CAULMERT LIMITED

Engineering, Environmental & Planning
Consultancy Services

Bryn Posteg Landfill Site

Potters Waste Management

Annual Monitoring Review

January - December 2016

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Doc ref: 2601.7.POT.SDB.DB.A0

Feburary 2017

Caulmert
Engineering, Environmental and Planning

APPROVAL RECORD

Site:	**Bryn Posteg Landfill Site**
Client:	**Potters Waste Management**
Document Title:	**Annual Monitoring Review (January – December 2016)**
Document Ref:	**2601.7.POT.SDB.DB**
Report Status:	**A0**
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Approved	Diana Brookshaw	**Date**	05/05/2017

DISCLAIMER

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APPENDICES

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 2016.

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.

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 land filling 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 four residential receptors located within approximately 325 m of the waste mass, these are:

- Valley View, 200 m to the north west;
- Rhoswen, 250 m to the east;
- Pant, 260 m to the east; and
- Penbryn Du, 325 m to the north.

1.3 Environmental Context

Geology

1.3.1 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.

1.3.2 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

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

1.3.4 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

1.3.5 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 Summary of 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. Average concentrations in the boreholes ranged between 0.4 % (at 13 locations) and 71.9 % in G20.

2.1.3 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 1.6 % (G01, G30 and G39) and a maximum of 32.9 % in G19. Locations G13, G16 – G18 and G32 remained below the trigger limit throughout the review period

2.1.4 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 No trace gas monitoring was carried out during 2016. A trace gas monitoring survey is due to be completed in 2017 and will be submitted separately.

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 14th & 15th September 2016. Monitoring reports are enclosed in Appendix 2.

2.4 Landfill Gas from Capped Surfaces

2.4.1 No surface emissions surveys were undertaken during 2016. A Flame Ionisation Detector (FID) walkover survey of the landfill is due to be carried out in 2017 and will be submitted separately.

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

3. GROUNDWATER

3.1 Summary of Monitoring Results

3.1.1 Groundwater is sampled at locations W1 – W9 as required by Table S4.5 in the EP. W10 is no longer monitored. Groundwater samples are analysed monthly for pH, electrical conductivity and sulphate. In March, June and September, groundwater samples were analysed for the monthly and quarterly suites. In December, samples were analysed for the monthly and quarterly suite and an additional annual suite. All monitoring data is included in Appendix 3.

3.1.2 Ammoniacal nitrogen concentrations remained below the 2 mg/l EP limit in all groundwater locations throughout 2016. A maximum concentration was detected at W4 at 1.43 mg/l during July 2016.

3.1.3 pH ranged between a minimum of 5.6 in W5, and a maximum of 8.6 in W2. Electrical conductivity ranged between a minimum of 66.0 µS/cm in W6 and a maximum of 1630 µS/cm in W1. Sulphate concentrations ranged between <4.4 mg/l in W2, W3 and W4 to 92.1 mg/l in W3.

3.1.4 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 316.25 mg/l. Chloride concentration within W1 reduced over the review period to a minimum of 176 mg/l during November.

3.1.5 W1 and W2 are situated very close to the B4518 Llanidloes to Tylwch Road, in previous annual reviews it was noted that the groundwater quality within these boreholes may be influenced by the application of road salt during the winter months. The chloride concentration within W2 remained below the EP limit throughout this review period and decreased from a maximum of 46.8 mg/l during February to 29.3 mg/l in September. Chloride concentration within W1 was also highest during the first quarter, with a maximum of 513 mg/l in January. Following this the chloride concentration decreased over the spring and summer months and further into November with a minimum of 176 mg/l. The fluctuations in W1 during 2016 again indicate that this location may be influenced by road salt, with highest concentrations being detected in the winter and decreasing into spring and summer. This is a similar pattern to that identified during 2014 and 2015.

3.1.6 No ethyl benzene or xylenes were detected in any of the groundwater monitoring locations. 2, 4 – D was above the EP Limit (0.1 µg/l) at 0.19 µg/l and 0.23 µg/l in W1 and W5 respectively, during the second quarter. 2,4-D was also detected in low concentrations at W3 and W4 but remained below the EP limit and was not detected at any other locations during 2016.

3.1.7 Mecoprop was detected above the trigger limit at W5 during the second and third quarters with concentrations of 0.23 µg/l and 0.18 µg/l respectively. Mecoprop was also detected below the trigger limit at W5 in the first and fourth quarters of 2016 and throughout the year at W4.

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

3.1.9 In December, a full annual suite was undertaken, including a hazardous substances suite. Six 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 within the groundwater, with the exception of one occurrence of bromoethane in W2 alone. Annual suite results are included in Appendix 3.

Table 1: Groundwater Hazardous substances suite – detected parameters

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Arsenic, Ultra Low Total as As	mg/l	0.022	<0.0010	0.035	0.018	0.0012	0.059	0.0034	0.0031	<0.0010
EH >C24 - C40	ug/l	<40	52	32	<40	<20	<20	<10	<10	<10
EH >C6 - C40	ug/l	<40	65	32	<40	<20	<20	<10	<10	<10
EH >C6 - C8	ug/l	<40	13	<20	<40	<20	<20	<10	<10	<10
Selenium Ultra Low Total as Se	mg/l	<0.0008	<0.0008	0.0044	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Bromomethane	ug/l	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

3.2 Groundwater Levels

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

4. LEACHATE

4.1 Summary of Monitoring Results

Leachate Sumps

4.1.1 Leachate was analysed monthly for pH and ammoniacal nitrogen at leachate sumps 1 – 6. Sump 3 was not sampled during 2016. Sump 6 was only sampled in the first quarter of 2016 and Sump 7 was sampled in August alone. Treated leachate (final discharge) was tested monthly for pH, ammoniacal nitrogen, sulphate, suspended solids, COD, and a TPH range (C6 – C40).

4.1.2 Highest ammoniacal nitrogen concentrations were detected in Sump 2 during 2016. Concentrations in this sump ranged between 1370 mg/l and 2660 mg/l. Ammoniacal nitrogen concentrations at Sump 4 (average concentration of 716.4 mg/l) and Sump 5 (average concentration of 770.8 mg/l) followed a similar trend, initially decreasing from January to March, then increasing by April and remained mostly stable for the remainder of the year. Ammoniacal nitrogen concentration in Sump 1 (average of concentration 379.0 mg/l) was similarly low in the first quarter of 2016 but fluctuated throughout the remainder of the year. Concentration within Sump 7 was 1680 mg/l during August.

4.1.3 pH in the leachate ranged between a minimum of 6.8 in Sump 6 to a maximum of 9.3 in Sump 2.

4.1.4 Landfill leachate was also analysed for a larger hazardous substances annual suite in December. 31 parameters were detected in the leachate chambers and are presented in Table 2 below. This is a significant increase from 215, when only 12 hazardous substances were detected within the landfill leachate.

Table 2: Landfill Leachate Hazardous substances suite – detected parameters

Sample Matrix	units	Leachate 1	Leachate 2	Leachate 4	Leachate 5
1,1-Dichloroethane	ug/l	0.35	<0.10	<0.10	<1.00
1,2,4-Trimethylbenzene	ug/l	3.3	7.7	2	<10.0
1,2-Dichlorobenzene	ug/l	0.29	0.39	0.36	<1.00
1,2-Dichloroethane	ug/l	0.56	<0.50	2.62	<5.00
1,3,5-Trimethylbenzene	ug/l	1	1.8	<1.0	<10.0
1,4-Dichlorobenzene	ug/l	1.25	9.75	0.87	1.09
2,4-Dimethylphenol	ug/l	5.9	51	<20.0	<20.0
2-Methylphenol	ug/l	11.9	46.6	<20.0	<20.0
3&4-Methylphenol	ug/l	130	586	33.4	<20.0
Benzene	ug/l	2.08	5.43	1.57	2.07
Bis(2-ethylhexyl)phthalate	ug/l	19.7	127	<100	<100
Chlorobenzene	ug/l	0.63	0.56	0.68	<1.00
Cyanide, Total as CN	mg/l	<0.009	0.047	0.036	0.018
Dichlobenil	ng/l	116	<165	<165	<165
Dichlorprop	ug/l	0.57	19.9	<6.5	<6.0
EH >C10 - C16	ug/l	2030	2320	532	358
EH >C16 - C24	ug/l	150	600	233	239
EH >C24 - C40	ug/l	<100	809	562	216

Sample Matrix	units	Leachate 1	Leachate 2	Leachate 4	Leachate 5
EH >C6 - C40	ug/l	2350	3940	1330	812
EH >C8 - C10	ug/l	164	216	<200	<200
Ethyl Benzene	ug/l	5.35	12.5	4.31	5.88
Isopropylbenzene	ug/l	<1.0	1.8	<1.0	<10.0
m&p-Xylene	ug/l	11.5	18.5	10.1	3.36
Mecoprop	ug/l	6.95	84.8	42	40.1
Naphthalene	ug/l	2	6.1	<1.0	<10.0
o-Xylene	ug/l	5.01	7.99	4.46	3.88
Phenol	ug/l	90.6	166	21.4	<20.0
p-Isopropyltoluene	ug/l	8.5	23	2.4	<10.0
Styrene	ug/l	0.26	0.89	0.39	<2.00
Toluene	ug/l	7.34	23.2	4.97	<5.00
Vinyl Chloride	ug/l	0.14	<0.10	0.12	<1.00

Treated Leachate

4.1.5 Several exceedances were recorded during the review period within the treated leachate. Concentrations of ammoniacal nitrogen exceeded the EP limit of 150 mg/l from January through April and again in September and October, with a maximum concentration of 656 mg/l (March).

4.1.6 The concentration of suspended solids within the treated leachate exceeded the EP limit in January – May, August and October – December with a maximum concentration of 1470 mg/l (January).

4.1.7 COD concentrations exceeded the EP limit of 1000 mg/l on all occasions except during February. Concentrations ranged between 880 mg/l in February and 2970 mg/l in August.

4.1.8 Concentrations of TPH were detected on all of the monitoring rounds, exceeding the trigger level of 'nil'. Concentrations ranged between 353 µg/l and 2730 µg/l. This maximum is significantly lower than the maximum detected during 2015 (4070 µg/l).

4.1.9 During June and December the Final Discharge was analysed for a 6 monthly suite. December samples were also analysed for additional hazardous substances. Table 3 below displays the detected parameters.

Table 3: Treated Leachate Hazardous substances suite – detected parameters

Analyte	Units	June	December
Cyanide, Total as CN	mg/l	0.88	0.845
Dichlorprop	µg/l	9.08	<8.5
Mecoprop	µg/l	48.6	36.8
EH >C16 - C24	ug/l	171	107
EH >C24 - C40	ug/l	240	454
EH >C10 - C16	ug/l	370	312
Dicamba	ug/l	<5.00	2.02
Phenol-d6	ug/l	49.4	<20.0
Chloromethane	ug/l	35.8	76.7
Bromomethane	ug/l	20	113

4.1.10 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 trigger level exceedances are recorded. The monitoring spreadsheet for this review period is included in Appendix 4, as requested by the Environment Agency. A summary of this data is included in Table 4 below:

Table 4: Treated leachate daily monitoring summary (January - December 2016)

DATE	pH (METER)	pH (STRIP)	Ammoniacal Nitrogen (mg/l)	Dissolved Oxygen (mg/l)	Temperature (°C)
Min	4.8	5.8	10.0	0.1	6.2
Max	14.0	9.0	600.0	10.9	28.8
Average	9.3	7.2	181.9	4.7	16.3
Count	247	247	247	247	247

4.1.11 The observed values represent a deterioration of treated leachate quality during Q4 compared to Q3. This is concurrent with decrease in temperature due to the onset of winter - low temperature decreases the rate of nitrification (treatment of leachate)[2]. A biomass boiler and heat exchange system is currently being commissioned, which will maintain the temperature of the leachate treatment lagoon within the optimum range for the biological treatment process. This is anticipated to significantly improve the quality of the treated leachate, particularly during the winter months.

4.1.12 Approximately 21,118 m^3 of treated leachate was discharged between the 1st of January and the 31st of December 2016.

4.1.13 Additionally to the leachate processed on site at the leachate treatment plant, 24,229 m^3 of leachate was tankered off site to maximize extraction from the site and lower leachate levels.

4.2 Leachate Levels

4.2.1 Leachate levels are measured monthly. Sump 2 and Sump 3 were sealed with gas extraction well heads installed to improve extraction in these areas, however monitoring access was made available for the final quarter of 2016. Sump 9C and Sump 9D were also sealed to improve gas extraction during January and February but were available for leachate level monitoring for the remainder of 2016. Level data and time series graphs are presented in Appendix 4.

4.2.2 Leachate levels in Sump 1 remained below the 1 m EP limit throughout 2016.

[2] Leachate Treatment System, Current Treatment Process, Process Upgrade and Implementation, Caulmert, 2233.1.POT.AKS.JDM.A1, May 2015

4.2.3 Leachate levels in Sumps 2 and 3 were above the compliance limit when available for monitoring during the final quarter of 2016. Average values for leachate above the base was 3.1 m and 3.5 m respectively.

4.2.4 Sump 4 and 5 leachate levels were highest during the first quarter with maximums of 8.66 m above base and 6.89 m above base respectively. Both locations leachate levels decreased and remained below the compliance limit from April to July. Sump 4 was slightly above the compliance at 1.01 m above base in August, then ranged from 2.85 m above base in September to 1.25 m above base in December. Sump 5 similarly contained leachate levels above the compliance limit from September to December, ranging from 2.15 m above base to 1.65 m above base.

4.2.5 Sump 9C was not accessible during January and February but was above the compliance limit during March and April at 1.88 m above base and 1.48 m above base respectively. This decreased during May and June and did not exceed the limit, however the level was calculated as below the cell base during June. The location was surveyed in July to improve the accuracy of leachate level recordings. Leachate level in Sump 9C was 9.61 m above base to 9.91 m above base from July to December 2016.

4.2.6 Sump 9D was similarly monitored from March onwards. Leachate levels were above the compliance limit during March, April and May at 2.77 m, 2.37 m and 1.07 m above base respectively. Levels were 0.07 m above base during June. Sump 9D was also surveyed during July and leachate levels varied from this point onwards from 9.96 m above base to 10.56 m above base during the remainder of 2016.

4.2.7 It is likely that leachate levels within Sump 9C and Sump 9D are representative of perched leachate, as the sudden increase in level is unlikely due to accumulation above the base of the cell. No leachate extraction malfunctions were recorded for the timeframe when these sumps recorded very high levels, so it is unlikely that leachate accumulated to this elevation.

5. SURFACE WATER

5.1 Summary of Monitoring Results

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 exceeded the respective trigger limits on occasion at both SW1 and SW2 during 2016. Ammoniacal nitrogen concentration was above the trigger limit on average at 1.6 mg/l and 4.2 mg/l in SW1 and SW2 respectively.

5.1.3 Suspended solids concentration exceeded the trigger limit on average in SW2 at 108 mg/l but remained below the trigger limit at SW1 throughout 2016.

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

5.1.5 Three hazardous substances were detected in the surface water locations as part of the quarterly suites in June and December. Concentrations of the detected substances are presented in Table 5 below.

Table 5: Surface Waters Hazardous substances suite – detected parameters

Parameters	Units	SW1	SW2	SW1	SW2
	date	June	June	December	December
2,4 - D	ug/l	0.15	0.11	<0.05	<0.05
2,4,5 - T	ug/l	0.1	<0.05	<0.05	<0.05
Mecoprop	ug/l	<0.04	0.18	<0.04	0.05

6. DUST

6.1 Monitoring

6.1.1 Dust monitoring at the site is carried out quarterly as outlined in the EP.

Table 6: Dust Monitoring Results

Dust	Concentration (mg/m²/day)
Period	**19/01/2016 - 18/02/2016**
BP 1	19
BP 2	640
BP 3	36
Period	**20/05/2016 - 23/06/2016**
BP 1	110
BP 2	49
BP 3	15
Period	**10/08/2016 -21/09/2016**
BP 1	50
BP 2	52
BP 3	16
Period	**19/10/2016 - 19/12/2016**
BP 1	<10
BP 2	<10
BP 3	43

6.1.2 Concentrations at BP2 exceeded the trigger limit of 200 mg/m²/day during the first quarter at 640 mg/m²/day. Dust concentrations remained below the EP limit at all locations for the remainder of 2016.

7. ANNUAL PRODUCTION / TREATMENT

7.1 Introduction

7.1.1 Annual production/treatment at Bryn Posteg during the period 1st January to 31st December 2016 is reported in accordance with Table S5.2 in the EP, see Table 7 below:

Table 7: Annual Production/Treatment

Annual production/treatment	
Leachate:	**Cubic metres/year:**
Disposed of off-site;	24229
Disposed of to any onsite effluent treatment plant;	21118
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;	0.152 million*
Combustion in gas engines;	4.3 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 8 below, which is a reproduction of Table S5.3 in the permit.

Table 8: Performance Parameters

Parameter	Frequency of assessment	Annual total	Unit
Energy Used (including for leachate treatment)	Annually	135*	MWh of Electricity

* estimated

8.1.2 It should be noted that 8535 MWh of energy was exported from the site during the same time period.

9. TOPOGRAPHICAL SURVEY

9.0.1 A topographical survey was undertaken at the site in March 2017.

9.0.2 The net volumetric difference between the most recent topographical survey (March 2017) and the annual topographical survey from January 2016 has been calculated as 84,700 m^3.

9.0.3 An assessment of the settlement behavior of the landfill body based on the difference between the most recent topographical survey and the January 2016 topographical survey for the areas of the landfill which did not receive waste between surveys is included in drawing number 2601.ISO.01 in Appendix 1.

9.0.4 A calculation of the remaining capacity gives a total airspace of 544,000 m^3 to the final restored pre-settlement shape.

9.0.5 Due to the nature of the waste accepted at the site, no WAC compliance testing has been required.

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 31 monitoring locations.

10.1.3 Landfill gas concentration detected in the perimeter boreholes in this review period are similar to those detected in 2015.

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

10.3 Leachate

10.3.1 Leachate levels in Sump 1 remained below the 1 m EP limit throughout the review. Sumps 2 and 3 were made available for leachate level monitoring during the fourth quarter of 2016 and were above the compliance limit. Sumps 4 and 5 were above the leachate level compliance limit for the first quarter but decreased to remain in compliance for the second quarter. Levels then rose at both locations and were above the compliance limit from September to December.

10.3.2 Sumps 9C and 9D were above the leachate level compliance limit early in 2016, then decreased by June. Following a topographical survey of the locations however, leachate levels were recorded at an average of 9.8 m above base and 10.3 m above base respectively from July to December.

10.3.3 Highest ammoniacal nitrogen concentrations were detected in Sump 2 during 2016. 31 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 ammoniacal nitrogen, suspended solids, COD and TPH were recorded. Treated leachate is not discharged if EP limit exceedances are recorded. A total of ten parameters from the hazardous substances suite were detected during 2016.

10.3.5 Approximately 21,118 m3 of treated leachate was discharged from the site and 24,229 m3 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.

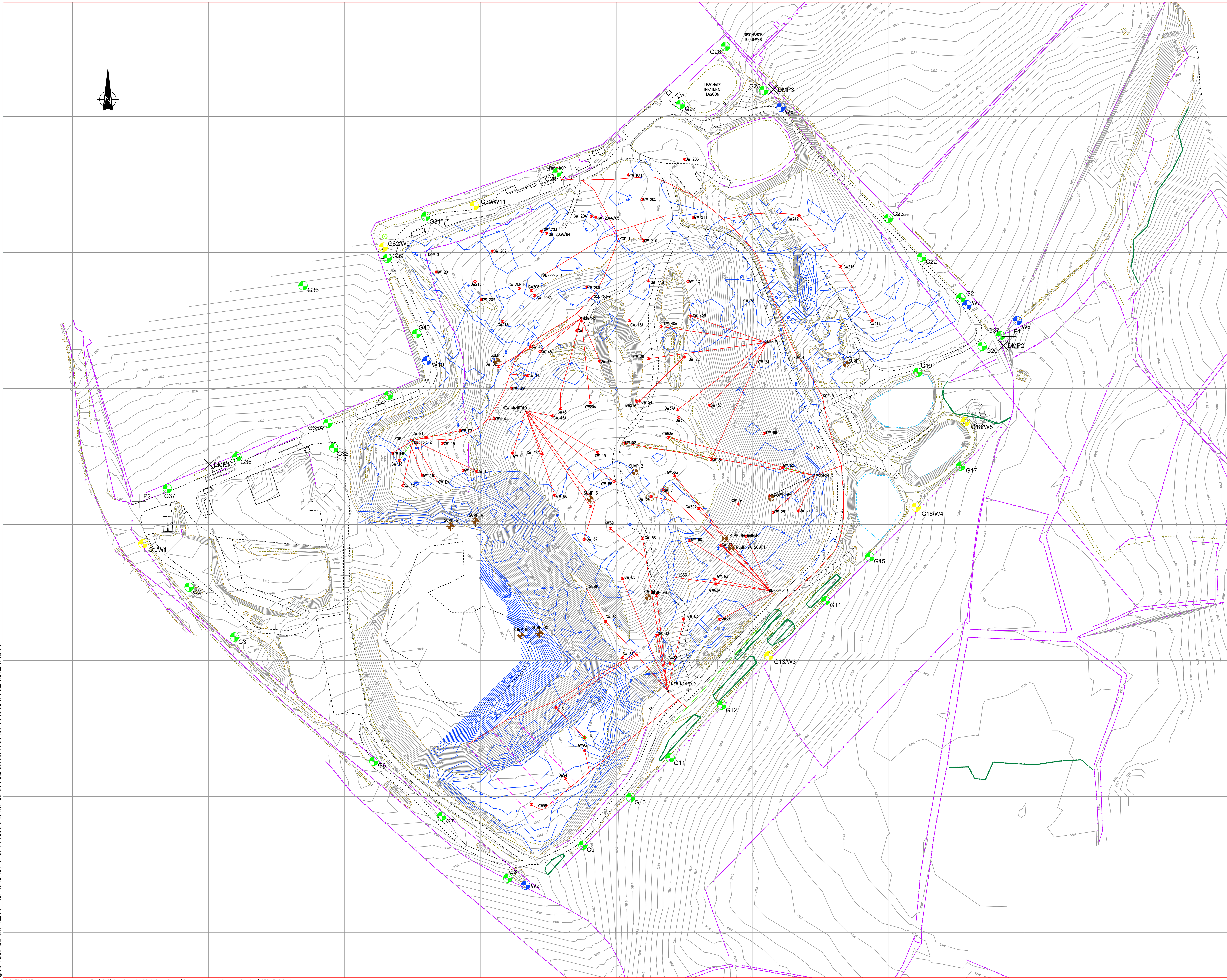
10.4.2 Ammoniacal nitrogen concentration exceeded the EP limit on one occasions at SW1 and seven times at SW2. Suspended solids concentrations exceeded the EP limit on eight occasions in SW2.

10.4.3 Five hazardous substances were detected in SW1 as part of the annual suite in December.

10.5 Dust

10.5.1 Dust concentrations exceeded the EP Limit at BP2 during the first quarter of 2016. Concentrations remained below the EP limit at all locations for the remainder of the review period.

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	

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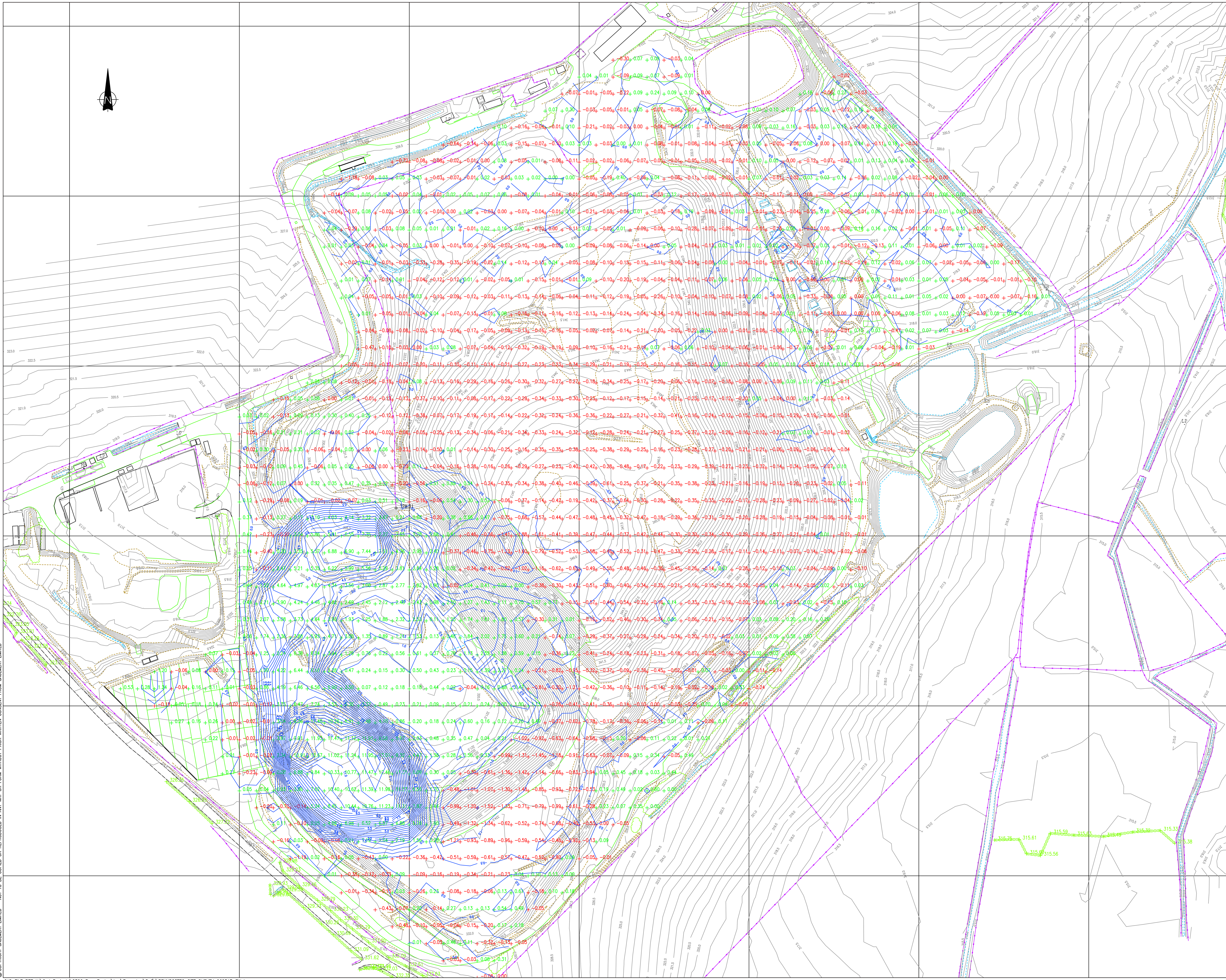
CAD FILE REF: \\caulmert.local\cmcore\Files\CAD\Cad Projects\2306 Bryn Posteg\Drawings\Current Working Drawings\2306.EMP.01.dwg

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



NOTES

1. SURVEY INFORMATION PROVIDED BY POTTERS WASTE MANAGEMENT. SURVEY DATED 06.03.2017
2. ALL LEVELS IN METRES ABOVE ORDNANCE DATUM.
3. DO NOT SCALE FROM THIS DRAWING

LEGEND

+ 5.17 LEVEL DIFFERENCE POSITIVE BETWEEN JANUARY 2016 SURVEY AND MARCH 2017 SURVEY

+ 5.17 AREAS SETTLED – LEVEL DIFFERENCE NEGATIVE BETWEEN JANUARY 2016 SURVEY AND MARCH 2017 SURVEY

— 0.5 — LEVEL DIFFERENCE CONTOURS

REV	MODIFICATIONS	BY	RE	AP	DATE

POTTERS WASTE MANAGEMENT

BRYN POSTEG LANDFILL SITE

LEVEL DIFFERENCE BETWEEN JAN 2016 AND MARCH 2017

DRAWN BY	EW	DATE	22.03.2017
REVIEWED BY	SOB	SCALE @ A1	1:1000
AUTHORISED BY	SOB	ISSUE P	REVISION -
DRAWING NUMBER	2601.ISO.01		

Caulmert
Engineering, Environmental and Planning

WWW.CAULMERT.COM

CAD FILE REF: N:\Cad Projects\2306 Bryn Posteg\Lss\From Lss\Dxf's\BRYNPOSTEG_SITE SURVEY_060317_EW.dwg

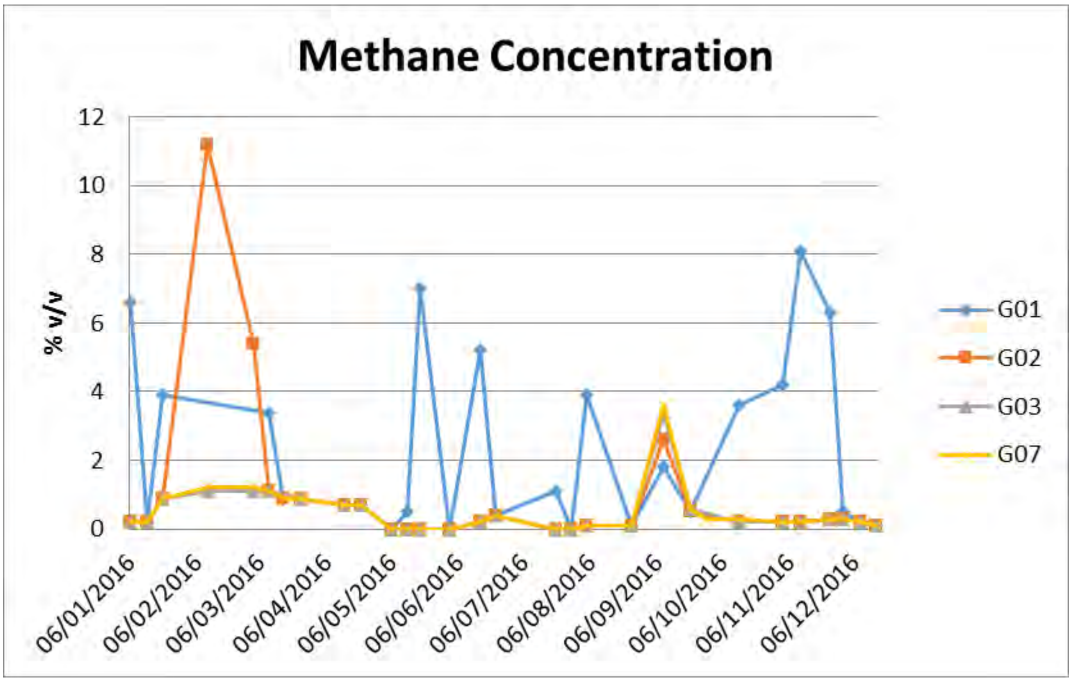
Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG Company Registered No: 06716319

