Corranure Landfill W0077-04
Annual Environmental Report 2017

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1.0 INTRODUCTION

Cavan County Council is the licensee for the Corranure Landfill Facility. The landfill facility is currently closed and is not accepting waste for landfill.

A Civic Amenity (CA) facility is located at the landfill site. The CA facility was operated and managed by McElvaney Waste and Recycling in 2017.

The main activities on-site during 2017 were the remediation of Cell 4 using non-hazardous soil and alum sludge materials to re-profile and re-contour the site and the management of landfill gas, landfill leachate and environmental monitoring. The facility was managed by Enviroguide Consulting for and on behalf of Cavan County Council. This annual environmental report (AER) has been completed by Enviroguide Consulting.

Waste Licence W0077-04 was granted to Cavan County Council on the 19th of May 2011. On the 19th December 2013, the licence was deemed to be an Industrial Emissions Licence granted under part IV of the Environmental Protection Agency Act 1992 as amended and shall not be a waste licence or a revised waste licence. The original licence for the facility (Waste Licence Register Number W077-01) was granted on the 12th of June 2001. This is the 14th AER for the facility. The AER is prepared in accordance with the requirements as set out in Schedule F of the Licence. The report format follows guidelines set in *"Draft Guidance on Environmental Management Systems and Reporting to the Agency*", issued by the EPA in 1999.

The AER details the site activities from the 1st of January 2017 to the 31st of December 2017.

2.0 SITE DESCRIPTION

Corranure Landfill is located approximately 3km North-East of Cavan Town. It is located adjacent to the Cavan-Cootehill Road (R188), in the townlands of Corranure and Lismagratty. The total footprint of the landfill covers an area of 11 hectares.

The original Waste Licence, Waste Licence Register Number W077-01, for the facility was granted in June 2001 to Cavan County Council for the operation of a non-hazardous landfill with a licensed annual intake of 30,050 tonnes.

Cavan County Council applied to the Agency for a review of Waste Licence W077-1 in April 2003. Following this review process, a revised Waste Licence was granted to Cavan County Council by the Agency on the 10th of May 2005. This Licence was for the continued operation and expansion of the landfill and also provided for the operation of a civic amenity site at the facility. The facility boundary was extended to allow for two new lined cells to be installed (Phase 3 -Cells 3 and 4). The annual waste intake was increased to 90,000 tonnes per annum.

In 2009 the EPA commenced a review of existing EPA waste licences issued for landfill facilities. The purpose of this review was to restrict the acceptance of biodegradable waste at landfills which will assist in complying with the targets set by the EU Landfill Directive, reduce the potential for odours from landfill facilities, reduce greenhouse gas emissions and maximise the use and value of waste prior to it being landfilled. As part of this review process, a review was initiated by the EPA in June 2009 on Waste Licence Register Number W0077-02. A revised Licence (W0077-03) was issued in March 2010. Limits on the acceptance of biodegradable waste were introduced in this Licence.

The operation of the landfill was contracted by Cavan County Council to Oxigen Environmental by means of a concession agreement in September 2007. The facility was managed and operated by Oxigen Environmental until April 2011.

In May 2011, the EPA refused to grant waste Licence Register Number W0248-01 to Oxigen Environmental. A revised Waste Licence was granted to Cavan County Council, Waste Licence Register Number W077-04. This Licence was for the continued operation of the landfill and civic amenity site at the facility. The revised Licence limited the acceptance of waste for disposal to an intake of 45,000 tonnes per annum, a reduction from the previously authorised 90,000 tonnes per annum.

The facility has operated under this licence since May 2011 and this was subsequently changed by the EPA to an Industrial Emissions Licence on the 19th December 2013. Since the granting of the revised Licence, the landfill facility has been managed by Enviroguide Consulting. The Civic Amenity site was closed in April 2011 but reopened in August 2011. Since August 2011 the Civic Amenity Facility has been operated and managed by McElvaney Waste and Recycling.

The Civic Amenity Site at the Facility was originally opened in February 2002 and is used by the general public for recycling. At present the Civic Amenity Facility accepts various waste types including segregated recyclables from householders, newspapers and magazines, cardboard, tetra-pak, glass bottles and jars, aluminium and steel cans, plastic containers and plastic shrink wrap, wood, textiles/footwear, electrical goods, fluorescent tubes, batteries wet and household, scrap steel, waste engine oil and oil filters, vegetable oil, Construction and Demolition waste, gypsum material and green waste.

Table 1 below shows the waste categories which the facility is licensed to accept by Waste Licence W0077-04:

Table 1: Categories of Waste Acceptance

WASTE TYPE	MAXIMUM TONNES PER ANNUM
DISPOSAL AT LANDFILL	
Municipal (Household & Commercial) Waste	35,000
Construction and Demolition Waste	5,000
Industrial Solid Waste	4,000
Treated Sludge	1,000
TOTAL	**45,000**
COLLECTION AT CIVIC AMENITY FACILITY	
Non-hazardous waste	3,000
Hazardous household, commercial and agricultural waste	100
TOTAL COLLECTION AT CIVIC AMENITY FACILITY	**3,100**

Licensed waste disposal and recovery activities are carried out in accordance with the 3rd and 4th Schedule of the Waste Management Act as per Part 1 of Industrial Emissions Licence W0077-04.

3.0 EMISSIONS FROM THE FACILITY

All monitoring was carried out in accordance with monitoring requirements as set out in Schedule C: Control & Monitoring of Waste Licence W0077-04 or as agreed with the Agency.

Environmental monitoring was carried out in 2017 by the following companies:

- Boylan Engineering, Main St., Mullagh, Kells, Co. Meath.
- Odour Monitoring Ireland, Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath

3.1. NOISE MONITORING

Noise monitoring is scheduled to be carried out on a quarterly basis under conditions of Waste Licence W077-04. As the facility is a closed landfill site and there is no waste being accepted for disposal at the facility, a request was submitted to the Agency in April 2011 to request the temporary cessation of noise monitoring until the acceptance of waste for landfill is recommenced. Following agreement from the Agency, no noise monitoring was conducted in 2017. Noise did not give rise to nuisance at the facility at any stage during the year.

3.2. SURFACE WATER MONITORING

Surface water monitoring is carried out on a monthly and quarterly basis at Corranure Landfill as agreed with the Agency. Surface water monitoring was carried out by Boylan Engineering (January to December). Samples are taken from all monitoring points identified on surface monitoring location Maps 1 & 2 included in Appendix 1 of this report. SW1, S4 and S5 are located on the Corranure Stream and SW2 and S3 on the Lismagratty Stream.

SW1 and SW2, surface water discharge points and S3, S4 and S5, surface water sampling locations, are monitored on a quarterly basis.

Annual monitoring was carried in December 2017 by Boylan Engineering for additional parameters as listed in Schedule C.2.2. Annual monitoring results have been submitted to the Agency as part of the quarterly reports for the facility. The results of analysis carried out were compared to Class A1 limits outlined in 1989 "European Communities (Quality of Surface Water Intended for Abstraction of Drinking Water) Regulations 1989".

Results from the quarterly monitoring are summarised in Tables 2 to 7 below.

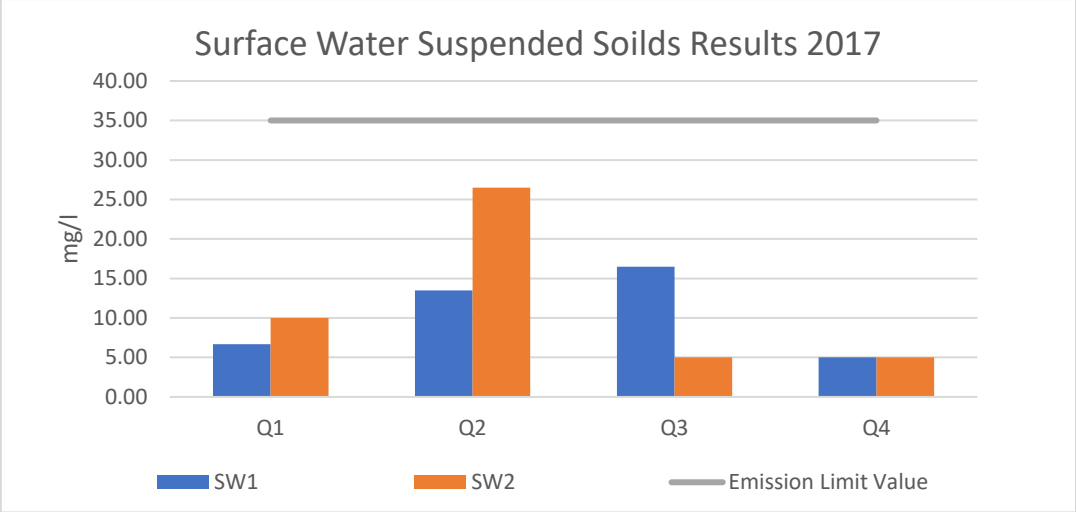
Table 2: Quarterly Monitoring Results 2017 for SW1

SW1 Surface Water Monitoring Results 2017										
Parameters	Ammonia	pH	Cond	BOD	COD	SS	Nitrogen	Chloride	Phosphorus	DO
Units	mg/l N	pH Units	us/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l No	mg/L
Q1	0.11	7.37	299.67	1.43	19.00	6.67	1.37	9.13	0.06	8.33
Q2	0.09	7.75	405.00	4.40	18.50	13.50	1.20	15.90	0.15	9.00
Q3	0.07	7.45	450.00	2.70	31.00	16.50	1.25	9.95	0.26	8.00
Q4	0.11	7.30	279.00	1.20	42.67	<5	<1.0	9.40	0.08	8.33

Table 3: Quarterly Monitoring Results 2017 for SW2

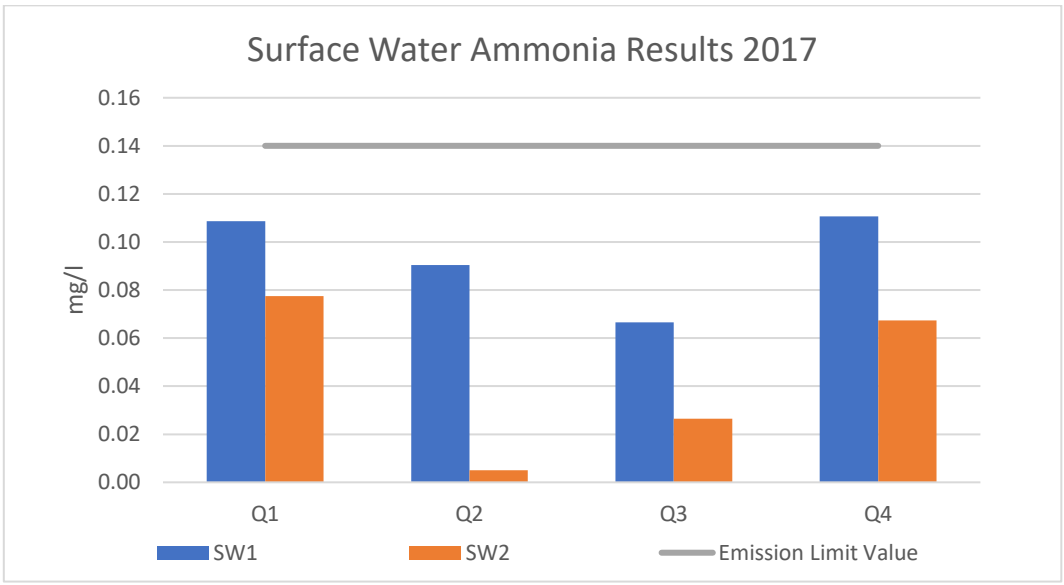
SW2 Surface Water Monitoring Results 2017										
Parameters	Ammonia	pH	Cond	BOD	COD	SS	Nitrogen	Chloride	Phosphorus	DO
Units	mg/l N	pH Units	us/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l No	mg/L
Q1	0.08	8.10	417.00	1.00	16.50	10.00	1.05	19.00	0.02	9.00
Q2	0.01	7.90	661.50	4.50	84.00	26.50	1.10	23.00	1.18	6.50
Q3	0.03	7.45	198.50	1.10	21.50	5.00	1.00	6.00	0.08	9.50
Q4	0.07	8.07	532.00	1.10	24.33	<5	<1.0	60.67	0.01	10.00

Table 4: Suspended Solids Results 2017 at SW1 & SW2



An emission limit value of 35mg/l is set out in Schedule B.2 of Waste Licence W0077-04. All quarterly samples of Surface water at all monitoring points were compliant with this ELV.

Table 5: Ammonia Results 2017 at SW1 & SW2



The emission limit value for ammonia as set out in Schedule B.2 of the Licence is 0.14mg/l. All quarterly samples of Surface water at all monitoring points were compliant with this ELV.

A range of other parameters were monitored during the annual monitoring at SW1, SW2, S3, S4 and S5. The monitoring results for Boron, Cadmium, Chromium, Faecal Coliforms, Total Coliforms, Copper, Cyanide, Fluoride, Mercury, Manganese, Sulphate, and Zinc were all within the Class A1 limits as set out in the Surface Water Regulation Limits (S.I. 294 of 1989). Faecal Coliforms and Total Coliforms were above the recommended limits of 0 MPN/100ml at SW2.

