalate	ug/l	<2.0	<1.0
2,6-Dinitrotoluene	ug/l	<2.0	<1.0
Acenaphthylene	ug/l	<2.0	<1.0
Acenaphthene	ug/l	<2.0	<1.0
2,4-Dinitrotoluene	ug/l	<2.0	<1.0
Diethylphthalate	ug/l	<2.0	<1.0
4-Nitrophenol	ug/l	<10.0	<5.0
4-Chlorophenyl phenyl ether	ug/l	<2.0	<1.0

Parameter	Units	SW 1	SW 2
SVOC			
Fluorene	ug/l	<2.0	<1.0
Diphenylamine	ug/l	<2.0	<1.0
4-Bromophenyl Phenyl Ether	ug/l	<2.0	<1.0
Hexachlorobenzene	ug/l	<2.0	<1.0
Pentachlorophenol	ug/l	<2.0	<1.0
Phenanthrene	ug/l	<2.0	<1.0
Anthracene	ug/l	<2.0	<1.0
di-n-Butylphthalate	ug/l	<2.0	<1.0
Fluoranthene	ug/l	<2.0	<1.0
Pyrene	ug/l	<2.0	<1.0
Benzyl Butyl Phthalate	ug/l	<2.0	<1.0
Benzo(a)anthracene	ug/l	<2.0	<1.0
Chrysene	ug/l	<2.0	<1.0
Bis(2-ethylhexyl)phthalate	ug/l	<10.0	<5.0
Di-n-octylphthalate	ug/l	<2.0	<1.0
Benzo(b)fluoranthene	ug/l	<2.0	<1.0
Benzo(k)fluoranthene	ug/l	<2.0	<1.0
Benzo(a)pyrene	ug/l	<2.0	<1.0
Indeno(1,2,3-c,d)pyrene	ug/l	<2.0	<1.0
Dibenz(a,h)anthracene	ug/l	<2.0	<1.0
Benzo(g,h,i)perylene	ug/l	<2.0	<1.0
Dichlorodifluoromethane	ug/l	<1.0	<1.0
Chloromethane	ug/l	<1.0	<1.0
Chloroethane	ug/l	<1.0	<1.0
Bromomethane	ug/l	<1.0	<1.0
Trichlorofluoromethane	ug/l	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0
Dichloromethane	ug/l	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	<1.0	<1.0
2,2-Dichloropropane	ug/l	<1.0	<1.0
Chloroform	ug/l	<1.0	<1.0
Bromochloromethane	ug/l	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	<1.0	<1.0
1,1-Dichloropropene	ug/l	<1.0	<1.0
1,2-Dichloroethane	ug/l	<1.0	<1.0
Benzene	ug/l	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0
Trichloroethene	ug/l	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0
Carbon Tetrachloride	ug/l	<1.0	<1.0
Vinyl Chloride	ug/l	<0.5	<0.5
1,3-Dichloropropane	ug/l	<1.0	<1.0
Tetrachloroethene	ug/l	<1.0	<1.0
Dibromochloromethane	ug/l	<1.0	<1.0
1,2-Dibromoethane	ug/l	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0
Ethyl Benzene	ug/l	<1.0	<1.0
m&p-Xylene	ug/l	<1.0	<1.0
o-Xylene	ug/l	<1.0	<1.0
Styrene	ug/l	<1.0	<1.0

Parameter	Units	SW 1	SW 2
SVOC			
Bromoform	ug/l	<1.0	<1.0
Isopropylbenzene	ug/l	<1.0	<1.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<1.0	<1.0
n-Propylbenzene	ug/l	<1.0	<1.0
Bromobenzene	ug/l	<1.0	<1.0
2-Chlorotoluene	ug/l	<1.0	<1.0
1,3,5-Trimethylbenzene	ug/l	<1.0	<1.0
4-Chlorotoluene	ug/l	<1.0	<1.0
tert-Butylbenzene	ug/l	<1.0	<1.0
1,2,4-Trimethylbenzene	ug/l	<1.0	<1.0
sec-Butylbenzene	ug/l	<1.0	<1.0
p-Isopropyltoluene	ug/l	<1.0	<1.0
1,3-Dichlorobenzene	ug/l	<1.0	<1.0
1,4-Dichlorobenzene	ug/l	<1.0	<1.0
n-Butylbenzene	ug/l	<1.0	<1.0
1,2-Dichlorobenzene	ug/l	<1.0	<1.0
1,2-Dibromo-3-chloropropane	ug/l	<2.0	<2.0
1,2,4-Trichlorobenzene	ug/l	<1.0	<1.0
Hexachlorobutadiene	ug/l	<1.0	<1.0
Naphthalene	ug/l	<1.0	<1.0
1,2,3-Trichlorobenzene	ug/l	<1.0	<1.0
MTBE	ug/l	<1.0	<1.0