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	8.1	2.4	0.0	4.1	1.6	9.8	20.7	16.7	30
G02	0.0	11.2	1.0	0.0	3.3	0.4	19.2	21.5	20.6	29
G03	0.0	3.4	0.5	0.0	3.0	1.3	8.1	20.7	17.0	29
G07	0.0	3.6	0.5	0.0	4.3	2.3	16.7	20.8	19.1	30
G08	0.0	3.6	0.5	0.0	3.6	0.6	17.1	22.0	20.2	31
G09	0.0	3.6	0.5	0.0	2.1	0.2	20.3	22.1	21.2	30
G10	0.0	3.6	0.5	0.0	8.7	3.1	12.2	21.5	17.7	30
G11	0.0	1.2	0.4	0.0	2.4	0.6	18.2	22.1	20.7	30
G12	40.5	93.4	68.8	2.8	4.9	3.8	0.3	8.2	4.1	30
G13	0.0	1.2	0.4	0.0	0.4	0.0	20.3	22.5	21.4	30
G14	0.0	1.2	0.4	0.0	3.9	2.9	16.0	21.3	17.8	30
G15	0.0	1.2	0.4	1.1	4.8	2.3	10.3	19.1	16.7	30
G16	0.0	1.2	0.4	0.0	0.1	0.0	20.4	22.7	21.5	30
G17	0.0	1.2	0.4	0.0	0.3	0.1	20.3	22.7	21.5	31
G18	0.0	1.2	0.4	0.0	0.2	0.0	20.7	22.8	21.5	30
G19	52.4	83.0	71.4	19.4	38.9	32.9	0.2	2.5	0.4	30
G20	48.1	90.6	71.9	8.4	38.9	28.3	0.1	3.9	0.8	30
G21	1.2	78.7	50.0	0.0	22.3	12.9	0.1	21.2	2.9	30
G22	29.0	82.8	67.8	8.8	27.7	20.1	0.1	12.2	0.9	30
G23	0.0	70.3	14.4	5.8	13.3	9.4	0.1	3.6	0.9	30
G24	0.0	61.7	8.7	0.5	35.7	5.0	1.7	21.8	17.3	31
G25	27.5	84.8	51.0	6.1	20.8	13.0	0.1	8.6	1.4	30
G26	0.0	1.2	0.4	0.2	3.9	2.2	16.9	21.0	19.0	30
G27	0.0	42.0	2.4	0.0	18.2	2.4	2.3	22.6	19.3	24
G29	0.0	19.8	1.8	0.0	4.7	0.6	8.7	22.3	20.3	32
G30	0.0	23.8	5.6	0.0	4.6	1.6	10.0	22.5	17.8	29
G31	0.0	1.2	0.4	0.3	6.8	3.1	10.9	21.9	17.9	29
G32	0.0	1.1	0.4	0.0	1.5	0.3	19.8	22.3	21.3	31
G35	0.0	67.6	26.8	0.0	36.5	15.4	0.2	22.1	11.2	28
G36	0.1	22.5	5.3	0.3	8.6	2.8	5.7	21.6	16.8	30
G37	0.0	1.1	0.4	0.0	3.2	1.8	19.7	21.8	20.6	30
G38	1.1	81.1	57.3	0.0	37.5	27.9	0.1	21.1	1.9	31
G39	0.0	1.2	0.4	0.0	2.7	1.6	17.8	21.7	19.9	32
G40	0.1	71.6	13.6	0.0	26.4	13.0	0.2	22.0	8.0	30
G41	0.0	1.1	0.4	0.6	5.4	2.7	6.6	21.3	15.5	29
G42	0.0	1.1	0.4	0.0	4.4	0.7	13.7	22.3	20.8	30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8
6
4
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06/03/2016
06/04/2016
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06/06/2016
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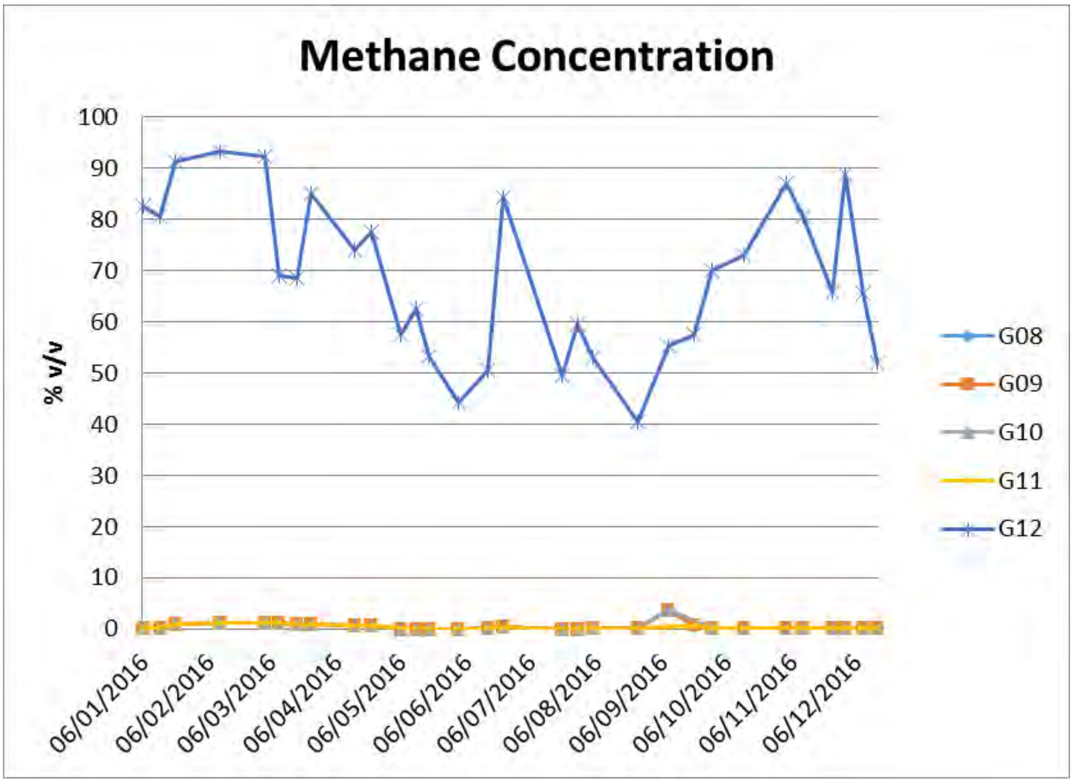
G01
G02
G03
G07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G11
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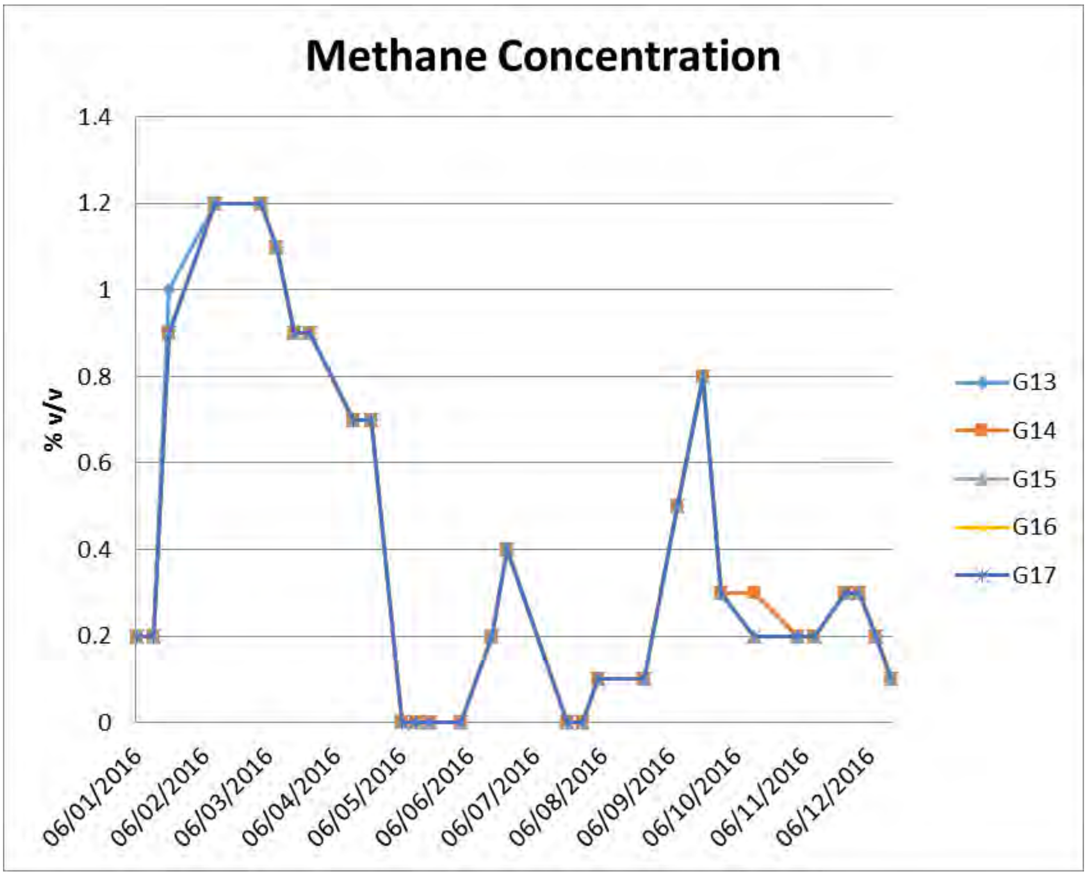
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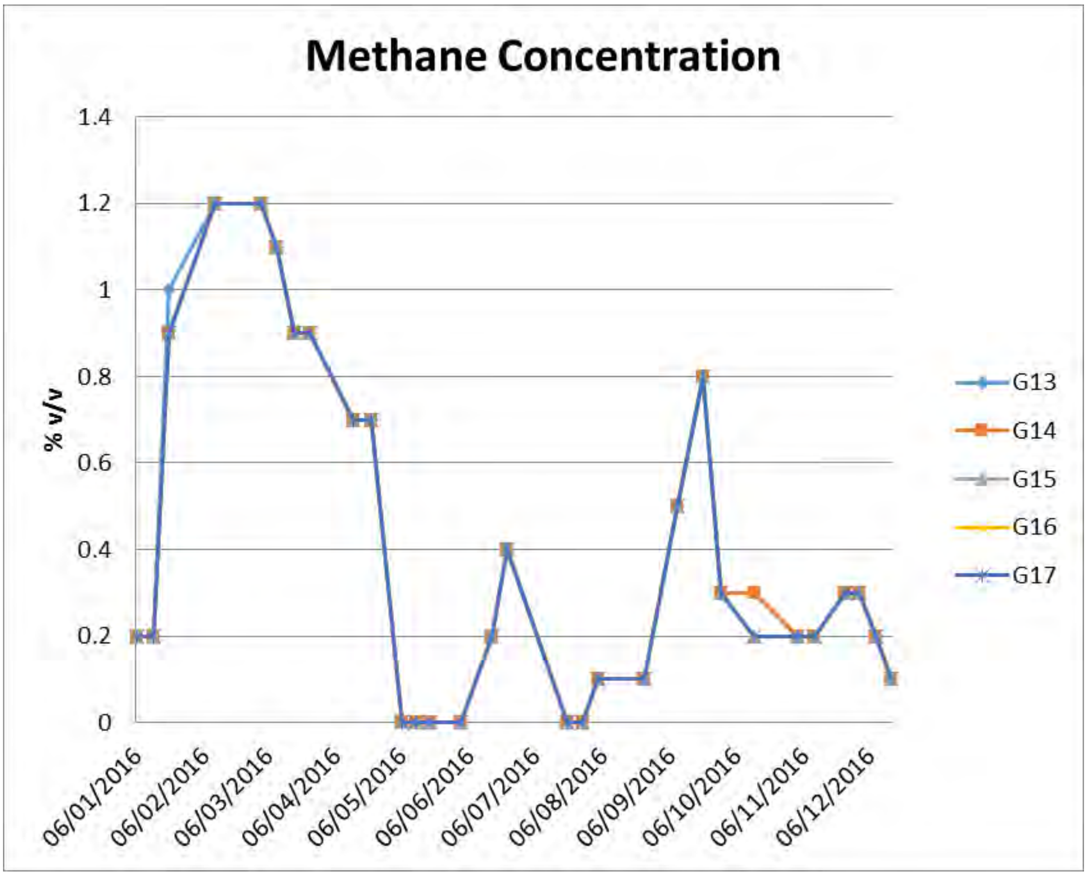
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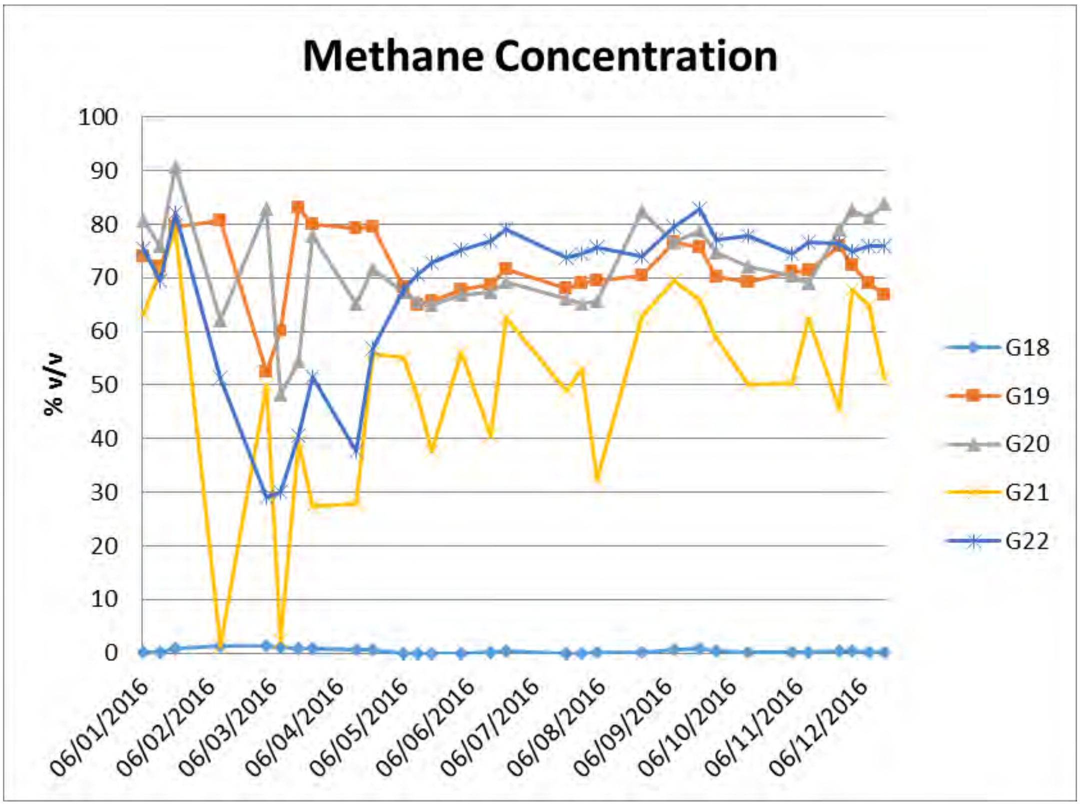
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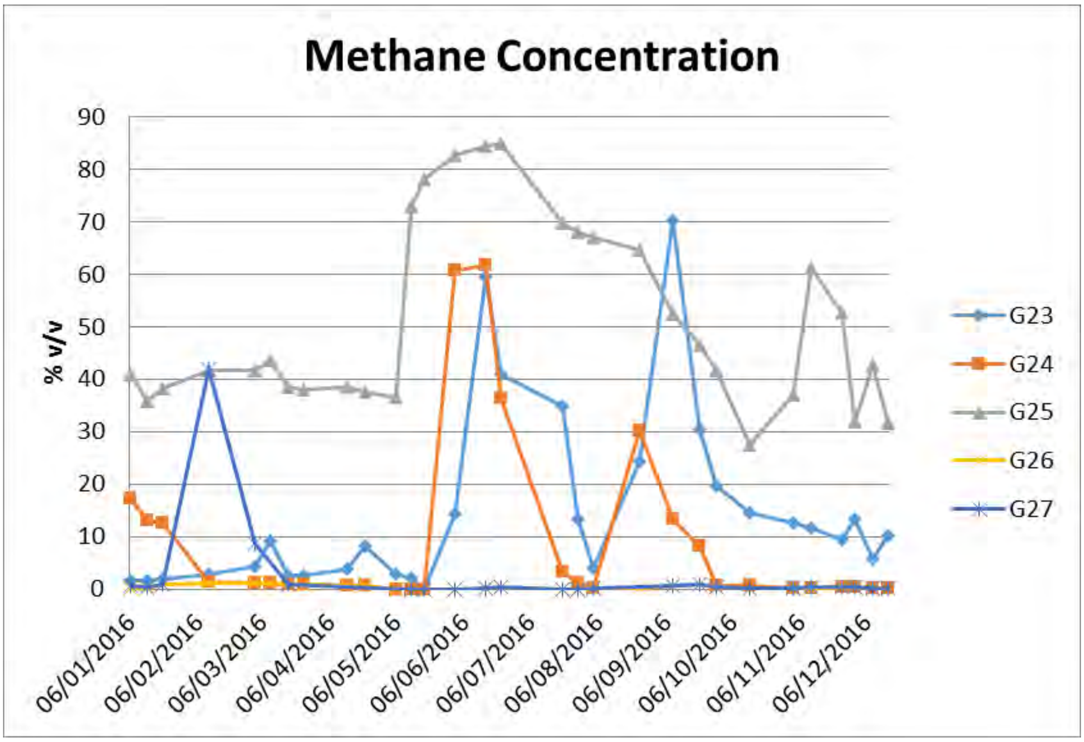
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20
10
0
% v/v
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06/02/2016
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06/06/2016
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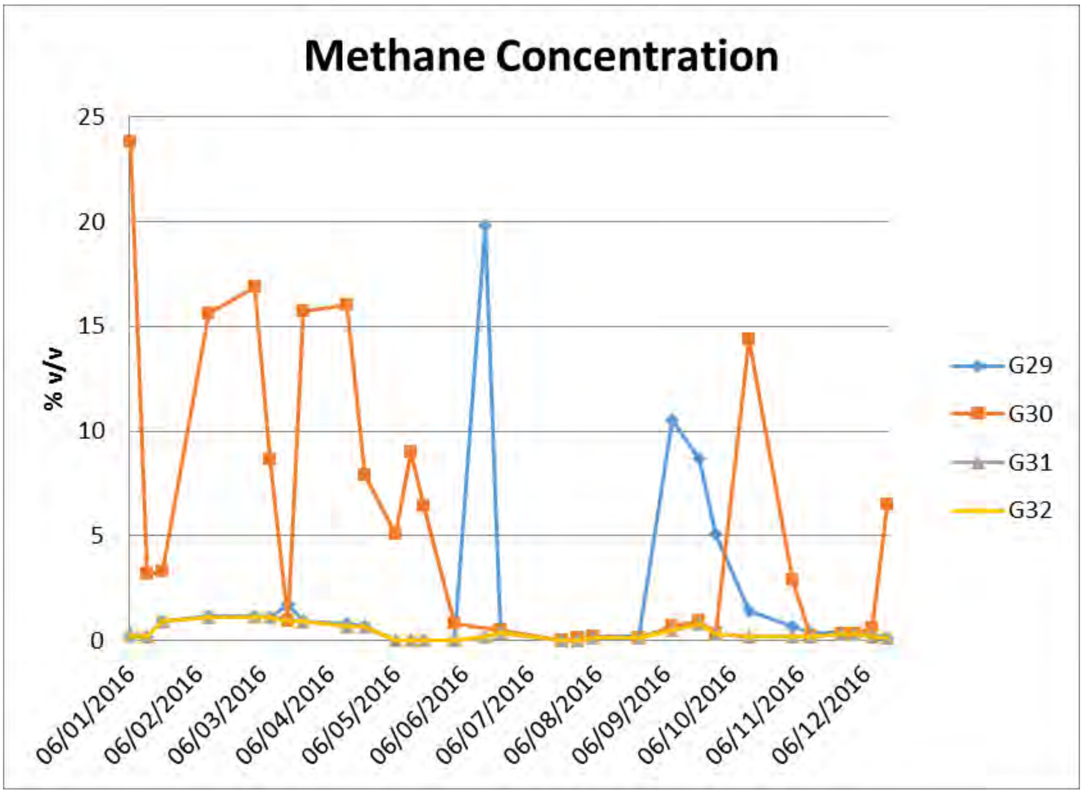
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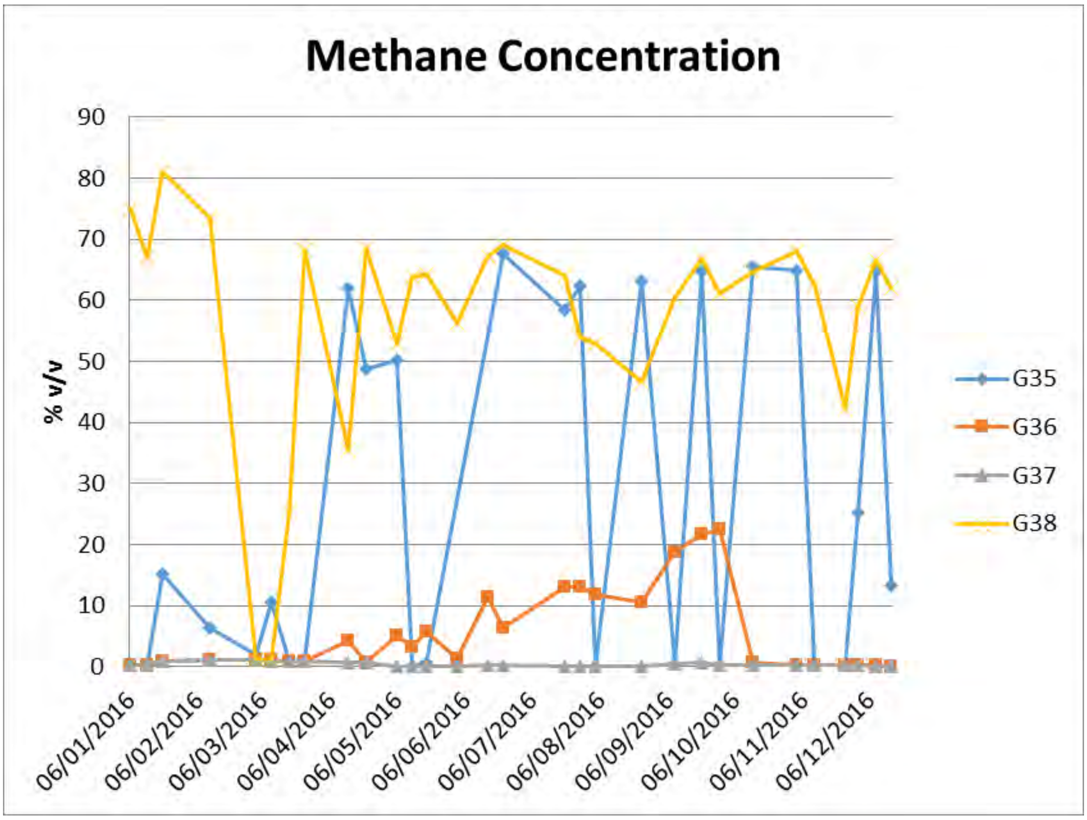
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20
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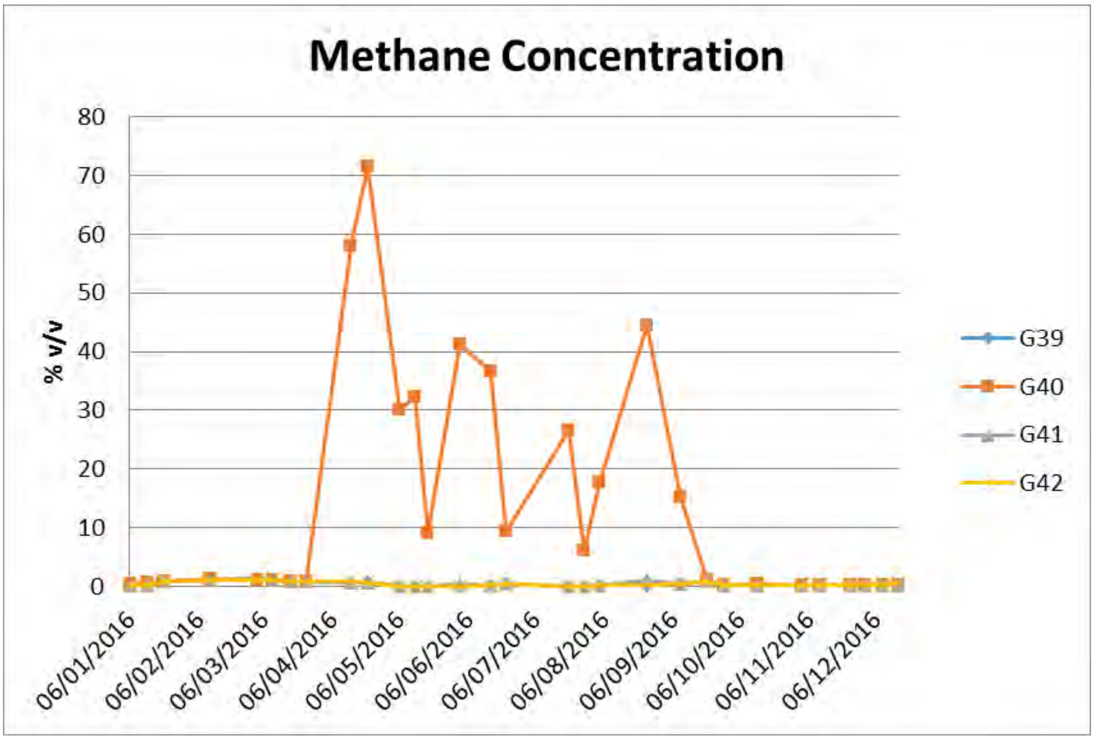
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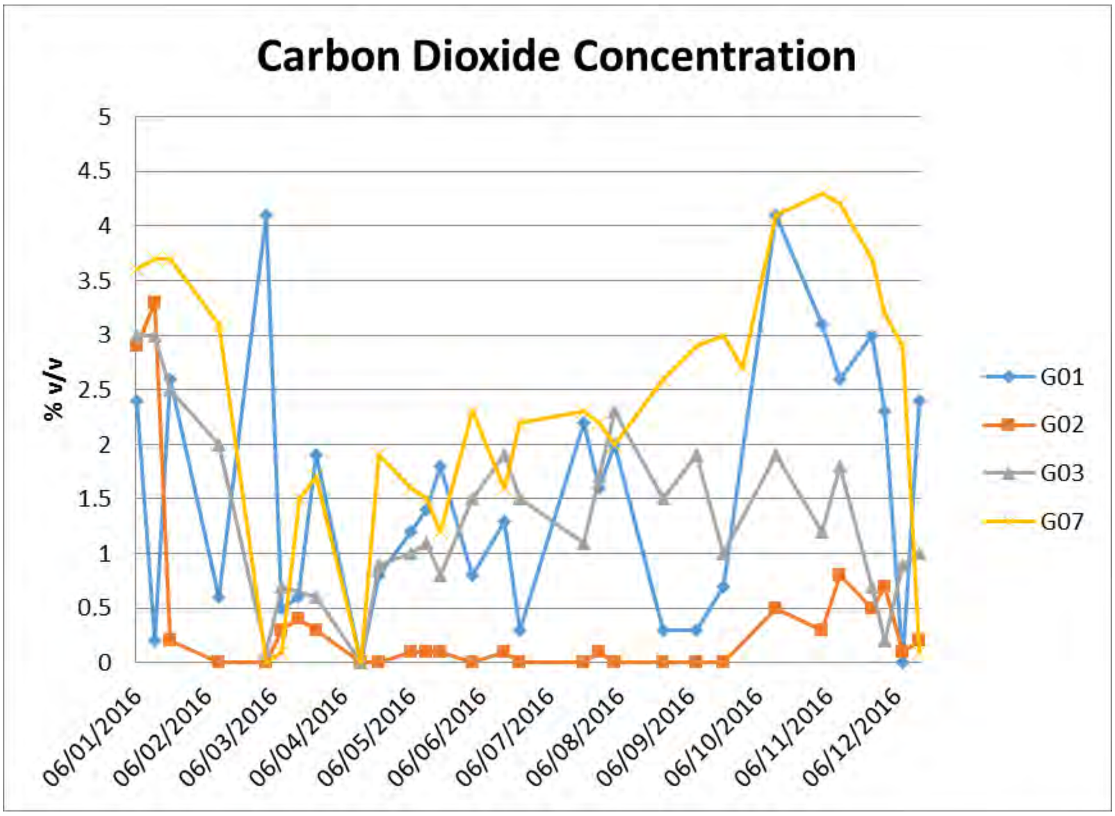
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% v/v
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1.5
2
2.5
3
3.5
4
4.5
5
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06/03/2016
06/04/2016
06/05/2016
06/06/2016
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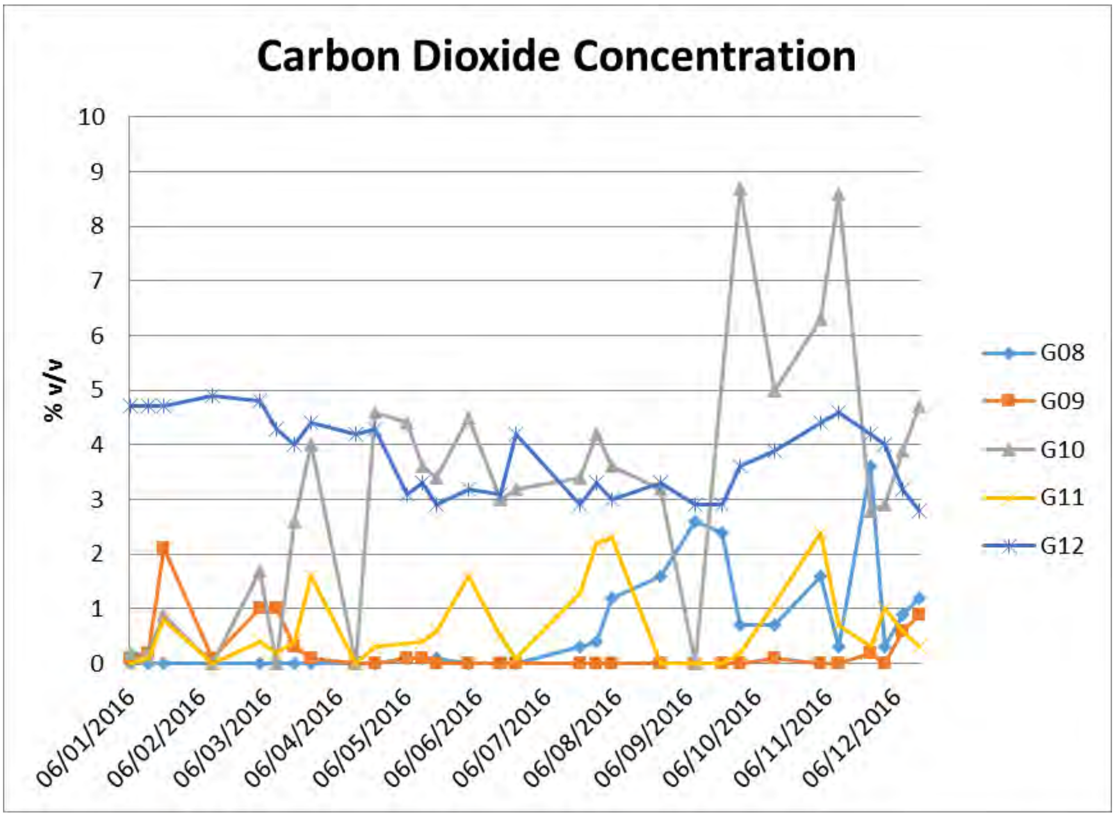
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% v/v
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7
8
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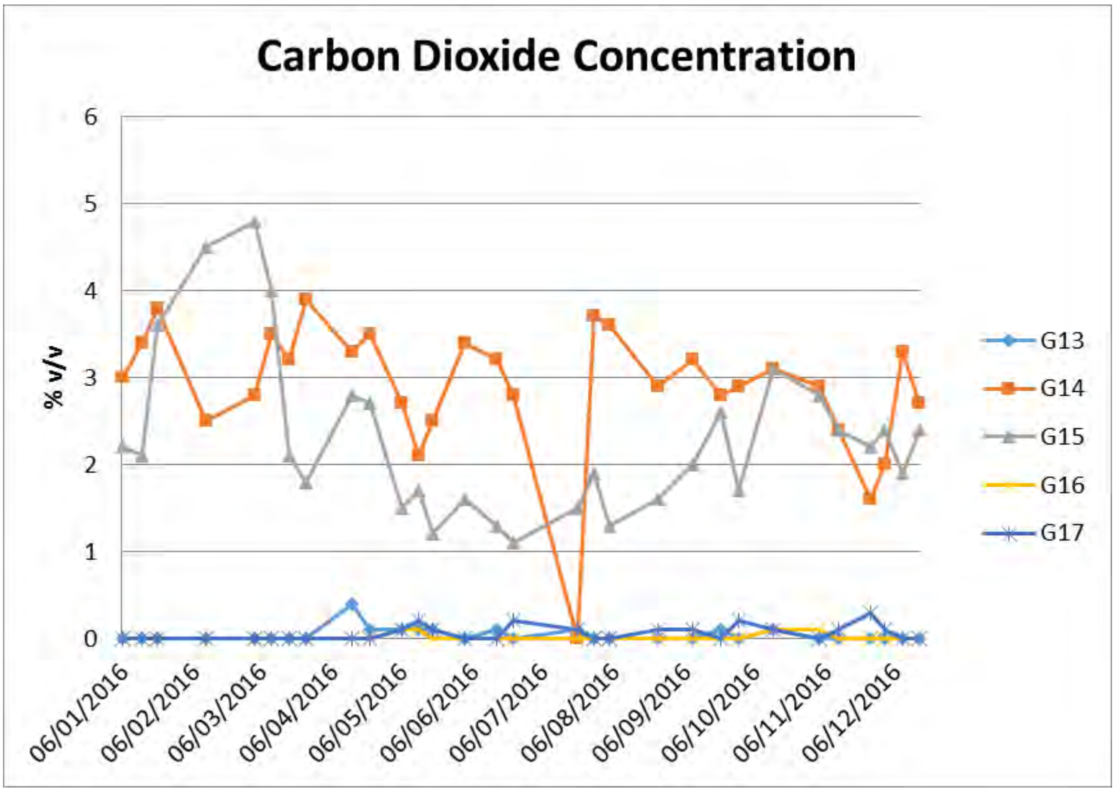
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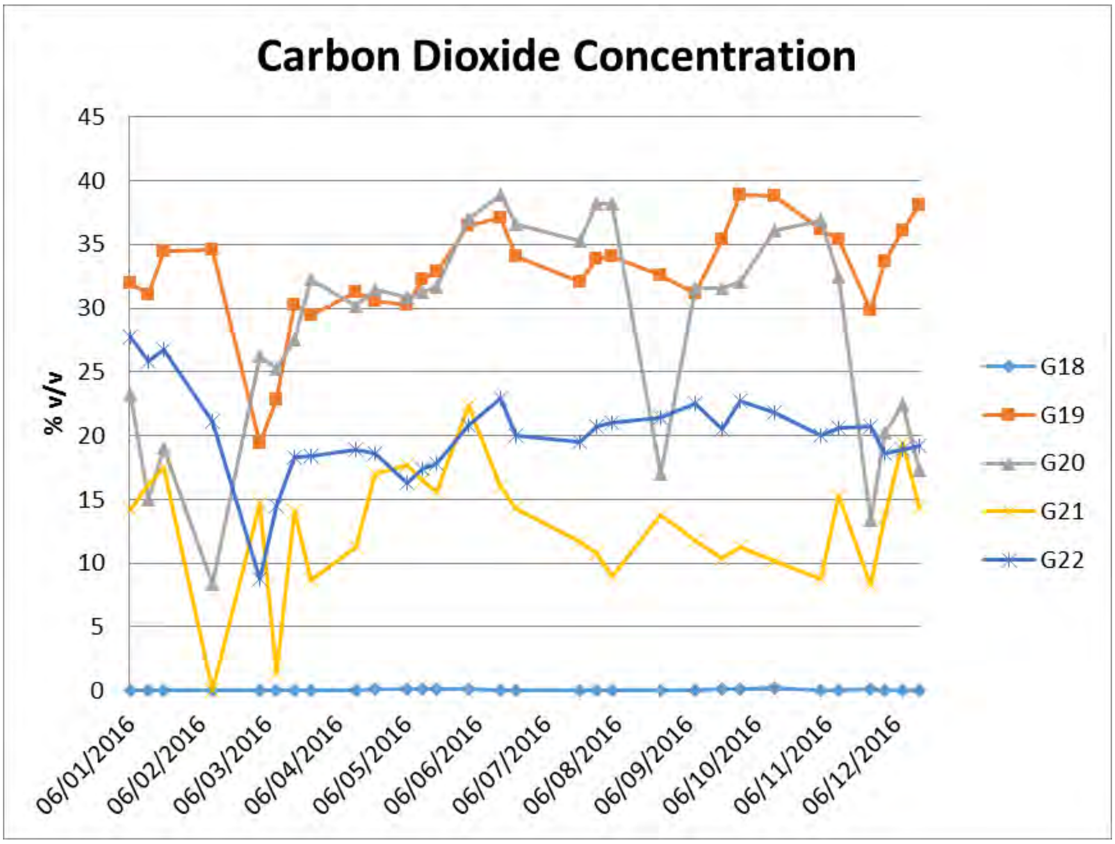
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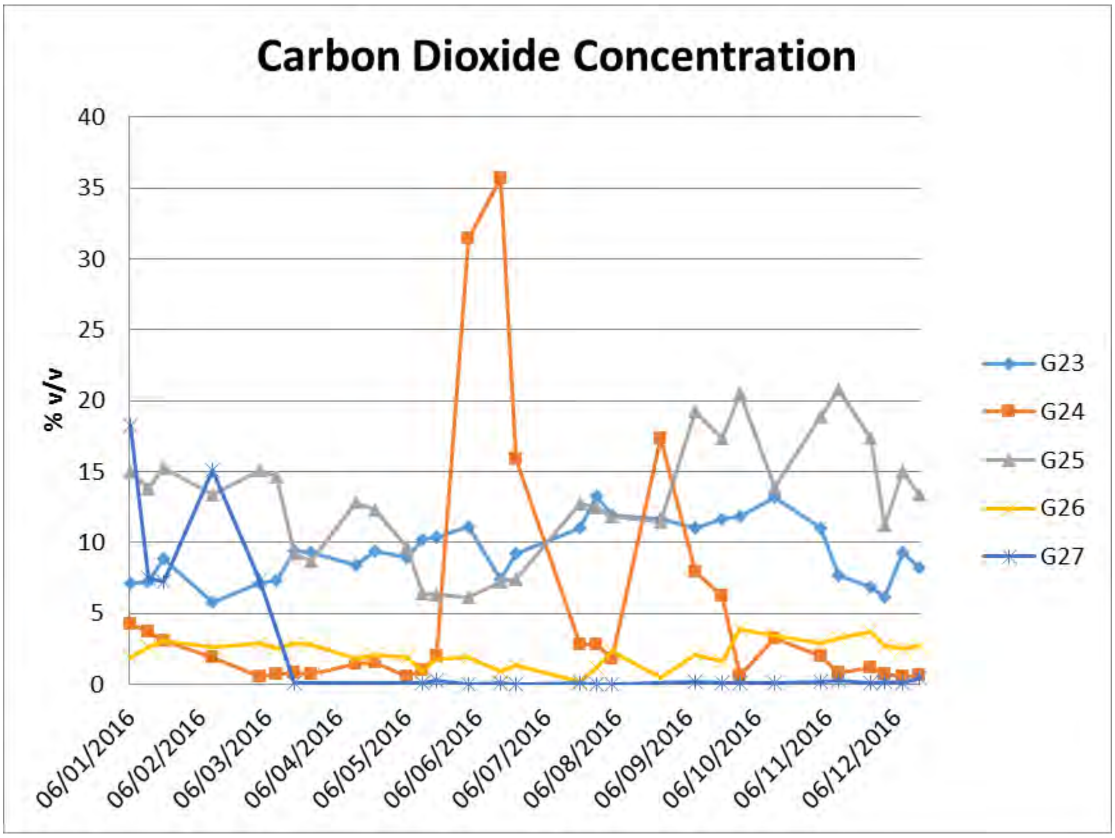
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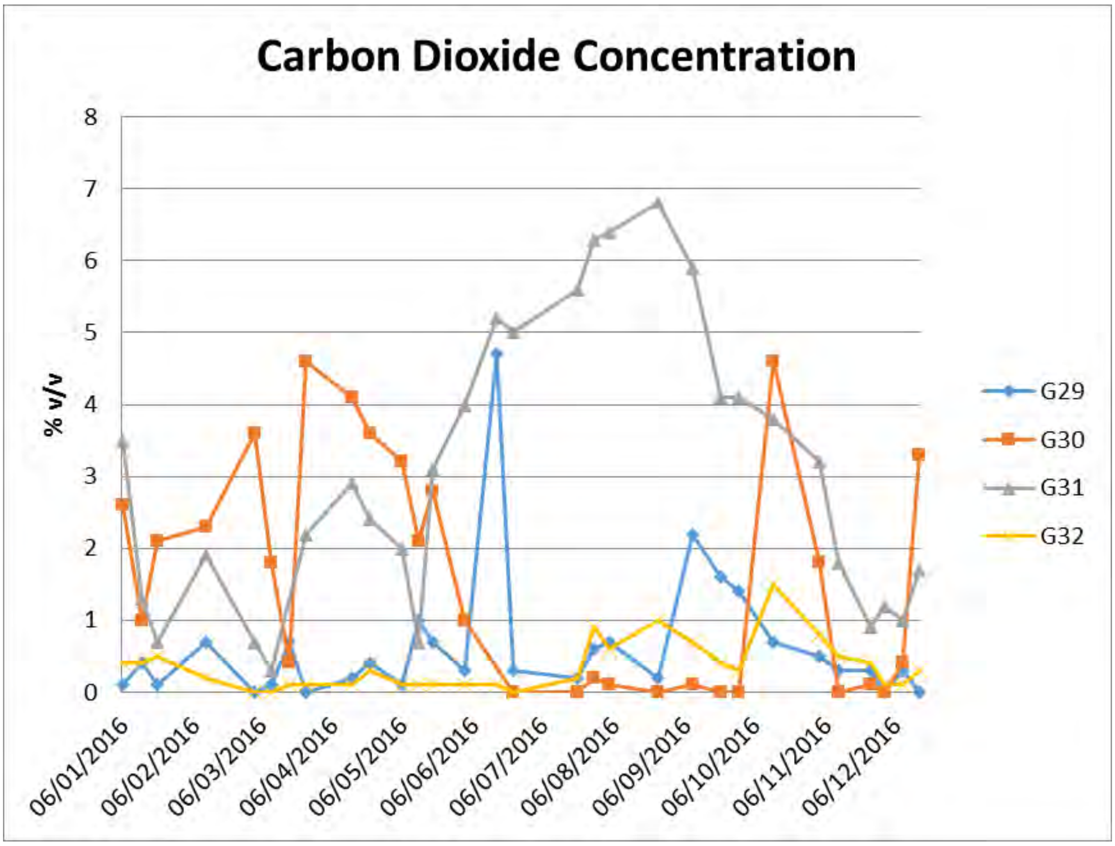
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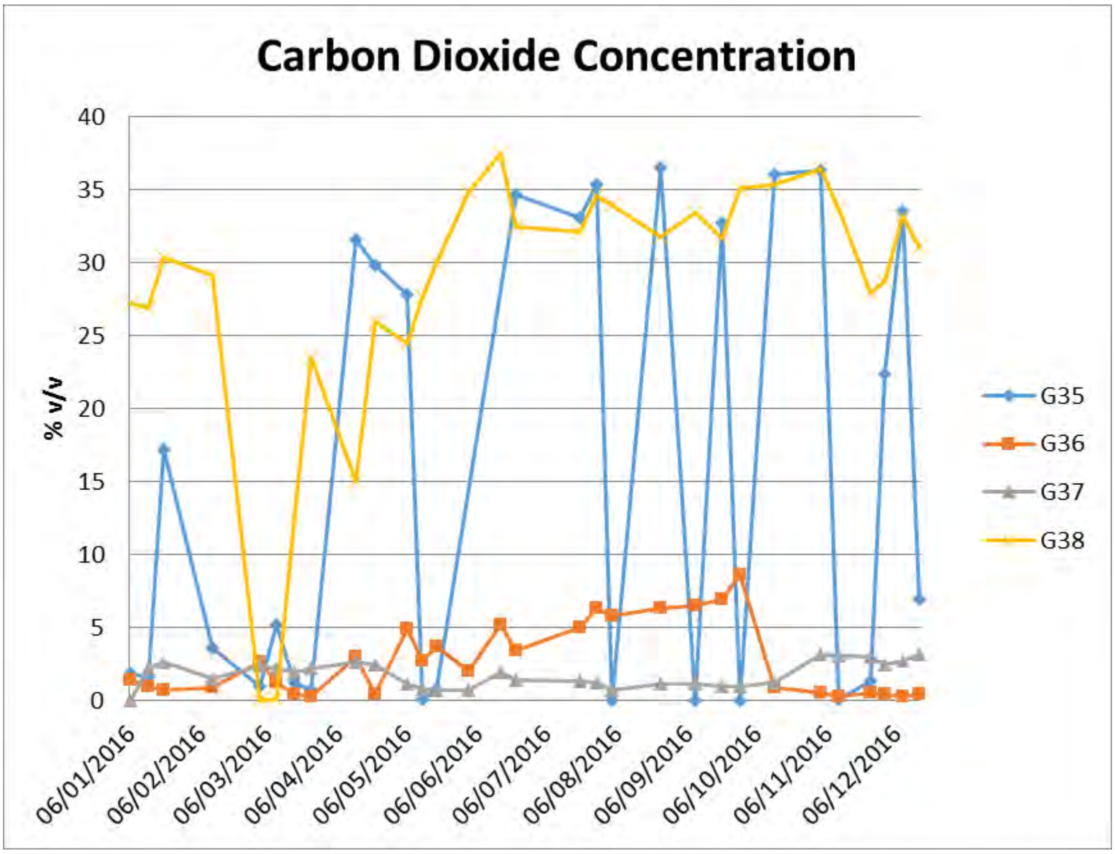
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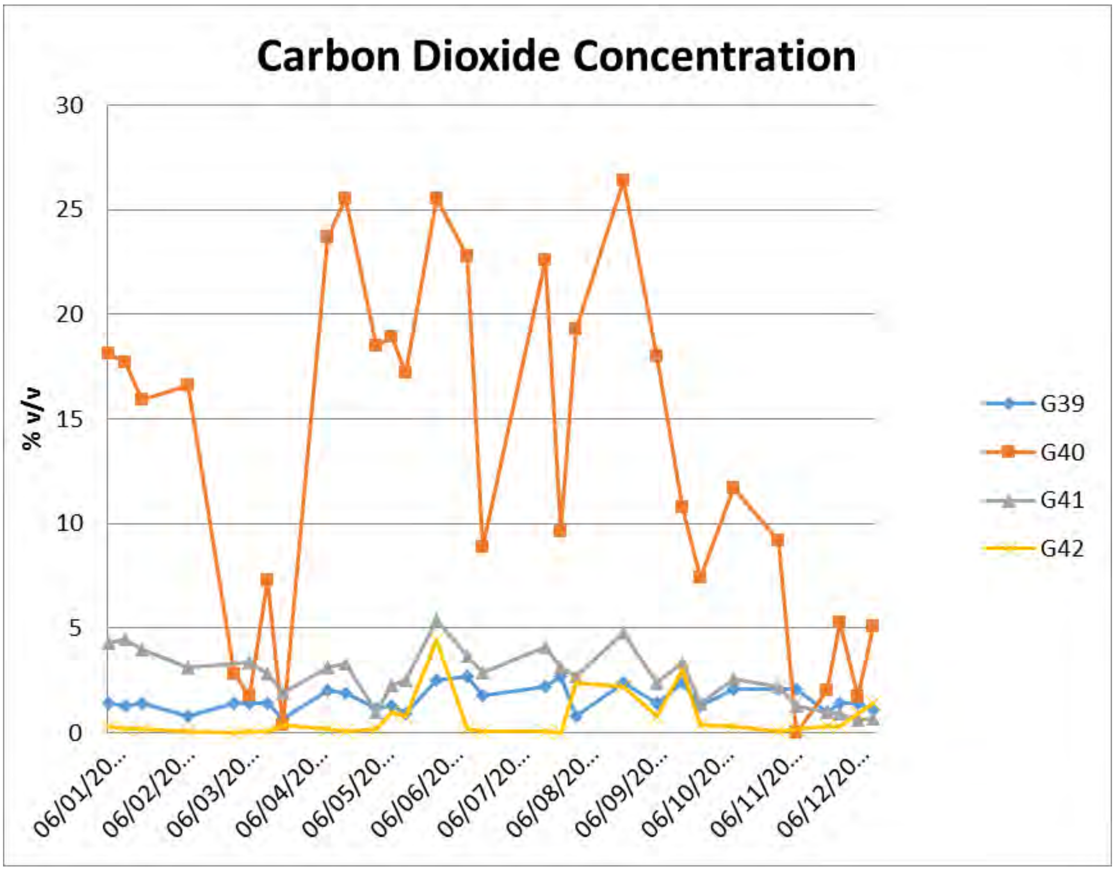
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15
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% v/v
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06/05/20...
06/06/20...
06/07/20...
06/08/20...
06/09/20...
06/10/20...
06/11/20...
06/12/20...
G39
G40
G41
G42