Table 6: Annual Monitoring Results 2017 for SW1 & SW2

Parameter	Unit	SW1	SW2
Ammonia	mg/l	0.17	0.17
BOD	mg/l	<1.0	1
Boron	mg/l	0.06	0.03
Cadmium	mg/l	0.0002	<0.0001
Calcium	mg/l	53.6	96.2
Chlorine	mg/l	8.8	140
Chromium	mg/l	<0.0003	<0.0003
COD	mg/l	77	21
Conductivity	uS/cm	288	802
Copper	mg/l	0.08	0.006
Dissolved Oxygen	mg/l	9	10
Faecal Coliforms	MPN/100m	0	9
Fluoride	mg/l	0.2	0.2
Iron	mg/l	370	68
Lead	mg/l	0.4	<0.3
Magnesium	mg/l	6.1	9.3
Manganese	mg/l	350	74
Mercury	mg/l	0.05	<0.02
Nickel	ug/l	2.5	2.1
Nitrate	mg/l as N	<0.15	1.1
pH	pH Units	7.2	8.1
Potassium	mg/l	3.3	5.4
Sodium	mg/l	9	72.2
Sulphate	mg/l	13	70
Suspended Solids	mg/l	<5	<5
SVOC	ug/l	<1.0	<1.0
Total Coliforms	MPN/100m	0	11
Total Nitrogen	mg/l	<1.0	1.9
Total Phosphorus	mg/l	0.06	<0.01
VOC	ug/l	>0.5	>0.5
Zinc	mg/l	8.1	10

Table 7: Annual Monitoring Results 2017 for S3, S4 & S5

Parameter	Unit	S3	S4	S5
Ammonia	mg/l	7.481	0.067	0.536
BOD	mg/l	7.6	2	6.3
Boron	mg/l	0.03	<0.02	<0.02
Cadmium	mg/l	<0.0001	<0.0001	<0.0001
Calcium	mg/l	44.1	45.3	27.8
Chlorine	mg/l	29	15	15
Chromium	mg/l	<0.0003	<0.0003	<0.0003
COD	mg/l	68	30	102
Conductivity	uS/cm	406	285	415
Copper	mg/l	0.004	<0.003	0.005
Dissolved Oxy-gen	mg/l	8	7	7
Faecal Coliforms	MPN/100m	>100	>60	>100
Fluoride	mg/l	0.4	0.2	0.2
Iron	mg/l	0.4	0.25	0.2
Lead	mg/l	<0.0003	<0.0003	<0.0003
Magnesium	mg/l	8.4	5.5	3.8
Manganese	mg/l	0.31	0.082	0.07
Mercury	mg/l	<0.0002	<0.0002	<0.0002
Nickel	ug/l	3.3	1.8	1.9
Nitrate	mg/l as N	1.2	0.45	-
pH	pH Units	7.5	7.8	7.5
Potassium	mg/l	16.9	3.7	6.3
Sodium	mg/l	15.8	10.8	10
Sulphate	mg/l	16	15	15
Suspended Sol-ids	mg/l	254	13	13
SVOC	ug/l	<10.0	<10.0	<10.0
Total Coliforms	MPN/100m	>100	>80	>100
Total Nitrogen	mg/l	9.6	1.4	2.5
Total Phospho-rus	mg/l	0.63	0.14	0.56
VOC	ug/l	<10.0	<10.0	<10.0
Zinc	mg/l	0.0075	0.004	0.018

3.3. DUST

Dust monitoring was carried out using Bergerhoff Instrument according to the VDI 2119 Standard Method. With this method atmospheric deposits are collected in vessels over a 30 day period ±2 days. The collected samples are then concentrated and the residue subjected to gravimetric weight analysis. Collection jars with a volume of 1.5 litres were placed in wire baskets. The top of the jar was positioned 1.5 meters above ground level. Results were calculated from the formula correlating the dust collected, sampling period and the collecting surface of the jars.

All but one dust monitoring results in 2017 were within licence emission limit values of 350mg/m^2/day as illustrated in Figure 1 below. The Q3 D4 sample was contaminated with detritus matter most likely caused by birds, resulting in an elevated reading on that monitoring occasion.

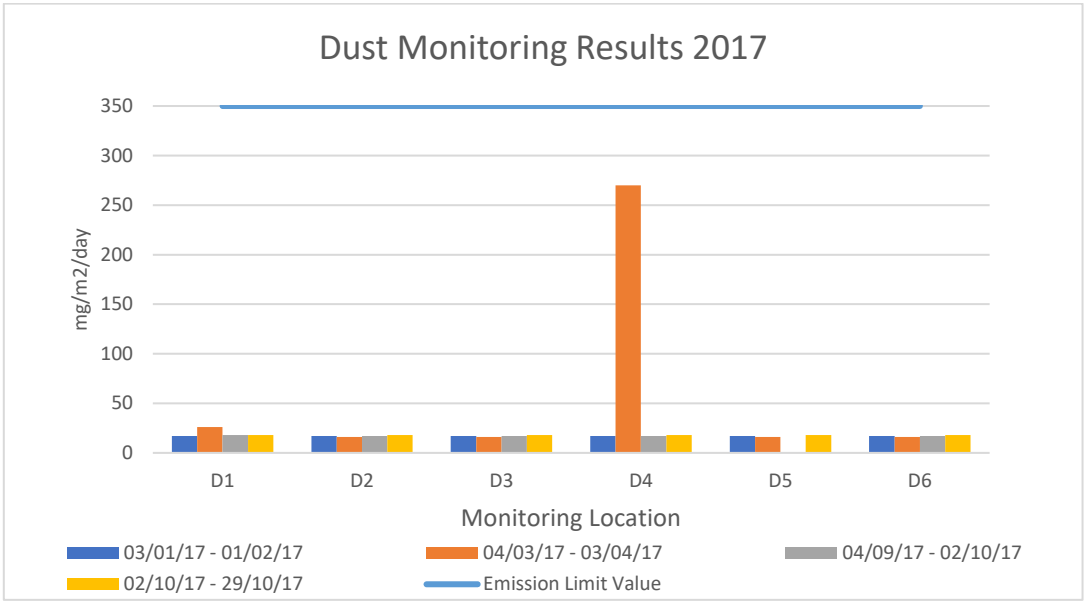


Figure 1: Dust Monitoring Results 2017

3.4. GROUNDWATER

There are no direct emissions to groundwater from the facility. The old landfill (Cell 0) was designed as a 'dilute and disperse' landfill and is underlain by stiff clays. Cells 1 to 3 are fully lined cells with separate leachate and surface water management systems. Groundwater is monitored on a quarterly and annual basis at points GW04, GW05.

No emission limit values have been set in the Licence for groundwater. Tables 8 to 10 below detail the quarterly and annual monitoring results for 2017.

Table 8: Quarterly Monitoring Results GW04

GW04 Groundwater Monitoring Results 2017							
Parameter	**TOC**	**Ammonia**	**pH**	**Conductivity**	**Cl**	**S04**	**DO**
Units	mg/L	mg/L	pH units	us/cm	mg/L	mg/L	mg/L
Q1	5.3	0.068	7.2	705	11	83	7
Q2	3.39	0.129	7.3	686	10	91	5
Q3	2.49	0.126	8.1	266	13	9.6	9
Q4	4.91	0.005	7.2	708	11	97	5

Table 9: Quarterly Monitoring Results GW05

GW05 Groundwater Monitoring Results 2017							
Parameter	**TOC**	**Ammonia**	**pH**	**Conductivity**	**Cl**	**S04**	**DO**
Units	mg/L	mg/L	pH units	us/cm	mg/L	mg/L	mg/L
Q1	0.91	0.168	7.5	555	11	83	7
Q2	0.62	0.134	7.7	560	11	3.3	6
Q3	<9	0.067	7.1	722	10	100	8
Q4	0.89	0.15	7.6	522	12	3.8	7

In addition to the quarterly groundwater sampling results depicted in the figures above, annual and quarterly groundwater sampling is carried out for an additional range of parameters. The quarterly and annual results of the analysis conducted on the groundwater are presented in detail in the quarterly reports which were submitted to the Agency during the reporting period.

There are no emission limit values set out in the Waste Licence for the facility, therefore, groundwater parameters are compared with the Interim Guideline Values (IGVs) as indicated on the EPA Document "Towards Setting Guideline values for the Protection of Groundwater in Ireland -Interim Report".

Table 10: Annual Groundwater Monitoring Results

Parameter	Unit	GW04	GW05
Alkalinity	mg/l	229	342
Ammonia	mg/l	0.126	0.067
Boron	mg/l	0.04	0.02
Cadmium	mg/l	<0.0001	<0.0001
Calcium	mg/l	91	140
Chlorine	mg/l	13	10
Chromium	mg/l	<0.003	0.0079
Conductivity	uS/cm	266	722
Copper	mg/l	<0.003	<0.003
Dissolved Oxygen	mg/l	9	8
Faecal Coliforms	MPN/100m	0	0

Fluoride	mg/l	0.4	<0.1
Iron	mg/l	<0.02	<0.02
Lead	mg/l	<0.003	<0.003
Magnesium	mg/l	16.4	17.3
Manganese	mg/l	0.15	0.58
Mercury	mg/l	<0.00002	<0.00002
Nickel	ug/l	<0.0005	0.0015
Nitrate	mg/l as N	<0.15	<0.15
pH	pH Units	8.2	7.0
Potassium	mg/l	1.5	1.8
Sodium	mg/l	31.7	14.2
Sulphate	mg/l	9.6	100
SVOC	ug/l	Below limit of detection	Below limit of detection
TOC	mg/l	2.49	<9
Total Coliforms	MPN/100m	27	179
Total Cyanide	mg/l	<9	<9
Total Phosphorus	mg/l	0.08	0.18
Total Solids	mg/l	275	595
VOC	ug/l	Below limit of detection	Below limit of detection
Zinc	mg/l	0.16	0.0044

3.5. LANDFILL GAS

Corranure Landfill currently has a 0.5 megawatt gas utilization plant in operation at the site. Gas is extracted from Cells 0, 1, 2 and 3. Concentrations of methane (CH4), carbon dioxide (CO2), oxygen (O2), temperature and flow are continuously monitored through the SCADA system. Gas at the utilization plant/Flare is monitored using a GA5000 or GA2000 gas monitor. All gas monitoring results are updated on a daily basis and maintained at the facility.

The facility has a backup flare with a capacity of 1,500 m3 and an additional 500m^3 flare to provide backup support in the event of a breakdown of the engine or during periods of down-time for scheduled maintenance. This plant and flare is operated by Electrical Mechanical Control Automation (EMCA) Rakane Road, Annalee, Kill, Cootehill, County Cavan.

Landfill Gas monitoring is undertaken on at least a monthly basis at each and every gas extraction borehole (well). Analyses were performed on each for methane (CH4), carbon dioxide (CO2), oxygen (O2) and pressure. Copies of these sampling results have been submitted to the Agency as per the requirements of C1.3 Monitoring of Landfill Gas Emissions in the Licence.

Average monthly concentrations for the flare and the engine are shown in Figures 2 and 3 below.