Table 3: Six monthly monitoring data, December

Parameters	Units	SW1	SW2
2,3,6 - TBA	**ug/l**	<0.05	<0.05
2,4 - D	**ug/l**	<0.05	<0.05
2,4 - DB	**ug/l**	<0.05	<0.05
2,4,5 - T	**ug/l**	<0.05	<0.05
Bromoxynil	**ug/l**	<0.05	<0.05
Cadmium , Total as Cd	**mg/l**	<0.0006	<0.0006
COD (Total)	**mg/l**	35	37
Cyanide, Total as CN	**mg/l**	<0.009	<0.009
Dicamba	**ug/l**	<0.05	<0.05
Dichlorprop	**ug/l**	<0.05	<0.05
Dissolved Oxygen, Fixed	**mg/l**	8.3	11.4
Ioxynil	**ug/l**	<0.05	<0.05
MCPA	**ug/l**	<0.05	<0.05
MCPB	**ug/l**	<0.05	<0.05
Mecoprop	**ug/l**	<0.04	0.05

Parameter	Units	SW 1	SW 2
SVOC			
Phenol	ug/l	<1.0	<2.0
Bis(2-chloroethyl)ether	ug/l	<1.0	<2.0
2-Chlorophenol	ug/l	<1.0	<2.0
1,3-Dichlorobenzene	ug/l	<1.0	<2.0
1,4-Dichlorobenzene	ug/l	<1.0	<2.0
2-Methylphenol	ug/l	<1.0	<2.0
3&4-Methylphenol	ug/l	<1.0	<2.0
Dibenzofuran	ug/l	<1.0	<2.0
1,2-Dichlorobenzene	ug/l	<1.0	<2.0
Bis(2-chloroisopropyl)ether	ug/l	<1.0	<2.0
n-Nitrosodi-n-propylamine	ug/l	<1.0	<2.0
Hexachloroethane	ug/l	<1.0	<2.0
Nitrobenzene	ug/l	<1.0	<2.0
Isophorone	ug/l	<1.0	<2.0
2,4-Dimethylphenol	ug/l	<1.0	<2.0
2-Nitrophenol	ug/l	<1.0	<2.0
Bis(2-chloroethoxy)methane	ug/l	<1.0	<2.0
2,4-Dichlorophenol	ug/l	<1.0	<2.0
1,2,4-Trichlorobenzene	ug/l	<1.0	<2.0
Naphthalene	ug/l	<2.0	<4.0
Hexachlorobutadiene	ug/l	<1.0	<2.0
4-Chloro-3-methylphenol	ug/l	<1.0	<2.0
2-Methylnaphthalene	ug/l	<1.0	<2.0
2,4,6-Trichlorophenol	ug/l	<1.0	<2.0
2,4,5-Trichlorophenol	ug/l	<1.0	<2.0
2-Chloronaphthalene	ug/l	<1.0	<2.0
Dimethylphthalate	ug/l	<1.0	<2.0
2,6-Dinitrotoluene	ug/l	<1.0	<2.0
Acenaphthylene	ug/l	<1.0	<2.0
Acenaphthene	ug/l	<1.0	<2.0
2,4-Dinitrotoluene	ug/l	<1.0	<2.0
Diethylphthalate	ug/l	<1.0	<2.0
4-Nitrophenol	ug/l	<5.0	<10.0
4-Chlorophenyl phenyl ether	ug/l	<1.0	<2.0
Fluorene	ug/l	<1.0	<2.0
Diphenylamine	ug/l	<1.0	<2.0
4-Bromophenyl Phenyl Ether	ug/l	<1.0	<2.0

Parameter	Units	SW 1	SW 2
SVOC			
Hexachlorobenzene	ug/l	<1.0	<2.0
Pentachlorophenol	ug/l	<1.0	<2.0
Phenanthrene	ug/l	<1.0	<2.0
Anthracene	ug/l	<1.0	<2.0
di-n-Butylphthalate	ug/l	<1.0	<2.0
Fluoranthene	ug/l	<1.0	<2.0
Pyrene	ug/l	<1.0	<2.0
Benzyl Butyl Phthalate	ug/l	<1.0	<2.0
Benzo(a)anthracene	ug/l	<1.0	<2.0
Chrysene	ug/l	<1.0	<2.0
Bis(2-ethylhexyl)phthalate	ug/l	<5.0	<10.0
Di-n-octylphthalate	ug/l	<1.0	<2.0
Benzo(b)fluoranthene	ug/l	<1.0	<2.0
Benzo(k)fluoranthene	ug/l	<1.0	<2.0
Benzo(a)pyrene	ug/l	<1.0	<2.0
Indeno(1,2,3-c,d)pyrene	ug/l	<1.0	<2.0
Dibenz(a,h)anthracene	ug/l	<1.0	<2.0
Benzo(g,h,i)perylene	ug/l	<1.0	<2.0