EMISSIONS MONITORING SURVEY

Prepared for:

Potters Waste
Brynposteg Landfill Site
Llanidloes
Powys
SY18 6JJ

Permit Number	**: BU7766IC**
Variation Number	**: …**
Installation	**: Flare Stack**
Visit Details	**: Annual Compliance**
Job Number	**: P2723**
Report Number	**: R001**
Report Issue Date	**: 28th November 2016**
Survey Dates	**: 14th & 15th September 2016**

Prepared by:

Environmental Compliance Limited
Unit G1
Main Avenue
Treforest Industrial Estate
Pontypridd
CF37 5BF.

Tel: 01443 841760
Fax: 01443 841761

<table>
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<tr><td colspan="2">Report Prepared by:</td><td colspan="2">Report Reviewed & Approved by
MCERTS Level Two
Technical Endorsements TE1, TE2, TE3 & TE4</td></tr>
<tr><td rowspan="3">Name:</td><td rowspan="3">Christopher Pickford</td><td>Name:</td><td>Sam Brookes</td></tr>
<tr><td>MCERTS No:</td><td>MM 06 775</td></tr>
<tr><td>Signature:</td><td></td></tr>
<tr><td>Date:</td><td>21/11/2016</td><td>Date:</td><td>28/11/2016</td></tr>
</table>

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".

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING 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.

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

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** site. This report presents the findings of the study.

The monitoring at this installation was carried out in accordance with our quotation reference **SEB/P2723/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 [1]	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] Please note HCl and Dioxins were included on the quotation SEB/P2723/Q001 but not on the SSP, see Section 2 of this report for details.

Potters Waste			**Installation Name**	**: Flare Stack**
Permit No	**: BU7766IC**		**Visit Details**	**: Annual Compliance**
Variation No	**: ...**		**Survey Dates**	**: 14th & 15th September 2016**
Report Ref	**: P2723**	**: R001**	**Report Issue Date**	**: 28th November 2016**

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
	Stack temperature	>1000	1000	°C	...	...				UKAS / MCERTS	✔	
	Volumetric Flowrate	...	39.26	m^3/sec	12	Stack Conditions		15:10 – 15:19	BS EN 16911-1	UKAS / MCERTS	✔	
	Volumetric Flowrate	...	2.74	m^3/sec	21					UKAS / MCERTS	✔	
	TVOC as Carbon	10	5.15	mgC/m^3	2			14:01 – 15:00	BS EN 12619:2013	UKAS / MCERTS		
	Carbon Monoxide	50	12.19	mg/m^3	4				BS EN 15058: 2006	UKAS / MCERTS		
Flare Stack	Oxides of Nitrogen (as NO_2)	150	123.84	mg/m^3	3	Dry & 3% O_2	15/09/2016		BS EN 14792: 2005	UKAS / MCERTS		Normal
	Sulphur Dioxide	...	79.52	mg/m^3	3			14:06 – 15:05	EA TGN M21:V1.1 Jan 2010 (AM for BS EN 14791)	UKAS / MCERTS		
	Oxygen (Zirconia Cell)	...	14.58	%	3	Dry			BS EN 14789: 2005	UKAS / MCERTS		
	Carbon Dioxide	...	5.30	%	7				ISO 12039:2001	UKAS / MCERTS		
	Non Methane VOC $	5	3.11	mg/m^3	9	Dry & 3% O_2		10:09 – 11:09	Modified BS EN 13649	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, SO_2, 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 was a substance deviation from the original and agreed emissions monitoring schedule as follows:

- **HCl & Dioxins –** Both were included in the initial quotation but not required during this survey and not included on the SSP as not on site permit.
- **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.

Non-conforming tests are as follows:

- Due to Health & Safety restrictions only a single sapling 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.

Homogeneity tests have 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
David Boles	14-15/09/2016	MM03 215	2	TE1, TE2, TE3, TE4
Christopher Pickford		MM14 1301	1	TE1

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 & MID** and In-house technical procedure **ECL/TPD/022.**

Temperature was recorded using a thermocouple and digital temperature reader.

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

Combustion Gases (NO_x, SO_2, CO, CO_2 & O_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: 2005
• SO_2	Non dispersive infrared	EA TGN M21
• CO	Non-dispersive infrared	BS EN 15058: 2006
• O_2	Galvanic / Zirconia	BS EN 14789: 2005
• CO_2	Non-dispersive infrared	ISO 12039: 2001

The analyser was set up with reference to the manufacturers 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.

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.

Non-Methane VOCs

Non-continuous sampling for **Non-Methane VOC** was carried out in accordance with **BS EN 13649** 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.

Scientific Analysis Laboratories Ltd (SAL) who is situated in Manchester carried out the analysis of the samples. **SAL** is 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 BS EN 13649, MCERTS/UKAS accreditation can only be claimed when the target parameters are organic compounds, the sorbent tube used is a standard charcoal 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.

Water Vapour

Testing was carried out using a Universal Stack Sampling system in accordance with **BS EN 14790** 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.

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 0.5m 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 sapling 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)

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		U002							
MST Nozzle set									
MST "S" Type Pitot		489							
MST Probe									
MST Hot Box		336							
MST Impinger Arm	E001	659							
Barometer		1045							
Site Balance		1069							
Site Check weights		190							
		191							
Horiba		096							
Heated Probe / Filter		631							
Chiller	E002	1092							
Sonimix / MFC		761	934						
Heated Line		1013	1014						
FID	E003	304							
Heated Line		1013	1014						
Heated Probe / Filter		631							
Testo	E004								
FTIR									
Heated Probe / Filter	E005								
Heated Line									
Stackmite									
"L" Type Pitot									
Digital Manometer									
Stack Thermocouple	E006	1094							
Thermocouple Reader									
Nozzle Set									
Workhorse Pumps	E007								
Low Flow Pumps									

Quantity of Ice Required / Used for Survey	8	Bags (2kg bags)

FIGURES

Figure 1

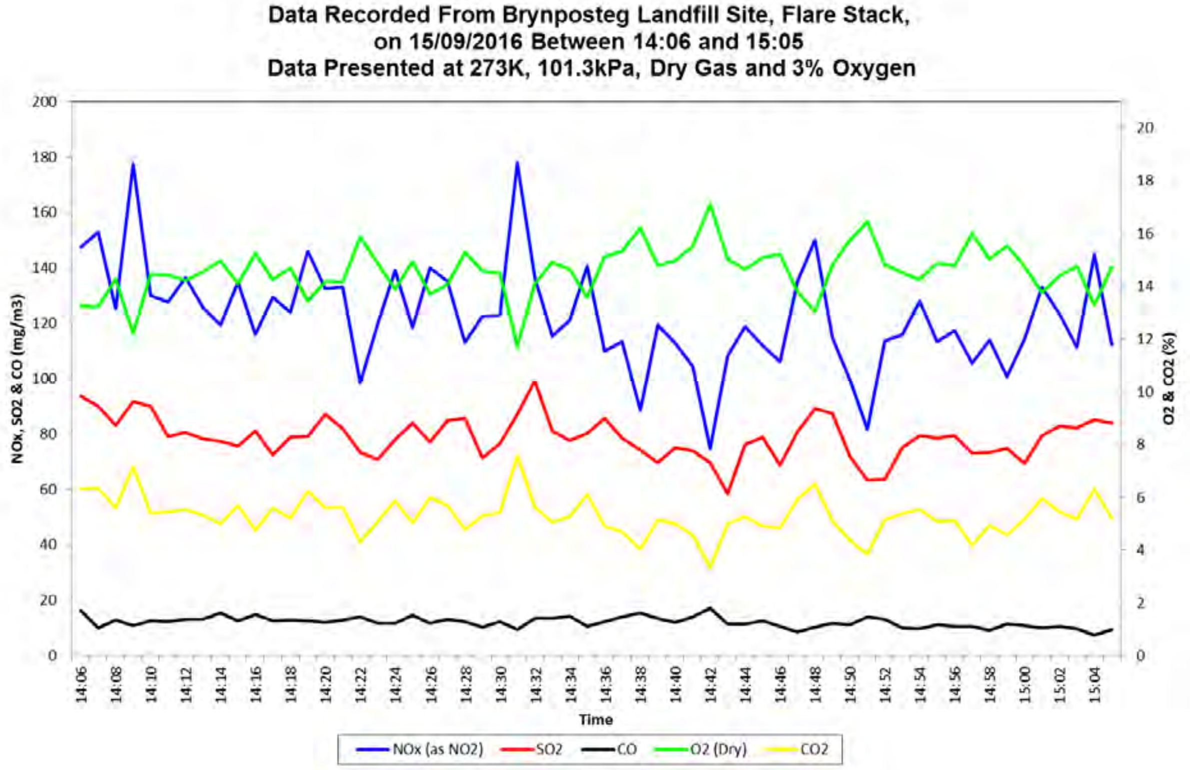
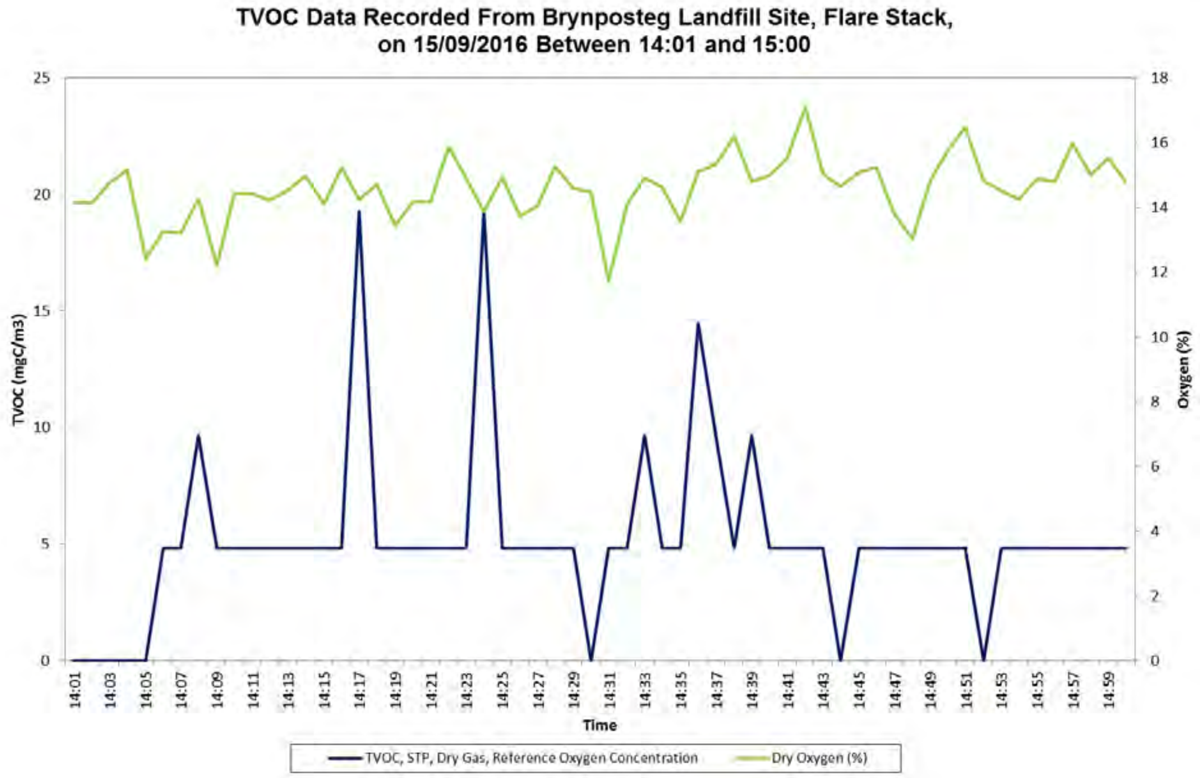


Figure 2



TABLES

Table 1 – TVOC

Data Recorded from Flare Stack

Sample Period: 14:01 – 15:00 on the 15th September 2016

Volumetric Flowrate (Reference Conditions) = **2.74 m^3/sec ***

	Average	Emission Rate
	mg/m^3	Kg/hr
TVOC (as carbon)*	5.15	0.051

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

Table 2 – Gases

Data Recorded from Flare Stack

Sample Period: 14:06 – 15:05 on the 15th September 2016

Volumetric Flowrate (Reference Conditions) = **2.74 m^3/sec ***

	Average	Emission Rate
	mg/m^3	Kg/hr
Sulphur Dioxide *	79.52	0.784
Oxides of Nitrogen (as NO_2) *	123.84	1.222
Carbon Monoxide *	12.19	0.120
Carbon Dioxide (%) **	5.30	...
Oxygen (%) **	14.58	...

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

Table 3 – NMVOCs

Potters Landfill
Brynpostef Flare Flare Stack

Emission Parameter	Units	Value		
Stack Diameter	mm	2300		
Area of Sample Plane	m^2	4.155		
Moisture Content	%	4.09		
Expanded Uncertainty of Moisture (%Relative)	%	22.48		
Measured Oxygen (Dry)	%Vol	14.58		
Meter Temperature	°C	21.25		
StackTemperature	°C	1,000.00		
Sample Date	...	15/09/2016		
Sample Period	...	10:09 - 11:09		
Sample Volume (as Measured)	m^3	0.10		
Sample Volume (reference Conditions)	m^3*	0.033		
Sample Tube Results		one		Blank
Sample Reference ECL/16/4740	Units	Concentration*	Uncertainty	Concentration
Concentration of Total VOCs	mg/m^3	3.11	8.69%	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	**: ...**	**Survey Dates**	**: 14th & 15th September 2016**
Report Ref	**: P2723 : R001**	**Report Issue Date**	**: 28th November 2016**

Environmental Compliance Limited	Traverse Data Profoma	Date of Measurement	15/09/2016

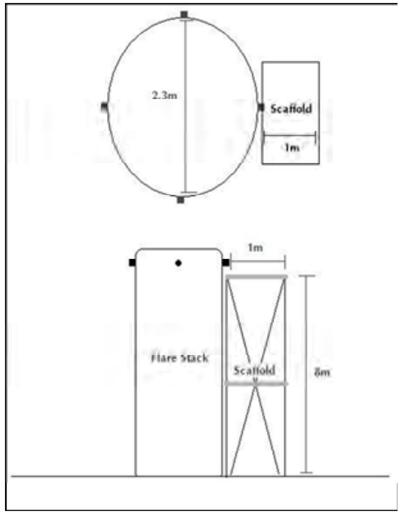
Company	Potters Landfill	Stack Diameter Port A (mm)	2300	Average Stack Diameter (mm)	2300	Pitot tube coefficient	1.00
Site	Brynposteg	Stack Diameter Port B (mm)		Port Length (mm)	90	Pitot Id	489
Location	Flare Stack	Duct Length Port A (mm)		Average Duct Length (mm) L		Stack Thermocouple ID	1094
Stack	Flare Stack	Duct Length Port B (mm)		Duct width (mm) B		Stack Temp Reader ID	116
Job No	P2723	Duct Length Port C (mm)		Barometric Pressure. (mb)	972	Manometer ID	357
Operators	DB + CP	Duct Length Port D (mm)		Ave Static Press. (mm $H_2$0)	-0.10	Barometer ID	1069

Pre - Traverse Checks Carried Out	Time	Pass/ Fail
Pre - Traverse Visual Inspection	15:10:00	PASS
Pre - Traverse Pitot Leak Check	15:12:00	PASS

Smooth Walls

Static Pressure Readings (Pascals)			
Port A	Port B	Port C	Port D
-1.00			

Diagram/ Description of Cross Section of Stack/Duct



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	15:14:00	1000.0	1000.0	1000.0	12.0	11.0	13.0	1000.0	12.0	2
Blockage Check @ A1 (L-Type Pitot Only)		15:18:00	1000.0	1000.0	1000.0	12.0	12.0	12.0	1000.0	12.0	Total
			Mean		1000.0	Mean		12.0	1000.0	12.0	Max
			Difference <5% from Initial ?		0.00	Difference <5% from Initial ?		0.00	1000.0	12.0	Min
									1000.0	12.0	Average

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

Very high temp on platform

Post - Traverse Checks Carried Out	Time	Pass/ Fail
Post - Traverse Visual Inspection	15:19:00	PASS

Average temp (K)	1273.000

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

Suitability of Sampling Position	Actual Stack Conditions
Highest:lowest flow pressure ratio < 9:1?	1:1
Maximum deviation of flow from axis <15° ?	2
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

Compliance With Positional Requirements?

Height of sample ports from Platform	0.5m
Number of sample ports	4
Width of platform (port back to handrail)	1m

Nearest downstream disturbance	Exit	0.5m
Nearest upstream disturbance	Bend	5.0m
Disturbances are classed as bends, fans or diameter variations		

Stack Moisture	4.09	%	Gas Velocity (as Measured) Adjusted for Smooth Walls	9.44938	m/sec
Measured Oxygen	14.58	%	Gas Velocity (Reference Conditions) Adjusted for Smooth Walls	0.65844	m/sec*
Measured Carbon Dioxide	5.3	%	Volumetric Flowrate (as Measured) Adjusted for Smooth Walls	39.25989	m^3/sec
Dry Gas Molecular Weight	29.43120	g/g mole	Volumetric Flowrate (Ref Cond) Adjusted for Smooth Walls	2.73567	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°

FIELD CALIBRATION AND SAMPLING DATA

Combustion Gases Field Calibration Sheet

	Horiba PG 250 Measurement Ranges:				
	NO as NO_2	SO_2	CO	O_2	CO_2
	1025	1430	1250	25	20
Units	mg/m^3	mg/m^3	mg/m^3	%Vol	%Vol
	Zero Values (Direct)				
Mean Initial Direct Zero	-0.25	-0.86	0.57	0.04	0.02
Mean Confirmation Direct Zero	-0.27	1.39	1.72	-0.10	0.12
Difference in Direct Zero	0.02	2.25	1.15	0.14	0.10
Repeatability at Zero	4.10	5.72	2.50	0.20	0.20
<2 x Repeatability at Zero?	YES	YES	YES	YES	YES
	Pre Zero Values (System)				
Mean Pre Test Zero	-0.49	-2.05	0.03	-0.27	0.05
% of Measurement Range?	-0.05%	-0.14%	0.00%	-1.09%	0.25%
Detection Limit (LOD)	0.18	1.14	0.71	0.20	0.00
	Applied Span:				
	NO	SO_2	CO	O_2	CO_2
Actual Applied Span Concentration	535.87	591.45	250.13	15.03	17.73
	Pre Test System Zero Values				
Mean Pre Test System Zero	-0.49	-2.05	0.03	-0.27	0.05
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.09%	0.35%	0.01%	1.81%	0.28%
	Post Zero Values (System)				
Mean Post Test Zero	-0.35	1.07	1.48	-0.40	0.06
% of Certified Range?	-0.03%	0.07%	0.12%	-1.61%	0.32%
Zero Drift ≤ ± 5% of Applied Span?	0.03%	0.53%	0.58%	0.87%	0.09%
	Pre Test System Span Values				
Mean Pre Test System Span	535.51	596.59	250.65	15.03	17.90
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.07%	0.87%	0.21%	0.02%	0.93%
	Post Test System Span Values				
Mean Post Test System Span	525.45	574.65	244.90	14.96	17.67
Span Drift ≤ ± 5% Span Value?	1.88%	3.68%	2.30%	0.43%	1.28%
	1.88%	3.68%	2.30%	0.87%	1.28%
	See Note 3	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.

TVOC - FIELD DATA SHEET

Client	Potters Waste		
Site	Brynposteg		
Date	15/09/2016		
Location	Flare		
Stack ID	Flare Stack		
Stack Temp °C	1000		
Ambient Temp (sampling)	1=20	2=22	3=20
Ambient Temp (sampling)	4=21	5=22	6=21
Job No	P2723		
Operators	DB + CP		

Barometric Pressure mb	972	
Barometer ID	ECL/ID/ 1045	
Analyser ID	ECL/ID/ 304	
Sonimix/ MFC ID	ECL/ID/ n/a	
Heated Line/ Controller ID	ECL/ID/ 1013+1014	
Heated Line Set Temp °C	180	YES
Heated Line Length	10	m
Heated Probe Filter ID	ECL/ID/ 631	
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/ 1629	...	...
Hydrogen / Helium	Gas/ 1597	...	...
Propane (In Air)	Gas/ 1634	919.7ppm	9.2

	Analyser Range	Span Gas value used
Propane	1000ppm	919.7ppm

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	09:30	09:35	09:36	09:39	09:40	09:44

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	
22	20	Start Time	End Time	Start Time	End Time
ZERO / SPAN		09:45	09:50	09:51	09:56

Response Time		
SYSTEM Span Gas Cal		
Start Time	90% Time	less than 200s (Y/N)
09:51:00	09:51:30	y

	Start Time	End Time	Location	Production Details
Sample Period	14:00	15:10	Flare Stack	
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	
22	20	Start Time	End Time	Start Time	End Time
ZERO / SPAN		15:15	15:20	15:20	15:25

Process Details / Comments

TVOCs Field Calibration Sheet

Calibration Summary		TVOC ppm
Analyser Range		**1000**
Repeatability at Zero		2
Span Gas Concentration Applied		**919.7**
Zero Gas Concentration Applied		0
Direct Cal	**Zero**	0.00
	Span	919.7
	Zero	0.00
Difference (Zero)		0.0000
< 2 x Repeatability @ Zero?		**YES**
Pre Test (System)	**Zero**	0.00
	Span	919.7
Difference (Zero)		0.0000
< 2% Relative to Direct Span		YES
Difference (Span)		0.0000
< 2% Relative to Direct Span		**YES**
Post Test (System)	**Zero**	0.00
	Span	919.2
Difference (Zero)		0.0000
Zero Drift < 2% of Applied Span?		YES
Difference (Span)		0.5084
Span Drift < 2% of Applied Span?		**YES**
Zero and Span Drift < 5% of Applied Span?		**YES**

Non-methane TVOCs Field Data Sheet

Environmental Compliance Limited	SAMPLE TUBE DATA SAMPLING PROFORMA

Client	Potters Landfill	◉ Circular ○ Rectangular ○ Elipse		Pump ID	U002
Site	Brynypostef	Stack Diameter (mm)	2300	Meter ID	U002
Location	Flare			MST Probe ID	QUARTZ
Stack ID	Flare Stack	Stack Area (m^2)	4.155	MST Probe Heating Temp (C)	QUARTZ
Test No	one	Barometric Pressure (mb)	972	DGM Yd or ml/count	1.0527
Job No	P2723	Stack Thermocouple ID	1094	MST Hot Box ID	336
ECL Site Staff	DB + CP	Tube Thermocouple ID	n/a	MST Hot Box Heating Temp (C)	180
Barometer ID	1069	Meter Thermocouple ID	U002	Workhorse Set Sample Rate (%)	N/A
		In-Stack Sinter Used (Y/N)	N	MST Delta H Sampling Rate	0.5

Date of Test	15/09/2016
Sample Start Time	10:09
Sample End Time	11:09
Duration	60
Measured O2	14.58
O2 Uncertainty %Vol	0.87

Meter Units ○ ml ◉ litres	Sample	Leak 1	Time (start/ end) (minimum 1 minute)	Leak 2	Time (start/ end) (minimum 1 minute)	Total
Start Volume	5629.3	5620.3	10:07:00	5729.8	11:11:00	
Final Volume	5728.7	5620.3	10:08:00	5729.8	11:12:00	
Total Volume	98.3	0.0		0.0		98.3
Sample Train Internal Volume	1.11383	ml / Litres				

Impinger 1	EMPTY
Start Weight (g)	587.8
End Weight (g)	589.4
Total weight (g)	1.6

Sample Point	A1	A1	A1	A1
Time/ point (mins)	0-10	10...20	20-30	30-40
Tube Temp ^{O}C	11	10	11	12
Stack Temp ^{O}C	1000	1000	1000	1000
Meter Temp In ^{O}C	17	22	22	23
Meter Temp Out ^{O}C	16	21	21	21

Impinger 2	EMPTY
Start Weight (g)	600.4
End Weight (g)	600.4
Total weight (g)	0

Sample Point	A1	A1		
Time/ point (mins)	40-50	50-60		
Tube Temp ^{O}C	12	12		
Stack Temp ^{O}C	1000	1000		
Meter Temp In ^{O}C	24	24		
Meter Temp Out ^{O}C	22	22		

Impinger3	SILICA
Start Weight (g)	829.1
End Weight (g)	830.5
Total weight (g)	1.4

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

SCIENTIFIC ANALYSIS LABORATORIES
DELIVERING SCIENCE

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

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Tel : 0161 874 2400
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Report Number: 601256-1

Date of Report: 31-Oct-2016

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

Customer Contact: Mr David Boles

Customer Job Reference: P2723
Customer Purchase Order: E5694
Date Job Received at SAL: 19-Sep-2016
Date Analysis Started: 21-Sep-2016
Date Analysis Completed: 26-Sep-2016

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 SAL SOPs
All results have been reviewed in accordance with Section 25 of the SAL Quality Manual

UKAS TESTING 1549

Report checked
and authorised by :
Mary Hughes
Customer Service Manager

Issued by :
Emma Spear
Project Manager

Validity unknown
Digitally signed by Emma Spear
Date: 2016.10.31 15:58:44 GMT
Reason: Issue
Location: SAL

Page 1 of 2
601256-1

SAL Reference: 601256
Customer Reference: P2723

Impinger(peroxide) Analysed as Impinger(peroxide)
Miscellaneous

				SAL Reference	601256 001	601256 002	601256 003	601256 004	601256 005
				Customer Sample Reference	ECL/16/4730	ECL/16/4731	ECL/16/4732	ECL/16/4733	ECL/16/4734
				Test Sample	AR	AR	AR	AR	AR
				Date Sampled	14-SEP-2016	14-SEP-2016	14-SEP-2016	14-SEP-2016	14-SEP-2016
Determinand	Method	LOD	Units	Symbol					
Sulphur Dioxide	IC	0.05	mg/l	U	(13,195) 110	(13) 13	(13) 0.60	(13,195) 130	(13) 15
Volume	Vol	1	ml	U	320	130	160	300	97

SAL Reference: 601256
Customer Reference: P2723

Impinger(peroxide) Analysed as Impinger(peroxide)
Miscellaneous

				SAL Reference	601256 006
				Customer Sample Reference	ECL/16/4735
				Test Sample	AR
				Date Sampled	14-SEP-2016
Determinand	Method	LOD	Units	Symbol	
Sulphur Dioxide	IC	0.05	mg/l	U	(13) 0.41
Volume	Vol	1	ml	U	260

SAL Reference: 601256
Customer Reference: P2723

Tube (Charcoal 226-09) Analysed as Tube (Charcoal 226-09)
Miscellaneous

				SAL Reference	601256 008	601256 009	601256 010	601256 011	601256 012
				Customer Sample Reference	ECL/16/4737 FRONT	ECL/16/4737 BACK	ECL/16/4738 FRONT	ECL/16/4738 BACK	ECL/16/4739 FRONT
				Test Sample	AR	AR	AR	AR	AR
				Date Sampled	14-SEP-2016	14-SEP-2016	14-SEP-2016	14-SEP-2016	14-SEP-2016
Determinand	Method	LOD	Units	Symbol					
Volatile Organic Compounds (Total)	GC/MS	1	µg	N	120	<1	<1	<1	85

SAL Reference: 601256
Customer Reference: P2723

Tube (Charcoal 226-09) Analysed as Tube (Charcoal 226-09)
Miscellaneous

				SAL Reference	601256 013	601256 014	601256 015
				Customer Sample Reference	ECL/16/4739 BACK	ECL/16/4740 FRONT	ECL/16/4740 BACK
				Test Sample	AR	AR	AR
				Date Sampled	14-SEP-2016	15-SEP-2016	15-SEP-2016
Determinand	Method	LOD	Units	Symbol			
Volatile Organic Compounds (Total)	GC/MS	1	µg	N	<1	100	<1

Index to symbols used in 601256-1

Value	Description
AR	As Received
13	Results have been blank corrected.
195	Due to levels found in the sample that are outside of the normal calibration range of the instrument, analysis was conducted on a diluted sample
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

UNCERTAINTY CALCULATIONS

Volumetric Flowrate Uncertainty

Stack Reference Flare Stack

Measurement Uncertainty Calculations - Velocity at Stack Conditions

Contribution From	**Standard u/c (Pa)**	
Pitot Calibration Uncertainty Contribution	0.06	A
Manometer Calibration Uncertainty Contribution	0.06	B
Variation in Actual Pitot reading at sample points	1.00	C
Combined u/c (Pa) =	**Combined u/c (Pa)**	
SQRT $(A/\sqrt{3})^2 + (B/\sqrt{3})^2 + (C/\sqrt{3})^2)$	0.58	
Expanded Uncertainty of Flow Measurements Pa	**1.16**	
	Standard u/c (K)	
Temperature Calibration (K)	6.37	D
Variation in Actual Temp reading at sample points	0.00	E
Combined u/c of Temp (K)	**Combined u/c (K)**	
SQRT $((D/\sqrt{3}^2) + (E/\sqrt{3})^2)$	3.67	
Expanded Uncertainty of Temp Measurements (K)	**7.35**	
Measured Average Velocity (m/s) at Stack Conds	9.50	
Maximum Average Velocity (m/s) at Stack Conds	9.97	
Standard Uncertainty Velocity at Stack Conditions (%)	5.02	
Expanded Uncertainty Velocity (at Stack Conditions)	**10.04**	**(%)**

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	39.46	
Maximum Average Flowrate (m^3/s) at Stack Conds	41.85	
Standard Uncertainty Flowrate (m^3/s) at Stack Conditions (%)	6.07	
Expanded Uncertainty Flowrate (m^3/s) at Stack Conditions	**12.14**	**(%)**

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	8.12	
Maximum Average Flowrate (m^3/s) at STP Wet	8.62	
Standard Uncertainty Flowrate (m^3/s) at STP Wet	6.18	
Expanded Uncertainty Flowrate (m^3/s) at STP Wet	**12.37**	**(%)**

Measurement Uncertainty Calculations - Flowrate at STP & Dry Gas

Contribution From	**Standard u/c (%)**	
Moisture Uncertainty (% v/v)	0.46	
Measured Average Flowrate (m^3/s) at STP Dry	7.79	
Maximum Average Flowrate (m^3/s) at STP Dry	8.31	
Standard Uncertainty Flowrate (m^3/s) at STP Dry	6.69	
Expanded Uncertainty Flowrate (m^3/s) at STP Dry	**13.38**	**(%)**

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

Contribution From	**Standard u/c (%)**	
Oxygen Uncertainty (% v/v)	0.219	
Measured Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	2.78	
Maximum Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	3.06	
Standard Uncertainty Flowrate (m^3/s) at STP Dry & Ref Oxygen	10.33	
Expanded Uncertainty Flowrate (m^3/s) at STP Dry & Ref O_2	**20.65**	**(%)**

Combustion Gases Uncertainty of Measurements

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	SO_2 0 - 460 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	0.80	0.40	0.13	0.60
Span drift[2]	$u_{d,s}$			0.27	0.27	0.29	0.029	0.24
Losses / leakage in the sample system[4]	u_{loss}			0.29	1.12	0.55	0.015	0.83
Temperature dependant span drift[5]	u_t			0.18	0.15	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	SO_2 0 - 460 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	2.12	0.22	0.019	0.069
Span drift	$u_{d,s}$			0.20	0.72	0.16	0.0041	0.028
Temperature dependant span drift	u_t			0.47	1.44	0.099	0.036	0.0092
Interferents	u_i			0.87	3.98	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	SO_2 0 - 460 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}	15/09/16 14:06 - 15:05	0.36	0.89	0.067	0.0022	0.044
Standard Error of Measured Value	u_{SE}	15/09/16 14:06 - 15:05	0.87	0.35	0.089	0.12	0.094

Effect on Uncertainty Caused by Oxygen $uCorr^n_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})x(20.9\% - O_{2,measured})} x\,Uncertainty\ of\ O_2\ Measurement =$ 0.081

$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} =$ 1.2277 $uf_{O_2} = \frac{uCorr^n_{O_2}}{f_{O_2}} x100 =$ 6.57 %

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	SO_2 0 - 460 mg/m³	CO 0 - 95 mg/m³	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Measured Concentration	15/09/16 14:06 - 15:05	123.84	79.52	12.19	14.58	5.30
Expanded Uncertainty as Percentage of Measured Concentration		7%	14%	27%	7%	8%

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%

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	SO_2 0 - 460 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	0.80	0.40	0.13	0.60
Span drift[2]	$u_{d,s}$	Rectangular (Divisor = √3)	0.27	0.27	0.29	0.029	0.24
Repeatability Standard Deviation (span)[3]	u_r	Normal (Divisor = 1)	4.31	2.55	3.41	0.15	0.89
Losses / leakage in the sample system[4]	u_{loss}	Rectangular (Divisor = √3)	0.29	1.12	0.55	0.015	0.83
Temperature dependant span drift[5]	u_t	Rectangular (Divisor = √3)	0.18	0.15	0.050	0.070	0.040
Interferents[1]	u_i	Rectangular (Divisor = √3)	1.20	1.50	2.90	0.56	0.010
Uncertainty of Reference Gas[6]	u_{ref}	Rectangular (Divisor = √3)	9.28	10.24	4.33	0.15	0.31

Note:

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

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 Applies to TVOC only

Measurement Uncertainty Calculations Part 2

Horiba PG 250 Performance Characteristics	Uncertainty	Value of Standard Uncertainty	NO 0 - 125 mg/m^3	SO_2 0 - 460 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	2.12	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	0.72	0.16	0.0041	0.0280
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	4.31	2.55	3.41	0.15	0.63
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	0.21	2.97	0.30	0.0022	0.10
Temperature dependant span drift	u_t	$u(x_i)=\frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max}-x_{adj})^2+(x_{i,min}-x_{adj})(x_{i,max}-x_{adj})+(x_{i,min}-x_{adj})^2}{3}}$	0.39	1.20	0.082	0.030	0.014
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.87	3.98	1.59	0.081	0.01
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	5.36	5.91	2.50	0.087	0.18
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	6.95	8.52	4.54	0.20	0.66
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	13.91	17.04	9.07	0.39	1.33
Applied Span Concentration			535.87	591.45	250.13	15.03	17.73
Measured Span Concentration, STP Dry Gas			529.47	586.62	247.45	14.99	17.80
Expanded measurement uncertainty as % of Applied Span			3%	3%	4%	3%	7%

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)]	$u_{\text{d,s}}$			0.029	0.35
Losses / leakage in the sample system[(4)]	u_{loss}			1.00	0.00
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}			0.20	0.52
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}	15/09/16 14:01 - 15:00	0.15	0.00
Standard Error of Measured Value	u_{SE}	15/09/16 14:01 - 15:00	0.12	0.16
Uncertainty due to Moisture Correction[(6)]	u_{H2O}	15/09/16 14:01 - 15:00	0.06	0.022

Effect on Uncertainty Caused by Oxygen

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

0.08

$$f_{o_2} = \frac{20.9\% - O_{2,\,ref}}{20.9\% - O_{2,\,measured}} = \quad 2.8304$$

$$uf_{O_2} = \frac{uCorr\ ^{n}{}_{O_2}}{f_{O_2}} x100 = \quad 2.85 \quad \%$$

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	15/09/16 14:01 - 15:00	14.58	5.15
Expanded Uncertainty as Percentage of Measured Concentration		4 %	26 %

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 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%

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/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)	7.10
Losses / leakage in the sample system[(4)]	u_{loss}	Rectangular (Divisor = √3)	0.00
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)	20.93

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

Flare - 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	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	1.06
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	0.00
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max}-x_{adj})^2 + (x_{i,min}-x_{adj})(x_{i,max}-x_{adj}) + (x_{i,min}-x_{adj})^2}{3}}$	0.013
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.38
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	12.08
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	12.14
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	24.28
Applied Span Concentration			1477.96
Measured Span Concentration, STP Dry Gas			1477.69
Expanded measurement uncertainty as % of Applied Span			2 %

* Signal 3030 FID

Non-methane TVOCs Uncertainty

Site: Potters Landfill, Brynpostef
Location: Flare, Stack ID:A3

				Standard Uncertainty @ 95%		
Sampled Volume	V_m	0.09829	m^3	uV_m	0.000	m^3
Meter Correction Factor or ml/count	Yd	1.0527	...	...	...	...
Meter Temperature	T_m	294.25	k	uT_m	1.5	k
Barometric Pressure	ρ_b	972.00	mBar		10.0	mBar
Oxygen content	$O_{2,m}$	14.58	%Vol	$uO_{2,m}$	0.87	%Vol
Moisture	H_2O	4.09	%Vol	uH_2O	0.92	%Vol

Tubes					
Determinand	Recovered Mass		Standard Uncertainty		
Total VOCs	101.00	µg	uM	5.00	µg

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 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 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

$$f_s = \frac{273}{T_m} \times \frac{\rho}{101.3} = \quad 0.89$$

	Maximum	Minimum	Sensitivity	ufstp
$u\rho_b$	0.47	0.46	0.000475	0.00475
uT_m	0.89	0.89	0.00303	0.00454
uH_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00579$$

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

$$V_{std} = V_{measured} \times f_s = \quad 0.0921$$

	Maximum m³	Minimum m³	Sensitivity	Standard Uncertainty m³
Effect of uf_s	0.0927	0.0915	0.10	0.000599
Effect of uV_m	0.0921	0.0921	0.94	9.371E-06

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.00953$$

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
Total VOCs	0.0127	...