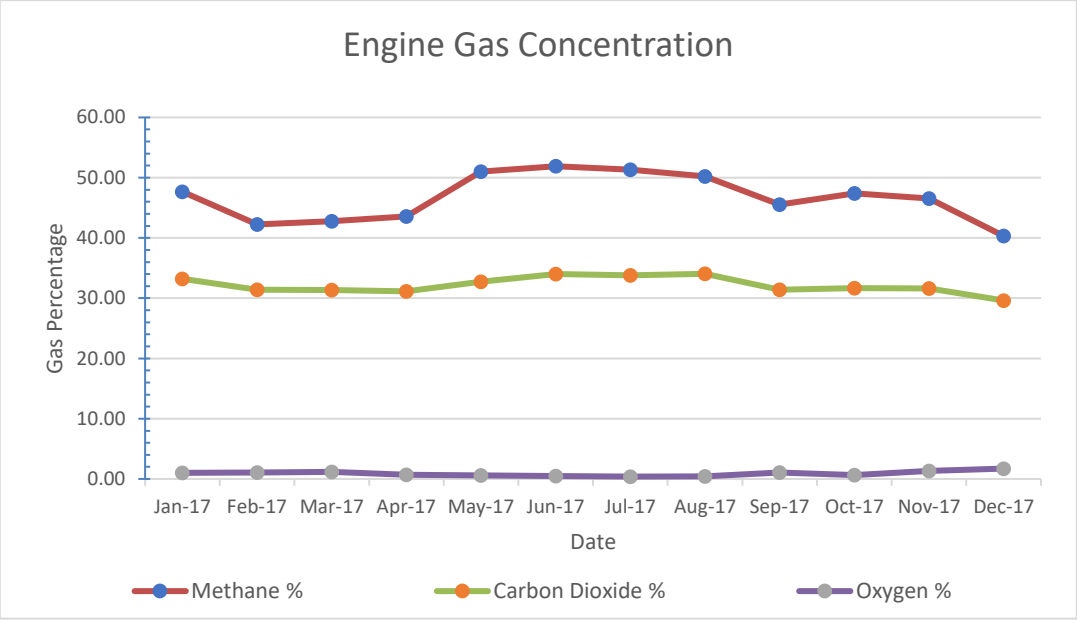


Figure 2: Gas Monitoring at Engine 2017

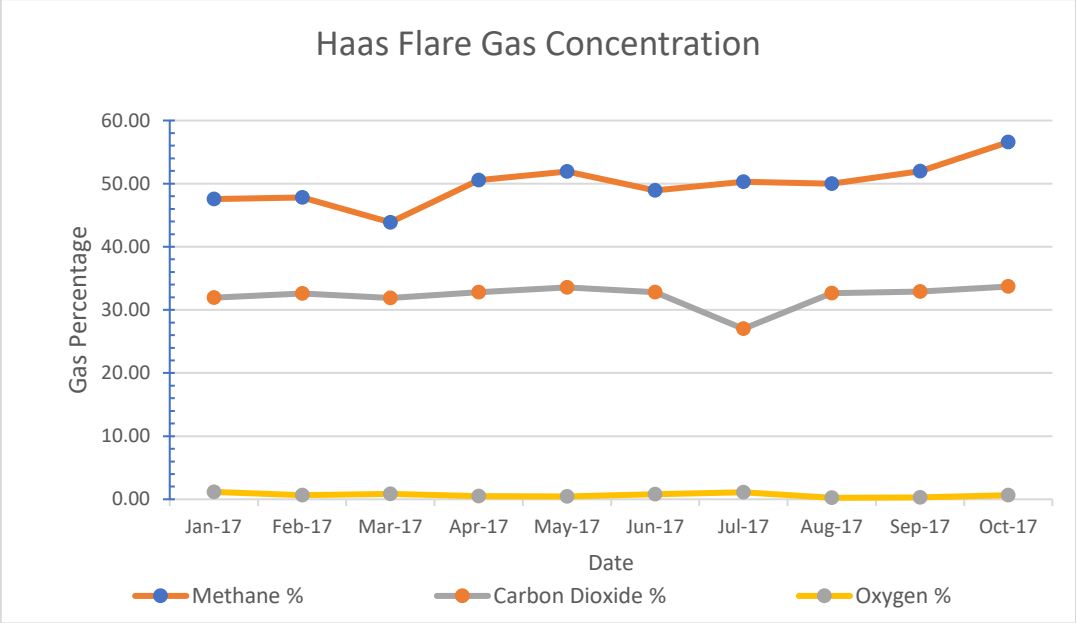


Figure 3: Gas Monitoring at Flare 2017

Environmental monitoring was completed by Odour Monitoring Ireland as per C.1.2 Monitoring of Emissions to Air, Schedule C: Control and Monitoring of the waste licence W077-04. The Gas utilisation plant was monitored in December 2017. The results were within the emission limit values. A copy of the report is included in Appendix 5. A landfill gas emission survey was completed by Odour Monitoring Ireland on behalf of Cavan County Council in May 2017 and completed again in November 2017 and submitted to the agency. The survey which was

carried out in May identified eleven zones of surface emissions. Remediation works were undertaken, and a further survey was carried out on the 3rd of November 2017. The November report identified no zones of surface emissions identified within the landfill facility that exceeded trigger levels.

3.6. LEACHATE

Table 11 details the annual leachate monitoring parameters and results for 2017.

Table 11: Annual Leachate Monitoring Results

Parameter	Unit	Results 2017
Ammonia	mg/l	100
BOD	mg/l	68
Boron	mg/l	0.000312
Cadmium	mg/l	<0.0001
Calcium	mg/l	224
Chlorine	mg/l	380
Chromium	mg/l	0.0125
COD	mg/l	235
Conductivity	uS/cm	2538
Copper	mg/l	0.006
Fluoride	mg/l	0.25
Iron	mg/l	0.37
Lead	mg/l	0.001
Magnesium	mg/l	23.7
Manganese	mg/l	0.51
Mercury	mg/l	<0.00002
Nickel	mg/l	0.0122
Nitrite	mg/l	1.298
Nitrate	mg/l as N	2.4
pH	pH Units	7.5
Potassium	mg/l	0.0621
Sodium	mg/l	232.8
Sulphate	mg/l	310
Total Cyanide	mg/l	16
Total Oxidized Nitrogen	mg/l	3.7
Total Phosphorus	mg/l	12.3
Zinc	mg/l	0.3

4.0 Waste Management Records

4.1. QUANTITY OF WASTE ACCEPTED AT THE FACILITY

The only waste accepted at the facility in 2017 was material that was delivered by public customers to the civic amenity site. In addition to this soil and stones EWC Code 17 05 04 and

Alum Sludge EWC Code 19 09 02 were accepted for profiling works ongoing at Cell 4 at the facility. No waste material was accepted for landfill at the facility.

Not all materials are currently weighed in upon entry to the Civic Amenity facility. However, all materials are weighed out when being removed from the facility. As a result, weights presented in Appendix 2 in respect of the Civic Amenity facility are for all wastes removed from the facility during 2017.

4.2. Quantity of Waste Disposed of at the Facility

No waste was disposed of at the facility during 2017. Table 12 below shows the tonnages of wastes disposed of at the landfill in previous years since the grant of the original waste licence for the facility. This information has been extracted from previous AER's.

Table 12: Quantity of Waste Landfilled pre-2017

Period	Quantity (Tonnes)
11th March 2002 – 31st June 2002	4,469.25
1st July 2002 – 31st June 2003	36,206.21
1st July 2003 – 31st December 2003	19,911.21
1st January 2004 – 31st December 2004	53,813.44
1st January 2005 – 31st December 2005	45,889.47
1st January 2006 – 31st December 2006	85,869.00
1st January 2007 - 31st December 2007	83,262.91
1st January 2008 - 31st December 2008	87,238.32
1st January 2009 - 31st December 2009	88,932.96
1st January 2010 - 5th February 2010	4,956.5
6th January 2010 - 31st December 2010	0
1st January 2011 - 31st December 2011	0
1st January 2012 - 31st December 2012	0
1st January 2013- 31st December 2013	0
1st January 2014- 31st December 2014	0
1st January 2015-31st December 2015	0
1st January 2016-31st December 2016	0
1st January 2017-31st December 2017	0
Total	510,549.27

4.3. QUANTITY OF RECOVERED WASTE USED IN THE DEVELOPMENT / OPERATION OF THE LANDFILL

In 2012, approval was received from the Agency to accept soil and stones material (EWC Code 17 05 04) from a customer who was carrying out site excavation works. In 2014, approval was received from the Agency to accept Alum Sludge (EWC Code 19 02 02) and this material was accepted from June 2014. This material is inspected upon entry to the facility and recorded on the facility weighbridge system. The material is used exclusively for the remediation of Cell 4. Records of all loads accepted into Cell 4 are maintained on-site and are available for inspection.

The recovered materials that were accepted on-site for 2017 and previous years are outlined in Table 13 below.

Table 13: Quantity of Materials Recovered 2008-2017

Period	Quantity (Tonnes)
1st January 2011 - 31st December 2011	154.06
1st January 2012 - 31st December 2012	14,178.64
1st January 2013 - 31st December 2013	8,910.09
1st January 2014 - 31st December 2014	11,563.41
1st January 2015-31st December 2015	41,030
1st January 2016-31st December 2016	107,698
1st January 2017-31st December 2017	76,678

4.4. QUANTITY OF WASTE REMOVED OFF SITE FOR RECOVERY OR DISPOSAL

All materials that were consigned offsite from the Civic Amenity Facility for onward recovery or disposal were all weighed and recorded at the facility weighbridge. These weights have been summarised and are presented in the PRTR returns for the facility. A copy of the PRTR waste treatment data is included in Appendix 2 of this AER.

4.5 STATEMENT ON ACHIEVEMENT OF THE WASTE ACCEPTANCE AND PRE-TREATMENT REQUIREMENTS

It is considered that the waste acceptance and pre-treatment obligations have been met as materials accepted at the CA site were source segregated. No materials were disposed of at the facility.

5.0 TOTAL CONSENTED LANDFILL VOID (M3)

Waste Licence W0077-04 that was granted in May 2011 states that the total permitted landfill capacity of Cell 4 is 250,000m^3. In August 2013, a remediation and capping plan for Cell 4 was submitted and approved by the Agency.

During 2017, filling of 'Area A' as part of this remediation was ongoing with a total weight of 76,678 tonne of soil and stone and Alum Sludge accepted for remedial works in Cell 4.

6.0 TOPOGRAPHICAL SURVEY

A topographical survey was carried out in December 2017 by Enviroguide Consulting. The Topographical findings are attached in Appendix 6.

A slope stability assessment of the site was completed in December 2015 by RPS. The Slope stability assessment report is attached in Appendix 4.

7.0 UPDATES/AMENDMENTS TO ODOUR MANAGEMENT PLAN

An Odour Management Plan has been prepared by RPS for the facility, this report was completed in April 2015. The facility is currently a closed landfill which is not giving rise to any offsite odours. Odour monitoring patrols are carried out as deemed necessary, following the guidelines as laid out in the Odour Management Plan.

An odour patrol route has been mapped. Any odours detected on this route are recorded on the odour patrol sheet. If an odour is detected that is considered to be originating at the landfill facility, a full investigation is carried out until the source of the odour is defined and the odour eliminated. All records of odour are recorded at the facility.

8.0 Statement of Compliance of Facility with any Update to Waste Management Plan

The Management of Corranure Landfill is fully committed to meeting all relevant policies and targets set out in the North-East Waste Management Plan. As the facility is a closed landfill site, no materials for disposal were accepted for landfill in 2017. However, a Civic Amenity is operated at the facility which provides a recycling platform for members of the public. This CA facility formed an integral part in meeting objectives and targets of the Strategic Environmental Management Plan for County Cavan.

9.0 COMPLAINTS SUMMARY

During the course of 2017, there were three complaints received in relation to odour at the facility. These complaints were made on the 7/02/2017, 11/2/2017 and 26/9/2017. An investigation carried out by Enviroguide Consulting and Cavan County Council into all complaints received. All investigations deemed agricultural odours as the odour source and no odour emissions were sourced from the Landfill facility.

An out of hours emergency help line is in operation in order to facilitate any potential complaints and to ensure that they can be investigated and addressed in a timely manner. A complaints folder is maintained on-site, showing details of any complaints and follow up investigations.

10.0 Reported Incidents Summary

There were 0 notified incidents during the reporting period.

11.0 SCHEDULE OF ENVIRONMENTAL OBJECTIVES & TARGETS

A summary of the objectives and targets for 2017 are outlined in Table 14 below.

Table 14: Objectives and Targets 2017

Objective 1	**Target**	**Completion Date**
Remediation of Cell 4	• Remediation of Cell 4 using non-hazardous soils to re-profile.	Ongoing in 2017
Objective-2	**Target**	**Completion Date**
Gas and Odour Management	• Monitoring of the gas system on a daily basis through gas field balancing and flare/ engine daily checks. • Complete and commence trial Leachate Recirculation System	Ongoing in 2017
Objective-3	**Target**	**Completion Date**
Upgrade & management of CA site	• Upgrade of weigh in system in line with the introduction of mandatory pay by weight (per kilogram) charging.	When brought into legislation
Objective-4	**Target**	**Completion Date**
Upgrade & management of Landfill site	• Installation of key-fob entrance pedestrian and vehicle entrance gates to the landfill.	31.12.17
Objective-5	**Target**	**Completion Date**
Reduce energy consumption	• Reduce electricity and energy consumption in site offices and on site by increasing awareness in relation to sites heating systems • Putting a formal energy management plan in place whereby consumption is measured • Ensuring electrical equipment is set to energy efficient setting.	31.12.17

Objective 1: Remediation of Cell 4

Remediation of Cell 4 using non-hazardous soils to re-profile was ongoing in 2017 and into 2018.

Objective 2: Gas and Odour Management

The gas and odour management systems were reviewed periodically throughout 2017. Balancing of landfill gas carried was out on an ongoing basis throughout 2017 to ensure gas was suitable for the gas utilisation plant in operation at the site and to ensure the gas did not give rise to odours on or offsite. Approval was obtained from the EPA to install a trial Leachate recirculation system in 2016. The trial is due to be undertaken in 2018.

Objective 3: Upgrade & management of CA site

Upgrade of weigh in system in line with the introduction of mandatory pay by weight (per kilogram) charging was postponed as charges were not introduced.

Objective 4: Upgrade & management of Landfill site

The installation of key-fob entrance gate to the landfill has been completed.

Objective 5: Reduce energy consumption

Reduce electricity and energy consumption in site offices and on site by increasing awareness in relation to sites heating systems

Putting a formal energy management plan in place whereby consumption is measured

Ensuring electrical equipment is set to energy efficient setting.

No progress has been made on this objective in 2017 so it has been brought forward into 2018 objective and targets.

Table 15 shows the proposed Objectives and Targets for 2018.