Parameter	Units	SW 1	SW 2
VOC			
Dichlorodifluoromethane	ug/l	<1.0	<1.0
Chloromethane	ug/l	<1.0	<1.0
Chloroethane	ug/l	<1.0	<1.0
Bromomethane	ug/l	<1.0	<1.0
Trichlorofluoromethane	ug/l	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0
Dichloromethane	ug/l	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	<1.0	<1.0
2,2-Dichloropropane	ug/l	<1.0	<1.0
Chloroform	ug/l	<1.0	<1.0
Bromochloromethane	ug/l	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	<1.0	<1.0
1,1-Dichloropropene	ug/l	<1.0	<1.0
1,2-Dichloroethane	ug/l	<1.0	<1.0
Benzene	ug/l	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0
Trichloroethene	ug/l	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0
Carbon Tetrachloride	ug/l	<1.0	<1.0
Vinyl Chloride	ug/l	<0.5	<0.5
1,3-Dichloropropane	ug/l	<1.0	<1.0
Tetrachloroethene	ug/l	<1.0	<1.0
Dibromochloromethane	ug/l	<1.0	<1.0
1,2-Dibromoethane	ug/l	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0
Ethyl Benzene	ug/l	<1.0	<1.0
m&p-Xylene	ug/l	<1.0	<1.0
o-Xylene	ug/l	<1.0	<1.0
Styrene	ug/l	<1.0	<1.0

Parameter	Units	SW 1	SW 2
VOC			
Bromoform	ug/l	<1.0	<1.0
Isopropylbenzene	ug/l	<1.0	<1.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<1.0	<1.0
n-Propylbenzene	ug/l	<1.0	<1.0
Bromobenzene	ug/l	<1.0	<1.0
2-Chlorotoluene	ug/l	<1.0	<1.0
1,3,5-Trimethylbenzene	ug/l	<1.0	<1.0
4-Chlorotoluene	ug/l	<1.0	<1.0
tert-Butylbenzene	ug/l	<1.0	<1.0
1,2,4-Trimethylbenzene	ug/l	<1.0	<1.0
sec-Butylbenzene	ug/l	<1.0	<1.0
p-Isopropyltoluene	ug/l	<1.0	<1.0
1,3-Dichlorobenzene	ug/l	<1.0	<1.0
1,4-Dichlorobenzene	ug/l	<1.0	<1.0
n-Butylbenzene	ug/l	<1.0	<1.0
1,2-Dichlorobenzene	ug/l	<1.0	<1.0
1,2-Dibromo-3-chloropropane	ug/l	<2.0	<2.0
1,2,4-Trichlorobenzene	ug/l	<1.0	<1.0
Hexachlorobutadiene	ug/l	<1.0	<1.0
Naphthalene	ug/l	<1.0	<1.0
1,2,3-Trichlorobenzene	ug/l	<1.0	<1.0
MTBE	ug/l	<1.0	<1.0

Appendix 6

Appendix 6. Dust Monitoring Results

	Dust Monitoring 2017		**1**	**2**	**3**
Q2	Number of Days Exposed		13	13	13
	Mass of Undissolved Solids	mg	13.7	21.8	16.1
	Deposited Dust, Total, Calc.	mg/m2/day	26	41	31
	Frisbee Diameter	mm	227	227	227
Q3	Number of Days Exposed		34	34	34
	Mass of Undissolved Solids	mg	62.8	95.2	51.3
	Deposited Dust, Total, Calc.	mg/m2/day	46	69	37
	Frisbee Diameter	mm	227	227	227
Q4	Number of Days Exposed		34	34	34
	Mass of Undissolved Solids	mg	1.9	4.7	32.3
	Deposited Dust, Total, Calc.	mg/m2/day	<10	<10	23
	Frisbee Diameter	mm	230	230	230

Caulmert Limited

InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG
Tel: 01248 672671
Fax: 01248 672601
Email: contact@caulmert.com
Web: www.caulmert.com