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

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
Total VOCs	1.15	1.04	10.86	0.0543
Condensate Results				
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	Standard Uncertainty mg/Nm^3
Total 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
Total VOCs	1.22	0.99	12.03	0.11

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
Total VOCs	0.13	0.26	3.11	8.21

EMISSIONS MONITORING SURVEY

Prepared for:

Potters Waste.
Brynposteg Landfill Site
Llanidloes
Powys
SY18 6JJ

Permit Number	**: TP3736SQ**
Variation Number	**: …**
Installation	**: Engine 1 & 2**
Visit Details	**: Annual Compliance**
Job Number	**: P2723**
Report Number	**: R002**
Report Issue Date	**: 28th November 2016**
Survey Dates	**: 14th & 15th September 2016**

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Report Issue:		**FINAL**	
Report Prepared by:		**Report Reviewed & Approved by** MCERTS Level Two Technical Endorsements TE1, TE2, TE3 & TE4	
Name:	Christopher Pickford	***Name:***	Sam Brookes
		MCERTS No:	MM 06 775
		Signature:	[signature]
Date:	01/11/2016	***Date:***	28/11/2016

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".

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING 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.

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- 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

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 **SEB/P2723/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: Engine 1	Ref No: 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	…	2.33	m^3/sec	6	Stack Conditions	14/09/2016	10:30 - 10:40	BS EN 16911-1	UKAS / MCERTS	✔	Normal
	Volumetric Flowrate	…	0.71	m^3/sec	9	Dry & 5% O_2			BS EN 16911-1	UKAS / MCERTS	✔	
	TVOC as Carbon	1750	1291.51	mgC/m^3	2	Dry & 5% O_2		13:41 – 14:40	BS EN 12619:2013	UKAS / MCERTS		
	Oxides of Nitrogen (as NO_2)	441.18	440.51	mg/m^3	2	Dry & 5% O_2		13:41 – 14:40	BS EN 14792: 2005	UKAS / MCERTS		
	Carbon Monoxide	1500	990.06	mg/m^3	4	Dry & 5% O_2			BS EN 15058: 2006	UKAS / MCERTS		
	Oxygen (Zirconia Cell)	…	5.28	%	4	Dry			BS EN 14789: 2005	UKAS / MCERTS		
	Carbon Dioxide	1448.7	12.48	%	4	Dry			ISO 12039:2001	UKAS / MCERTS		
	Non-Methane VOC $	150	0.90	mg/m^3	33	Dry & 5% O_2		15:00 – 16:00	Modified BS EN 13649	NU	✔	
	Sulphur Dioxide	…	61.54	mg/m^3	13	Dry & 5% O_2		13:45 – 14:45	BS EN 14791	UKAS / MCERTS	✔	

<u>See page 6 for notes.</u>

Potters Waste
Permit No : TP3736SQ
Variation No : ...
Report Ref : P2723 : R002

Installation Name : Engine 1 & 2
Visit Details : Annual Compliance
Survey Dates : 14th & 15th September 2016
Report Issue Date : 28th November 2016

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	...	3.75	m^3/sec	9	Stack Conditions	14/09/2016	17:30 – 17:48	BS EN 16911-1	UKAS / MCERTS	✔	Normal
	Volumetric Flowrate	...	0.91	m^3/sec	12	Dry & 5% O_2			BS EN 16911-1	UKAS / MCERTS	✔	
	TVOC as Carbon	1750	1229.33	mgC/m^3	2	Dry & 5% O_2		15:21 – 16:20	BS EN 12619:2013	UKAS / MCERTS		
	Oxides of Nitrogen (as NO_2)	441.18	392.13	mg/m^3	2	Dry & 5% O_2		15:31 – 16:30	BS EN 14792: 2005	UKAS / MCERTS		
	Carbon Monoxide	1500	1157.21	mg/m^3	4	Dry & 5% O_2			BS EN 15058: 2006	UKAS / MCERTS		
	Oxygen (Zirconia Cell)	...	7.92	%	4	Dry			BS EN 14789: 2005	UKAS / MCERTS		
	Carbon Dioxide	1448.7	10.28	%	4	Dry			ISO 12039:2001	UKAS / MCERTS		
	Non-Methane VOC $	150	0.96	mg/m^3	23	Dry & 5% O_2		17:26 – 18:26	Modified BS EN 13649	NU	✔	
	Sulphur Dioxide	...	80.71	mg/m^3	13	Dry & 5% O_2		16:19 – 17:19	BS EN 14791	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, 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
Engine 1	Continuous	Dependent on gas supply	Landfill Gas	NA	NA	60%	...	...	...	NP	...	...
Engine 2	Continuous		Landfill Gas	NA	NA	70%	...	...	...	NP	...	...

<u>Notes:</u>

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 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 on Gas Engine 1 are non-conforming as they were sampled on the stack exit. Please note that no alternative sample location is available.
- Flowrate tests are non-conforming on Gas Engine 2, as there is only one sampling port accessible, rather than two as required by the sampling standard. In order to maintain the UKAS/MCERTS accreditation status of the tests, extra sample points were used on the one available sample line.
- Analytical laboratory SAL do not hold UKAS accreditation for the analysis of total NMVOCs.

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

PART 2 – SUPPORTING INFORMATION

3 SAMPLING STAFF DETAILS

Site Sampling Team

Names of Site Team	Dates on Site	MCERTS No.	LEVEL	Technical Endorsements
David Boles	14-15/09/2016	MM03 215	2	TE1, TE2, TE3, TE4
Christopher Pickford		MM14 1301	1	TE1

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 & MID** and In-house technical procedure **ECL/TPD/022.**

Temperature was recorded using a thermocouple and digital temperature reader.

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

Combustion Gases (NO_x, CO, O_2 & 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: 2005
• CO	Non-dispersive infrared	BS EN 15058: 2006
• O_2	Galvanic / Zirconia	BS EN 14789: 2005
• CO_2	Non-dispersive infrared	ISO 12039

The analyser was set up with reference to the manufacturers 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.

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** 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).

Scientific Analysis Laboratories Ltd (SAL) who are situated in Manchester carried out the analysis of the samples. **SAL** are 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-Methane VOC** was carried out in accordance with **BS EN 13649** 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.

Scientific Analysis Laboratories Ltd (SAL) who is situated in Manchester carried out the analysis of the samples. **SAL** is 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 BS EN 13649, MCERTS/UKAS accreditation can only be claimed when the target parameters are organic compounds, the sorbent tube used is a standard charcoal 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.

Water Vapour

Testing was carried out using a Universal Stack Sampling system in accordance with **BS EN 14790** 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.

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 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 on 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, January 2007, Version 4.1,* and BS EN 13284-1.

However, as isokinetic testing was not required for this particular survey, 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.

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.

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 health and safety restrictions.

The stack diameter is 0.4m and the sample platform width back from the sample port is not applicable as both ports overhang the scaffold platform.

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 2m from the working sample platform. Only Port A could be safely accessed from the scaffolding provided as both ports overhang the 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.

Access was only possible to one port. Consequently, the volumetric flowrate tests 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)

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	U002							
MST Nozzle set									
MST "S" Type Pitot		489							
MST Probe									
MST Hot Box		336							
MST Impinger Arm		659							
Barometer		1045							
Site Balance		1069							
Site Check weights		190							
		191							
Horiba	E002	096							
Heated Probe / Filter		631							
Chiller		1092							
Sonimix / MFC		761	934						
Heated Line		1013							
FID	E003	304							
Heated Line		1013	1014						
Heated Probe / Filter		631							
Testo	E004								
FTIR	E005								
Heated Probe / Filter									
Heated Line									
Stackmite	E006								
"L" Type Pitot									
Digital Manometer									
Stack Thermocouple									
Thermocouple Reader									
Nozzle Set									
Workhorse Pumps	E007								
Low Flow Pumps									

Quantity of Ice Required / Used for Survey	8	Bags (2kg bags)

FIGURES

Figure 1 Engine 1 TVOCs

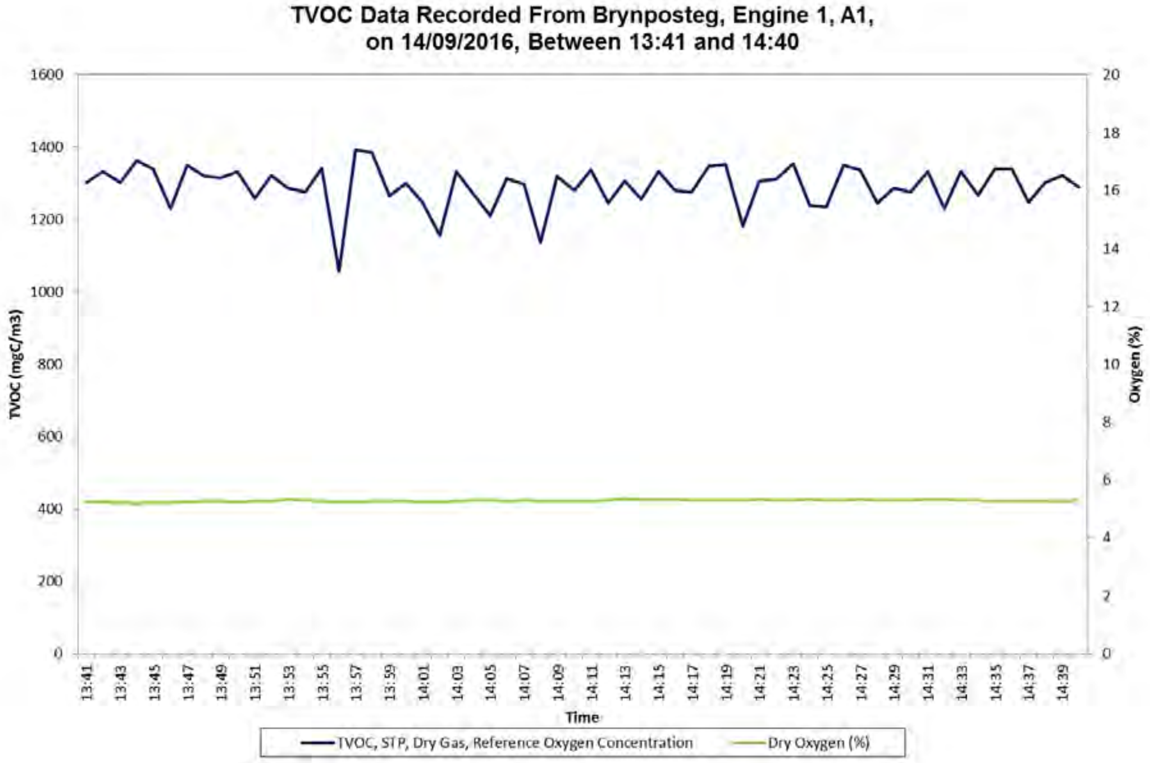


Figure 2 Engine 1 Combustion Gases

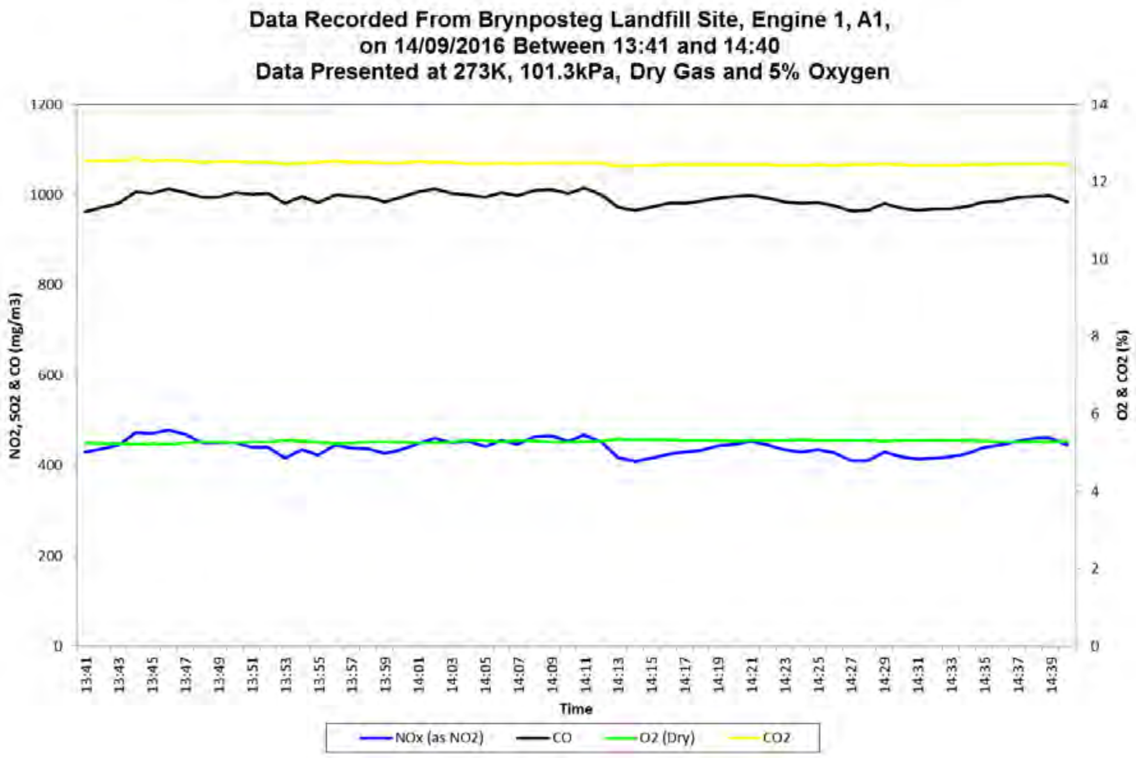


Figure 3 Engine 2 TVOCs

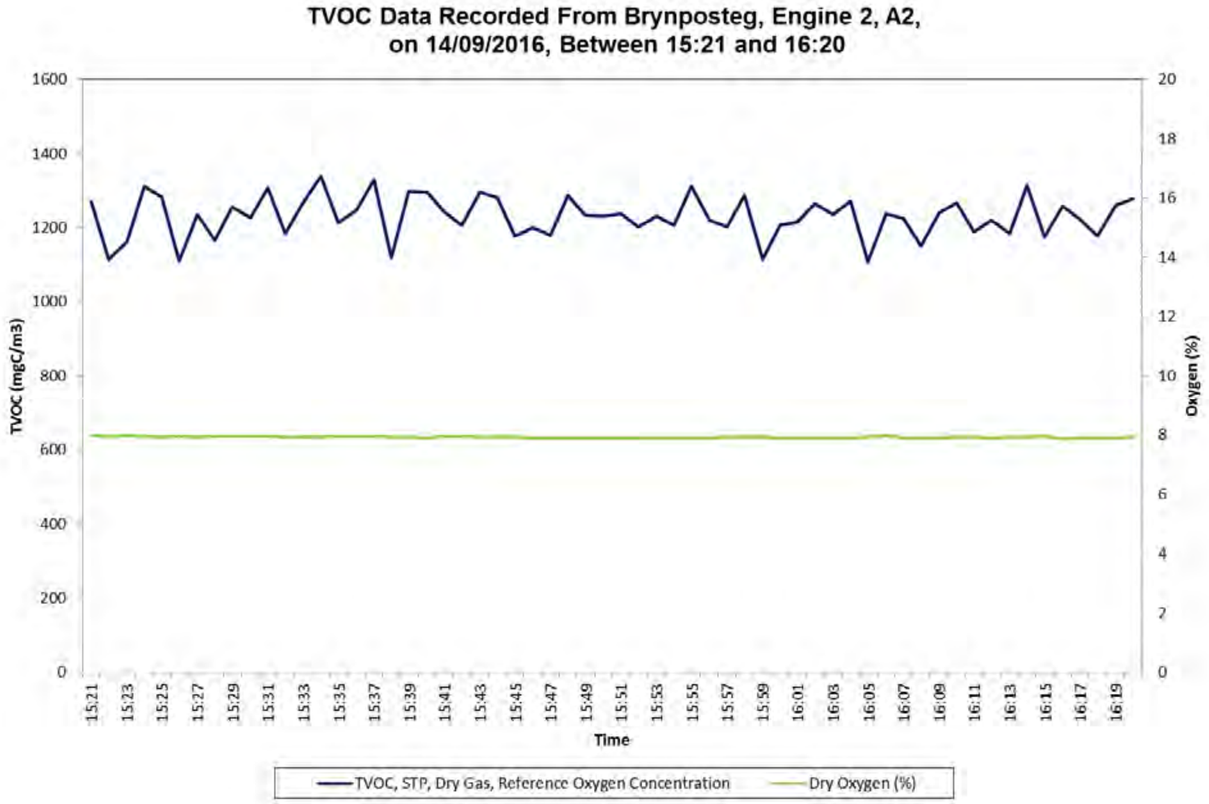
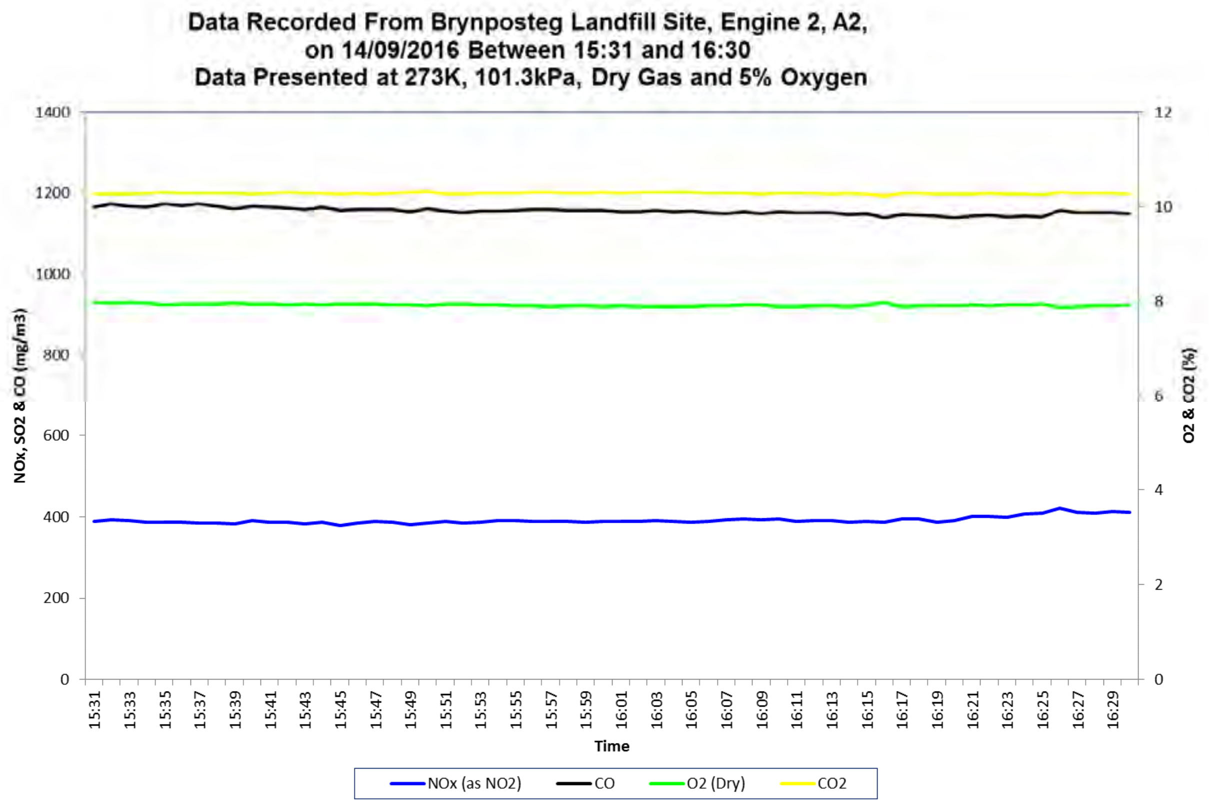


Figure 4 Engine 2 Combustion Gases



TABLES

Table 1 – TVOCs

Data Recorded from A1 – Engine 1

Sample Period: 13:41 – 14:40 on the 14th September 2016

Volumetric Flowrate (Reference Conditions) = **0.71 m^3/sec ***

	Average	Emission Rate
	mg/m^3	Kg/hr
TVOC (as carbon)*	1291.51	3.301

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

Table 2 – Gases

Data Recorded from A1 – Engine 1

Sample Period: 13:41 – 14:40 on the 14th September 2016

Volumetric Flowrate (Reference Conditions) = **0.71 m^3/sec ***

	Average	Emission Rate
	mg/m^3	Kg/hr
Oxides of Nitrogen (as NO_2) *	440.51	1.126
Carbon Monoxide *	990.06	2.531
Carbon Dioxide (%) **	12.48	...
Oxygen (%) **	5.28	...

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

Table 3 – SO2

Data Recorded from A1 - Engine 1

Emission Parameter	Units	one	Blank
Stack Diameter	metres	0.30	
Area of Sample Plane	m^2	0.071	
Moisture Content	%	13.56	
Oxygen Content	%	5.28	
Stack Temperature	°C	455	
Gas Velocity (as Measured)	m/sec	32.63	
Gas Velocity (Reference Conditions)	m/sec*	10.00	
Volumetric Flowrate (as Measured)	m^3/sec	2.31	
Volumetric Flowrate (Reference Conditions)	m^3/sec*	0.71	
Dry Gas Molecular Weight	g/gmole	30.20812389	
Sample Date	...	14/09/2016	
Sample Period	...	13:45 - 14:45	
Sample Volume (reference Conditions)	m^3*	0.599	0.599
Sample Reference	ECL/16/	4730+4731	4732
Mass of Sulphur Dioxide Collected	mg	36.89	0.10
Concentration of Sulphur Dioxide	mg/m^3*	**61.54**	0.16
Emission Rate of Sulphur Dioxide	kg/hr	0.16	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	95	...

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

Table 4 – Non-methane TVOCs

Potter Landfill

Brynposteg Engine 1 A1

Emission Parameter	Units	Value		
Stack Diameter	mm	300		
Area of Sample Plane	m^2	0.071		
Moisture Content	%	12.46		
Expanded Uncertainty of Moisture (%Relative)	%	13.54		
Measured Oxygen (Dry)	%Vol	5.28		
Meter Temperature	°C	25.17		
StackTemperature	°C	455.00		
Sample Date	...	14/09/2016		
Sample Period	...	15:00 - 16:00		
Sample Volume (as Measured)	m^3	0.16		
Sample Volume (reference Conditions)	m^3*	0.13		
Sample Tube Results		one		Blank
Sample Reference ECL/16/4737	Units	Concentration*	Uncertainty	Concentration
Concentration of Total Non-methane VOCs	mg/m^3	0.90	33.03%	0.015

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

Table 5 – TVOCs

Data Recorded from A2 – Engine 2

Sample Period: 15:21 – 16:20 on the 14th September 2016

Volumetric Flowrate (Reference Conditions) = **$0.91m^3$/sec ***

	Average	Emission Rate
	mg/m³	Kg/hr
TVOC (as carbon)*	1229.33	4.027

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

Table 6

Data Recorded from A2 – Engine 2

Sample Period: 15:31 – 16:30 on the 14th September 2016

Volumetric Flowrate (Reference Conditions) = **$0.91m^3$/sec ***

	Average	Emission Rate
	mg/m³	Kg/hr
Oxides of Nitrogen (as NO_2) *	392.13	1.285
Carbon Monoxide *	1157.21	3.791
Carbon Dioxide (%) **	10.28	...
Oxygen (%) **	7.92	...

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

Table 7 – SO2

Data Recorded from A2 - Engine 2

Emission Parameter	Units	one	Blank
Stack Diameter	metres	0.40	
Area of Sample Plane	m^2	0.126	
Moisture Content	%	12.68	
Oxygen Content	%	7.92	
Stack Temperature	°C	450	
Gas Velocity (as Measured)	m/sec	29.84	
Gas Velocity (Reference Conditions)	m/sec*	7.24	
Volumetric Flowrate (as Measured)	m^3/sec	3.75	
Volumetric Flowrate (Reference Conditions)	m^3/sec*	0.91	
Dry Gas Molecular Weight	g/gmole	29.96151389	
Sample Date	...	14/09/2016	
Sample Period	...	16:19 - 17:19	
Sample Volume (reference Conditions)	m^3*	0.501	0.501
Sample Reference	ECL/16/	4733 + 4734	4735
Mass of Sulphur Dioxide Collected	mg	40.46	0.11
Concentration of Sulphur Dioxide	mg/m^3*	**80.71**	0.21
Emission Rate of Sulphur Dioxide	kg/hr	0.26	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	96	...

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

Table 8 – Non-methane TVOCs

Potters Landfill

Brynposteg Engine 2 A2

Emission Parameter	Units	Value		
Stack Diameter	mm	400		
Area of Sample Plane	m^2	0.126		
Moisture Content	%	12.94		
Expanded Uncertainty of Moisture (%Relative)	%	13.75		
Measured Oxygen (Dry)	%Vol	7.92		
Meter Temperature	°C	26.83		
StackTemperature	°C	500.00		
Sample Date	...	14/09/2016		
Sample Period	...	17:26 - 18:26		
Sample Volume (as Measured)	m^3	0.13		
Sample Volume (reference Conditions)	m^3*	0.090		
Sample Tube Results		one		Blank
Sample Reference ECL/16/4739	Units	Concentration*	Uncertainty	Concentration
Concentration of Total Non-methane VOCs	mg/m^3	0.96	22.62%	0.022

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

VELOCITY TRAVERSE PROFILES

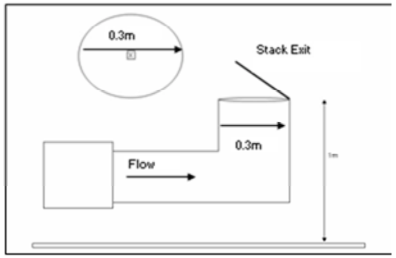
Environmental Compliance Limited

Potters Waste			**Installation Name**	: Engine 1 & 2
Permit No	: TP3736SQ		**Visit Details**	: Annual Compliance
Variation No	: ...		**Survey Dates**	: 14th & 15th September 2016
Report Ref	: P2723	: R002	**Report Issue Date**	: 28th November 2016

Environmental Compliance Limited	Traverse Data Profoma	Date of Measurement	14/09/2016

Company	Potter Landfill	Stack Diameter Port A (mm)	300	Average Stack Diameter (mm)	300	Pitot tube coefficient	1.01
Site	Brynposteg	Stack Diameter Port B (mm)		Port Length (mm)	n/a	Pitot Id	489
Location	Engine 1	Duct Length Port A (mm)		Average Duct Length (mm) L		Stack Thermocouple ID	1094
Stack	A1	Duct Length Port B (mm)		Duct width (mm) B		Stack Temp Reader ID	116
Job No	P2723	Duct Length Port C (mm)		Barometric Pressure. (mb)	972	Manometer ID	357
Operators	DB + CP	Duct Length Port D (mm)		Ave Static Press. (mm H_2O)	3.06	Barometer ID	1069

Diagram/ Description of Cross Section of Stack/Duct



Pre - Traverse Checks Carried Out	Time	Pass/ Fail
Pre - Traverse Visual Inspection	10:30:00	PASS
Pre - Traverse Pitot Leak Check	10:32:00	PASS

Smooth Walls

Static Pressure Readings (Pascals)			
Port A	Port B	Port C	Port D
30.00			

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	150	10:34:00	455.0	455.0	455.0	240.0	244.0	256.0	455.0	246.7	0
Blockage Check @ A1 (L-Type Pitot Only)		10:38:00	455.0	455.0	455.0	240.0	245.0	256.0	455.0	246.7	Total
			Mean		455.0	Mean		247.0	455.0	246.7	Max
			Difference <5% from Initial ?		0.00	Difference <5% from Initial ?		0.14	455.0	246.7	Min
									455.0	246.7	Average

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

Sampling from stack exit, can't do swirl properly

Post - Traverse Checks Carried Out	Time	Pass/ Fail
Post - Traverse Visual Inspection	10:40:00	PASS

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

Average temp (K)	728.000

Suitability of Sampling Position	Actual Stack Conditions
Highest:lowest flow pressure ratio < 9:1?	1.03:1
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	OK

Compliance With Positional Requirements?

Height of sample ports from Platform	1.0m
Number of sample ports	1
Width of platform (port back to handrail)	2.0m

Stack Moisture	13.56	%	Gas Velocity (as Measured) Adjusted for Smooth Walls	32.95154	m/sec
Measured Oxygen	5.28	%	Gas Velocity (Reference Conditions) Adjusted for Smooth Walls	10.07155	m/sec*
Measured Carbon Dioxide	12.48	%	Volumetric Flowrate (as Measured) Adjusted for Smooth Walls	2.32921	m^3/sec
Dry Gas Molecular Weight	30.20800	g/g mole	Volumetric Flowrate (Ref Cond) Adjusted for Smooth Walls	0.71192	m^3/sec*

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

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

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

Environmental Compliance Limited

Potters Waste			Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ		Visit Details	: Annual Compliance
Variation No	: ...		Survey Dates	: 14th & 15th September 2016
Report Ref	: P2723	: R002	Report Issue Date	: 28th November 2016

Environmental Compliance Limited	Traverse Data Profoma	Date of Measurement	14/09/2016

Company	Potters Landfill	Stack Diameter Port A (mm)	400	Average Stack Diameter (mm)	400	Pitot tube coefficient	1.00
Site	Brynposteg	Stack Diameter Port B (mm)		Port Length (mm)	90	Pitot Id	489
Location	Engine 2	Duct Length Port A (mm)		Average Duct Length (mm) L		Stack Thermocouple ID	1094
Stack	A2	Duct Length Port B (mm)		Duct width (mm) B		Stack Temp Reader ID	116
Job No	P2723	Duct Length Port C (mm)		Barometric Pressure. (mb)	972	Manometer ID	357
Operators	DB + CP	Duct Length Port D (mm)		Ave Static Press. (mm H_20)	4.08	Barometer ID	1069

Pre - Traverse Checks Carried Out	Time	Pass/ Fail
Pre - Traverse Visual Inspection	17:30:00	pass
Pre - Traverse Pitot Leak Check	17:32:00	pass

Smooth Walls

Static Pressure Readings (Pascals)

Port A	Port B	Port C	Port D
40.00			

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	27	17:34:00	500.0	498.0	500.0	198.0	188.0	202.0	499.3	196.0	5
A2	100	17:36:00	500.0	500.0	500.0	198.0	187.0	205.0	500.0	196.7	5
A3	300	17:38:00	500.0	500.0	500.0	178.0	194.0	207.0	500.0	193.0	5
A4	373	17:40:00	500.0	500.0	500.0	182.0	184.0	201.0	500.0	189.0	5
Blockage Check @ A1 (L-Type Pitot Only)		17:46:00	500.0	500.0	500.0	195.0	195.0	195.0	1999.3	774.7	Total
			Mean		500.0	Mean		195.0	500.0	196.7	Max
			Difference <5% from Initial ?		0.09	Difference <5% from Initial ?		-0.51	499.3	189.0	Min
									499.8	193.7	Average

Post - Traverse Checks Carried Out	Time	Pass/ Fail
Post - Traverse Visual Inspection	17:48:00	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)	772.833

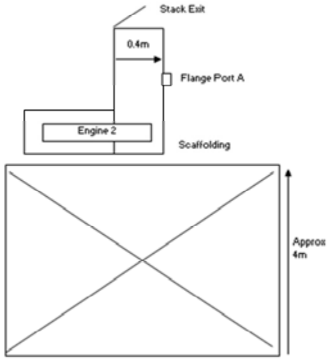
Suitability of Sampling Position	Actual Stack Conditions
Highest:lowest flow pressure ratio < 9:1?	1.11:1
Maximum deviation of flow from axis <15° ?	5
X-sectional area for stacks= πr2	0.13 m^2
X-sectional area for ducts = L x B	m^2
Suitability of Position for Sampling	OK

Stack Moisture	12.68	%	Gas Velocity (as Measured) Adjusted for Smooth Walls	29.83930	m/sec
Measured Oxygen	7.92	%	Gas Velocity (Reference Conditions) Adjusted for Smooth Walls	7.21260	m/sec*
Measured Carbon Dioxide	10.28	%	Volumetric Flowrate (as Measured) Adjusted for Smooth Walls	3.74972	m^3/sec
Dry Gas Molecular Weight	29.96160	g/g mole	Volumetric Flowrate (Ref Cond) Adjusted for Smooth Walls	0.90636	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

Compliance With Positional Requirements?