Table 15: Proposed Objectives and Targets 2018

Objective 1	**Target**	**Completion Date**
Remediation of Cell 4	• Remediation of Cell 4 using non-hazardous soils to re-profile.	Ongoing in 2018
Objective-2	**Target**	**Completion Date**
Gas and Odour Management	• Monitoring of the gas system on a daily basis through gas field balancing and flare/ engine daily checks. • Complete and commence trial Leachate Recirculation System	Ongoing in 2018
Objective-3	**Target**	**Completion Date**
Upgrade & management of CA site	• Upgrade of weigh in system in line with the introduction of mandatory pay by weight (per kilogram) charging.	When brought into legislation
Objective-4	**Target**	**Completion Date**
Reduce energy consumption	• Reduce electricity and energy consumption in site offices and on site by increasing awareness in relation to sites heating systems • Putting a formal energy management plan in place whereby consumption is measured • Ensuring electrical equipment is set to energy efficient setting.	31.12.18
Objective-5	**Target**	**Completion Date**
Remediation of land North of Cell 4	• Remediation and reprofiling of land North of Cell 4. • Seek EPA agreement to amend licence boundary to include said area. • Design and construct adequate settlement ponds.	31.12.18

12.0 ENVIRONMENTAL MANAGEMENT PROGRAMME

An environmental landfill management plan (ELMP) is in place at the facility in accordance with Condition 2.2.2.3 of the Licence. This programme outlines how the objectives and targets for the facility are going to be met. Responsibility for each target is assigned along with a completion date. An ELMP is completed for each forthcoming year and reviewed during internal audits as part of the EMS for the facility.

13.0 POLLUTANT RELEASE AND TRANSFER REGISTER

A copy of the 2017 pollutant releases data as reported in the PRTR returns is included in Appendix 3 of this report.

14.0 WASTE ANALYSIS

No waste was accepted for landfill at the facility in 2017, soil and stone and alum sludge materials were accepted for remediation works at Cell 4. Prior to acceptance of such waste the alum sludge materials are subject to lab analyses and all material is subject to onsite waste acceptance criteria. All materials accepted at the facility are recorded on the facility weighbridge system (Genesys) and weighbridge records are available for inspection at the facility.

15.0 METERORLOGICAL DATA SUMMARY

The meteorological data summary recorded at the facility by the weather sensor for 2017 is outlined in Table 16 below.

Table 16: Meteorological Data Summary

Month	Year	WSpd (mph)	WDir	Temp (^{O} C)	Humidity (%)	Pressure (hPa)
January	2017	6	SW	6	93	1021
February	2017	9	SW	6	92	1009
March	2017	7	SW	7	89	1012
April	2017	0	WNW	8	85	1024
May	2017	3	E	23	59	1043
June	2017	6	WSW	14	82	1013
July	2017	6	WSW	14	85	1012
August	2017	5	WSW	14	87	1013
September	2017	6	WSW	12	89	1011
October	2017	8	WSW	11	89	1013
November	2017	6	WSW	6	90	1016
December	2017	6	WSW	5	92	1013

16.0 TANK AND PIPELINE INSPECTION REPORT

In accordance with Condition 6.10 of the Licence the testing of integrity and water tightness of all underground pipes, tanks, bunding structures and containers and their resistance to penetration by water should be carried out once every three years.

In September 2014, RPS Consultants completed an inspection on the leachate storage tank and the structure was found to be in sound condition with its integrity verified. Any recommendations such as maintenance as stated in the report have been completed and verified by RPS. Retesting is due again in Q1 2018.

17.0 ENERGY EFFICIENCY AUDIT REPORT SUMMARY

Electricity is used in site offices, Civic Amenity Facility and weighbridge facilities. An energy awareness system is in place whereby all equipment and lighting is powered off when not in use or at the end of each working day. The site employs a good housekeeping approach and this is reflected in the Environmental Management System Status on site. An Energy Audit was completed by RPS Consultants in September 2015. A copy of the Energy Audit Report and its findings was included in the 2015 AER.

18.0 RESOURCE CONSUMPTION SUMMARY

In 2017, the estimated electricity consumption at the facility was as follows:

- Day Time Units: 89513 kWh
- Night Time Units: 73238 kWh

The electricity consumption at the facility for 2017 and previous years are outlined in Table 17 below.

Table 17: Electricity Consumption from 2012 to 2017

	2012	2013	2014	2015	2016	2017
Day (kWh)	220000	209000	101310	91179	86620	89513
Night (kWh)	175000	166250	84327	75894	72099	73238

Electricity consumption has reduced steadily from 2012-2017. The gas utilisation plant is producing electricity for the site with a saving of up to €30,000 annually and is also exporting energy to the national grid.

19.0 DEVELOPMENTAL/INFRASTRUCTURAL WORKS SUMMARY

In 2013, discussions were held with the EPA in respect of Cell 4 which was constructed but remained unused. It was agreed by the Agency that Cavan County Council could accept non-hazardous soil and stone into this cell in order to re-profile it. This is a remediation activity as

it has been decided that waste would not be accepted into this cell. Following these discussions a filling plan was provided to the Agency and agreed.

The Construction Quality Analysis (CQA) report for Cell 4 was submitted to the Agency in November 2014 and further information supplied in December 2014. This was approved by the Agency in January 2014.

Non-hazardous, inert materials classified as Soil & Stone EWC Code 17 05 04 has been accepted on-site for the remediation of Cell 4. In June 2014, the Agency approved the acceptance of an additional material, non-hazardous dewatered sludge EWC Code 19 09 02 as a buffer between the liner and the soil and stones being used in the restoration of Cell 4. This material Alum Sludge has been accepted at the facility from the 24th June 2014.

In September 2014, permission was sought from the Agency to drill No.8 additional gas wells on Cell2/3 to optimise gas extraction and quality. This work was completed during December. Following completion of the installation of the new gas wells, Irish Biotech Services were contracted by Cavan County Council to upgrade the surface infrastructure on Cell 0 and Cell 1. This included well heads, pipes and valves. This work was completed in early January 2015.

Cavan County Council received approval from the EPA in March 2015 to conduct leachate recirculation trials for improved gas quality and generation. Works are ongoing and trial leachate recirculation is proposed to commence in 2018.

20.0 MANAGEMENT AND STAFFING STRUCTURE AT THE FACILITY

The facility was operated and managed by Enviroguide Consulting since April 2011 on behalf of Cavan County Council. Details of the new management structure were submitted to the Agency for approval prior to changes in management taking place. Below is the staffing structure for 2017.

- Landfill Manager: Jim Dowdall
- Deputy Landfill Manager: Gillian Free
- Deputy Landfill Manager: Michelle Cass

The Civic Amenity (CA) facility was operated and managed by McElvaney Waste and Recycling in 2017. The staff onsite consist of a weighbridge operator and up to two site operatives. It received an award for best Civic Amenity facility in 2015.

21.0 PROGRAMME FOR PUBLIC INFORMATION

A programme for public information is in place at the facility. Any interested party wishing to view this public information is advised to make an appointment with the Landfill Manager. A suitable time will be arranged for the viewing of files to take place. A room will be provided to the interested party to view the public information files. Files available as part of the public information programme include the EPA Licence for the facility, the previous year's AERs, monitoring results and monitoring location maps. Any files specific or additional files that are required by the interested party can be requested and will be considered by the Landfill Manager.

22.0 FINANCIAL PROVISIONS

The EPA has developed a dedicated financial model to facilitate and streamline the reporting to the EPA of compliance with Section 53(A). This financial model will be completed for Corranure landfill and submitted to the EPA annually as required. This will be done directly by Cavan County Council.

23.0 REVIEW OF ENVIRONMENTAL LIABILITIES

An ELRA and CRAMP has been completed in 2015 for Corranure Landfill. RPS Consultants completed an Environmental Liabilities and Risk Assessment (ELRA) in September 2015. A copy of this report is included in Appendix 8.

A Closure Restoration and Aftercare Management Plan (CRAMP) was completed by RPS Consultants in November 2015. Projected costs including annual inflation were costed until 2044. A copy of this report is included in Appendix 7.

24.0 STATEMENT OF COSTS OF LANDFILL INCLUDING LANDFILL LEVY

This facility is currently a closed landfill site. No materials were accepted for disposal at the landfill therefore no costs or landfill levy were assigned.

25.0 HYDROGEOLOGICAL

A Hydrogeological Tier 1 Risk Assessment was compiled by Envirologic Ltd. for Corranure Landfill in October 2013 as per Condition 6.29 of licence number W0077-04. This report has been submitted to the agency as part of the AER for 2013.

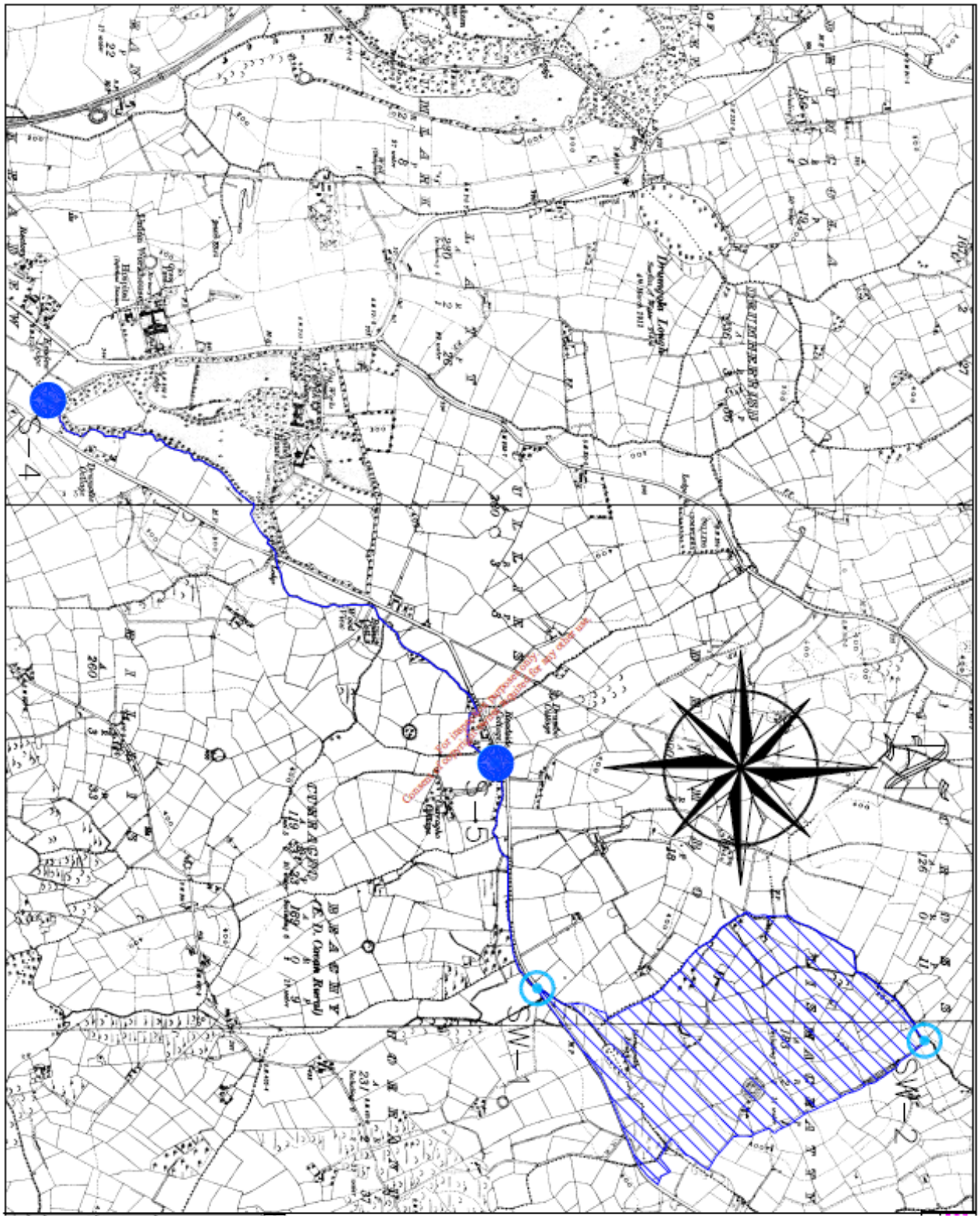
26.0 ENVIRONMENTAL MANAGEMENT SYSTEM

A certified environmental management system is in operation. It is maintained and updated in accordance with Condition 2.2 of licence number W0077-04. The Environmental Management System is certified to ISO 14001:2004 standard. An audit was completed by EQA (Ireland) Ltd. in October 2017 and the audit confirmed the management system meets the needs of the organisation and conforms to the requirements of ISO14001:2004.

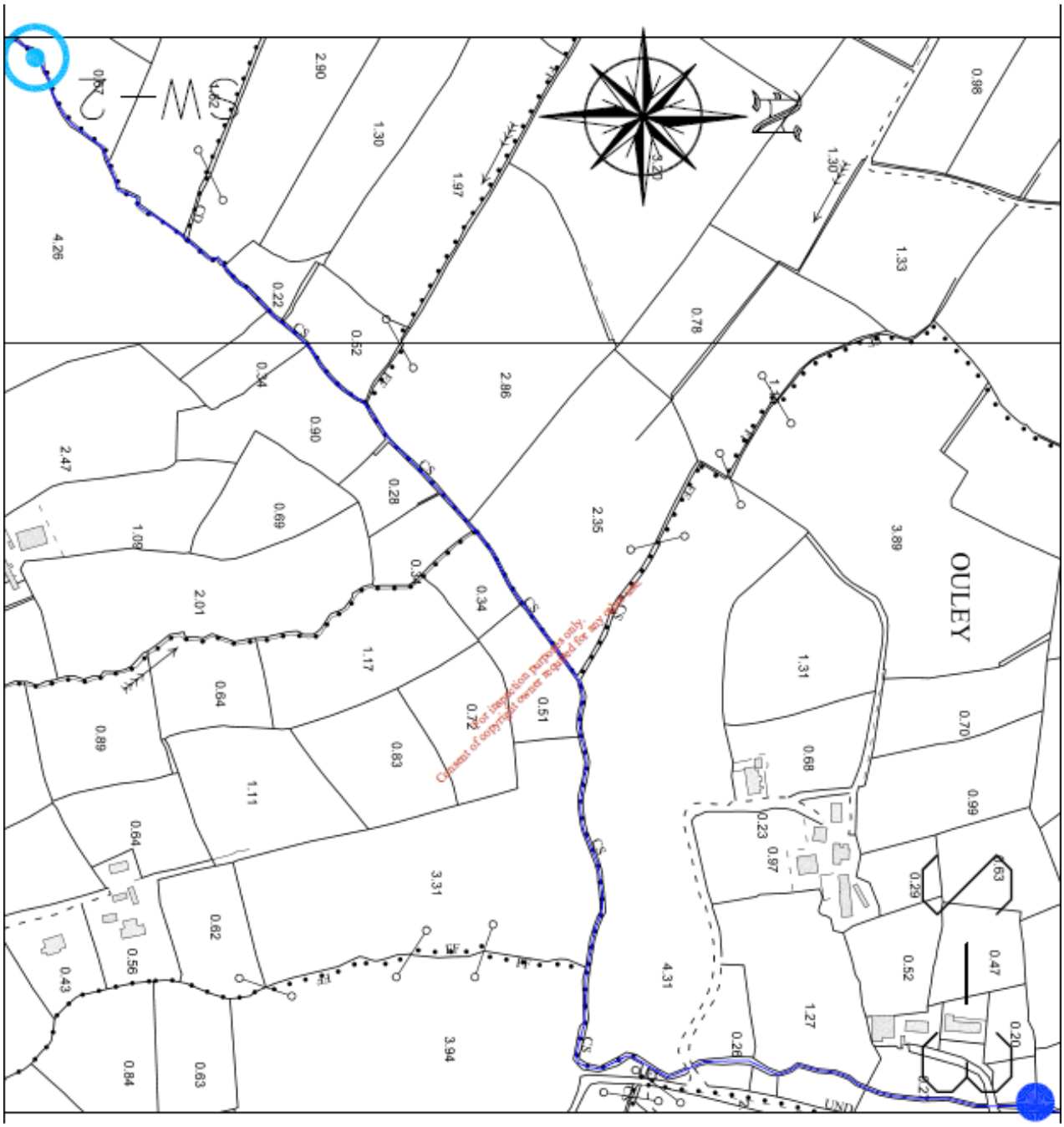
APPENDIX 1

SURFACE WATER MONITORING LOCATION MAPS

Map 1: Surface monitoring Locations SW1, S4, S5 (Corranure Stream)



Map 2: Surface Monitoring Locations SW2, S3 (Lismagratty Stream)



APPENDIX 2

PRTR OFFSITE TRANSFERS OF WASTE 2017

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE | PRTR# : W0077 | Facility Name : Corranure Landfill | Filename : W0077_2017.xls | Return Year : 2017 | 31/01/2018 14:51

Please enter all quantities on this sheet in Tonnes 3

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used M/C/E	Method Used	Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
Within the Country	08 03 18	No	0.0	waste printing toner other than those mentioned in 08 03 17	R13	M	Weighed	Offsite in Ireland	HP Planet Partners,P0195-02	Liffey Park Technology Campus,Barnhall Parsonstown ,Leixlip,County Kildare,Ireland		
Within the Country	13 02 08	Yes	0.0	other engine, gear and lubricating oils	R1	M	Weighed	Offsite in Ireland	Enva Ireland Ltd.,W0184-01	Clonminam Industrial Estate ,Portlaoise ,Co. Laoise,,,Ireland	Enva Ireland Limited,W0184-02,Clonminam Industrial Estate,,,Portlaoise,County Laois,Ireland	Clonminam Industrial Estate,,,Portlaoise,County Laois,Ireland
Within the Country	15 01 01	No	104.51	paper and cardboard packaging	R3	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		
Within the Country	15 01 02	No	27.04	plastic packaging	R3	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		
Within the Country	15 01 04	No	1.3	metallic packaging	R4	M	Weighed	Offsite in Ireland	Wilton Waste Recycling,.	Kiffa,Crosserlough,Ballyjaamesduff,Co. Cavan,Ireland		
Within the Country	15 01 04	No	6.79	metallic packaging	R4	M	Weighed	Offsite in Ireland	Wilton Waste Recycling,.	Kiffa,Crosserlough,Ballyjaamesduff,Co. Cavan,Ireland		
Within the Country	15 01 07	No	50.16	glass packaging	R5	M	Weighed	Offsite in Ireland	Rehab Glassco Ltd.,WFP-KE-09-0357-01	Unit 4 Oberstown Industrial Park,Caragh Road,Naas,Co. Kildare,Ireland		
To Other Countries	16 01 07	Yes	0.14	oil filters	R13	M	Weighed	Abroad	Enva Ireland Ltd.,W0184-01	Clonminam Industrial Estate ,Portlaoise ,Co. Laoise,,,Ireland	RD Recycling,51727/1/KD,Houthalen,,,,,,Belgium	Houthalen,,,Belgium,,,Belgium
To Other Countries	16 05 04	Yes	0.12	gases in pressure containers (including halons) containing dangerous substances	R13	M	Weighed	Abroad	Enva Ireland Ltd.,W0184-01	Clonminam Industrial Estate ,Portlaoise ,Co. Laoise,,,Ireland	RD Recycling,51727/1/KD,Houthalen,,,,,,Belgium	Houthalen,,,Belgium,,,Belgium
Within the Country	16 05 04	Yes	0.253	gases in pressure containers (including halons) containing dangerous substances	R13	M	Weighed	Offsite in Ireland	Flo Gas,.	Knockbrack house,Matthews lane,Drogheda,louth,Ireland	Flo Glas,Na,Drogheda,Co.Louth,Louth,NA,Ireland	Drogheda,Co.Louth,Louth,NA,Ireland
Within the Country	16 06 01	Yes	3.82	lead batteries	R4	M	Weighed	Offsite in Ireland	Wilton Waste Recycling,.	Kiffa,Crosserlough,Ballyjaamesduff,Co. Cavan,Ireland	Recycling Village,WFP/MH/11/0005/01, Unit 21 Duleek Business Park,Commons,Duleek,Co. Meath,Ireland	Unit 21 Duleek Business Park,Commons,Duleek,Co. Meath,Ireland
Within the Country	17 01 07	No	103.72	mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	R13	M	Weighed	Offsite in Ireland	Corranure Landfill,W0077-04	Lismagratty & Corranure Townlands,Cootehill Road,Cavan,Co. Cavan,Ireland		
Within the Country	17 08 02	No	3.32	gypsum-based construction materials other than those mentioned in 17 08 01	D15	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		
Within the Country	19 07 03	No	25621.0	landfill leachate other than those mentioned in 19 07 02	D9	E	Volume Calculation	Offsite in Ireland	Cavan County Council WWTP,.	,,,,,,,Ireland		
Within the Country	20 01 01	No	87.29	paper and cardboard	R3	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		
Within the Country	20 01 10	No	16.06	clothes	R12	M	Weighed	Offsite in Ireland	Textile Recycling Limited,N/A	504 A Grants Drive,Greenogue Business Park,Greenogue Industrial Estate,Dublin 24,Ireland		
To Other Countries	20 01 21	Yes	0.32	fluorescent tubes and other mercury-containing waste	R13	M	Weighed	Abroad	KMK Metals Recycling Limited,W0113-03	Cappincur Industrial Estate,Daingean Road,Tullamore,Co. Offaly,Ireland	Remondis Electro Recycling,01/245A,ZAC des Marots,Route l'Ecluse,St. Thilbault,BP0310800,France	ZAC des Marots,Route l'Ecluse,St. Thilbault,BP0310800,France
To Other Countries	20 01 25	No	0.42	edible oil and fat	R9	M	Weighed	Abroad	Frylite Ltd,.	Orchard Road Industrial Estate,Orchard Road ,Strabane,Co. Tyrone BT82 9FR,Ireland		
To Other Countries	20 01 27	Yes	0.8	01 23 and 20 01 35	R13	M	Weighed	Abroad	Enva Ireland Ltd.,W0184-01	Clonminam Industrial Estate ,Portlaoise ,Co. Laoise,,,Ireland	RD Recycling,51727/1/KD,Houthalen,,,,,,Belgium	Houthalen,,,Belgium,,,Belgium
Within the Country	20 01 33	Yes	0.342	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries	R4	M	Weighed	Offsite in Ireland	The Recycling Village,WFP/MH/11/0005/01	Unit 21 Duleek Business Park,Commons,Duleek,Co. Meath,Ireland	,,,,,,,,,,Ireland	,,,,,,Ireland
within the Country	20 01 35	Yes	20.97	discarded electrical and electronic equipment other than those mentioned in 20 01 21 and	R4	M	Weighed	Offsite in Ireland	ERP Ireland,.	Unit 9D ,Nutgrove Office Park ,Nutgrove Avenue ,Rathfarnham Dublin 14,Ireland	EMR,,,,,,,,,,Ireland	,,,,,,Ireland
Within the Country	20 01 35	Yes	40.75	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	R4	M	Weighed	Offsite in Ireland	The Recycling Village,WFP/MH/11/0005/01	Unit 21 Duleek Business Park,Commons,Duleek,Co. Meath,Ireland	,,,,,,,,,,Ireland	,,,,,,Ireland
Within the Country	20 01 36	No	44.15	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20	R4	M	Weighed	Offsite in Ireland	ERP Ireland,.	Unit 9D ,Nutgrove Office Park ,Nutgrove Avenue ,Rathfarnham Dublin 14,Ireland	EMR,,,,,,,,,,Ireland	,,,,,,Ireland
Within the Country	20 01 36	No	25.29	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	R4	M	Weighed	Offsite in Ireland	Electrical Waste Management LTD,WFP-DS-11-0014-05	Block 648 Jordanstown Drive,Greenogue Industrial Estate,Rathcoole,County Dublin,Ireland		
Within the Country	20 01 38	No	112.96	wood other than that mentioned in 20 01 37	R3	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		
Within the Country	20 01 39	No	28.72	plastics	R3	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		
Within the Country	20 01 40	No	97.48	metals	R4	M	Weighed	Offsite in Ireland	Wilton Waste Recycling,.	Kiffa,Crosserlough,Ballyjaamesduff,Co. Cavan,Ireland		
Within the Country	20 02 01	No	71.14	biodegradable waste	R3	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		
Within the Country	20 03 01	No	730.08	mixed municipal waste	D15	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		
Within the Country	20 03 07	No	352.02	bulky waste	D15	M	Weighed	Offsite in Ireland	Scotch Corner ,W0020-02	Annyalla,Castleblaney ,Co. Monaghan,,,Ireland		

* Select a row by double-clicking the Description of Waste then click the delete button

Link to previous years waste data
Link to previous years waste summary data & percentage change
Link to Waste Guidance

APPENDIX 3

POLLUTANT RELEASE AND TRANSFER REGISTER

4.1 RELEASES TO AIR Link to previous years emissions data | PRTR# : W0077 | Facility Name : Corranure Landfill | Filename : W0077_2017.xls | Return Year : 2017 | 30/01/2018 12:07

8

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01	**Methane (CH4)**	C	OTH		0.0	91621.35	0.0	91621.35

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs				
POLLUTANT		METHOD			QUANTITY				
			Method Used						
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Corranure Landfill

Please enter summary data on the quantities of methane flared and / or utilised	**T (Total) kg/Year**	**M/C/E**	**Method Used**		**Facility Total Capacity m3 per hour**	
			Method Code	**Designation or Description**		
Total estimated methane generation (as per site model)	702430.35	C	Calculated -not using ga	Gassim Lite	N/A	
Methane flared	237164.0	M	Landfill Gas Survey 201	Landfill Gas Survey 2017	750.0	(Total Flaring Capacity)
Methane utilised in engine/s	373645.0	M	Landfill Gas Survey 201	Landfill Gas Survey 2017	300.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	91621.35	C	Calculation	Calculation	N/A	

APPENDIX 4

SLOPE STABILITY REPORT

Corranure Landfill

Slope Stability Assessment Report

Document Control Sheet

Client:	Cavan County Council
Project Title:	Corranure Landfill
Document Title:	Slope Stability Assessment Report
Document No:	MGE0068RP0003WPR

Text Pages:	15	Appendices:	1

Rev.	Status	Date	Author(s)		Reviewed By		Approved By	
A01	Issue for Client Approval	21st Jan 2016	GPR		RS		CMcG	

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1 INTRODUCTION

A visual assessment of the soil slopes at Corranure Landfill was undertaken by a geotechnical engineer from RPS Group Plc. (RPS) on 16 December 2015. Weather conditions on the day of the assessment were dry and overcast. There had been very heavy rainfall during the previous week. This assessment is carried out in order to satisfy Condition 6.23 of the Waste License (W077-04) for Corranure Landfill which states:

"The licensee shall carry out a stability assessment of the side slopes of the facility annually. The results of this assessment shall be reported as part of the Annual Environmental Report (AER)".