Height of sample ports from Platform	2m
Number of sample ports	2
Width of platform (port back to handrail)	n/a

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

Engine 1 Combustion Gases

	Horiba PG 250 Measurement Ranges:			
	NO as NO_2	CO	O_2	CO_2
	1025	1250	25	20
Units	mg/m^3	mg/m^3	%Vol	%Vol
	Zero Values (Direct)			
Mean Initial Direct Zero	-0.22	0.57	0.12	0.02
Mean Confirmation Direct Zero	-0.27	1.67	-0.10	0.12
Difference in Direct Zero	0.05	1.09	0.22	0.10
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	0.26	2.64	-0.11	0.05
% of Measurement Range?	0.03%	0.21%	-0.45%	0.24%
Detection Limit (LOD)	0.26	0.32	0.20	0.01
	Applied Span:			
	NO	CO	O_2	CO_2
Actual Applied Span Concentration	535.87	250.13	15.03	17.73
	Pre Test System Zero Values			
Mean Pre Test System Zero	0.26	2.64	-0.11	0.05
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.05%	1.06%	0.75%	0.28%
	Post Zero Values (System)			
Mean Post Test Zero	0.47	4.17	-0.20	0.04
% of Certified Range?	0.05%	0.33%	-0.79%	0.20%
Zero Drift ≤ ± 5% of Applied Span?	0.04%	0.61%	0.57%	0.05%
	Pre Test System Span Values			
Mean Pre Test System Span	534.38	251.42	14.94	17.78
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.28%	0.52%	0.60%	0.30%
	Post Test System Span Values			
Mean Post Test System Span	528.28	257.26	14.86	17.67
Span Drift ≤ ± 5% Span Value?	1.14%	2.32%	0.53%	0.67%
	1.14%	2.32%	0.57%	0.67%
	See Note 3	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.

Engine 1 & 2 TVOCs Calibrations Summary

TVOC - FIELD DATA SHEET

Client	Potters Waste	Barometric Pressure mb	972	
Site	Brynposteg	Barometer ID	ECL/ID/ 1045	
Date	14/09/2016	Analyser ID	ECL/ID/ 304	
Location	Engines	Sonimix/ MFC ID	ECL/ID/ n/a	
Stack ID	1 + 2	Heated Line/ Controller ID	ECL/ID/ 1013 + 1014	
Stack Temp °C	455	Heated Line Set Temp °C	180	YES
Ambient Temp (sampling)	1 = 22 2 = 22 3 = 23	Heated Line Length	10	m
Ambient Temp (sampling)	4 = 23 5 = 24 6 = 24	Heated Probe Filter ID	ECL/ID/ 631	
Job No	P2723	Heated Filter Set Temp °C	180	YES
Operators	DB + CP	Logger ID	926	

Calibration Gas Details

Calibration Gas	Gas Bottle ID	Gas Value	Uncertainty of Gas (k=2)
Zero Gas (Synthetic Air)	Gas/ 1629	...	...
Hydrogen / Helium	Gas/ 1597	...	...
Propane (In Air)	Gas/ 1634	919.7 ppm	9.2

	Analyser Range	Span Gas value used
Propane	1000ppm	919.7 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	11:14	11:18	11:25	11:30	11:36	11:41

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	
21	21	Start Time	End Time	Start Time	End Time
ZERO / SPAN		11:44	11:49	11:50	11:55

Response Time SYSTEM Span Gas Cal		
Start Time	90% Time	less than 200s (Y/N)
11:50:00	11:50:30	y

	Start Time	End Time	Location	Production Details
Sample Period	13:40	14:40	A1	Engine 1 60%
Sample Period	15:20	16:20	A2	Engine 2 70%
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	
24	24	Start Time	End Time	Start Time	End Time
ZERO / SPAN		17:22	17:26	17:28	17:31

Process Details / Comments

Engine 1 & 2 TVOCs data Sheet

Calibration Summary		TVOC ppm
Analyser Range		**1000**
Repeatability at Zero		2
Span Gas Concentration Applied		**919.7**
Zero Gas Concentration Applied		0
Direct Cal	Zero	0.00
	Span	919.7
	Zero	-1.70
Difference (Zero)		1.7048
< 2 x Repeatability @ Zero?		**YES**
Pre Test (System)	Zero	-1.91
	Span	916.4
Difference (Zero)		1.9094
< 2% Relative to Direct Span		YES
Difference (Span)		3.2732
< 2% Relative to Direct Span		**YES**
Post Test (System)	Zero	1.16
	Span	916.1
Difference (Zero)		3.0686
Zero Drift < 2% of Applied Span?		YES
Difference (Span)		0.3682
Span Drift < 2% of Applied Span?		**YES**
Zero and Span Drift < 5% of Applied Span?		**YES**

Potters Waste			Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ		Visit Details	: Annual Compliance
Variation No	: ...		Survey Dates	: 14th & 15th September 2016
Report Ref	: P2723	: R002	Report Issue Date	: 28th November 2016

Engine 1 SO2 Field Data Sheet

Environmental Compliance Limited	NON ISOKINETIC SAMPLING PROFORMA	Date of Measurement	14/09/2016
ECL/TPD/ 39	Time taken to change Ports? 0	Start Time 13:45	End Time 14:45
		Test Duration	60 mins

Client	Potters Waste	Stack Profile	Circular	Console id	U002	Barometer id	1045
Site	Brynposteg	Stack Area (m^2)	0.07	Pump id	U002	Nozzle Id	n/a
Location	Engine 1	Barometric Pressure (mb)	972	Probe id	N/A	Nozzle size	n/a
Stack ID	A1	Static Pres. (mm H_20)	30	DGM Yd	1.0524	Filter Id	N/A
Test No.	one	Pitot coefficient	n/a	ΔH@	41.47	Pitot ID	n/a
Job No	P2723	Probe Heater Setting (^OC)	n/a	Impinger Id	659	Hot Box ID	336
ECL Site Staff	DB + CP	Hot Box Setting (^OC)	n/a	Balance Id	1069		

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

	Sample	Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total
Start Volume	4025.7						
Final Volume	4680.3						
Total Volume	654.6	0.0	0.0	0.0	0.0	0.0	654.6
Leak Check	First	Second	Third	Fourth	Fifth		
Leak rate l/min	0.1				0.1		
Vaccum "Hg	-4				-5		
Time of Check	10:17				14:50		
Set Rate l/min	20				10.9		
Leak <2%?	YES				YES		

Dry O_2 (Atmospheric)	5.28
Dry Carbon Dioxide %	12.48
Dry Carbon Monoxide ppm	990.06

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)	10.00	10.00	10.00	10.00	10.00	10.00			10.00
Meter (Tm in)	21.00	22.00	24.00	25.00	26.00	26.00			24.00
Meter (Tm out)	21.00	21.00	22.00	22.00	23.00	22.00			21.83
Stack Temp (Ts)	455.00	455.00	455.00	455.00	455.00	455.00			455.00
Impinger T Outlet	10.00	11.00	12.00	14.00	14.00	15.00			12.67
Vaccum (" Hg)	-2.00	-4.00	-4.00	-4.00	-4.00	-4.00			-3.67

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	H2O2
SOL/	3026
Start Weight (g)	704.9
End Weight (g)	765.9
Total weight (g)	61
Impinger 2	H2O2
SOL/	3026
Start Weight (g)	714.1
End Weight (g)	723.4
Total weight (g)	9.3
Impinger3	H2O2
SOL/	3026
Start Weight (g)	713.4
End Weight (g)	714.2
Total weight (g)	0.8
Impinger 4	Empty
SOL/	...
Start Weight (g)	585
End Weight (g)	587.8
Total weight (g)	2.8
Impinger 5	Silica
SOL/	...
Start Weight (g)	824
End Weight (g)	827
Total weight (g)	3
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)	76.90
Silica <50% used at End of Test? Y/N	YES

Rinse Solutions used	
Solution	SOL NO
DI Water	3034
Acetone	3028

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.

Engine 1 SO2 Non-methane Field Data Sheet

Environmental Compliance Limited	SAMPLE TUBE DATA SAMPLING PROFORMA

Client	Potter Landfill	◉ Circular ○ Rectangular ○ Elipse		Pump ID	U002
Site	Brynposteg	Stack Diameter (mm)	300	Meter ID	U002
Location	Engine 1			MST Probe ID	N/A
Stack ID	A1	Stack Area (m^2)	0.071	MST Probe Heating Temp (C)	N/A
Test No	one	Barometric Pressure (mb)	972	DGM Yd or ml/count	1.0524
Job No	P2723	Stack Thermocouple ID	1094	MST Hot Box ID	336
ECL Site Staff	DB + CP	Tube Thermocouple ID	N/A	MST Hot Box Heating Temp (C)	180
Barometer ID	1069	Meter Thermocouple ID	u002	Workhorse Set Sample Rate (%)	N/A
		In-Stack Sinter Used (Y/N)	N	MST Delta H Sampling Rate	0.5

Date of Test	14/09/2016
Sample Start Time	15:00
Sample End Time	16:00
Duration	60
Measured O2	5.28
O2 Uncertainty %Vol	0.32

Meter Units ○ ml ◉ litres	Sample	Leak 1	Time (start/ end) (minimum 1 minute)	Leak 2	Time (start/ end) (minimum 1 minute)	Total
Start Volume	4680.1	4670.2	14:57:00	4842.2	16:03:00	
Final Volume	4830.1	4670.2	14:58:00	4842.2	16:04:00	
Total Volume	148.3	0.0		0.0		148.3
Sample Train Internal Volume	1.71983	ml / Litres				

Sample Point	A1	A1	A1	A1
Time/ point (mins)	0-5	10...20	20-30	30-40
Tube Temp ^OC	10	12	12	12
Stack Temp ^OC	455	455	455	455
Meter Temp In ^OC	25	25	26	26
Meter Temp Out ^OC	22	23	24	26

Sample Point	A1	A1		
Time/ point (mins)	40-50	50-60		
Tube Temp ^OC	13	14		
Stack Temp ^OC	455	455		
Meter Temp In ^OC	26	27		
Meter Temp Out ^OC	26	26		

Sample Point				
Time/ point (mins)				
Tube Temp ^OC				
Stack Temp ^OC				
Meter Temp In ^OC				
Meter Temp Out ^OC				

Impinger 1	Empty
Start Weight (g)	589.9
End Weight (g)	604.2
Total weight (g)	14.3
Impinger 2	Empty
Start Weight (g)	600.3
End Weight (g)	600.6
Total weight (g)	0.3
Impinger3	Silica
Start Weight (g)	827
End Weight (g)	827.3
Total weight (g)	0.3
Silica	(IF USED)
<50% Spent at end Y/N?	Yes
Sample train upstream of sorbent tube condensation free for entire sample (Y/N)	NO

- Not UKAS/MCERTS due to high stack temperature & moisture -

Engine 2 Combustion Gases

	Horiba PG 250 Measurement Ranges:			
	NO as NO_2	CO	O_2	CO_2
	1025	1250	25	20
Units	mg/m^3	mg/m^3	%Vol	%Vol
	Zero Values (Direct)			
Mean Initial Direct Zero	-0.22	0.57	0.12	0.02
Mean Confirmation Direct Zero	-0.27	1.67	-0.10	0.12
Difference in Direct Zero	0.05	1.09	0.22	0.10
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	0.26	2.64	-0.11	0.05
% of Measurement Range?	0.03%	0.21%	-0.45%	0.24%
Detection Limit (LOD)	0.26	0.32	0.20	0.01
	Applied Span:			
	NO	CO	O_2	CO_2
Actual Applied Span Concentration	535.87	250.13	15.03	17.73
	Pre Test System Zero Values			
Mean Pre Test System Zero	0.26	2.64	-0.11	0.05
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.05%	1.06%	0.75%	0.28%
	Post Zero Values (System)			
Mean Post Test Zero	0.47	4.17	-0.20	0.04
% of Certified Range?	0.05%	0.33%	-0.79%	0.20%
Zero Drift ≤ ± 5% of Applied Span?	0.04%	0.61%	0.57%	0.05%
	Pre Test System Span Values			
Mean Pre Test System Span	534.38	251.42	14.94	17.78
Difference ≤ ± 2% of Span Value (5% for SO_2)?	0.28%	0.52%	0.60%	0.30%
	Post Test System Span Values			
Mean Post Test System Span	528.28	257.26	14.86	17.67
Span Drift ≤ ± 5% Span Value?	1.14%	2.32%	0.53%	0.67%
	1.14%	2.32%	0.57%	0.67%
	See Note 3	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.

Engine 2 SO2 Field Data Sheet

Environmental Compliance Limited	NON ISOKINETIC SAMPLING PROFORMA	Date of Measurement	14/09/2016

If moisture was not measured see detailed notes below.

ECL/TPD/	39	Time taken to change Ports?	0	Start Time	16:19	End Time	17:19
				Test Duration	60 mins		

Client	Potters Waste	Stack Profile	Circular	Console id	U002	Barometer id	1045
Site	Brynposteg	Stack Area (m^2)	0.13	Pump id	U002	Nozzle Id	n/a
Location	Engine 2	Barometric Pressure (mb)	972	Probe id	N/A	Nozzle size	n/a
Stack ID	A2	Static Pres. (mm H_20)	40	DGM Yd	1.0524	Filter Id	N/A
Test No.	one	Pitot coefficient	n/a	ΔH@	41.47	Pitot ID	n/a
Job No	P2723	Probe Heater Setting (^OC)	n/a	Impinger Id	659	Hot Box ID	336
ECL Site Staff	DB + CP	Hot Box Setting (^OC)	n/a	Balance Id	1069		

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

	Sample	Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total
Start Volume	4837.6						
Final Volume	5506.4						
Total Volume	668.8	0.0	0.0	0.0	0.0	0.0	668.8
Leak Check	First	Second	Third	Fourth	Fifth		
Leak rate l/min	0.2				0.2	Dry O_2 (Atmospheric)	7.92
Vaccum "Hg	-7				-8	Dry Carbon Dioxide %	10.28
Time of Check	16:15				17:30	Dry Carbon Monoxide ppm	1157.21
Set Rate l/min	20				11.1		
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)	10.00	10.00	10.00	10.00	10.00	10.00			10.00
Meter (Tm in)	27.00	28.00	29.00	30.00	30.00	30.00			29.00
Meter (Tm out)	27.00	27.00	27.00	27.00	27.00	27.00			27.00
Stack Temp (Ts)	450.00	450.00	450.00	450.00	450.00	450.00			450.00
Impinger T Outlet	10.00	11.00	11.00	12.00	12.00	14.00			11.67
Vaccum (" Hg)	-5.00	-4.00	-4.00	-4.00	-4.00	-4.00			-4.17

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	H2O2
SOL/	3026
Start Weight (g)	694.9
End Weight (g)	750.1
Total weight (g)	55.2
Impinger 2	H2O2
SOL/	3026
Start Weight (g)	704.4
End Weight (g)	713
Total weight (g)	8.6
Impinger3	H2O2
SOL/	3026
Start Weight (g)	689.5
End Weight (g)	691.8
Total weight (g)	2.3
Impinger 4	Empty
SOL/	...
Start Weight (g)	580.8
End Weight (g)	583
Total weight (g)	2.2
Impinger 5	Silica
SOL/	...
Start Weight (g)	827.3
End Weight (g)	830.5
Total weight (g)	3.2
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)	71.50
Silica <50% used at End of Test? Y/N	YES

Rinse Solutions used	
Solution	SOL NO
DI Water	3034
Acetone	3028

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.

Potters Waste		Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ	Visit Details	: Annual Compliance
Variation No	: ...	Survey Dates	: 14th & 15th September 2016
Report Ref	: P2723 : R002	Report Issue Date	: 28th November 2016

Engine 2 SO2 Non-methane Field Data Sheet

Environmental Compliance Limited				SAMPLE TUBE DATA SAMPLING PROFORMA			
Client	Potters Landfill	◉ Circular ○ Rectangular ○ Elipse		Pump ID	U002	Date of Test	14/09/2016
Site	Brynposteg	Stack Diameter (mm)	400	Meter ID	U002	Sample Start Time	17:26
Location	Engine 2			MST Probe ID	N/A	Sample End Time	18:26
Stack ID	A2	Stack Area (m^2)	0.126	MST Probe Heating Temp (C)	N/A	Duration	60
Test No	one	Barometric Pressure (mb)	972	DGM Yd or ml/count	1.0524	Measured O2	7.92
Job No	P2723	Stack Thermocouple ID	1094	MST Hot Box ID	N/A	O2 Uncertainty %Vol	0.48
ECL Site Staff	DB + CP	Tube Thermocouple ID		MST Hot Box Heating Temp (C)	N/A		
Barometer ID	1069	Meter Thermocouple ID	U006	Workhorse Set Sample Rate (%)	N/A		
		In-Stack Sinter Used (Y/N)	N	MST Delta H Sampling Rate	0.5		

Meter Units ○ ml ◉ litres	Sample	Leak 1	Time (start/ end) (minimum 1 minute)	Leak 2	Time (start/ end) (minimum 1 minute)	Total		Impinger 1	EMPTY
Start Volume	5506.4	5500.2	17:24:00	5637.8	18:28:00			Start Weight (g)	588.7
Final Volume	5627.9	5500.2	17:25:00	5637.8	18:29:00			End Weight (g)	600
Total Volume	119.8	0.0		0.0		119.8		Total weight (g)	11.3
Sample Train Internal Volume	1.71983	ml / Litres							

Sample Point	A1	A1	A1	A1	Impinger 2	EMPTY
Time/ point (mins)	0-10	10...20	20-30	30-40		
Tube Temp ^{O}C	10	11	12	13	Start Weight (g)	600.6
Stack Temp ^{O}C	500	500	500	500		
Meter Temp In ^{O}C	30	29	28	26	End Weight (g)	603.2
Meter Temp Out ^{O}C	27	26	26	26	Total weight (g)	2.6

Sample Point	A1	A1			Impinger3	SILICA
Time/ point (mins)	40-50	50-60				
Tube Temp ^{O}C	14	15			Start Weight (g)	830.5
Stack Temp ^{O}C	500	500				
Meter Temp In ^{O}C	26	26			End Weight (g)	829.1
Meter Temp Out ^{O}C	26	26			Total weight (g)	-1.4

Sample Point					Silica	(IF USED)
Time/ point (mins)					<50% Spent at end Y/N?	Yes
Tube Temp ^{O}C					Sample train upstream of sorbent tube condensation free for entire sample (Y/N)	NO
Stack Temp ^{O}C						
Meter Temp In ^{O}C						
Meter Temp Out ^{O}C						

- Not UKAS/MCERTS due to high stack temperature & moisture -

LABORATORY ANALYSIS RESULTS

SCIENTIFIC ANALYSIS LABORATORIES
DELIVERING SCIENCE

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

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

Report Number: 601256-1

Date of Report: 31-Oct-2016

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

Customer Contact: Mr David Boles

Customer Job Reference: P2723
Customer Purchase Order: E5694
Date Job Received at SAL: 19-Sep-2016
Date Analysis Started: 21-Sep-2016
Date Analysis Completed: 26-Sep-2016

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 SAL SOPs
All results have been reviewed in accordance with Section 25 of the SAL Quality Manual

UKAS TESTING
1549

Report checked
and authorised by :
Mary Hughes
Customer Service Manager

Issued by :
Emma Spear
Project Manager

Validity unknown
Digitally signed by Emma Spear
Date: 2016.10.31 15:58:44 GMT
Reason: Issue
Location: SAL

SAL Reference: 601256
Customer Reference: P2723

Impinger(peroxide) Analysed as Impinger(peroxide)
Miscellaneous

					SAL Reference	601256 001	601256 002	601256 003	601256 004	601256 005
					Customer Sample Reference	ECL/16/4730	ECL/16/4731	ECL/16/4732	ECL/16/4733	ECL/16/4734
					Test Sample	AR	AR	AR	AR	AR
					Date Sampled	14-SEP-2016	14-SEP-2016	14-SEP-2016	14-SEP-2016	14-SEP-2016
Determinand	Method	LOD	Units	Symbol						
Sulphur Dioxide	IC	0.05	mg/l	U		(13,195) 110	(13) 13	(13) 0.60	(13,195) 130	(13) 15
Volume	Vol	1	ml	U		320	130	160	300	97

SAL Reference: 601256
Customer Reference: P2723

Impinger(peroxide) Analysed as Impinger(peroxide)
Miscellaneous

					SAL Reference	601256 006
					Customer Sample Reference	ECL/16/4735
					Test Sample	AR
					Date Sampled	14-SEP-2016
Determinand	Method	LOD	Units	Symbol		
Sulphur Dioxide	IC	0.05	mg/l	U		(13) 0.41
Volume	Vol	1	ml	U		260

SAL Reference: 601256
Customer Reference: P2723

Tube (Charcoal 226-09) Analysed as Tube (Charcoal 226-09)
Miscellaneous

					SAL Reference	601256 008	601256 009	601256 010	601256 011	601256 012
					Customer Sample Reference	ECL/16/4737 FRONT	ECL/16/4737 BACK	ECL/16/4738 FRONT	ECL/16/4738 BACK	ECL/16/4739 FRONT
					Test Sample	AR	AR	AR	AR	AR
					Date Sampled	14-SEP-2016	14-SEP-2016	14-SEP-2016	14-SEP-2016	14-SEP-2016
Determinand	Method	LOD	Units	Symbol						
Volatile Organic Compounds (Total)	GC/MS	1	µg	N		120	<1	<1	<1	85

SAL Reference: 601256
Customer Reference: P2723

Tube (Charcoal 226-09) Analysed as Tube (Charcoal 226-09)
Miscellaneous

					SAL Reference	601256 013	601256 014	601256 015
					Customer Sample Reference	ECL/16/4739 BACK	ECL/16/4740 FRONT	ECL/16/4740 BACK
					Test Sample	AR	AR	AR
					Date Sampled	14-SEP-2016	15-SEP-2016	15-SEP-2016
Determinand	Method	LOD	Units	Symbol				
Volatile Organic Compounds (Total)	GC/MS	1	µg	N		<1	100	<1

Index to symbols used in 601256-1

Value	Description
AR	As Received
13	Results have been blank corrected
195	Due to levels found in the sample that are outside of the normal calibration range of the instrument, analysis was conducted on a diluted sample
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

UNCERTAINTY CALCULATIONS

Engine 1
Volumetric Flowrate Uncertainty

Stack Reference A1

Measurement Uncertainty Calculations - Velocity at Stack Conditions

Contribution From	**Standard u/c (Pa)**	
Pitot Calibration Uncertainty Contribution	1.23	A
Manometer Calibration Uncertainty Contribution	1.233333333	B
Variation in Actual Pitot reading at sample points	8.00	C
Combined u/c (Pa) =	**Combined u/c (Pa)**	
SQRT $(A/\sqrt{3})^2 + (B/\sqrt{3})^2 + (C/\sqrt{3})^2)$	4.73	
Expanded Uncertainty of Flow Measurements Pa	**9.45**	
	Standard u/c (K)	
Temperature Calibration (K)	3.64	D
Variation in Actual Temp reading at sample points	0.00	E
Combined u/c of Temp (K)	**Combined u/c (K)**	
SQRT $((D/\sqrt{3}^2) + (E/\sqrt{3})^2)$	2.10	
Expanded Uncertainty of Temp Measurements (K)	**4.20**	
Measured Average Velocity (m/s) at Stack Conds	33.12	
Maximum Average Velocity (m/s) at Stack Conds	33.84	
Standard Uncertainty Velocity at Stack Conditions (%)	2.19	
Expanded Uncertainty Velocity (at Stack Conditions)	**4.38**	**(%)**

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	2.34	
Maximum Average Flowrate (m^3/s) at Stack Conds	2.42	
Standard Uncertainty Flowrate (m^3/s) at Stack Conditions (%)	3.21	
Expanded Uncertainty Flowrate (m^3/s) at Stack Conditions	**6.43**	**(%)**

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	0.84	
Maximum Average Flowrate (m^3/s) at STP Wet	0.87	
Standard Uncertainty Flowrate (m^3/s) at STP Wet	3.41	
Expanded Uncertainty Flowrate (m^3/s) at STP Wet	**6.81**	**(%)**

Measurement Uncertainty Calculations - Flowrate at STP & Dry Gas

Contribution From	**Standard u/c (%)**	
Moisture Uncertainty (% v/v)	0.21	
Measured Average Flowrate (m^3/s) at STP Dry	0.73	
Maximum Average Flowrate (m^3/s) at STP Dry	0.75	
Standard Uncertainty Flowrate (m^3/s) at STP Dry	3.66	
Expanded Uncertainty Flowrate (m^3/s) at STP Dry	**7.32**	**(%)**

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

Contribution From	**Standard u/c (%)**	
Oxygen Uncertainty (% v/v)	0.106	
Measured Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	0.72	
Maximum Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	0.75	
Standard Uncertainty Flowrate (m^3/s) at STP Dry & Ref Oxygen	4.35	
Expanded Uncertainty Flowrate (m^3/s) at STP Dry & Ref O_2	**8.71**	**(%)**

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/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	$\sqrt{3}$	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}			1.19	1.37	0.36	0.27
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/m^3	CO 0 - 95 mg/m^3	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			0.34	0.073	0.027	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/m^3	CO 0 - 95 mg/m^3	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Losses / leakage in the sample system	u_{loss}	14/09/16 13:41 - 14:40	5.25	13.53	0.019	0.033
Standard Error of Measured Value	u_{SE}	14/09/16 13:41 - 14:40	2.19	1.81	0.0041	0.0055

Effect on Uncertainty Caused by Oxygen $uCorr^{n}{}_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})x(20.9\% - O_{2,measured})} x\,Uncertainty\ of\ O_2\ Measurement =$ 0.020

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = \quad 3.0096 \qquad uf_{o_2} = \frac{uCorr^{n}{}_{o_2}}{f_{o_2}} x100 = \quad 0.65\ \%$$

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/m^3	CO 0 - 95 mg/m^3	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Measured Concentration	14/09/16 13:41 - 14:40	440.51	990.06	5.28	12.48
Expanded Uncertainty as Percentage of Measured Concentration		3%	3%	3%	1%

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 $>100\%$

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)	2.72	3.51	0.27	0.34
Losses / leakage in the sample system[(4)]	u_{loss}	Rectangular (Divisor = √3)	1.19	1.37	0.36	0.27
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)	9.28	4.33	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 Applies to TVOC only

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	$\sigma=\sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n-1}}=$	2.72	3.51	0.27	0.34
Losses / leakage in the sample system	u_{loss}	$u(x_i)=\frac{u_{loss}\times R_i}{\sqrt{3}}=$	0.86	0.75	0.052	0.03
Temperature dependant span drift	u_t	$u(x_i)=\frac{u_t}{100}\times R_i\times\sqrt{\frac{(x_{i,max}-x_{adj})^2+(x_{i,min}-x_{adj})(x_{i,max}-x_{adj})+(x_{i,min}-x_{adj})^2}{3}}$	0.26	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}	$u(x_i)=\frac{u_{ref}}{\sqrt{3}}=$	5.36	2.50	0.087	0.18
Combined Standard Uncertainty		$u_c=\sqrt{u_{lof}^2+u_{d,s}^2+u_r^2+u_{loss}^2+u_t^2+u_i^2+u_{ref}^2}$	6.15	4.66	0.30	0.39
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP}=2\times u_c$	12.30	9.33	0.60	0.79
Applied Span Concentration			535.87	250.13	15.03	17.73
Measured Span Concentration, STP Dry Gas			530.72	254.34	14.90	17.72
Expanded measurement uncertainty as % of Applied Span			2%	4%	4%	4%

TVOCs Uncertainty of Measurement

1 + 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/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	0.36
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			0.013	0.034
Interferents	u_i			0.081	0.38
Effect of Voltage Fluctuation (See Note)	u_v			...	0.16

1 + 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/m^3
Losses / leakage in the sample system	u_{loss}	14/09/16 13:41 - 14:40	0.053	4.60
Standard Error of Measured Value	u_{SE}	14/09/16 13:41 - 14:40	0.0041	6.58
Uncertainty due to Moisture Correction(6)	u_{H2O}	14/09/16 13:41 - 14:40	0.096	20.27

Effect on Uncertainty Caused by Oxygen

$$uCorr^n_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})x(20.9\% - O_{2,measured})} \text{ x Uncertainty of } O_2 \text{ Meas} =$$

0.02

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} =$$ 1.0181

$$uf_{o_2} = \frac{uCorr^n_{o_2}}{f_{o_2}} x100 =$$ 1.92 %

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 $C_i = \frac{\partial f}{\partial x_i}$

1 + 2 - TVOC - Uncertainty of Measurement Results - Calculations Part 3

Uncertainty	Date & Time	O_2 0 - 25 %Vol	*TVOC 0 - 15 mgC/m^3
Measured Concentration	14/09/16 13:41 - 14:40	5.28	1291.51
Expanded Uncertainty as Percentage of Measured Concentration		5 %	4 %

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 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%

TVOCs Measurement Uncertainty

1 + 2 - 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)	18.32
Losses / leakage in the sample system[(4)]	u_{loss}	Rectangular (Divisor = √3)	21.82
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)	25.60

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

1 + 2 - 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	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	2.75
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	1.89
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.039
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.38
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	14.78
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	15.16
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	30.32
Applied Span Concentration			1477.96
Measured Span Concentration, STP Dry Gas			1473.39
Expanded measurement uncertainty as % of Applied Span			2 %

* Signal 3030 FID

SO2 Uncertainty

Site: Brynposteg
Location: A1

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

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	...	36.89	36.89	...	4.80	...	2.40	2.40
...	...	...	...	...	...	...	...	...
				...				
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...

	one		Standard Uncertainty @ 95%			
Sampled Volume (V_m)	0.65	m^3	uV_m	0.001	m^3	
Meter Correction Factor (Yd)	1.05	...		...	...	
Meter Temperature (T_m)	295.92	k	uT_m	1.5	k	
Average Differential Pressure (ΔH)	10.00	mmH_2O	uΔH	0.25	mmH_2O	
Barometric Pressure (ρ_b)	729.06	mmHg	$u\rho_b$	3.8	mmHg	
ΔH + ρs (ρ_m)	97.30	kPa		...	...	
Oxygen content ($O_{2,m}$)	5.28	% by volume	$uO_{2,m} = \sigma/\sqrt{n}$	0.00406		% by volume
Moisture Content (H_2O)	13.56	% by volume	uH_2O	0.42		% 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_s) & measured temperature of dry gas uncertainty component ($uT_{m\ Dry}$)

one:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = \quad 0.932$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.93	0.93	0.0000939	0.0000235
$u\rho_b$	0.94	0.93	0.00128	0.00479
uT_m	0.94	0.93	0.00315	0.00473
H_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00618$$

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

one:

$$V_{std} = V_{measured} \times f_s = \quad 0.610$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty (m^3)
Effect of uV_{std}	0.61	0.61	0.65	0.00404
Effect of uV_m	0.61	0.61	0.93	0.000932

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.00279$$

Uncertainty of Oxygen Correction Factor (%):-

one:

$$f_{o_2} = \frac{20.9\% - O_{2,\,ref}}{20.9\% - O_{2,\,measured}} = \quad 1.02$$

$$uCorr^{n}{}_{o_2} = \frac{20.9\% - O_{2,\,ref}}{(20.9\% - O_{2,\,measured}) x (20.9\% - O_{2,\,measured})} x\, Uncertainty\ of\ O_2\ Measurement = \quad 0.0196$$

$$uf_{o_2} = \frac{uCorr^{n}{}_{o_2}}{f_{o_2}} x100 = \quad 1.92\ \%$$

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	65.54	57.54	1.67	4.00
...	...	...	...	...

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	0.71
...	...

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	61.82	61.26	100.84	0.28
...	...	...	...	...

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	4.07	8.15	61.54	13.24
...	...	...	...	...

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	13.24	1.92	13.37
...	...	...	...

Non-methane Uncertainty

Site: Potter Landfill, Brynposteg
Location: Engine 1, Stack ID:A1

				Standard Uncertainty @ 95%		
Sampled Volume	V_m	0.14828	m^3	uV_m	0.000	m^3
Meter Correction Factor or ml/count	Yd	1.0524	...	...	...	...
Meter Temperature	T_m	298.17	k	uT_m	1.5	k
Barometric Pressure	ρ_b	972.00	mBar		10.0	mBar
Oxygen content	$O_{2,m}$	5.28	%Vol	$uO_{2,m}$	0.32	%Vol
Moisture	H_2O	12.46	%Vol	uH_2O	1.69	%Vol

Tubes					
Determinand	Recovered Mass		Standard Uncertainty		
Total Non-methane VOCs	121.00	µg	uM	6.00	µg

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 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

$$f_s = \frac{273}{T_m} \times \frac{\rho}{101.3} = \quad 0.88$$

	Maximum	Minimum	Sensitivity	ufstp
$u\rho_b$	0.46	0.45	0.000472	0.00472
uT_m	0.88	0.87	0.00295	0.00442
uH_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00560$$

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

$$V_{std} = V_{measured} \times f_s = \quad 0.14$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty m^3
Effect of uf_s	0.14	0.14	0.16	0.000883
Effect of uV_m	0.14	0.14	0.92	9.246E-06

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.0219$$

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
Total Non-methane VOCs	0.0101	...

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

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

Charcoal Tube Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Total Non-methane VOCs	0.93	0.84	7.29	0.0438

Condensate Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Total Non-methane VOCs				

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

Charcoal Tube Results				
	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	Standard Uncertainty mg/Nm³
Total Non-methane VOCs	1.05	0.76	6.60	0.14

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
Total Non-methane VOCs	0.15	0.30	0.90	32.97

Engine 2
Volumetric Flowrate Uncertainty

Stack Reference A2

Measurement Uncertainty Calculations - Velocity at Stack Conditions

Contribution From	**Standard u/c (Pa)**	
Pitot Calibration Uncertainty Contribution	0.97	A
Manometer Calibration Uncertainty Contribution	0.968333333	B
Variation in Actual Pitot reading at sample points	10.00	C
Combined u/c (Pa) =	**Combined u/c (Pa)**	
SQRT $(A/\sqrt{3})^2 + (B/\sqrt{3})^2 + (C/\sqrt{3})^2)$	5.83	
Expanded Uncertainty of Flow Measurements Pa	**11.65**	
	Standard u/c (K)	
Temperature Calibration (K)	3.86	D
Variation in Actual Temp reading at sample points	0.25	E
Combined u/c of Temp (K)	**Combined u/c (K)**	
SQRT $((D/\sqrt{3}^2) + (E/\sqrt{3})^2)$	2.24	
Expanded Uncertainty of Temp Measurements (K)	**4.47**	
Measured Average Velocity (m/s) at Stack Conds	29.99	
Maximum Average Velocity (m/s) at Stack Conds	30.97	
Standard Uncertainty Velocity at Stack Conditions (%)	3.26	
Expanded Uncertainty Velocity (at Stack Conditions)	**6.52**	**(%)**

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	3.77	
Maximum Average Flowrate (m^3/s) at Stack Conds	3.93	
Standard Uncertainty Flowrate (m^3/s) at Stack Conditions (%)	4.30	
Expanded Uncertainty Flowrate (m^3/s) at Stack Conditions	**8.59**	**(%)**

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	1.28	
Maximum Average Flowrate (m^3/s) at STP Wet	1.33	
Standard Uncertainty Flowrate (m^3/s) at STP Wet	4.48	
Expanded Uncertainty Flowrate (m^3/s) at STP Wet	**8.96**	**(%)**

Measurement Uncertainty Calculations - Flowrate at STP & Dry Gas

Contribution From	**Standard u/c (%)**	
Moisture Uncertainty (% v/v)	0.20	
Measured Average Flowrate (m^3/s) at STP Dry	1.12	
Maximum Average Flowrate (m^3/s) at STP Dry	1.17	
Standard Uncertainty Flowrate (m^3/s) at STP Dry	4.72	
Expanded Uncertainty Flowrate (m^3/s) at STP Dry	**9.44**	**(%)**

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

Contribution From	**Standard u/c (%)**	
Oxygen Uncertainty (% v/v)	0.158	
Measured Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	0.91	
Maximum Average Flowrate (m^3/s) at STP Dry & Ref Oxygen	0.97	
Standard Uncertainty Flowrate (m^3/s) at STP Dry & Ref Oxygen	5.99	
Expanded Uncertainty Flowrate (m^3/s) at STP Dry & Ref O_2	**11.97**	**(%)**

Environmental Compliance Limited

Potters Waste			**Installation Name**	**: Engine 1 & 2**
Permit No	**: TP3736SQ**		**Visit Details**	**: Annual Compliance**
Variation No	**: ...**		**Survey Dates**	**: 14th & 15th September 2016**
Report Ref	**: P2723**	**: R002**	**Report Issue Date**	**: 28th November 2016**

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/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	$\sqrt{3}$	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}			1.19	1.37	0.36	0.27
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/m^3	CO 0 - 95 mg/m^3	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			0.39	0.082	0.030	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/m^3	CO 0 - 95 mg/m^3	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Losses / leakage in the sample system	u_{loss}	14/09/16 15:31 - 16:30	4.68	15.82	0.029	0.028
Standard Error of Measured Value	u_{SE}	14/09/16 15:31 - 16:30	0.89	0.90	0.0032	0.0021

Effect on Uncertainty Caused by Oxygen

$$uCorr''_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) x (20.9\% - O_{2,measured})} x\, Uncertainty\ of\ O_2\ Measurement = 0.028$$

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 2.0081 \qquad uf_{O_2} = \frac{uCorr''_{O_2}}{f_{O_2}} x100 = 1.41\ \%$$

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/m^3	CO 0 - 95 mg/m^3	O_2 0 - 25 %Vol	CO_2 0 - 20 %Vol
Measured Concentration	14/09/16 15:31 - 16:30	392.13	1157.21	7.92	10.28
Expanded Uncertainty as Percentage of Measured Concentration		3%	3%	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 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%

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)	2.72	3.51	0.27	0.34
Losses / leakage in the sample system[4]	u_{loss}	Rectangular (Divisor = √3)	1.19	1.37	0.36	0.27
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)	9.28	4.33	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 Applies to TVOC only

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	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	2.72	3.51	0.27	0.34
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	0.86	0.75	0.052	0.03
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max}-x_{adj})^2+(x_{i,min}-x_{adj})(x_{i,max}-x_{adj})+(x_{i,min}-x_{adj})^2}{3}}$	0.26	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}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	5.36	2.50	0.087	0.18
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	6.15	4.66	0.30	0.39
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	12.30	9.33	0.60	0.79
Applied Span Concentration			535.87	250.13	15.03	17.73
Measured Span Concentration, STP Dry Gas			530.72	254.34	14.90	17.72
Expanded measurement uncertainty as % of Applied Span			2%	4%	4%	4%

Potters Waste			Installation Name	: Engine 1 & 2
Permit No	: TP3736SQ		Visit Details	: Annual Compliance
Variation No	: ...		Survey Dates	: 14th & 15th September 2016
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TVOCs Uncertainty of Measurement

1 + 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/m^3
Lack of fit[1]	u_{lof}	Rectangular	$\sqrt{3}$	0.13	0.73
Span drift[2]	$u_{\text{d,s}}$			0.029	0.35
Losses / leakage in the sample system[4]	u_{loss}			1.00	0.36
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}			0.013	0.034
Interferents	u_{i}			0.081	0.38
Effect of Voltage Fluctuation (See Note)	u_{v}			...	0.16

1 + 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/m^3
Losses / leakage in the sample system	u_{loss}	14/09/16 15:21 - 16:20	0.079	4.38
Standard Error of Measured Value	u_{SE}	14/09/16 15:21 - 16:20	0.0032	5.23
Uncertainty due to Moisture Correction[6]	u_{H2O}	14/09/16 15:21 - 16:20	0.13	17.86

Effect on Uncertainty Caused by Oxygen

$$uCorr^n_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \text{ x Uncertainty of } O_2 \text{ Meas} =$$

0.03

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = \quad 1.2248$$

$$uf_{O_2} = \frac{uCorr^n_{O_2}}{f_{O_2}} x100 = \quad 2.31 \quad \%$$

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 $C_i = \frac{\partial f}{\partial x_i}$

1 + 2 - TVOC - Uncertainty of Measurement Results - Calculations Part 3

Uncertainty	Date & Time	O$_2$ 0 - 25 %Vol	*TVOC 0 - 15 mgC/m^3
Measured Concentration	14/09/16 15:21 - 16:20	7.92	1229.33
Expanded Uncertainty as Percentage of Measured Concentration		4 %	4 %

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 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**	: 14th & 15th September 2016
Report Ref	: P2723	: R002	**Report Issue Date**	: 28th November 2016

TVOCs Measurement Uncertainty

1 + 2 - 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)	18.32
Losses / leakage in the sample system[4]	u_{loss}	Rectangular (Divisor = √3)	21.82
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)	25.60
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

1 + 2 - 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	$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} =$	2.75
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	1.89
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max}-x_{adj})^2+(x_{i,min}-x_{adj})(x_{i,max}-x_{adj})+(x_{i,min}-x_{adj})^2}{3}}$	0.04
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	0.38
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	14.78
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		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	15.16
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	30.32
Applied Span Concentration			1477.96
Measured Span Concentration, STP Dry Gas			1473.39
Expanded measurement uncertainty as % of Applied Span			2 %

* Signal 3030 FID

SO2 Uncertainty

Site: Brynposteg
Location: A2

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

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	...	40.46	40.46	...	5.26	...	2.63	2.63
...	...	...	...	...	...	...	...	...
				...				
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...

	one		Standard Uncertainty @ 95%			
Sampled Volume (V_m)	0.67	m^3	uV_m	0.001	m^3	
Meter Correction Factor (Yd)	1.05	...		...	...	
Meter Temperature (T_m)	301.00	k	uT_m	1.5	k	
Average Differential Pressure (ΔH)	10.00	mmH_2O	uΔH	0.25	mmH_2O	
Barometric Pressure (ρ_b)	729.06	mmHg	$u\rho_b$	3.8	mmHg	
ΔH + ρs (ρ_m)	97.30	kPa		...	...	
Oxygen content ($O_{2,m}$)	7.92	% by volume	$uO_{2,m} = \sigma/\sqrt{n}$	0.00323		% by volume
Moisture Content (H_2O)	12.68	% by volume	uH_2O	0.40		% 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 ($u\rho_s$) & measured temperature of dry gas uncertainty component ($uT_{m\,Dry}$)

one:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = \quad 0.917$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.92	0.92	0.0000923	0.0000231
$u\rho_b$	0.92	0.91	0.00126	0.00471
uT_m	0.92	0.91	0.00305	0.00457
H_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00589$$

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

one:

$$V_{std} = V_{measured} \times f_s = \quad 0.613$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty (m^3)
Effect of uV_{std}	0.62	0.61	0.67	0.00394
Effect of uV_m	0.61	0.61	0.92	0.000917

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.00276$$

Uncertainty of Oxygen Correction Factor (%):-

one:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = \quad 1.22$$

$$uCorr^n{}_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})x(20.9\% - O_{2,measured})} x\,Uncertainty\ of\ O_2\ Measurement = \quad 0.0283$$

$$uf_{o_2} = \frac{uCorr^n{}_{o_2}}{f_{o_2}} x100 = \quad 2.31\ \%$$

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	86.08	75.57	2.00	5.25
...	...	...	...	...