This report includes observations made during the site visit and some general maintenance recommendations.

A topographic survey was carried out on the site on 21 December 2015. Previous topographic surveys were carried out in 2011 and in 2014. A visual comparison between these surveys was carried out to assess any significant topographic changes to the site over the past five years.

2 SITE LOCATION AND HISTORY

Corranure Landfill is located off the R188 Cootehill Road, County Cavan, and is surrounded by farmland (refer to Site Location Map and Site Layout - **Appendix A**).

The landfill was operated from the mid 1980's to 2010. It is sited on what was originally a lake and which was subsequently filled in with waste. Boreholes in the landfill have indicated that waste is found 2m to 3m below the current ground levels and that the waste overlies significant thicknesses of low permeability clay.

The landfill previously accepted mainly domestic waste as well as some commercial waste from private contractors. The landfill is currently closed and is not accepting waste. The site is operated as a recycling facility. The landfill currently consists of the five sections summarised in **Table 1**. Locations are shown on the Site Layout Drawing (**Appendix A**).

Table 1 – Summary of Landfill Cells

Name	Current Condition	Lined	Leachate and Gas Collection Systems
Cell 0 (Old Landfill)	Remediated (capped)	No	Yes
Cell 1	Remediated (capped)	Yes	Yes
Cell 2	Remediated (capped)	Yes	Yes
Cell 3	Remediated (capped in 2013)	Yes	Yes
Cell 4	Construction completed in July 2013. Commenced filling in 2015	Yes	-

3 SITE OBSERVATIONS

3.1 CELL 0 (OLD LANDFILL)

3.1.1 East Slope

This slope, shown in **Figure 1,** is at an angle of about 1V:2H and is located adjacent to the site entrance. It is well vegetated with grass, rushes and gorse. A drainage channel at the toe of the slope appears to be operational and there were no obvious signs of ponding. There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 1 – East Slope of Cell 0 (facing south from the recycling depot carpark)

3.1.2 Southeast Slope (West of Entrance)

The Southeast Slope is bounded by the R188 at the southeast edge of the landfill (refer **Figure 2**). The slope stands at an angle of approximately 1V:2.5H. It is well-vegetated with grass, rushes, gorse and small to medium sized trees. The drain at the toe of the slope appears to be functional but there was some minor ponding within the drain as a result of the recent heavy rainfall. There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 2 – Southeast Slope of Cell 0 (facing northeast)

3.1.3 Southwest Slope

The Southwest Slope, shown in **Figure 3**, is at an angle of approximately 1V:2H. The slope is well-vegetated with grass and rushes and it is hummocky in places. A haul road is located at the base of this slope. There is also a drainage channel on the downslope side of the haul road, between the road and the landfill boundary. The drain at the toe of the slope appears to be functional but there was some ponding within the drain as a result of the recent heavy rainfall (shown in **Figure 4**). There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 3 – Southwest Slope of Cell 0 (facing northwest from the southwest corner of the landfill)

Figure 4 – Ponding in channel at the toe of the Southwest Slope of Cell 0 (facing southwest)

3.2 CELL 1

3.2.1 Northeast Slope

The gradient of this slope varies between approximately 1V:3H at the northern end (shown in **Figure 5**) and approximately 1V:2H at southern end (shown in **Figure 6**). The southern end was regraded from 1V:3H to 1V:2H in August 2007. An extra layer of liner was placed over the slope and leachate and gas extraction wells were installed. At the northern end of the slope is an access track which ascends to the crest of the landfill. The slope is well-vegetated with grass. There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 5 – Northeast Slope of Cell 1 (facing southwest from the base of the access track)

Figure 6 – Northeast Slope of Cell 1 (facing northwest from the recycling depot carpark)

3.2.2 Northwest Slope

The Northwest Slope of Cell 1 stands between approximately 1V:3H and 1V:2.5H. There is an access track at the crest of the slope and a haul road at the toe of the slope. There is a gravel-lined drain between the haul road and the toe of the slope. There is also a larger drainage channel downslope of the haul road which contains ponding water resulting from the recent heavy rainfall.

A shallow failure occurred on the Northwest Slope of Cell 1 in early 2006, as shown in **Figure 7**. The weather had generally been dry prior to the failure but the toe of the slope had been left truncated for at least one month to facilitate the installation of a toe drain. This resulted in tensile loading of the liner in excess of its capacity. It was also concluded that leachate streams flowing from the top of the exposed landfill to the western slope contributed to the failure.

Following the failure, remediation measures included installing a geogrid and reducing leachate levels. The crest of the slope was also regraded as part of the capping works to reduce the overall slope angle. The slope was then buttressed with a toe bund and was revegetated. The haul road now sits on the toe bund. During capping works, care was taken to ensure that the toe of the slope was not truncated or oversteepened. The vegetation (mainly grass) took a number of years to become re-established (as shown in **Figure 8, Figure 9** and **Figure 10**) but the slope is now well-vegetated with green grass. There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 7 – Northwest Slope of Cell 1 in 2006 following shallow slope failure (facing northwest)

Figure 8 – Northwest Slope of Cell 1 in 2008 (facing northwest)

Figure 9 – Northwest Slope of Cell 1 in 2013 (facing northwest)

Figure 10 – Northwest Slope of Cell 1 in 2015 (facing northwest)

3.3 CELL 2

3.3.1 Northeast Slope

This slope is well-vegetated with grass and stands at a gradient of approximately 1V:3H as shown in **Figure 11**. Disused farm buildings stand a short distance from the toe of the slope. A haul road runs parallel to the toe of the slope and there is a gravel-lined drain between the toe of the slope and the haul road. There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 11 – Northeast Slope of Cell 2 (facing northwest)

3.3.2 Northwest Slope

This slope is well-vegetated with grass and stands at approximately 1V:2H as shown in **Figure 12**. The northern end of the slope was considered to be oversteep during filling but it was regraded to an acceptable gradient during capping. A haul road exists at the toe of the slope on a bund which buttresses the slope. There is a gravel-lined drain between the haul road and the toe of the slope. There is also a larger drainage channel downslope of the haul road which contains ponding water resulting from the recent heavy rainfall. There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 12 – Northwest Slope of Cell 2 (facing southeast)

3.4 CELL 3

3.4.1 Northeast Slope

The Northeast Slope of Cell 3 is well-vegetated with grass and stands at a gradient of approximately 1V:3H as shown in **Figure 13**. This slope was regraded during capping works. A haul road runs parallel to the toe of the slope and there is a gravel-lined drain between the toe of the slope and the haul road. There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 13 – Northeast Slope of Cell 3 (facing northwest)

3.4.2 Northwest Slope

This slope is well-vegetated with grass and has a gradient of approximately 1V:3H as shown in **Figure 14**. A haul road exists at the toe of the slope on a bund which buttresses the slope. There is a gravel-lined drain between the haul road and the toe of the slope. There is also a larger drainage channel downslope of the haul road which contains ponding water resulting from the recent heavy rainfall **(shown in Figure 15).** There are no obvious signs of movement or distress visible at the surface of this slope.

Figure 14 – Northwest Slope of Cell 3 (facing northwest)

Figure 15 – Ponding in Drain at Toe of Northwest Slope of Cell 3 (facing northwest)

3.4.3 North Slope

The surface of the northern end of Cell 3 has not been permanently capped. It is lined with a LLDPE landfill liner and a geofabric overliner as shown in **Figure 16**. An assessment of the underlying soil/waste was not possible during the site visit.

Figure 16 – North Slope of Cell 4 (facing southeast)

3.5 CELL 4

Cell 4 is located directly to the north of Cell 3. Construction of Cell 4 was completed in July 2013. The cell has begun to accept waste which is understood to comprise contaminated topsoil as shown in **Figure 17**. Some ponded water was also observed in the base of the cell as a result of the recent heavy rainfall.

Figure 17 – Topsoil in Cell 4 (facing west)

3.6 CREST OF LANDFILL

The area at the top of the capped cells was also assessed as shown in **Figure 18** and **Figure 19**. In 2014, some small settlement cracks were observed at the crest of Cell 3. These were not considered to indicate instability in the slope and they were not observed during the 2015 site visit.

Figure 18 – Crest of Landfill (facing southeast)

Figure 19 – Crest of Landfill (facing northwest)

4 TOPOGRAPHIC SURVEY REVIEW

A visual comparison of topographic surveys carried out in 2011, 2014 and 2015 indicates that:

- Capping of Cell 3 was completed between the 2011 and 2014 surveys;
- Material has been deposited in Cell 4 between the 2014 and 2015 surveys.

5 RECOMMENDATIONS

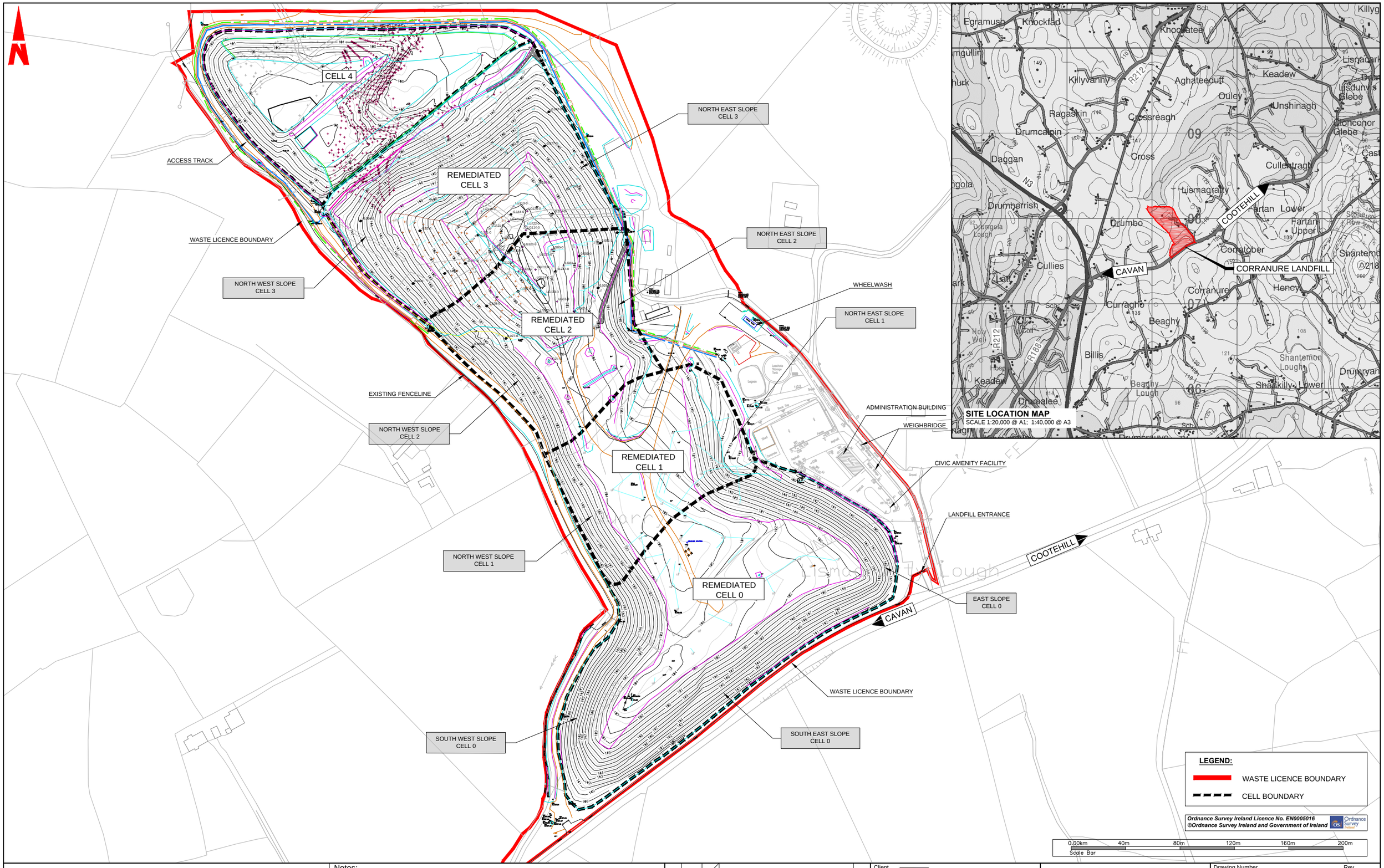
In general, the slopes of the landfill are well-vegetated and appear to in good condition with no obvious signs of distress. It is recommended that drainage measures are maintained to prevent water from ponding near the crest of the slopes. Water at the crest of slopes can reduce the strength of the soil and result in slope failure. Should depressions form in the crest of the landfill they should be regraded to prevent water ponding.