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	0.93
...	...

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	81.19	80.47	131.86	0.36
...	...	...	...	...

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	5.35	10.70	80.83	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	2.31	13.43
...	...	...	...

Non-methane Uncertainty

Site: Potters Landfill, Brynposteg
Location: Engine 2, Stack ID:A2

				Standard Uncertainty @ 95%		
Sampled Volume	V_m	0.12150	m^3	uV_m	0.000	m^3
Meter Correction Factor or ml/count	Yd	1.0524	...	...	...	...
Meter Temperature	T_m	299.83	k	uT_m	1.5	k
Barometric Pressure	ρ_b	972.00	mBar		10.0	mBar
Oxygen content	$O_{2,m}$	7.92	%Vol	$uO_{2,m}$	0.48	%Vol
Moisture	H_2O	12.78	%Vol	uH_2O	1.76	%Vol

Tubes					
Determinand	Recovered Mass		Standard Uncertainty		
Total Non-methane VOCs	86.00	µg	uM	4.25	µg

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 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

$$f_s = \frac{273}{T_m} \times \frac{\rho}{101.3} = \quad 0.87$$

	Maximum	Minimum	Sensitivity	ufstp
$u\rho_b$	0.46	0.45	0.000470	0.00470
uT_m	0.88	0.87	0.00291	0.00437
uH_2O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.00552$$

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

$$V_{std} = V_{measured} \times f_s = \quad 0.11$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty m^3
Effect of uf_s	0.11	0.11	0.13	0.000706
Effect of uV_m	0.11	0.11	0.92	9.194E-06

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.0143$$

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
Total Non-methane VOCs	0.00889	...

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

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
Total Non-methane VOCs	0.82	0.74	9.08	0.0386
Condensate Results				
	Maximum mg/Nm^3	Minimum mg/Nm^3	Sensitivity	Standard Uncertainty mg/Nm^3
Total 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
Total Non-methane VOCs	0.89	0.69	7.21	0.10

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
Total Non-methane VOCs	0.11	0.22	0.96	22.50

Appendix 3

APPENDIX 3 – GROUNDWATER

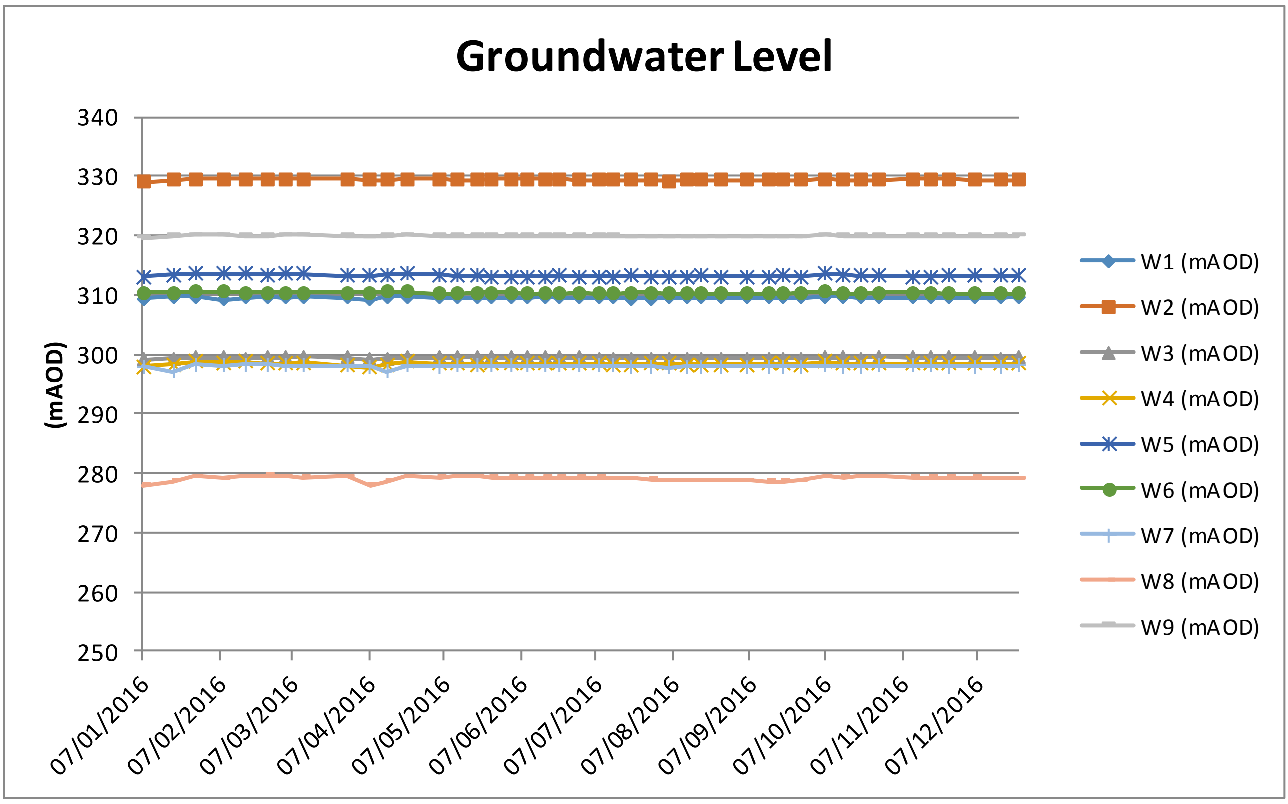
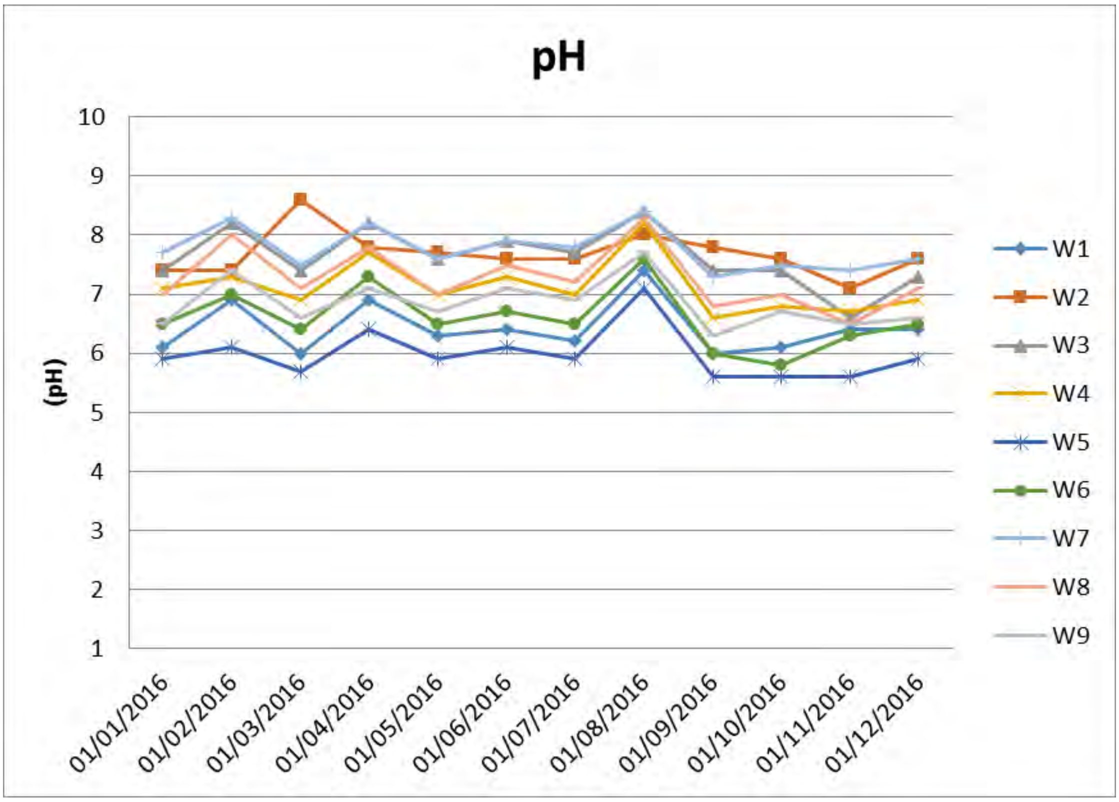


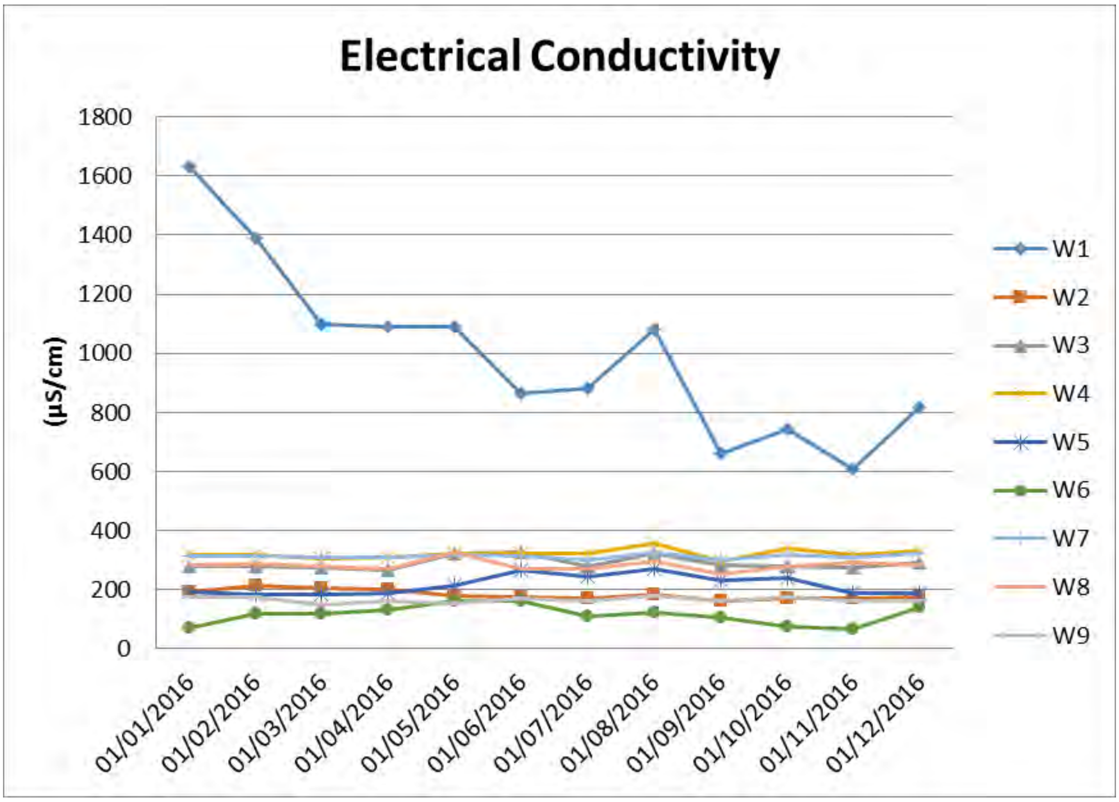
Figure 1 – Weekly level data (measured as metres above ordinance datum)

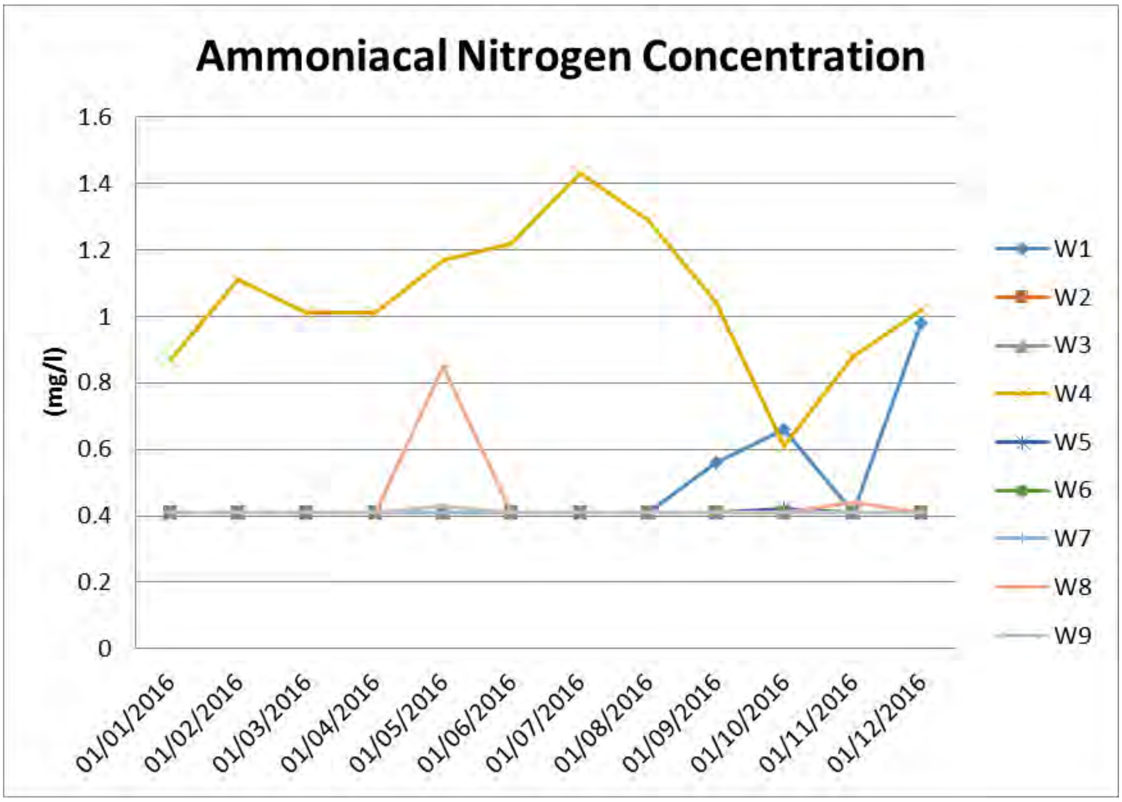
Table 1: Groundwater Monthly monitoring data

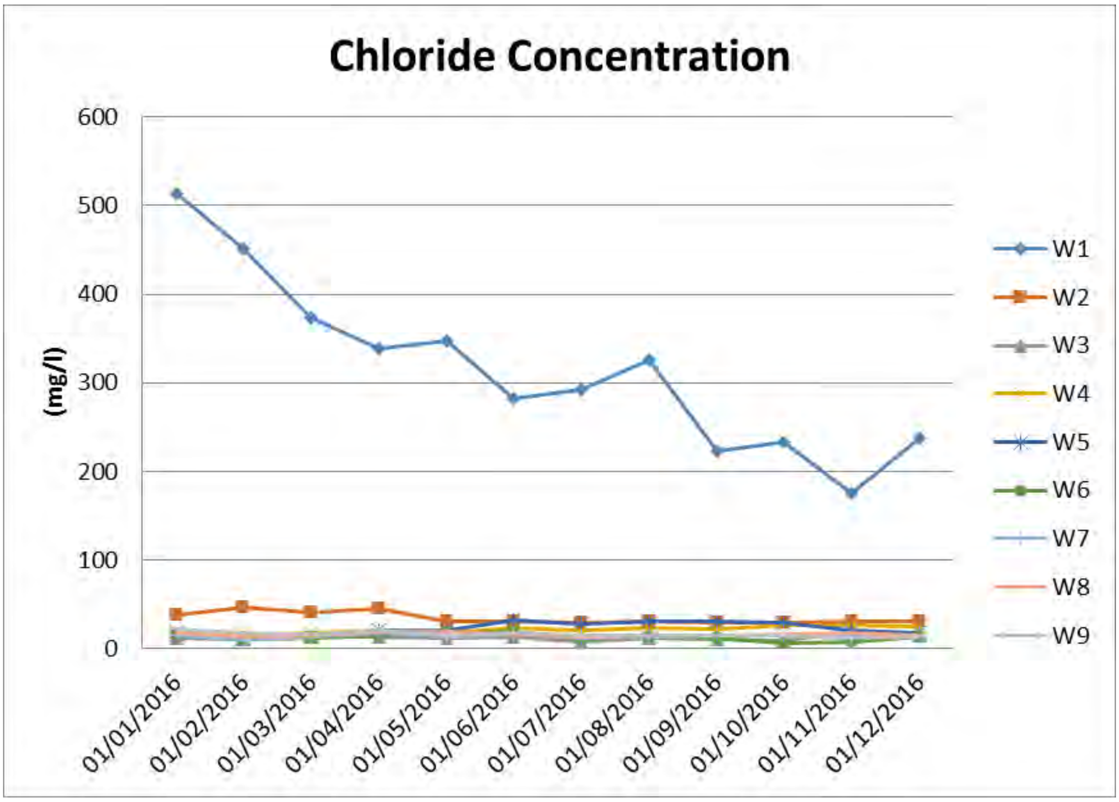
LOCATION		Ammoniacal Nitrogen	Chloride	Cyanide	Electrical Conductivity	pH	Sulphate
		2	69	-	-	-	-
		mg/l	mg/l	mg/l	µS/cm	pH	mg/l
GW1	MIN	0.41	176.00	0.009	608.00	6.00	4.80
	MAX	0.98	513.00	0.013	1630.00	7.40	23.30
	AVRG	0.49	316.25	0.009	996.08	6.43	16.76
GW2	MIN	0.41	29.30	0.009	164.00	7.10	4.40
	MAX	0.41	46.80	0.009	215.00	8.60	8.40
	AVRG	0.41	34.74	0.009	183.25	7.68	4.73
GW3	MIN	0.41	8.50	0.009	268.00	6.60	4.40
	MAX	0.41	19.60	0.009	327.00	8.40	92.10
	AVRG	0.41	12.63	0.009	289.58	7.63	20.13
GW4	MIN	0.61	16.70	0.009	298.00	6.60	25.30
	MAX	1.43	26.50	0.009	357.00	8.20	42.10
	AVRG	1.06	21.74	0.009	322.00	7.13	34.66
GW5	MIN	0.41	12.60	0.009	183.00	5.60	36.00
	MAX	0.42	32.60	0.009	271.00	7.10	66.50
	AVRG	0.41	22.88	0.009	215.83	5.98	50.09
GW6	MIN	0.41	6.30	0.009	66.00	5.80	4.40
	MAX	0.41	19.70	0.009	164.00	7.60	11.20
	AVRG	0.41	12.95	0.009	115.59	6.59	6.43
GW7	MIN	0.41	11.20	0.009	302.00	7.30	25.00
	MAX	0.41	17.40	0.009	325.00	8.40	42.10
	AVRG	0.41	14.14	0.009	313.25	7.77	30.14
GW8	MIN	0.41	13.80	0.009	252.00	6.50	21.50
	MAX	0.85	20.00	0.009	325.00	8.30	33.10
	AVRG	0.45	16.41	0.009	282.83	7.28	25.16
GW9	MIN	0.41	11.50	0.009	151.00	6.30	22.70
	MAX	0.43	22.00	0.009	179.00	7.70	36.70
	AVRG	0.41	16.31	0.009	165.67	6.84	26.99

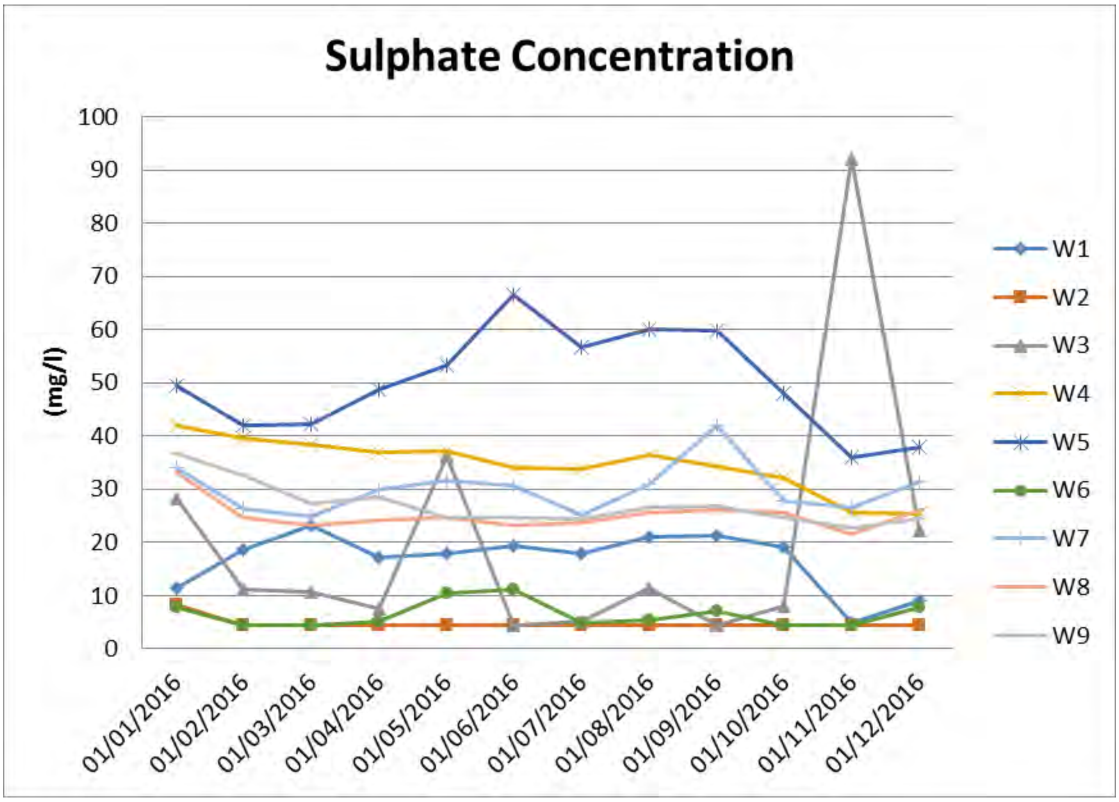
Key: (yellow) Above Permit Limit


pH
(pH)
10
9
8
7
6
5
4
3
2
1
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
W1
W2
W3
W4
W5
W6
W7
W8
W9


Electrical Conductivity
(µS/cm)
1800
1600
1400
1200
1000
800
600
400
200
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
W1
W2
W3
W4
W5
W6
W7
W8
W9


Ammoniacal Nitrogen Concentration
(mg/l)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
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
W1
W2
W3
W4
W5
W6
W7
W8
W9


Chloride Concentration
(mg/l)
600
500
400
300
200
100
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
W1
W2
W3
W4
W5
W6
W7
W8
W9


Sulphate Concentration
100
90
80
70
60
50
40
30
20
10
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
W1
W2
W3
W4
W5
W6
W7
W8
W9

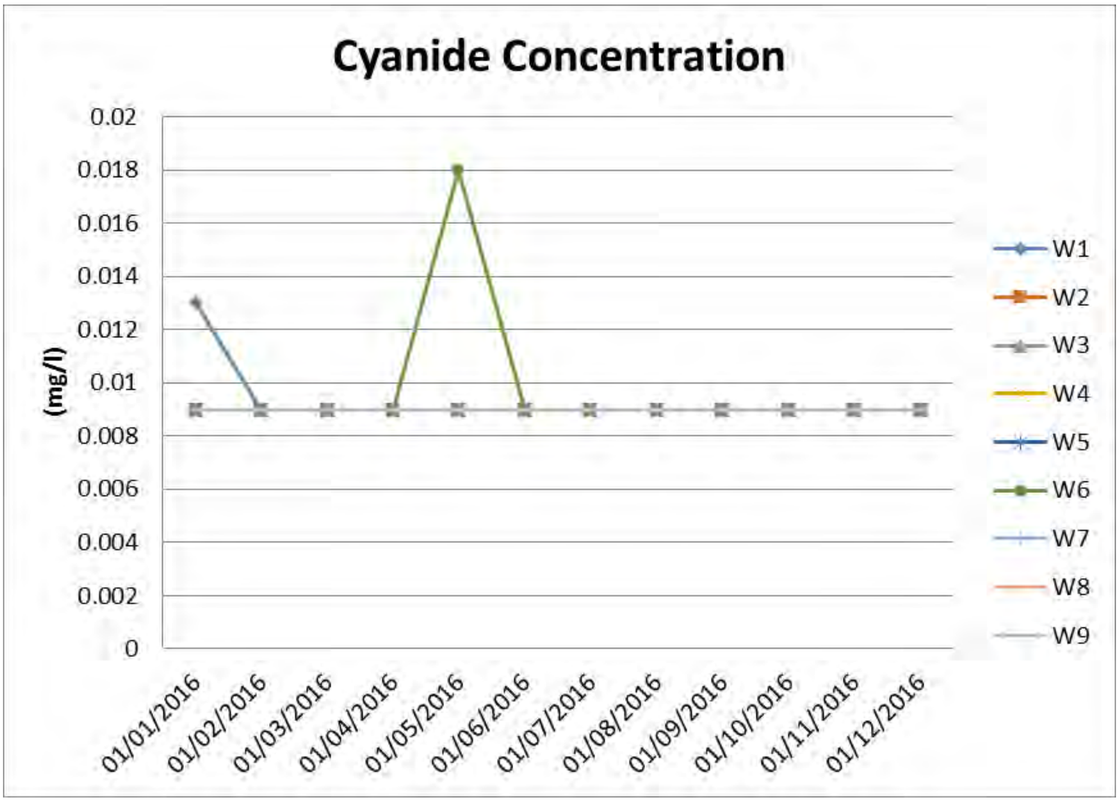

Cyanide Concentration
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
(mg/l)
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
W1
W2
W3
W4
W5
W6
W7
W8
W9

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	<0.05	<0.05	<0.05	<0.05	<0.05
			Q2	0.19	<0.05	0.06	0.09	0.23
			Q3	<0.20	<0.05	<0.05	0.31	<0.05
			Q4	<0.10	<0.05	<0.05	<0.05	<0.05
Ammoniacal Nitrogen	mg/l	2	Q1	<0.41	<0.41	<0.41	1.01	<0.41
			Q2	<0.41	<0.41	<0.41	1.22	<0.41
			Q3	0.56	<0.41	<0.41	1.04	<0.41
			Q4	0.98	<0.41	<0.41	1.02	<0.41
Cadmium	mg/l	0.0056	Q1	0.0020	<0.0006	<0.0006	<0.0006	<0.0006
			Q2	0.0022	<0.0006	0.0010	<0.0006	0.0006
			Q3	0.0012	<0.0006	<0.0006	<0.0006	<0.0006
			Q4	0.0010	<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	<0.04	<0.04	<0.04	0.07	0.04
			Q2	<0.04	<0.04	<0.04	0.08	0.23
			Q3	<0.16	<0.04	<0.04	0.1	0.18
			Q4	<0.08	<0.04	<0.04	0.08	0.05
Nickel	mg/l	0.12	Q1	0.015	0.004	0.008	0.012	0.022
			Q2	0.02	<0.003	0.013	0.008	0.027
			Q3	0.012	<0.003	0.004	0.009	0.024
			Q4	0.011	<0.003	0.007	0.007	0.015
Toluene	ug/l	4	Q1	<0.10	<0.10	<0.10	<0.10	<0.10
			Q2	<0.10	<0.10	<0.10	<0.10	<0.10
			Q3	0.13	0.25	0.53	<0.10	<0.10
			Q4	0.19	<0.10	<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	0.21	<0.018	<0.018	0.04	0.09
			Q2	0.10	<0.018	0.04	<0.018	0.13
			Q3	0.08	<0.018	<0.018	0.02	0.12
			Q4	0.08	<0.018	0.05	<0.018	0.09

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	0.0008	<0.0006	0.0008	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**	0.009	0.004	0.007	0.005
			Q2	0.008	<0.003	0.013	<0.003
			Q3	0.004	<0.003	0.004	<0.003
			Q4	0.005	<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**	0.02	<0.018	0.02	0.08
			Q2	<0.018	<0.018	<0.018	0.03
			Q3	0.03	<0.018	<0.018	0.02
			Q4	0.07	<0.018	0.03	0.08

Table 3: Groundwater Quarterly monitoring data (No EP Limits), Quarter 1

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Acenaphthene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Acenaphthylene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Alkalinity as CaCO3	mg/l	14.6	42	121	103	9.5	36.9	124	105	13
Anthracene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<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	0.023	0.0015	0.022	0.021	0.0015	0.025	0.0018	0.0033	<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	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Benzo (a) pyrene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Bicarbonate Alkalinity	mg/l	14.6	42	121	103	9.5	36.9	124	105	13
Calcium , Total as Ca	mg/l	16.3	8.8	37.9	40.3	13.1	12.4	42	38.4	9.97
Chloride as Cl	mg/l	373	40.9	13.3	18	13.5	11.7	13.7	15.1	16.7
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	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Conductivity-Electrical 20C	uS/cm	1100	204	274	303	183	120	310	279	151
Copper, Total as Cu	mg/l	0.015	<0.009	<0.009	<0.009	0.038	<0.009	0.1	<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	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Dissolved Oxygen, Fixed	mg/l	1.3	2.3	3.4	2	1.8	3.3	1.6	1.4	<0.5
Fluoranthene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Fluorene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Indeno (1,2,3) cd pyrene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Iron , Total as Fe	mg/l	3.4	<0.23	4.25	7.1	0.59	9.61	0.68	1.46	<0.23
Lead , Total as Pb	mg/l	0.011	<0.006	0.082	<0.006	<0.006	<0.006	0.021	0.011	<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	5.6	1.5	9.5	9.5	3.9	3.1	6.9	9.9	3
Manganese , Total as Mn	mg/l	1.2	0.02	2.57	3.9	1.78	2.18	0.759	0.981	0.153
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	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Nitrate as N	mg/l	<0.7	<0.7	<0.7	<0.7	2.5	<0.7	8.9	2.7	1.8
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	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Phenanthrene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<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	2.05	1.98	1.56	2.02	1.78	0.62	2.75	1.26	1.02
Pyrene	ug/l	<0.04	<0.04	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Selenium Ultra Low Total as Se	mg/l	<0.0008	<0.0008	0.0012	<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	188	30.1	9	10.2	9.88	5.58	18.9	9.4	11.9
Sulphate as SO4	mg/l	23.3	<4.4	10.6	38.3	42.3	4.4	25	23.1	27.2

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	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3	mg/l	40.2	44.6	166	107	15.6	24.2	125	105	38.1
Anthracene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<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	0.009	<0.0010	0.026	0.014	0.0012	0.002	0.0015	0.0019	<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	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Benzo (a) pyrene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Bicarbonate Alkalinity	mg/l	40.2	44.6	166	107	15.6	24.2	125	105	38.1
Calcium , Total as Ca	mg/l	9	9.73	42.5	39.8	18.1	10.3	38.7	34.3	14.1
Chloride as Cl	mg/l	223	29.3	10.3	22.9	31.1	12.7	14.5	15.7	14.4
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	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Conductivity-Electrical 20C	uS/cm	659	164	282	298	233	105	302	252	161
Copper, Total as Cu	mg/l	0.018	<0.009	<0.009	<0.009	0.038	<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	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Dissolved Oxygen, Fixed	mg/l	<0.5	2.2	2.2	1.2	1.3	5.9	1.5	2.2	4.2
Fluoranthene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Fluorene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Indeno (1,2,3) cd pyrene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Iron , Total as Fe	mg/l	2.55	<0.23	3.71	6.88	0.29	0.51	0.41	0.91	<0.23
Lead , Total as Pb	mg/l	0.007	<0.006	0.068	<0.006	<0.006	<0.006	0.013	<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	2.9	1.1	9.3	8.8	4.7	2.3	6.2	8.4	3.6
Manganese , Total as Mn	mg/l	0.581	0.02	2.07	3.4	2.32	0.106	0.668	0.826	0.027
Mercury, Total as Hg	mg/l	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Naphthalene	ug/l	<0.10	0.011	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/l	<0.7	<0.7	<0.7	<0.7	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
PAH, Total	ug/l	<0.10	0.011	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Phenanthrene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<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	1.38	2.17	1.6	2.67	2.27	0.56	2.81	1.09	0.88
Pyrene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Selenium Ultra Low Total as Se	mg/l	<0.0008	<0.0008	0.001	<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	106	19.1	8.53	10.2	13.5	5.11	22.6	8	11.2
Sulphate as SO4	mg/l	21.2	<4.4	<4.4	34.4	59.8	7	42.1	26.1	26.8