Ponding water was observed in a number of toe drains around the perimeter of the landfill. The ponding is likely the result of very heavy rainfall in the week preceding the site visit. Drains must be well maintained so that they can continue to allow water to efficiently flow away from the slopes. During any cleaning or other maintenance operations care must be taken not to excavate soil or vegetation from the toe of the slopes as this material may be providing additional support to the slope.

It is noted that this assessment is based on visual assessment only.

APPENDIX A

Site Location Map and Site Layout



Notes:

1. This drawing is the property of RPS Group PLC, it is a confidential document and must not be copied, used, or its content divulged without prior written consent.
2. Verifying Dimensions.
   The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
3. Existing Services.
   Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
4. Issue of Drawings.
   Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipients own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipients drawing production, or setting out on site.
5. Datum: Ordnance Survey Datum, Malin Head
6. Topographic Survey carried out by Bronra Surveys in December 2015

No.	Date	Dsn	Chk	Amendment / Issue	App
A01	15.01.16	GP	RS	ISSUE FOR CLIENT APPROVAL	CMcG

Client: Cavan County Council
Comhairle Chontae an Chabháin

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Project: CORRANURE LANDFILL

Drawing Number: MGE0068/DG0071
Rev: A01

Title: SITE LOCATION MAP AND SITE LAYOUT

Scale	Drawn By	Checked By	Approved By	Date
1:1,250 @A1 ; 1:2500 @A3	GP	RS	CMcG	Jan 2016

MGE0068DG0071.dwg

APPENDIX 5

AIR EMISSIONS COMPLIANCE MONITORING EMISSIONS REPORTS

Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
Stack Emissions Testing Report Commissioned by	Cavan County Council
Facility Name	Corranure Landfill Facility
Contact Person	Michelle Cass
EPA Licence Number	W0077-04
Licence Holder	Corranure Landfill Facility, E1
Stack Reference Number	E1
Dates of the Monitoring Campaign	30/11/2017
Job Reference Number	COLATL1301117 / 20171159
Report Written By	Dr. John Casey
Report Approved by	Dr. Brian Sheridan
Stack Testing Team	Dr. John Casey
Report Date	05/01/2018
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Brian Sheridan Technical Manager

Contents

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1. Executive Summary

I. Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter (TPM)
Carbon Monoxide (CO)
Oxides of Nitrogen (NOx) as NO_2
Sulphur Dioxide (SO_2)
Stack Gas Temperature
Volume ($m^3.h^{-1}$)

Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	$mg.m^{-3}$	$kg.h^{-1}$
TPM	130	-
CO	650	-
NOx as NO_2	500	-
SO_2	-	-
Stack Gas Temperature	-	-
Volume ($m^3.h^{-1}$)	-	-

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	5
Temperature K	273.15
Total Pressure kPa	101.3
Moisture %	Yes

Executive Summary

Overall Results

	Concentration					Mass Emission	
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**	**Units**	**Result**
Total Particulate Matter (TPM)	$mg.m^{-3}$	1.37	0.61	130	Yes	$kg.h^{-1}$	0.001
Carbon Monoxide (CO)	$mg.m^{-3}$	957.97	65.22	650	No	$kg.h^{-1}$	0.890
Oxides of Nitrogen (NOx) as NO_2	$mg.m^{-3}$	434.47	36.36	500	Yes	$kg.h^{-1}$	0.404
Sulphur Dioxide (SO_2)	$mg.m^{-3}$	1,233.28	81.88	-	N/A	$kg.h^{-1}$	1.146
Oxygen (%)	% v/v	8.97	0.15	-	N/A	-	-
Stack Gas Temperature	K	705.15	-	-	N/A	-	-
Stack Gas Velocity	$m.s^{-1}$	15.84	1.28	-	N/A	-	-
Volumetric Flow Rate	$m^3.h^{-1}$	1,231	-	-	N/A	-	-
Volumetric Flow Rate (Ref.)	$m^3.h^{-1}$	929	-	-	N/A	-	-

Accreditation details

Air Scientific Limited	INAB319T
External Analytical Laboratory	UKAS0605
Other	-

Executive Summary

Monitoring Dates & Times

Parameter	Run	Location ID	Sampling Dates	Sampling Time On	Sampling Time Off	Duration (mins.)
Total Particulate Matter (TPM)	Run 1	E1	30/11/2017	09:20:00	09:50:00	00:30:00
	Run 2					
	Run 3					
Carbon Monoxide (CO)	Run 1	E1	30/11/2017	10:01:00	10:40:00	00:39:00
	Run 2					
	Run 3					
Oxides of Nitrogen (NOx) as NO_2	Run 1	E1	30/11/2017	10:01:00	10:40:00	00:39:00
	Run 2					
	Run 3					
Sulphur Dioxide (SO_2)	Run 1	E1	30/11/2017	10:01:00	10:40:00	00:39:00
	Run 2					
	Run 3					
Oxygen (%)		E1	30/11/2017	10:01:00	10:40:00	00:39:00

Executive Summary

Process details

Parameter	
Process status	Normal
Capacity (per/hour) (if applicable)	302Kw
Continuous or Batch Process	Continuous
Feedstock	LFG
Abatement System	No
Abatement Systems Running Status	N/A
Fuel	N/A
Plume Appearance	Yes
Other information	None

Monitoring, Equipment & Analytical Methods

	Monitoring				Analysis	
Parameter	**Standard**	**Technical Procedure**	**Accredited Testing**	**Testing Lab**	**Analytical Technique**	**Analysis Lab**
Total Particulate Matter (TPM)	EN13284-1:2002	SOP 2000	Yes	AirSci	Gravimetric	RPS
Carbon Monoxide (CO)	EN15058:2006	SOP 2004	Yes	AirSci	NCIR By Horiba PG-250	AirSci
Oxides of Nitrogen (NOx)	EN14792:2006	SOP 2002	Yes	AirSci	Chemiluminescence	AirSci
Sulphur Dioxide (SO2)	TGN 21	SOP 2012	Yes	AirSci	NDIR Absorption	AirSci
Oxygen (%)	EN14789:2005	SOP 2008	Yes	AirSci	Paramagnetic	AirSci
Stack Gas Temperature	EN16911:2013	SOP 2005	Yes	AirSci	Thermocouple	AirSci
Stack Gas Velocity	EN16911:2013	SOP 2005	Yes	AirSci	Pitot tubes	AirSci

List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM12EQ513	Horiba PG2500 Portable Gas Analzer	Horiba	ZVM969TT
ASLTM12EQ517	Testo 400 Gas Pressure Vacumn and Flow	Testo	00828828/305
ASLTM12EQ520	Buhler Sample Gas Cooler	Buhler Technologies	100063602044367-001
ASLTM13EQ506	S TYPE PITOT TUBE	Tecora	O710
ASLTM13EQ509	10 metre industrial heated sample line (Temp controller box 1 & 2)	Neptech	13B088
ASLTM14EQ512	GemRed Electronic Level 0 to 180 Degrees	GemRed	8088
ASLTM14EQ513	ISO Stack Sampling Machine and associated equipment	TCR Tecora	070205976 & 049039P
ASLTM14EQ516	6" Digital Calliper	Stanley	052013w
ASLTM14EQ519	S TYPE PITOT TUBE	Tecora	33011

Sampling Deviations

Parameter	Deviation
Standard ID	EN16911 - In accordance with MID6911-1
Standard ID	-
Standard ID	-
Standard ID	-

Reference Documents

Risk Assessment (RA)	SOP1011
Site Review (SR)	SOP1015
Site Specific Protocol (SSP)	SOP1015

Executive Summary

Suitability of sampling location

General Information	Value
Permanent/Temporary	Temporary
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	No	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling Location / Platform Improvement Recommendations
None

BSEN 15259 Homogeneity Test Requirements
1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack
E.g. Select Option **1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack** **2: Test results were obtained from previous Homogeneity test carried out by ASL** **3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor** **4: Other: Enter Description**

Stack diagram

APPENDICES

II. Appendix I Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	**Name**	John Casey
	Qualifications	PhD. (Eng.), MSc. (Agr.), B. Agr. Sc.
	System approval	Air Scientific Limited Approved
		-

III. Appendix II Stack Details & flow characteristics

Preliminary stack survey calculations

General Stack Details		
Stack details	**Units**	**Value**
Date of survey		30/11/2017
Time of survey		09:00
Type		Circular
Stack Diameter / Depth, D	m	0.28
Stack Width, W	m	-
Average Stack Gas Temp., Ta	C	432
Average Static Pressure, P static	kPa	0.1
Average Barometric Pressure, Pb	kPa	101.9
Type of Pitot		S
Are Water Droplets Present ?		No
Average Pitot Tube Calibration Coeff, Cp		0.85
Negative flow		No
Highly homogeneous flow stream/gas velocity		Yes

Sample Port Size	mm	65
Initial Pitot Leak Check	Pa	18.04
Final Pitot Leak Check	Pa	18.03
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		1
Number of Lines Used		1

Sampling Line A						
Point	**Distance to duct (m)**	**Pa**	**Temp ºC**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	0.02	-	-	-	-	-
2	0.07	90	432	16.0	-	<15
3	0.21	86	432	15.7	-	<15
4	0.26	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	88.00	432	15.84	-	<15
Min	-	86	432	15.66	-	<15
Max	-	90	432	16.02	-	<15

Sampling Line B						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO_2	-	10.7	-	44.01
Oxygen O_2	-	8.9	-	32
Nitrogen N_2	-	80.4	-	28.1
Moisture (H_2O)	-	-	10.1	18.02
Reference Conditions	**Units**	**Numbers**		
Temperature	°C	273.15		
Total Pressure	kPa	101.3		
Moisture	%	-		
Oxygen (Dry)	%	5		

Stack Gas Composition & Molecular Weights								
Component	**Molar Mass M**	**Density Kg/m^3 p**	**Conc. Dry % v/v**	**Dry Volume Fraction r**	**Dry Conc. kg/m^3 pi**	**Conc. wet % v/v**	**Wet Volume Fraction r**	**Wet Conc.kg/m^3 pi**
Carbon Dioxide CO_2	44.01	1.96	10.7	0.107	0.21	9.62	0.10	0.19
Oxygen O_2	32	1.43	8.9	0.089	0.13	8.00	0.08	0.11
Nitrogen N_2	28.1	1.25	80.4	0.804	1.01	72.28	0.72	0.91
Moisture (H_2O)	18.02	0.80	-	-	-	10.1	0.10	0.08
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

Calculation of Stack Gas Densities		
Determinand	**Units**	**Result**
Dry Density (STP), P STD	$kg.m^{-3}$	1.345
Wet Density (STP), P STW	$kg.m^{-3}$	1.296
Dry Density (Actual), P Actual	$kg.m^{-3}$	0.524
Average wet Density (Actual), P ActualW	$kg.m^{-3}$	0.505
Where		
P STD = sum of component concentrations, kg/m3 (excluding water vapour)	-	-
P STW = (P STD + pi of H2O) / (1 + (pi of H2O / 0.8036))	-	-
P actual = P STD x (T STP / (P STP)) x (Pa / Ta)	-	-
P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta)	-	-

Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	86	Pa	>5 Pa	Yes	EN16911:2013
Lowest Gas Velocity	15.66	m/s	-	N/A	-
Highest Gas Velocity	16.02	m/s	-	N/A	-
Ratio of Above	1.02	:1	<3:1	Yes	EN16911:2013
Mean Velocity	15.84	m/s	-	N/A	-
Angle of flow with regard to duct axis	<15	degrees	< 15	Yes	EN16911:2013
No local negative flow	No	-	-	Yes	-
Homogeneous flow stream/gas velocity	Yes	-	-	Yes	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP) / Density)	-
Where	
Kpt = Pitot tube calibration coefficient	0.85
Compressibility correction factor, assumed at a constant 0.998	0.998

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flow Rate (Actual)	$m^3.h^{-1}$	3511
Gas Volumetric Flow Rate (STP, Wet)	$m^3. h^{-1}$	1370
Gas Volumetric Flowrate (STP, Dry)	$m^3. h^{-1}$	1231
Gas Volumetric Flowrate REF to Oxygen	$m^3. h^{-1}$	929