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	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3	mg/l	40.2	44.6	166	107	15.6	24.2	125	105	38.1
Anthracene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<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	0.009	<0.0010	0.026	0.014	0.0012	0.002	0.0015	0.0019	<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	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Benzo (a) pyrene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Bicarbonate Alkalinity	mg/l	40.2	44.6	166	107	15.6	24.2	125	105	38.1
Calcium , Total as Ca	mg/l	9	9.73	42.5	39.8	18.1	10.3	38.7	34.3	14.1
Chloride as Cl	mg/l	223	29.3	10.3	22.9	31.1	12.7	14.5	15.7	14.4
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	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Conductivity-Electrical 20C	uS/cm	659	164	282	298	233	105	302	252	161
Copper, Total as Cu	mg/l	0.018	<0.009	<0.009	<0.009	0.038	<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	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Dissolved Oxygen, Fixed	mg/l	<0.5	2.2	2.2	1.2	1.3	5.9	1.5	2.2	4.2
Fluoranthene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Fluorene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Indeno (1,2,3) cd pyrene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Iron , Total as Fe	mg/l	2.55	<0.23	3.71	6.88	0.29	0.51	0.41	0.91	<0.23
Lead , Total as Pb	mg/l	0.007	<0.006	0.068	<0.006	<0.006	<0.006	0.013	<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	2.9	1.1	9.3	8.8	4.7	2.3	6.2	8.4	3.6
Manganese , Total as Mn	mg/l	0.581	0.02	2.07	3.4	2.32	0.106	0.668	0.826	0.027
Mercury, Total as Hg	mg/l	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Naphthalene	ug/l	<0.10	0.011	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/l	<0.7	<0.7	<0.7	<0.7	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
PAH, Total	ug/l	<0.10	0.011	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Phenanthrene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<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	1.38	2.17	1.6	2.67	2.27	0.56	2.81	1.09	0.88
Pyrene	ug/l	<0.10	<0.01	<0.01	<0.04	<0.02	<0.01	<0.01	<0.01	<0.01
Selenium Ultra Low Total as Se	mg/l	<0.0008	<0.0008	0.001	<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	106	19.1	8.53	10.2	13.5	5.11	22.6	8	11.2
Sulphate as SO4	mg/l	21.2	<4.4	<4.4	34.4	59.8	7	42.1	26.1	26.8

Table 6: Groundwater Quarterly monitoring data (No EP Limits), Quarter 4

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
2,3,6 - TBA	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4 - DB	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4,5 - T	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Acenaphthylene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Alkalinity as CaCO3	mg/l	52	44	118	119	13.6	38.4	130	110	34.4
Anthracene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<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	0.022	<0.0010	0.035	0.018	0.0012	0.059	0.0034	0.0031	<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	<0.02	<0.02	<0.01	<0.01	<0.01
Benzo (a) pyrene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Bicarbonate Alkalinity	mg/l	52.0	44.0	118.0	119.0	13.6	38.4	130.0	110.0	34.4
Bromoxynil	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Calcium , Total as Ca	mg/l	9.7	10.0	36.3	38.1	11.9	11.2	38.2	34.6	12.1
Chloride as Cl	mg/l	238.0	30.6	15.0	24.6	17.7	14.0	13.0	14.9	13.9
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	<0.02	<0.02	<0.01	<0.01	<0.01
Conductivity-Electrical 20C	uS/cm	816	175	290	330	189	140	321	284	162
Copper, Total as Cu	mg/l	0.018	<0.009	0.043	<0.009	0.043	<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	<0.02	<0.02	<0.01	<0.01	<0.01
Dicamba	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dichlorprop	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dissolved Oxygen, Fixed	mg/l	<0.5	1.1	1.2	1.1	2.2	4.1	2.2	1.3	8.9
EH >C10 - C16	ug/l	<40	<10	<20	<40	<20	<20	<10	<10	<10
EH >C16 - C24	ug/l	<40	<10	<20	<40	<20	<20	<10	<10	<10
EH >C24 - C40	ug/l	<40	52	32	<40	<20	<20	<10	<10	<10
EH >C6 - C40	ug/l	<40	65	32	<40	<20	<20	<10	<10	<10
EH >C6 - C8	ug/l	<40	13	<20	<40	<20	<20	<10	<10	<10
EH >C8 - C10	ug/l	<40	<10	<20	<40	<20	<20	<10	<10	<10
Fluoranthene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Fluorene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Indeno (1,2,3) cd pyrene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Ioxynil	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron , Total as Fe	mg/l	7.19	0.28	6.82	7.68	0.32	13.00	1.13	1.02	<0.23
Lead , Total as Pb	mg/l	0.011	<0.006	0.445	<0.006	<0.006	0.014	0.043	0.017	<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	3.2	1.1	7.9	8.5	3	2.6	6	8.5	3.4
Manganese , Total as Mn	mg/l	2.69	0.017	1.65	3.71	1.48	2.13	0.323	0.845	0.076
MCPA	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MCPB	ug/l	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
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	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01

Reference	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9
Nitrate as N	mg/l	<0.7	<0.7	1.1	<0.7	2.7	<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
PAH, Total	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Phenanthrene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<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	1.46	2.21	2.72	1.89	1.89	0.64	2.70	1.16	0.83
Pyrene	ug/l	<0.04	<0.01	<0.02	<0.04	<0.02	<0.02	<0.01	<0.01	<0.01
Selenium Ultra Low Total as Se	mg/l	<0.0008	<0.0008	0.0044	<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	110.0	19.3	8.4	10.2	10.6	6.3	18.1	7.9	10.0
Sulphate as SO4	mg/l	9.1	<4.4	22.2	25.3	37.8	7.8	31.4	26.2	24.5

Table 7: Groundwater Annual Hazardous Substances Suite (No EP Limits) Detected Parameters Highlighted

Parameter		GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9
SVOC										
Phenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroethyl)ether	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
3&4-Methylphenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenzofuran	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroisopropyl)ether	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Nitrosodi-n-propylamine	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachloroethane	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrobenzene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isophorone	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitrophenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroethoxy)methane	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dichlorophenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Naphthalene	ug/l	<8.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hexachlorobutadiene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylnaphthalene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4,6-Trichlorophenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4,5-Trichlorophenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chloronaphthalene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dimethylphthalate	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,6-Dinitrotoluene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dinitrotoluene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Diethylphthalate	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Nitrophenol	ug/l	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Chlorophenyl phenyl ether	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Diphenylamine	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Bromophenyl Phenyl Ether	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
di-n-Butylphthalate	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzyl Butyl Phthalate	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)anthracene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-ethylhexyl)phthalate	ug/l	<20.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Di-n-octylphthalate	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b)fluoranthene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Indeno(1,2,3-c,d)pyrene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a,h)anthracene	ug/l	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Parameter		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	1.3	<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
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

Parameter		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

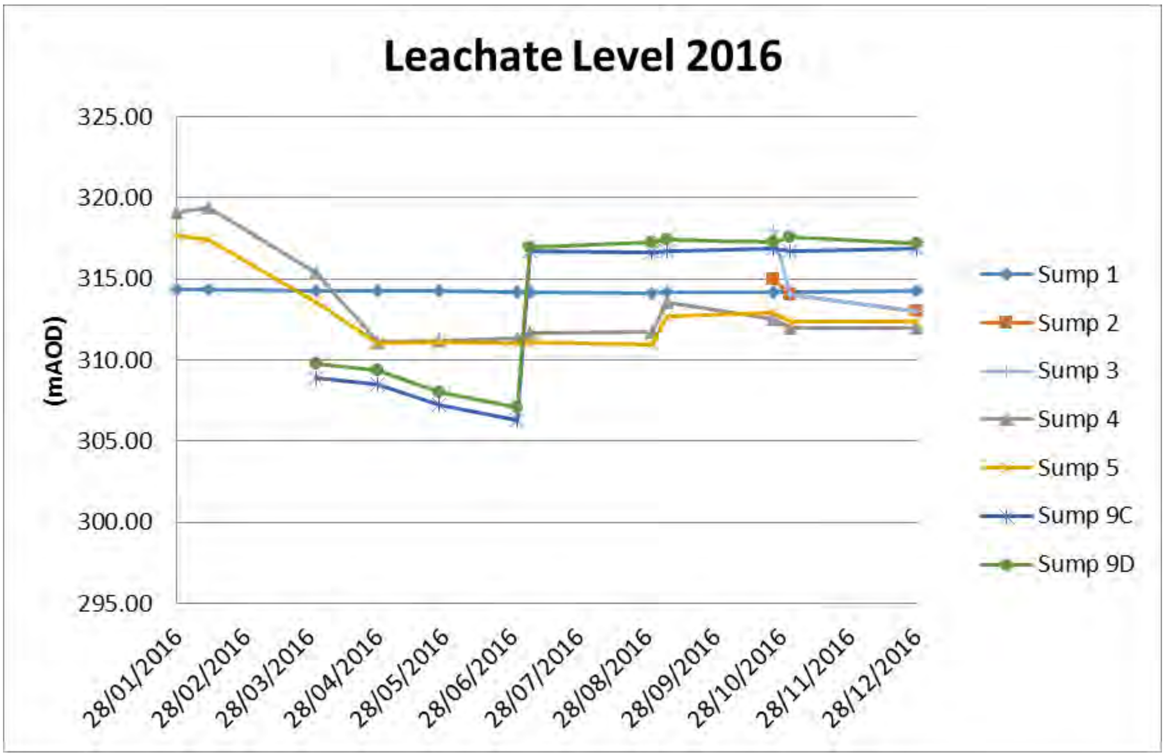
APPENDIX 4 – LEACHATE

Table 1 – Monthly leachate level data

Location	Sump 1			Sump 2			Sump 3		
	Datum (mAOD)	318.9	Leachate Level (m Above Base)	Datum (mAOD)	350	Leachate Level (m Above Base)	Datum (mAOD)	348	Leachate Level (m Above Base)
	Base (mAOD)	313.4		Base (mAOD)	310.9		Base (mAOD)	311.5	
	Dip (mBGL)	Depth (mAOD)		Dip (mBGL)	Depth (mAOD)		Dip (mBGL)	Depth (mAOD)	
Min	4.50	314.11	0.71	35.00	313.00	2.10	30.00	313.00	1.50
Max	4.75	314.36	0.96	37.00	315.00	4.10	35.00	318.00	6.50
Average	4.63	314.23	0.83	36.00	314.00	3.10	33.00	315.00	3.50
Count	12			3			3		

Location	Sump 4			Sump 5		
	Datum (mAOD)	325.8	Leachate Level (m Above Base)	Datum (mAOD)	323.5	Leachate Level (m Above Base)
	Base (mAOD)	310.75		Base (mAOD)	310.75	
	Dip (mBGL)	Depth (mAOD)		Dip (mBGL)	Depth (mAOD)	
Min	5.50	311.13	0.38	4.26	310.99	0.24
Max	16.23	319.41	8.66	13.60	317.64	6.89
Average	12.81	313.42	2.67	10.70	312.86	2.11
Count	12			12		

Location	Sump 9C			Sump 9D		
	Datum (mAOD)	321.91	Leachate Level (m Above Base)	Datum (mAOD)	322.26	Leachate Level (m Above Base)
	Base (mAOD)	307		Base (mAOD)	307	
	Dip (mBGL)	Depth (mAOD)		Dip (mBGL)	Depth (mAOD)	
Min	2.00	306.28	-0.72	1.80	307.07	0.07
Max	5.30	316.91	9.91	5.30	317.56	10.56
Average	4.35	313.15	6.15	4.19	313.79	6.79
Count	10			10		


Leachate Level 2016
325.00
320.00
315.00
310.00
305.00
300.00
295.00
(mAOD)
28/01/2016
28/02/2016
28/03/2016
28/04/2016
28/05/2016
28/06/2016
28/07/2016
28/08/2016
28/09/2016
28/10/2016
28/11/2016
28/12/2016
Sump 1
Sump 2
Sump 3
Sump 4
Sump 5
Sump 9C
Sump 9D

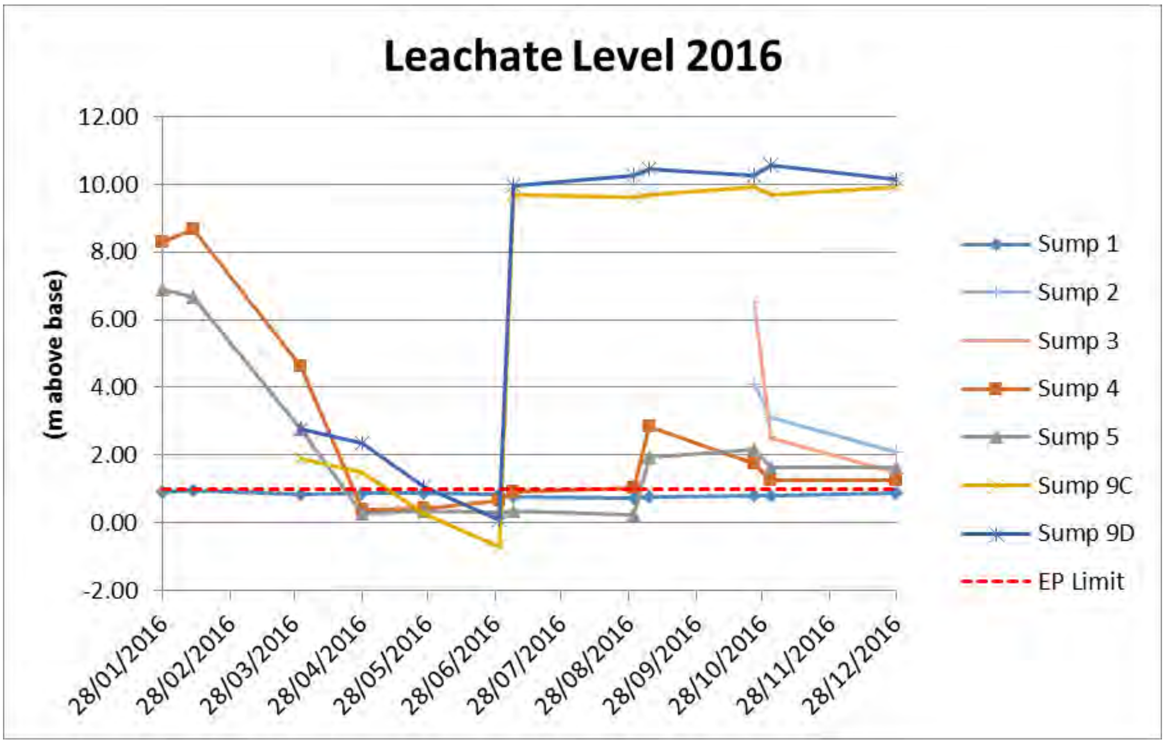
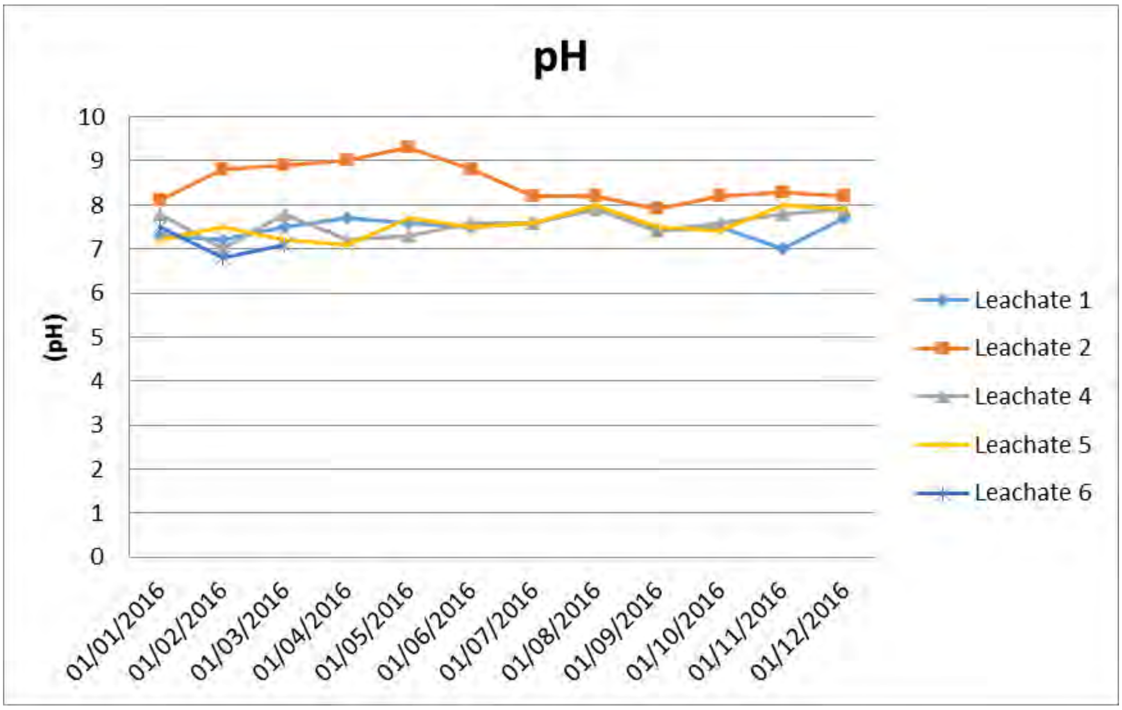

Leachate Level 2016
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
(m above base)
28/01/2016
28/02/2016
28/03/2016
28/04/2016
28/05/2016
28/06/2016
28/07/2016
28/08/2016
28/09/2016
28/10/2016
28/11/2016
28/12/2016
Sump 1
Sump 2
Sump 3
Sump 4
Sump 5
Sump 9C
Sump 9D
EP Limit

Table 2 – Monthly monitoring data

Location		pH	Ammoniacal Nitrogen
		pH units	mg/l
Leachate 1	Min	7.0	20.5
	Max	7.9	887.0
	Average	7.5	379.0
	Count	12	12
Leachate 2	Min	7.9	1370.0
	Max	9.3	2660.0
	Average	8.5	1947.5
	Count	12.0	12.0
Leachate 4	Min	7.0	71.1
	Max	7.9	1160.0
	Average	7.6	716.4
	Count	12	12
Leachate 5	Min	7.1	74.0
	Max	8.0	1110.0
	Average	7.6	770.8
	Count	12	12
Leachate 6	Min	6.8	172.0
	Max	7.5	637.0
	Average	7.1	387.3
	Count	3	3


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
Leachate 1
Leachate 2
Leachate 4
Leachate 5
Leachate 6

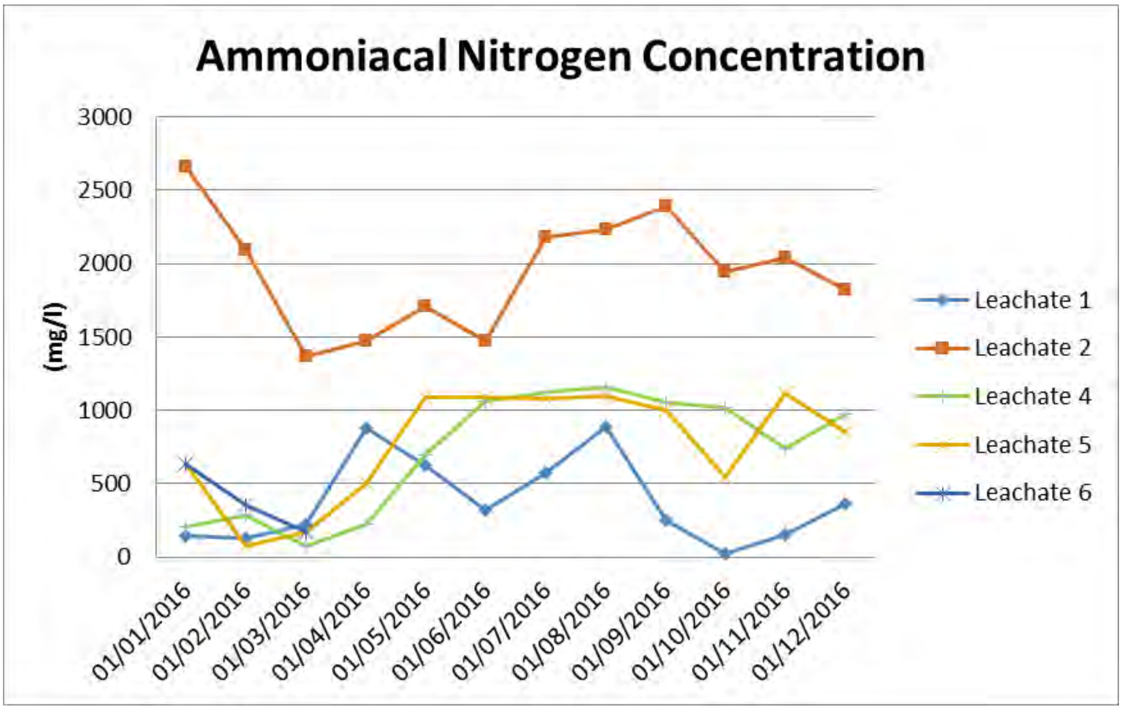

Ammoniacal Nitrogen Concentration
3000
2500
2000
1500
1000
500
0
(mg/l)
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
Leachate 1
Leachate 2
Leachate 4
Leachate 5
Leachate 6

Table 3: Final discharge monthly monitoring data (EP exceedances highlighted)

DATE	pH	Ammoniacal Nitrogen as N	Suspended Solids	COD (1 hr settled)	Total EH (C6 - C40)	Sulphate as SO4	Dissolved Methane
	pH units	mg/l	mg/l	mg/l	µg/l	mg/l	mg/l
Trigger Levels	**6 - 10**	**150**	**500**	**1000**	**nil**	**1000**	**N/A**
Jan-16	8	508	1470	2490	1320	280	0.840
Feb-16	8.3	404	744	880	510	174	0.370
Mar-16	8.2	656	936	1240	1070	143	0.013
Apr-16	8.4	582	644	1400	395	119	0.100
May-16	7.5	36.6	632	2950	2730	89	0.015
Jun-16	7.3	53.5	486	2340	781	89	0.013
Jul-16	7.2	86.5	450	2620	564	80	0.011
Aug-16	7.2	88.8	978	2970	1850	90	0.010
Sep-16	8.1	362	202	1410	547	99	0.022
Oct-16	7.5	151	864	2080	840	145	0.010
Nov-16	6.4	53.3	778	2080	353	130	0.010
Dec-16	8.2	453	660	2390	873	289	0.010
MIN	6.4	36.6	202	880	353	80	0.010
MAX	8.4	656.0	1470	2970	2730	289	0.840
AVRG	7.7	286.2	737	2071	986	144	0.119

Table 4: Final discharge six monthly monitoring data, June

Parameter	Units	Treated Leachate
Cadmium , Total as Cd	mg/l	0.0007
Chromium , Total as Cr	mg/l	0.276
Copper, Total as Cu	mg/l	0.133
Lead , Total as Pb	mg/l	0.039
Mercury, Total as Hg	mg/l	<0.00010
Nickel, Total as Ni	mg/l	0.149
Zinc, Total as Zn	mg/l	0.651
BOD + ATU (20 day)	mg/l	916
Cyanide, Total as CN	mg/l	0.88
Hexachlorobenzene	ng/l	<16
Fenthion	ug/l	<0.020
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
Dicamba	ug/l	<5.00
Dichlorprop	ug/l	9.08
Ioxynil	ug/l	<5.00
MCPA	ug/l	<5.00
MCPB	ug/l	<5.00
Mecoprop	ug/l	48.6
EH >C6 - C8	ug/l	<100
EH >C8 - C10	ug/l	<100
EH >C16 - C24	ug/l	171
EH >C24 - C40	ug/l	240
EH >C10 - C16	ug/l	370
Phenol	ug/l	49.4
Bis(2-chloroethyl)ether	ug/l	<20.0
2-Chlorophenol	ug/l	<20.0
1,3-Dichlorobenzene	ug/l	<20.0
1,4-Dichlorobenzene	ug/l	<20.0
2-Methylphenol	ug/l	<20.0
3&4-Methylphenol	ug/l	<20.0
Dibenzofuran	ug/l	<20.0
1,2-Dichlorobenzene	ug/l	<20.0
Bis(2-chloroisopropyl)ether	ug/l	<20.0
n-Nitrosodi-n-propylamine	ug/l	<20.0
Hexachloroethane	ug/l	<20.0
Nitrobenzene	ug/l	<20.0
Isophorone	ug/l	<20.0
2,4-Dimethylphenol	ug/l	<20.0
2-Nitrophenol	ug/l	<20.0
Bis(2-chloroethoxy)methane	ug/l	<20.0
2,4-Dichlorophenol	ug/l	<20.0
1,2,4-Trichlorobenzene	ug/l	<20.0
Naphthalene	ug/l	<40.0
Hexachlorobutadiene	ug/l	<20.0
4-Chloro-3-methylphenol	ug/l	<20.0
2-Methylnaphthalene	ug/l	<20.0
2,4,6-Trichlorophenol	ug/l	<20.0
2,4,5-Trichlorophenol	ug/l	<20.0
2-Chloronaphthalene	ug/l	<20.0
Dimethylphthalate	ug/l	<20.0
2,6-Dinitrotoluene	ug/l	<20.0
Acenaphthylene	ug/l	<20.0

Parameter	Units	Treated Leachate
Acenaphthene	ug/l	<20.0
2,4-Dinitrotoluene	ug/l	<20.0
Diethylphthalate	ug/l	<20.0
4-Nitrophenol	ug/l	<100
4-Chlorophenyl phenyl ether	ug/l	<20.0
Fluorene	ug/l	<20.0
Diphenylamine	ug/l	<20.0
4-Bromophenyl Phenyl Ether	ug/l	<20.0
Hexachlorobenzene	ug/l	<20.0
Pentachlorophenol	ug/l	<20.0
Phenanthrene	ug/l	<20.0
Anthracene	ug/l	<20.0
di-n-Butylphthalate	ug/l	<20.0
Fluoranthene	ug/l	<20.0
Pyrene	ug/l	<20.0
Benzyl Butyl Phthalate	ug/l	<20.0
Benzo(a)anthracene	ug/l	<20.0
Chrysene	ug/l	<20.0
Bis(2-ethylhexyl)phthalate	ug/l	<100
Di-n-octylphthalate	ug/l	<20.0
Benzo(b)fluoranthene	ug/l	<20.0
Benzo(k)fluoranthene	ug/l	<20.0
Benzo(a)pyrene	ug/l	<20.0
Indeno(1,2,3-c,d)pyrene	ug/l	<20.0
Dibenz(a,h)anthracene	ug/l	<20.0
Benzo(g,h,i)perylene	ug/l	<20.0
Dichlorodifluoromethane	ug/l	<20.0
Chloromethane	ug/l	35.8
Chloroethane	ug/l	<20.0
Bromomethane	ug/l	20
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
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

Parameter	Units	Treated Leachate
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

Table 5: Final discharge six monthly monitoring data, December

Parameter	Units	Treated Leachate
Cadmium , Total as Cd	mg/l	0.0012
Chromium , Total as Cr	mg/l	0.385
Copper, Total as Cu	mg/l	0.11
Lead , Total as Pb	mg/l	0.049
Mercury, Total as Hg	mg/l	<0.00010
Nickel, Total as Ni	mg/l	0.16
Zinc, Total as Zn	mg/l	0.466
Hardness, Total as Ca (Calc)	mg/l	249
Chloride as Cl	mg/l	1580
Nitrogen, Total as N	mg/l	942
BOD + ATU (20 day)	mg/l	1150
BOD + ATU (5 day)	mg/l	342
COD (Filtered)	mg/l	2000
COD (Total)	mg/l	2650
TOC as C	mg/l	382
Cyanide, Total as CN	mg/l	0.845
Hexachlorobenzene	ng/l	<155
PCB 28	ug/l	<0.169
PCB 52	ug/l	<0.140
PCB 101	ug/l	<0.168
PCB 118	ug/l	<0.250
PCB 138	ug/l	<0.182
PCB 153	ug/l	<0.148
PCB 180	ug/l	<0.232
Fenthion	ug/l	<0.192
2,3,6 - TBA	ug/l	<2.00
2,4 - D	ug/l	<2.00
2,4 - DB	ug/l	<2.00
2,4,5 - T	ug/l	<2.00
Bromoxynil	ug/l	<2.00
Dicamba	ug/l	2.02
Dichlorprop	ug/l	<8.5
Ioxynil	ug/l	<2.00
MCPA	ug/l	<2.00
MCPB	ug/l	<2.00
Mecoprop	ug/l	36.8
EH >C6 - C8	ug/l	<100
EH >C8 - C10	ug/l	<100
EH >C16 - C24	ug/l	107
EH >C24 - C40	ug/l	454
EH >C10 - C16	ug/l	312
Phenol	ug/l	<20.0
Bis(2-chloroethyl)ether	ug/l	<20.0
2-Chlorophenol	ug/l	<20.0
1,3-Dichlorobenzene	ug/l	<20.0
1,4-Dichlorobenzene	ug/l	<20.0
2-Methylphenol	ug/l	<20.0
3&4-Methylphenol	ug/l	<20.0
Dibenzofuran	ug/l	<20.0
1,2-Dichlorobenzene	ug/l	<20.0
Bis(2-chloroisopropyl)ether	ug/l	<20.0
n-Nitrosodi-n-propylamine	ug/l	<20.0
Hexachloroethane	ug/l	<20.0
Nitrobenzene	ug/l	<20.0
Isophorone	ug/l	<20.0
2,4-Dimethylphenol	ug/l	<20.0

Parameter	Units	Treated Leachate
2-Nitrophenol	ug/l	<20.0
Bis(2-chloroethoxy)methane	ug/l	<20.0
2,4-Dichlorophenol	ug/l	<20.0
1,2,4-Trichlorobenzene	ug/l	<20.0
Naphthalene	ug/l	<40.0
Hexachlorobutadiene	ug/l	<20.0
4-Chloro-3-methylphenol	ug/l	<20.0
2-Methylnaphthalene	ug/l	<20.0
2,4,6-Trichlorophenol	ug/l	<20.0
2,4,5-Trichlorophenol	ug/l	<20.0
2-Chloronaphthalene	ug/l	<20.0
Dimethylphthalate	ug/l	<20.0
2,6-Dinitrotoluene	ug/l	<20.0
Acenaphthylene	ug/l	<20.0
Acenaphthene	ug/l	<20.0
2,4-Dinitrotoluene	ug/l	<20.0
Diethylphthalate	ug/l	<20.0
4-Nitrophenol	ug/l	<100
4-Chlorophenyl phenyl ether	ug/l	<20.0
Fluorene	ug/l	<20.0
Diphenylamine	ug/l	<20.0
4-Bromophenyl Phenyl Ether	ug/l	<20.0
Hexachlorobenzene	ug/l	<20.0
Pentachlorophenol	ug/l	<20.0
Phenanthrene	ug/l	<20.0
Anthracene	ug/l	<20.0
di-n-Butylphthalate	ug/l	<20.0
Fluoranthene	ug/l	<20.0
Pyrene	ug/l	<20.0
Benzyl Butyl Phthalate	ug/l	<20.0
Benzo(a)anthracene	ug/l	<20.0
Chrysene	ug/l	<20.0
Bis(2-ethylhexyl)phthalate	ug/l	<100
Di-n-octylphthalate	ug/l	<20.0
Benzo(b)fluoranthene	ug/l	<20.0
Benzo(k)fluoranthene	ug/l	<20.0
Benzo(a)pyrene	ug/l	<20.0
Indeno(1,2,3-c,d)pyrene	ug/l	<20.0
Dibenz(a,h)anthracene	ug/l	<20.0
Benzo(g,h,i)perylene	ug/l	<20.0
Dichlorodifluoromethane	ug/l	<40.0
Chloromethane	ug/l	76.7
Chloroethane	ug/l	<40.0
Bromomethane	ug/l	113
Trichlorofluoromethane	ug/l	<40.0
1,1-Dichloroethene	ug/l	<40.0
Dichloromethane	ug/l	<40.0
1,1-Dichloroethane	ug/l	<40.0
cis-1,2-Dichloroethene	ug/l	<40.0
2,2-Dichloropropane	ug/l	<40.0
Chloroform	ug/l	<40.0
Bromochloromethane	ug/l	<40.0
1,1,1-Trichloroethane	ug/l	<40.0
1,1-Dichloropropene	ug/l	<40.0
1,2-Dichloroethane	ug/l	<40.0
Benzene	ug/l	<40.0
1,2-Dichloropropane	ug/l	<40.0

Parameter	Units	Treated Leachate
Trichloroethene	ug/l	<40.0
Bromodichloromethane	ug/l	<40.0
Dibromomethane	ug/l	<40.0
cis-1,3-Dichloropropene	ug/l	<40.0
Toluene	ug/l	<40.0
trans-1,3-Dichloropropene	ug/l	<40.0
1,1,2-Trichloroethane	ug/l	<40.0
Carbon Tetrachloride	ug/l	<40.0
Vinyl Chloride	ug/l	<20.0
1,3-Dichloropropane	ug/l	<40.0
Tetrachloroethene	ug/l	<40.0
Dibromochloromethane	ug/l	<40.0
1,2-Dibromoethane	ug/l	<40.0
Chlorobenzene	ug/l	<40.0
1,1,1,2-Tetrachloroethane	ug/l	<40.0
Ethyl Benzene	ug/l	<40.0
m&p-Xylene	ug/l	<40.0
o-Xylene	ug/l	<40.0
Styrene	ug/l	<40.0
Bromoform	ug/l	<40.0
Isopropylbenzene	ug/l	<40.0
trans-1,2-Dichloroethene	ug/l	<40.0
1,1,2,2-Tetrachloroethane	ug/l	<40.0
1,2,3-Trichloropropane	ug/l	<40.0
n-Propylbenzene	ug/l	<40.0
Bromobenzene	ug/l	<40.0
2-Chlorotoluene	ug/l	<40.0
1,3,5-Trimethylbenzene	ug/l	<40.0
4-Chlorotoluene	ug/l	<40.0
tert-Butylbenzene	ug/l	<40.0
1,2,4-Trimethylbenzene	ug/l	<40.0
sec-Butylbenzene	ug/l	<40.0
p-Isopropyltoluene	ug/l	<40.0
1,3-Dichlorobenzene	ug/l	<40.0
1,4-Dichlorobenzene	ug/l	<40.0
n-Butylbenzene	ug/l	<40.0
1,2-Dichlorobenzene	ug/l	<40.0
1,2-Dibromo-3-chloropropane	ug/l	<80.0
1,2,4-Trichlorobenzene	ug/l	<40.0
Hexachlorobutadiene	ug/l	<40.0
Naphthalene	ug/l	<40.0
1,2,3-Trichlorobenzene	ug/l	<40.0
MTBE	ug/l	<40.0

Table 6: Daily leachate monitoring from lagoon, January – December 2016

DATE	PH METER	AMM	PH STRIP	DO	TEMP	AIR PRODUCTS	AP Hrs Run	Discharge Allowed	OUFLOW	Actual Discharge
04-Jan-16	8.23	162.00	6.5	4.25	9.5	0	0	104.94	92322	121
05-Jan-16	8.26	162.00	6.5	3.22	9.5	0	0	104.94	92464	142
06-Jan-16	8.23	162.00	6.5	2.74	9.4	0	0	104.94	92598	134
07-Jan-16	8.24	162.00	6.5	0.61	9.4	0	0	104.94	92726	128
08-Jan-16	8.27	162.00	6.5	0.06	8.2	0	0	104.94	92886	160
11-Jan-16	8.34	162.00	6.5	8.35	8.3	0	0	104.94	92890	4
12-Jan-16	8.34	162.00	6.5	8.13	8.6	0	0	104.94	93014	124
13-Jan-16	8.23	162.00	6.5	8.17	8.1	0	0	104.94	93135	121
14-Jan-16	8.38	162.00	6.5	8.19	7.9	0	0	104.94	93265	130
15-Jan-16	8.55	164.00	6.5	8.63	7.6	0	0	103.66	93292	27
18-Jan-16	8.75	373.00	6.5	9.79	7.7	0	0	45.58	93292	0
19-Jan-16	8.63	367.00	6.5	7.79	7.7	0	0	46.32	93292	0
20-Jan-16	8.66	366.00	6.5	8.45	6.9	0	0	46.45	93292	0
21-Jan-16	8.41	247.00	6.5	6.87	7.7	0	0	68.83	93308	16
22-Jan-16	8.4	562.00	6.5	1.06	7.7	0	0	30.25	93394	86
25-Jan-16	8.2	600.00	6.5	3.27	10.1	0	0	28.33	93394	0
26-Jan-16	8.5	510.00	8	5.89	10.7	0	0	33.33	93435	41
27-Jan-16	8.7	400.00	8	5.78	10.77	0	0	42.50	93458	23
28-Jan-16	8.8	350.00	8.5	6.84	10.2	0	0	48.57	93458	0
29-Jan-16	8.7	400.00	8.5	7.48	10.1	0	0	42.50	93458	0
01-Feb-16	8.7	300.00	8.5	7.5	10.1	0	0	56.67	93458	0
02-Feb-16	8.8	400.00	8.7	8.34	9.5	0	0	42.50	93458	0
03-Feb-16	8.9	400.00	9	8.19	8.7	0	0	42.50	93458	0
04-Feb-16	8.8	400.00	9	7.86	9.1	0	0	42.50	93458	0
05-Feb-16	8.8	400.00	9	7.45	9.7	0	0	42.50	93458	0
08-Feb-16	9.1	350.00	9	6.59	8.1	0	0	48.57	93458	0
09-Feb-16	6.8	300.00	9	6.18	6.5	0	0	56.67	93539	81
10-Feb-16	8.77	300.00	9	6.12	6.9	0	0	56.67	93654	115
11-Feb-16	8.82	300.00	9	6.11	6.8	0	0	56.67	93933	279
12-Feb-16	8.84	300.00	9	5.98	7.1	0	0	56.67	93986	53
15-Feb-16	8.87	300.00	9	5.43	6.6	0	0	56.67	94092	106
16-Feb-16	8.95	300.00	9	5.32	6.2	0	0	56.67	94197	105
17-Feb-16	8.85	300.00	9	5.09	6.3	0	0	56.67	94303	106
18-Feb-16	8.85	300.00	9	7.43	9.4	0	0	56.67	94378	75

DATE	PH METER	AMM	PH STRIP	DO	TEMP	AIR PRODUCTS	AP Hrs Run	Discharge Allowed	OUFLOW	Actual Discharge
19-Feb-16	8.75	300.00	9	4.62	6.5	0	0	56.67	94402	24
22-Feb-16	8.82	300.00	9	3.91	6.6	0	0	56.67	94440	38
23-Feb-16	8.85	300.00	9	3.65	8.8	0	0	56.67	94552	112
24-Feb-16	8.83	300.00	9	3.39	8.5	0	0	56.67	94564	12
25-Feb-16	8.85	300.00	9	3.2	8.4	0	0	56.67	94765	201
26-Feb-16	8.9	300.00	9	3.01	8.4	0	0	56.67	94853	88
29-Feb-16	8.83	300.00	9	3.01	8.6	0	0	56.67	94853	0
01-Mar-16	8.87	300.00	8.8	3.02	8.8	0	0	56.67	94853	0
02-Mar-16	8.49	300.00	8.7	3.01	8.6	0	0	56.67	94853	0
03-Mar-16	8.47	300.00	8.8	2.97	8.6	0	0	56.67	94853	0
04-Mar-16	8.53	300.00	8.8	2.97	8.6	0	0	56.67	94853	0
07-Mar-16	8.46	300.00	8.8	2.94	8.5	0	0	56.67	94869	16
08-Mar-16	8.46	275.00	8.6	2.93	8.8	0	0	61.82	94903	34
09-Mar-16	8.43	280.00	8.6	2.93	8.8	0	0	60.71	94903	0
10-Mar-16	8.54	260.00	8.6	2.91	8.9	0	0	65.38	94903	0
11-Mar-16	8.54	260.00	8.5	2.97	8.9	0	0	65.38	94997	94
14-Mar-16	8.52	320.00	8.4	2.98	8.9	0	0	53.13	95126	129
15-Mar-16	8.54	320.00	8.4	2.98	9.3	0	0	53.13	95126	0
16-Mar-16	8.45	320.00	8.2	2.94	9.4	0	0	53.13	95126	0
17-Mar-16	8.51	330.00	7.9	2.93	9.7	0	0	51.52	95126	0
18-Mar-16	8.45	340.00	7.6	2.95	9.7	0	0	50.00	95126	0
21-Mar-16	8.5	340.00	7.7	2.95	9.6	0	0	50.00	95126	0
22-Mar-16	8.48	340.00	7.7	2.95	9.4	0	0	50.00	95337	211
23-Mar-16	8.47	325.00	7.7	2.92	9.5	0	0	52.31	95337	0
24-Mar-16	8.44	325.00	7.5	2.91	9.5	0	0	52.31	95337	0
25-Mar-16	8.51	325.00	7.5	2.93	9.8	0	0	52.31	95337	0
29-Mar-16	8.48	320.00	7.8	2.91	9.8	0	0	53.13	95337	0
30-Mar-16	8.48	320.00	7.5	2.94	9.8	0	0	53.13	95337	0
31-Mar-16	8.47	320.00	7.4	2.93	10.2	0	0	53.13	95337	0
01-Apr-16	8.49	320.00	7.4	2.91	10.2			53.13	95337	0
04-Apr-16	8.47	300.00	7.9	2.87	10.1	0	0	56.67	95337	0
05-Apr-16	8.46	300.00	7.9	2.84	10.8	0	0	56.67	95337	0
06-Apr-16	8.46	300.00	7.8	2.82	10.7	0	0	56.67	95337	0
08-Apr-16	8.49	300.00	7.8	2.67	10.6	0	0	56.67	95337	0
11-Apr-16	8.51	300.00	7.7	2.61	10.9	0	0	56.67	95337	0

DATE	PH METER	AMM	PH STRIP	DO	TEMP	AIR PRODUCTS	AP Hrs Run	Discharge Allowed	OUFLOW	Actual Discharge
12-Apr-16	8.48	280.00	7.6	2.53	10.9	0	0	60.71	95337	0
14-Apr-16	8.47	280.00	7.5	2.54	10.7	0	0	60.71	95337	0
15-Apr-16	8.43	280.00	7.5	2.48	10.21	0	0	60.71	95337	0
18-Apr-16	8.47	300.00	7.5	2.45	10.22	0	0	56.67	95337	0
19-Apr-16	8.44	300.00	7.4	2.38	15.8	0	0	56.67	95337	0
21-Apr-16	8.44	325.00	7.4	2.24	18.9	0	0	52.31	95337	0
22-Apr-16	8.44	320.00	7.4	2.17	18.7	0	0	53.13	95337	0
25-Apr-16	8.45	320.00	7.5	2.12	21.8	0	0	53.13	95337	0
26-Apr-16	8.57	320.00	7.5	2.05	23.5	0	0	53.13	95337	0
28-Apr-16	8.49	300.00	7.1	2.01	24.8	0	0	56.67	95337	0
29-Apr-16	8.51	300.00	7.5	1.94	26.7	0	0	56.67	95337	0
02-May-16	8.54	340.00	7.6	1.92	23.5	0	0	50.00	95337	0
03-May-16	8.55	320.00	7.8	1.91	22.9	0	0	53.13	95337	0
04-May-16	8.55	360.00	7.8	1.89	21.3	0	0	47.22	95337	0
05-May-16	7.99	320.00	7.4	1.87	21.4	0	0	53.13	95353	16
06-May-16	7.41	300.00	7.4	1.84	28.8	0	0	56.67	95435	82
09-May-16	7.07	60.00	6.5	0.97	25.5	0	0	283.33	95464	29
10-May-16	714	20.00	6.5	0.98	25	0	0	850.00	95544	80
11-May-16	7.07	130.00	7.1	1.1	22.8	0	0	130.77	95627	83
12-May-16	7.28	140.00	7.4	0.59	22.3	0	0	121.43	95747	120
13-May-16	6.9	50.00	7.1	0.95	22.9	0	0	340.00	95831	84
16-May-16	6.77	10.00	6.5	5.99	22.8	0	0	1700.00	95949	118
17-May-16	6.81	25.00	6.5	1.2	23.2	0	0	680.00	96072	123
18-May-16	6.92	26.90	6.5	1.11	22.1	0	0	631.97	96199	127
19-May-16	7.05	60.00	6.5	1.08	21.2	0	0	283.33	96329	130
20-May-16	6.89	50.00	6.5	1.22	21.4	0	0	340.00	96444	115
23-May-16	6.88	46.80	6.5	1.22	20.7	0	0	363.25	96563	119
24-May-16	6.17	30.00	7.1	1.18	21.5	0	0	566.67	96731	168
25-May-16	6.97	32.20	6.8	1.13	23.2	0	0	527.95	96894	163
26-May-16	7	49.90	7.1	1.05	21.1	0	0	340.68	96945	51
27-May-16	7.22	49.90	7.4	0.81	21.7	0	0	340.68	96945	0
28-May-16	7.12	15.00	6.5	1.04	24.3	0	0	1133.33	96969	24
01-Jun-16	7.14	25.00	6.5	0.76	23.6	0	0	680.00	97015	46
02-Jun-16	7.32	25.00	6.5	0.65	23.3	0	0	680.00	97132	117
03-Jun-16	7.33	25.00	6.8	0.28	22.9	0	0	680.00	97289	157

DATE	PH METER	AMM	PH STRIP	DO	TEMP	AIR PRODUCTS	AP Hrs Run	Discharge Allowed	OUFLOW	Actual Discharge
06-Jun-16	6.54	20.00	7.4	4.12	25.2	0	0	850.00	97337	48
07-Jun-16	6.69	40.00	7.7	0.74	25.8	0	0	425.00	97516	179
08-Jun-16	7.25	90.00	7.5	0.79	25	0	0	188.89	97679	163
09-Jun-16	7.64	40.00	7.1	0.89	25.7	0	0	425.00	97813	134
10-Jun-16	7.64	25.00	7.5	0.81	25.9	0	0	680.00	97996	183
13-Jun-16	7.07	15.00	6.2	5.16	24	0	0	1133.33	98096	100
14-Jun-16	7.12	60.00	6.5	1.06	23.1	0	0	283.33	98181	85
15-Jun-16	7.15	60.00	6.5	1.04	22.5	0	0	283.33	98265	84
16-Jun-16	7.68	157.00	7.1	0.41	21.9	0	0	108.28	98376	111
17-Jun-16	7.57	93.00	7.1	0.22	21.6	0	0	182.80	98477	101
20-Jun-16	7.33	35.00	6.8	1.54	21.4	0	0	485.71	98585	108
21-Jun-16	8.11	150.00	6.8	1.23	20.4	0	0	113.33	98809	224
22-Jun-16	7.95	123.00	6.8	0.9	20.5	0	0	138.21	98984	175
23-Jun-16	7.56	30.50	6.5	5.06	21.2	0	0	557.38	99205	221
24-Jun-16	7.12	51.10	6.5	5.19	22.2	0	0	332.68	99393	188
27-Jun-16	8.09	74.00	6.5	0.98	21.2	0	0	229.73	99489	96
28-Jun-16	7.49	40.00	6.2	7.21	21.8	0	0	425.00	99684	195
29-Jun-16	4.84	30.00	6.5	4.89	21.7	0	0	566.67	99881	197
30-Jun-16	4.98	30.00	6.2	6.98	20.2	0	0	566.67	100106	225
01-Jul-16	5.75	90.00	7.1	2.01	19.9	0	0	188.89	100311	205
04-Jul-16	6.25	145.00	6.8	1	20.1	0	0	117.24	100392	81
05-Jul-16	5.43	60.00	6.5	6.38	20.4	0	0	283.33	100605	213
06-Jul-16	5.6	35.00	6.2	8.01	20.8	0	0	485.71	100804	199
07-Jul-16	8.6	300.00	9	3.1	18.1	0	0	56.67	100905	101
08-Jul-16	7.46	300.00	9	1.48	17.5	0	0	56.67	100905	0
11-Jul-16	9	150.00	7.1	1.17	20.6	0	0	113.33	100905	0
12-Jul-16	9.2	100.00	6.8	7.93	20.2	0	0	170.00	100918	13
13-Jul-16	6.45	70.00	6.2	7.92	20.3	0	0	242.86	101080	162
14-Jul-16	6.5	70.00	6.2	8.87	20.6	0	0	242.86	101278	198
15-Jul-16	6.43	60.00	6.5	8.88	21.1	0	0	283.33	101352	74
18-Jul-16	7.23	145.00	7.1	0.69	21.9	0	0	117.24	101421	69
19-Jul-16	6.8	140.00	7.1	1.08	23.2	0	0	121.43	101615	194
20-Jul-16	6.33	130.00	7.1	0.64	24.7	0	0	130.77	101765	150
21-Jul-16	6.66	70.00	7.1	1.41	24.5	0	0	242.86	101818	53
22-Jul-16	8.49	300.00	7.1	0.64	21.5	0	0	56.67	101838	20

DATE	PH METER	AMM	PH STRIP	DO	TEMP	AIR PRODUCTS	AP Hrs Run	Discharge Allowed	OUFLOW	Actual Discharge
25-Jul-16	10.97	300.00	7.1	0.42	22.1	0	0	56.67	101838	0
26-Jul-16	8.94	250.00	7.1	0.44	21.9	0	0	68.00	101838	0
27-Jul-16	9.02	250.00	7.1	0.56	21.7	0	0	68.00	101838	0
28-Jul-16	8.8	150.00	7.4	3.14	22.2	0	0	113.33	101842	4
29-Jul-16	8.5	140.00	7.4	0.8	22.8	0	0	121.43	102058	216
01-Aug-16	8.57	130.00	7.1	8.06	22	0	0	130.77	102109	51
02-Aug-16	10.13	150.00	7.1	3.83	21.2	0	0	113.33	102185	76
03-Aug-16	9.17	140.00	6.8	5.67	21.8	0	0	121.43	102185	0
04-Aug-16	9.17	116.00	6.8	4.93	21.6	0	0	146.55	102414	229
05-Aug-16	9.48	120.00	6.2	5.63	21.8	0	0	141.67	102494	80
08-Aug-16	9.45	98.20	5.9	8.48	22.3	0	0	173.12	102494	0
09-Aug-16	9.91	60.00	6.2	8.87	22.1	0	0	283.33	102586	92
10-Aug-16	10.25	70.00	6.2	8.88	21.9	0	0	242.86	102677	91
11-Aug-16	10.54	85.00	6.2	8.85	21.7	0	0	200.00	102754	77
12-Aug-16	10.75	80.00	6.2	8.9	21.5	0	0	212.50	102847	93
15-Aug-16	11.18	80.00	6.2	8.67	21.9	0	0	212.50	102865	18
16-Aug-16	10.8	80.00	6.2	8.62	22.5	0	0	212.50	102958	93
17-Aug-16	12.05	80.00	6.2	7.56	22.8	0	0	212.50	102988	30
18-Aug-16	12.07	150.00	7.1	5.96	22	0	0	113.33	102988	0
19-Aug-16	11.99	150.00	7.4	6.31	21.9	0	0	113.33	102988	0
22-Aug-16	1203	150.00	7.1	5.15	19.8	0	0	113.33	103067	79
23-Aug-16	12.03	150.00	7.4	4.76	20	0	0	113.33	103127	60
24-Aug-16	12.03	150.00	7.4	1.02	20.9	0	0	113.33	103358	231
25-Aug-16	12.01	140.00	7.4	0.38	21.2	0	0	121.43	103493	135
26-Aug-16	12.07	150.00	7.4	0.94	20.5	0	0	113.33	103714	221
30-Aug-16	12.02	150.00	7.4	0.2	20.6	0	0	113.33	103902	188
31-Aug-16	12.03	150.00	7.4	0.2	20.4	0	0	113.33	104056	154
01-Sep-16	12.03	150.00	7.4	0.11	20.3	0	0	113.33	104127	71
02-Sep-16	12.03	150.00	7.4	0.17	20.1	0	0	113.33	104276	149
05-Sep-16	12.7	150.00	7.4	0.18	18.7	0	0	113.33	104327	51
06-Sep-16	12.04	150.00	7.1	0.51	19.4	0	0	113.33	104594	267
07-Sep-16	12.04	150.00	7.1	0.38	19.9	0	0	113.33	104871	277
08-Sep-16	14	150.00	7.4	0.27	20.8	0	0	113.33	105068	197
09-Sep-16	14	150.00	7.4	0.75	19.9	0	0	113.33	105352	284
12-Sep-16	14	150.00	7.4	0.67	18.1	0	0	113.33	105456	104

DATE	PH METER	AMM	PH STRIP	DO	TEMP	AIR PRODUCTS	AP Hrs Run	Discharge Allowed	OUFLOW	Actual Discharge
13-Sep-16	14	150.00	7.4	0.57	18.4	0	0	113.33	105631	175
14-Sep-16	14	150.00	7.4	0.45	18.9	0	0	113.33	105631	0
15-Sep-16	14	150.00	7.4	0.28	19.5	0	0	113.33	105833	202
16-Sep-16	14	150.00	7.4	0.17	13.2	0	0	113.33	106155	322
19-Sep-16	14	150.00	7.4	0.19	18.6	0	0	113.33	106263	108
20-Sep-16	14	150.00	7.4	0.56	18.2	0	0	113.33	106581	318
21-Sep-16	14	150.00	7.4	0.18	17.8	0	0	113.33	106656	75
22-Sep-16	14	150.00	7.4	0.48	17.5	0	0	113.33	106656	0
23-Sep-16	14	150.00	7.4	6.67	15.2	0	0	113.33	106900	244
26-Sep-16	14	150.00	7.4	7.47	15.6	0	0	113.33	106981	81
27-Sep-16	14	150.00	7.4	7.98	15.8	0	0	113.33	106981	0
28-Sep-16	14	150.00	7.7	7.71	16.3	0	0	113.33	107237	256
29-Sep-16	14	175.00	7.1	6.39	17.2	0	0	97.14	107349	112
30-Sep-16	14	150.00	7.1	6.51	17.2	0	0	113.33	107655	306
03-Oct-16	14	120.00	6.2	7.78	17.3	0	0	141.67	107909	254
04-Oct-16	14	90.00	6.2	7.78	17.1	0	0	188.89	108191	282
05-Oct-16	14	120.00	6.5	6.77	18	0	0	141.67	108489	298
06-Oct-16	14	120.00	6.5	6.04	18.3	0	0	141.67	108574	85
07-Oct-16	14	80.00	6.2	6.85	18.6	0	0	212.50	108574	0
10-Oct-16	14	80.00	6.2	8.06	19.5	0	0	212.50	108659	85
11-Oct-16	14	80.00	6.2	8.78	19.1	0	0	212.50	108956	297
12-Oct-16	14	150.00	6.2	6.81	18.4	0	0	113.33	109219	263
13-Oct-16	14	150.00	6.2	6.21	18.2	0	0	113.33	109472	253
14-Oct-16	14	150.00	6.2	5.42	18	0	0	113.33	109574	102
17-Oct-16	14	135.00	6.2	8.29	17.6	0	0	125.93	109606	32
18-Oct-16	14	80.00	6.2	8.77	16.8	0	0	212.50	109892	286
19-Oct-16	14	70.00	6.2	9.08	16.5	0	0	242.86	110149	257
20-Oct-16	14	55.50	6.2	9.3	16.6	0	0	306.31	110214	65
21-Oct-16	14	56.50	6.2	9.24	16.7	0	0	300.88	110418	204
24-Oct-16	14	63.80	5.8	9.15	16.6	0	0	266.46	110795	377
25-Oct-16	14	150.00	7.4	7.99	16.7	0	0	113.33	110910	115
26-Oct-16	14	150.00	7.4	5.69	16	0	0	113.33	110910	0
27-Oct-16	14	140.00	7.1	5.62	17.3	0	0	121.43	110910	0
28-Oct-16	14	80.90	6.2	8.64	17.6	0	0	210.14	110910	0
31-Oct-16	14	99.50	6.2	8.66	18.8	0	0	170.85	111134	224

DATE	PH METER	AMM	PH STRIP	DO	TEMP	AIR PRODUCTS	AP Hrs Run	Discharge Allowed	OUFLOW	Actual Discharge
01-Nov-16	14	131.00	6.8	4.55	19.9	0	0	129.77	111244	110
03-Nov-16	14	95.00	6.2	8.73	19.4	0	0	178.95	111449	205
04-Nov-16	14	98.50	6.2	8	18.7	0	0	172.59	111554	105
07-Nov-16	14	159.00	7.1	5.99	16.1	0	0	106.92	111554	0
08-Nov-16	14	150.00	6.8	5.66	15.2	0	0	113.33	111705	151
09-Nov-16	14	162.00	6.5	6.19	15.1	0	0	104.94	111819	114
10-Nov-16	14	105.00	6.2	9.26	15.3	0	0	161.90	111932	113
11-Nov-16	6.42	76.90	6.5	10.04	15.6	0	0	221.07	112027	95
14-Nov-16	6.42	78.00	6.2	10.08	15.7	0	0	217.95	112269	242
15-Nov-16	6.88	160.00	7.4	7.89	16.1	0	0	106.25	112384	115
16-Nov-16	7.16	162.00	6.8	7.24	16.4	0	0	104.94	112496	112
17-Nov-16	7.2	163.00	6.8	7.03	15.2	0	0	104.29	112610	114
18-Nov-16	7.13	170.00	6.8	7.34	13.8	0	0	100.00	112723	113
21-Nov-16	6.93	101.00	6.2	10.07	13.5	0	0	168.32	112837	114
22-Nov-16	7.08	120.00	6.5	8.69	14	0	0	141.67	113024	187
23-Nov-16	6.98	110.00	6.8	9.06	13.2	0	0	154.55	113153	129
24-Nov-16	7.4	101.00	6.8	9.32	13.6	0	0	168.32	113264	111
25-Nov-16	7.59	197.00	7.1	9.47	13.5	0	0	86.29	113319	55
28-Nov-16	7.46	220.00	7.1	8	14.2	0	0	77.27	113319	0
29-Nov-16	7.24	174.00	7.1	8.23	13.5	0	0	97.70	113319	0
30-Nov-16	6.87	153.00	6.8	8.66	12.9	0	0	111.11	113319	0
01-Dec-16	6.51	93.00	6.2	10.14	12.6	0	0	182.80	113319	0
02-Dec-16	6.24	72.00	6.2	10.53	13	0	0	236.11	113319	0
05-Dec-16	6.46	71.70	6.2	10.57	13.3	0	0	237.10	113319	0
06-Dec-16	7.26	97.50	7.1	9.79	13.5	0	0	174.36	113319	0
07-Dec-16	7.23	133.00	7.1	9.04	13.8	0	0	127.82	113319	0
08-Dec-16	7.34	182.00	7.1	8.22	14.6	0	0	93.41	113319	0
09-Dec-16	7.3	306.00	7.1	7.89	11.9	0	0	55.56	113319	0
12-Dec-16	6.99	182.00	7.1	9.84	13.6	0	0	93.41	113319	0
13-Dec-16	6.33	105.00	6.2	9.53	15.3	0	0	161.90	113319	0
14-Dec-16	6.66	137.00	6.5	9.29	14.3	0	0	124.09	113319	0
15-Dec-16	6.67	99.70	6.2	9.3	15.2	0	0	170.51	113319	0
16-Dec-16	7.51	139.00	6.4	9.07	8.9	0	0	122.30	113319	0
19-Dec-16	8.09	150.00	7.4	9.33	14.4	0	0	113.33	113319	0
23-Dec-16	7.51	150.00	7.3	7.82	13.7	0	0	113.33	113319	0

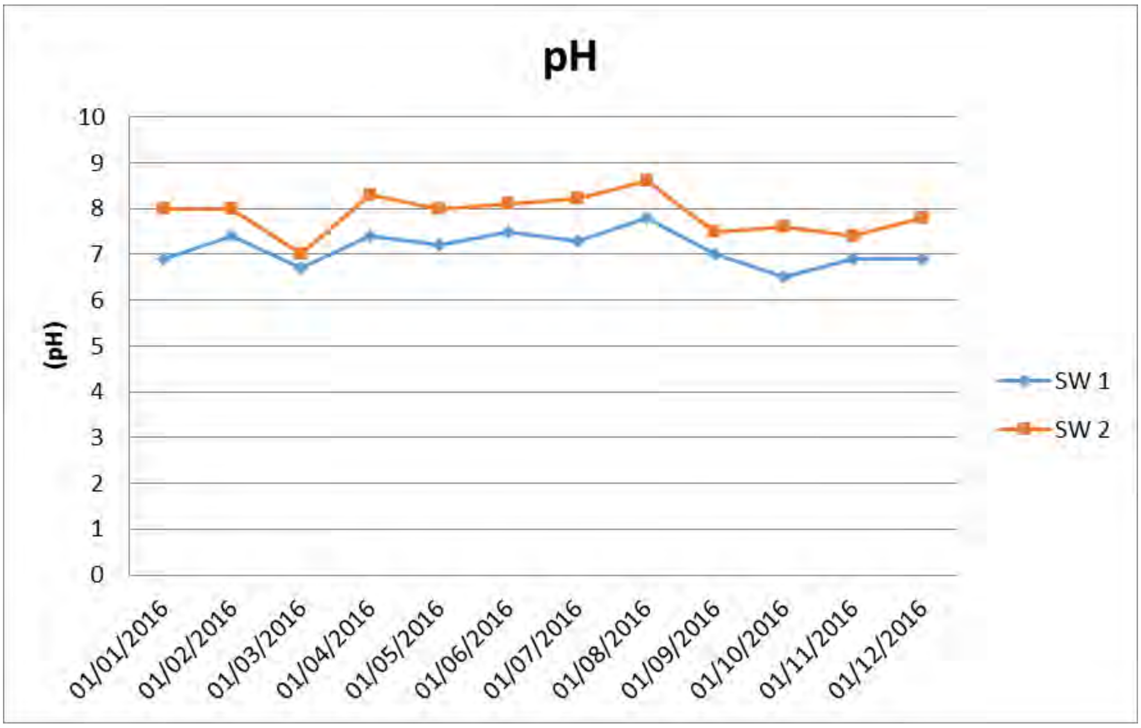
DATE	PH METER	AMM	PH STRIP	DO	TEMP	AIR PRODUCTS	AP Hrs Run	Discharge Allowed	OUFLOW	Actual Discharge
28-Dec-16	6.38	184.00	6.4	10.87	13.2	0	0	92.39	113319	0
29-Dec-16	6.43	176.00	6.2	10.79	13.2	0	0	96.59	113319	0
30-Dec-16	6.55	155.00	6.2	10.68	12.9	0	0	109.68	113319	0

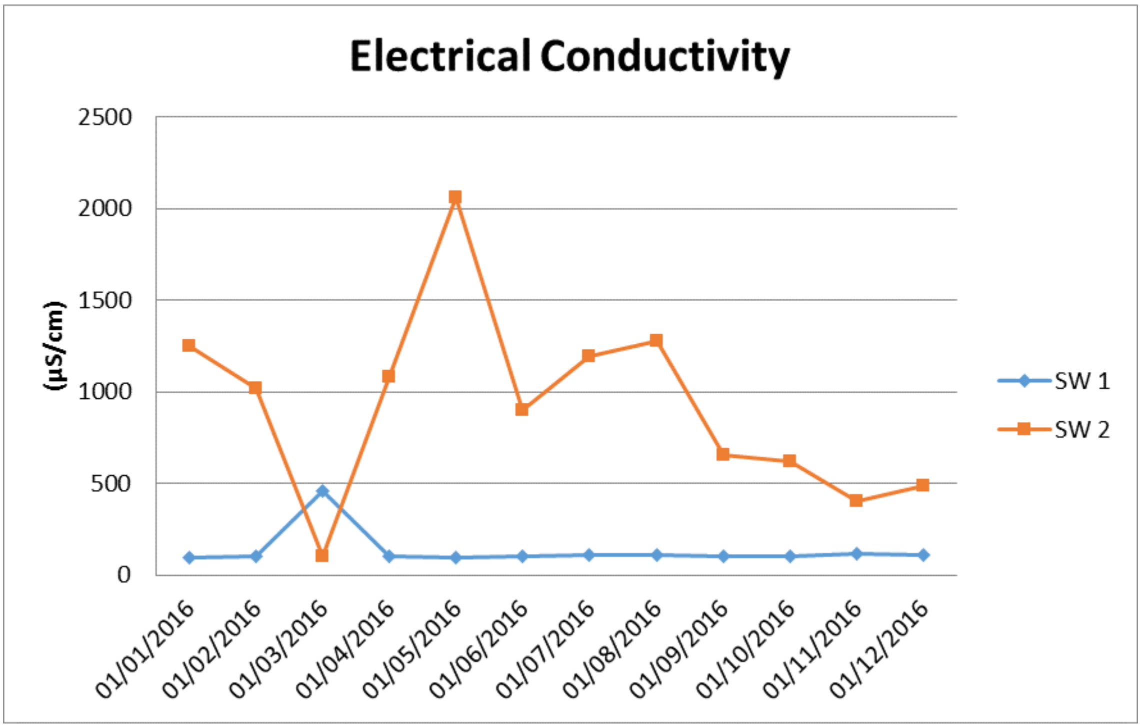
Appendix 5

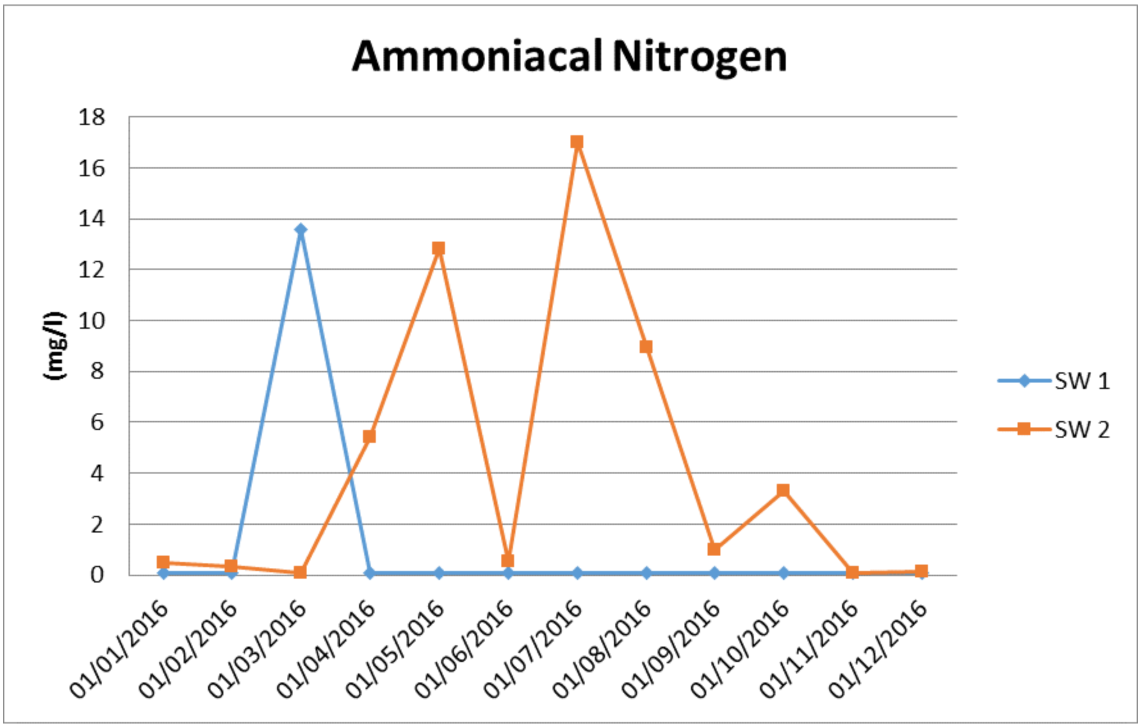
APPENDIX 5 – SURFACE WATER

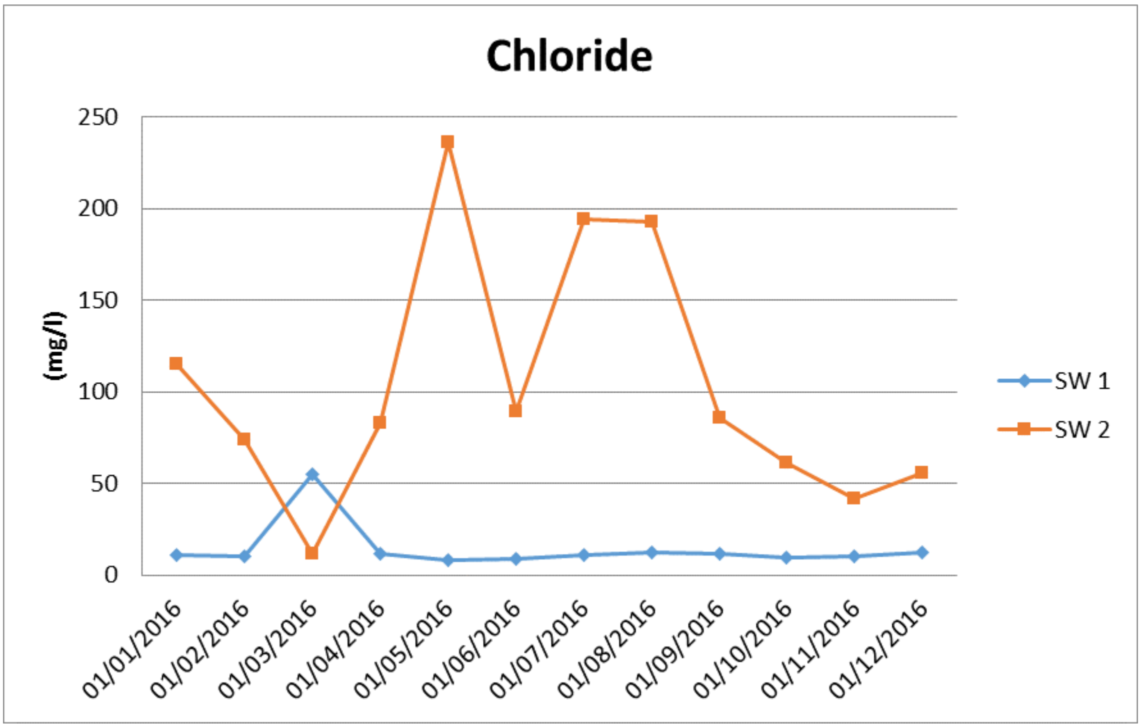
Table 1: Monthly monitoring data

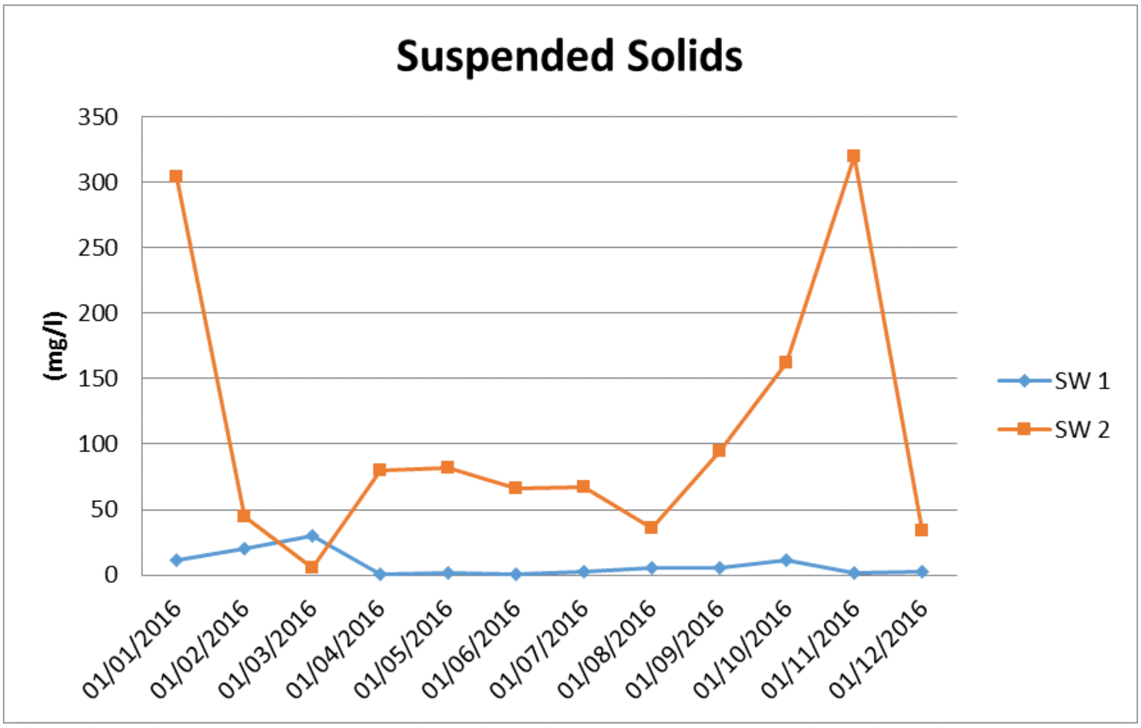
LOCATION		pH	Conductivity-Electrical 20C	Ammoniacal Nitrogen as N (LL)	Chloride as Cl	Total Suspended Solids	BOD + ATU (5 day)	EH >C6 - C40	EH >C6 - C8	EH >C8 - C10	EH >C16 - C24	EH >C24 - C40	EH >C10 - C16
		pH units	µS/cm	mg/l	mg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
EP Limit		6 - 9	N/A	0.25	N/A	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)
0
2
4
6
8
10
12
14
16
18
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)
0
50
100
150
200
250
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

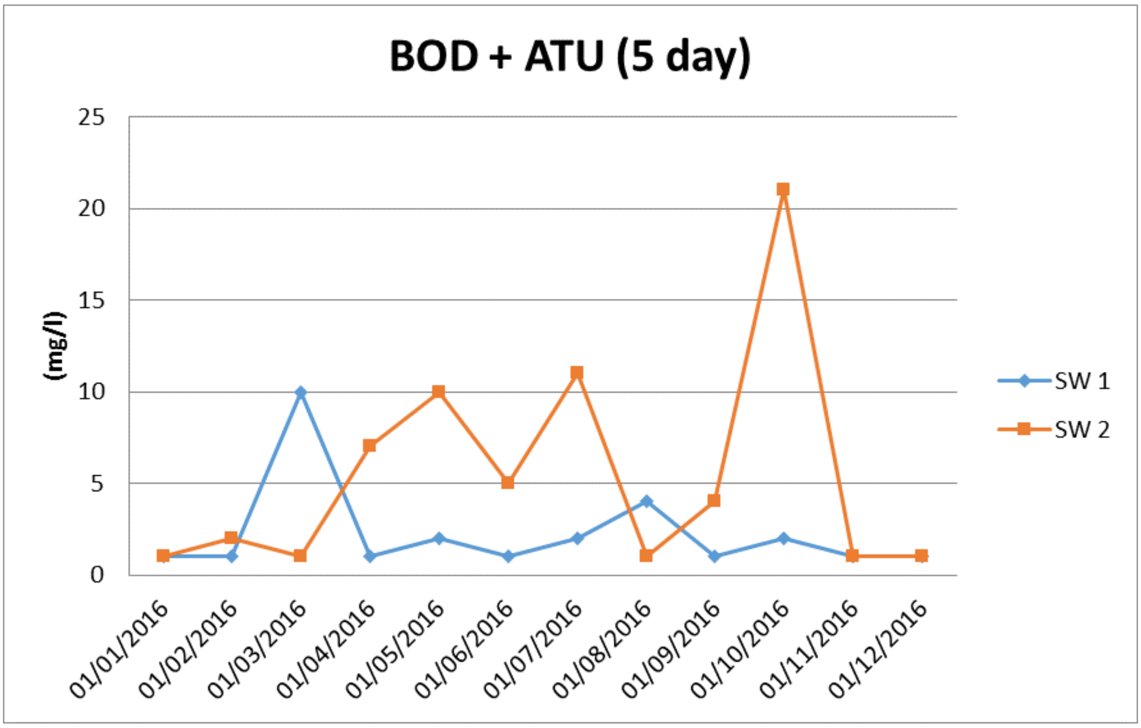

BOD + ATU (5 day)
25
20
15
10
5
0
(mg/l)
01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016
01/07/2016
01/08/2016
01/09/2016
01/10/2016
01/11/2016
01/12/2016
SW 1
SW 2

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

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