IV. Appendix III Individual parameter sampling details and results

Total Particulate Matter : Sampling details and results

Run 1			**Time On**	09:20:00	-
Stack ID	E1	-	**Time Off**	09:50:00	-
Filter ID	90945	-	**Uncertainty Data**	-	-
Start Dry Gas Meter	-	Nm3	**Temperature at Pump**	7	Deg C
Finish Dry Gas Meter	-	Nm3	**Pressure at Pump**	101.9	kPa
Average Stack Temperature	431	degrees	**Air Volume at Pump**	0.583	m^3
Moisture Content	10.10	%	**Humidity at Pumps**	0.1	%
Stack Flow Rate STP, Dry	1231	$m^3.h^{-1}$	**Filter Weight**	<0.04	mg
Volume of Air Sampled	0.57	m^3 (VgN)	**Front End Weight**	0.61	mg
Balance Calibration	**Weight**				
300.0	-	g	-	-	-
500.0	-	g	-	-	-
1000.0	-	g	-	-	-
Inpinger Weights	**Initial**	**Final**	**Difference**		
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
Volume of Air Sampled	0.57	Nm3	0	-	-
Moisture Content (EN 14790)	0.00	%	-	-	-
Leak Check Results	**Result**	-	**% Leak**		
Before Blank	0.12	l/min	0.5	-	-
After Blank	0.13	l/min	0.6	-	-
Before Sample 1	0.11	l/min	0.5	-	-
After Sample 1	0.14	l/min	0.6	-	-
Average Flow Rate	23	l/min	0.6	-	-
Standard Maximum	0.46	l/min	2%	-	-
Back Pressure	-	bar	-	-	-
Leak check acceptable	Yes	-	Yes/No	-	-
Water droplets present	No	-	Yes/No	-	-
Standard Criteria to be Met	**Result**	**Standard Requirement**			
Angle of Flow	<15	<15 Degrees			
Negative Flow in the Stack	None	None			
Pitot Pressure Difference	>5Pa	>5Pa			
Ratio of Flow Measurement	<3:1	<3:1			
Pitot Tube Leak Check	**Result**				
Positive Pressure	Pass	-			
Negative Pressure	Pass	-			

Number of Ports	1	2			
Straight length before sample point	> 5	> 5 Hydraulic Diameters			
Straight length after sample point	2	> 5 Hydraulic Diameters			
Sample Calculations	-	-			
Blank (Filter and Front Wash Combined)	1.55	mg			
Sample 1 (Filter and Front Combined)	0.65	mg			
Volume of Air Sampled	0.63	m^3			
Blank Result	2.44	$mg.m^{-3}$			
Sample Result	1.03	$mg.m^{-3}$			
Emission Limit Value	130	$mg.m^{-3}$			
Blank as Percentage of ELV	1.9	%	**Standard Requirement**	**<10% ELV**	-
Isokinetic Criterion Compliance					
Isokinetic Variation	%	0	-	-	-
Allowable IsoKinetic Range	%	95-115	-	-	-
Iso Kineticity Acceptable	-	Yes	-	-	-

Total Particulates Quality Assurance

Stack ID	E1	-
Parameter	**Units**	**Run 1**
Sampling Times	-	09:20:00
Sampling dates	-	30/11/2017
Sampling Device	-	Basic
Volume Sampled (REF.)	m3	0.57
Filter ID Number	-	90945
Probe rinse ID	-	090945W
Total Filter Mass	mg	<0.04
Probe Rinse Solids Mass	mg	0.6
Total Mass Collected	mg	0.65
General information		
Standard	ISEN13284-1	**Run 1**
Technical Procedure	-	2000
Probe Material	-	SS
Filter Housing	-	SS
Positioning of Filter	-	In-stack
Filter Size and Material	-	27mm filter, 8mm nozzle
Number of Sampling lines used	-	1
Number of Sampling Points used	-	2

Carbon Monoxide Quality Assurance

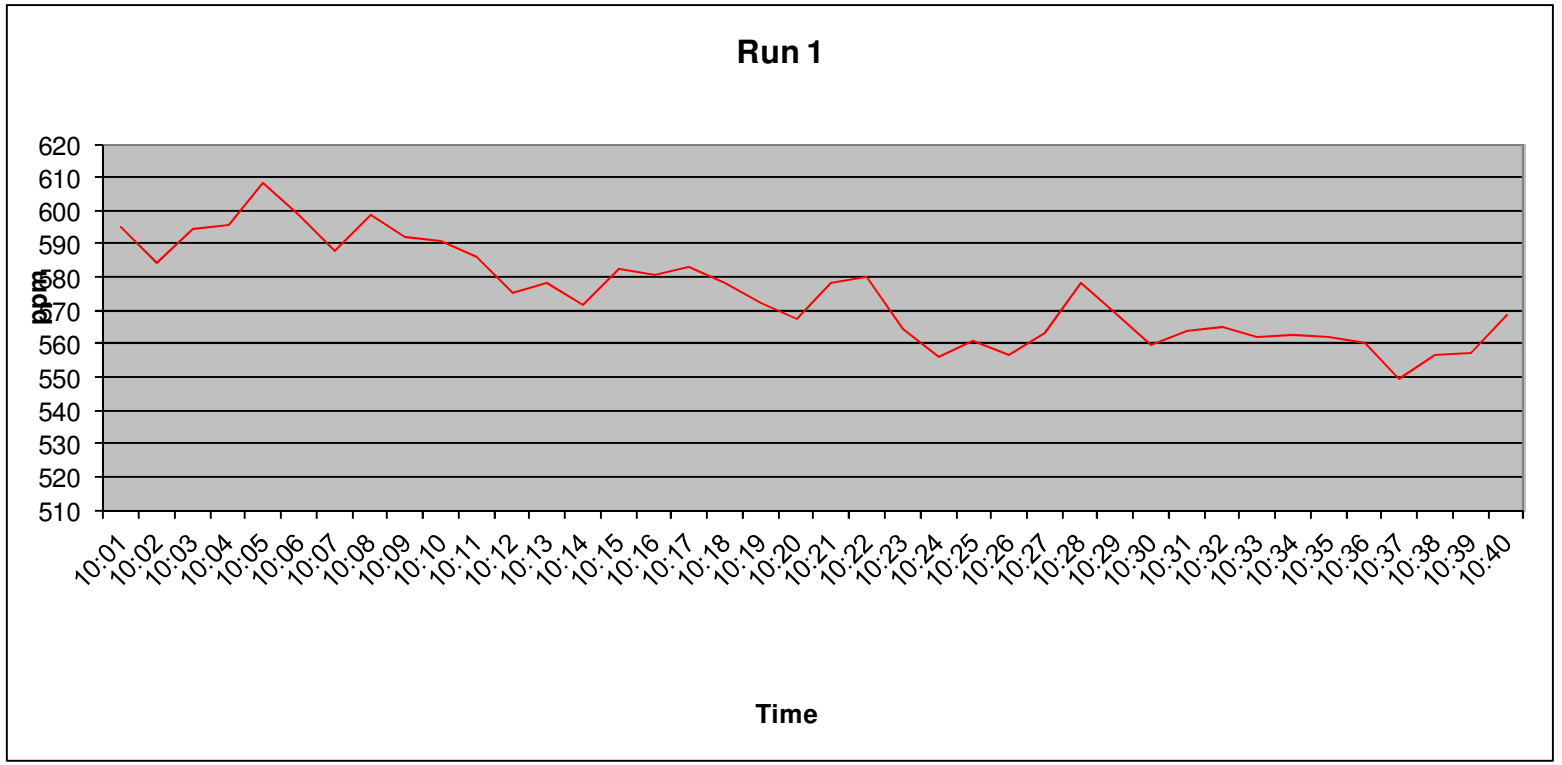
Sampling Details		
Stack ID	E1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	10:00
Sampling Dates	-	30/11/2017
Instrument Range	ppm	1000
Span Gas Value	ppm	598
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.4
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	1
Zero Down Sampling Line (Post)	ppm	4
Zero drift	ppm	3
Allowable Zero Drift	ppm	11.9
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	598
Span Down Sampling Line (Post)	ppm	591
Span Drift	ppm	7
Allowable Span Drift	ppm	11.9
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	598
Recorded Conc. down Line	ppm	598
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	3

Carbon Monoxide Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	718.59
Uncertainty	$mg.m^{-3}$	65.22
Mass Emission	kg.h	0.89

General Sampling Information	
Parameter	**Value**
Standard	EN15058
Technical Procedure	SOP2004
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Span Gas Reference Number	ASLTM15ING503
Span Gas Expiry Date	Nov-17
Span Gas Start Pressure (bar)	20
Gas Cylinder Concentration (ppm)	598
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	E1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	5

Carbon Monoxide Trend



Carbon Monoxide Measurement Uncertainty

	Units	**Run 1**
Measured Quantities		
Certified Range of Analyser	ppm	1.36 to 1000
Operational Range of Analyser	ppm	1000
Measured Reading	ppm	574.87
Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	0.9
Temperature Dependent Zero drift	%	0.14
Temperature Dependent Span drift	%	-0.12
Cross-sensitivity	%	0.08
Leak	%	0
Calibration Gas Uncertainty	%	<2
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	11.33
Expanded uncertainty	$mg.m^{-3}$	22.66
Uncertainty corrected to std conds.	$mg.m^{-3}$	65.22
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	10.03
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	65.22
Expanded uncertainty expressed with a level of confidence of 95%	% of value	9.08
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Oxides of Nitrogen Quality Assurance

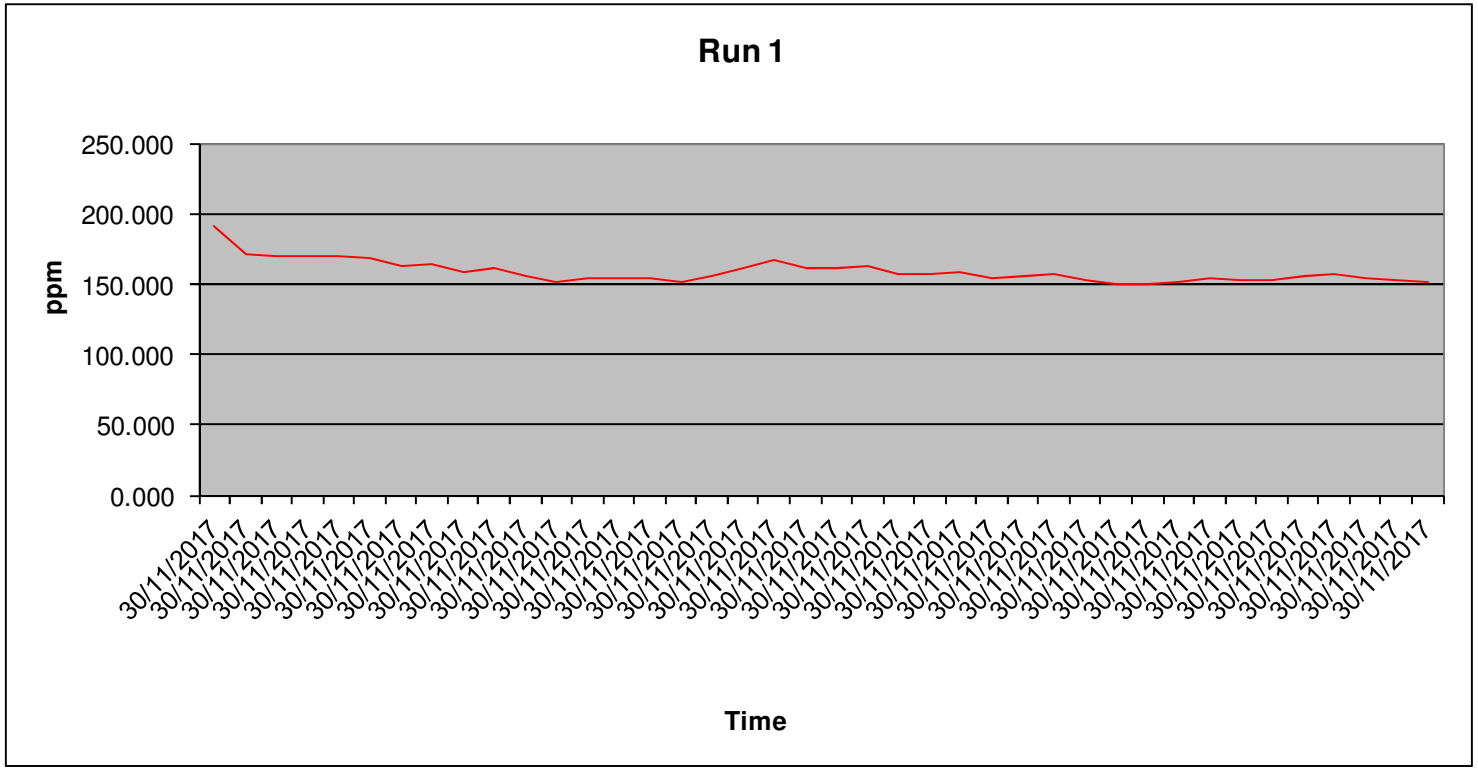
Sampling Details		
Stack ID	E1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	10:00
Sampling Dates	-	30/11/2017
Instrument Range	ppm	250
Span Gas Value	ppm	163
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.4
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.3
Zero drift	ppm	0.2
Allowable Zero Drift	ppm	3.2
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	163.3
Span Down Sampling Line (Post)	ppm	162.4
Span Drift	ppm	0.9
Allowable Span Drift	ppm	3.2
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	163
Recorded Conc. down Line	ppm	163.3
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	3
NOx Converter Efficiency	%	95.3

Oxides of Nitrogen Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	325.90
Uncertainty	$mg.m^{-3}$	36.36
Mass Emission	$kg.h^{-1}$	0.40

General Sampling Information	
Parameter	**Value**
Standard	EN14792
Technical Procedure	SOP2002
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Date & Result of last converter check	95.3 30/09/2017
Span Gas Reference Number	ASLTM16ING513
Span Gas Expiry Date	Jan-18
Span Gas Start Pressure (bar)	30
Gas Cylinder Concentration (ppm)	163
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	E1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	5

Oxides of Nitrogen Trend



Oxides of Nitrogen Measurement Uncertainty

Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	1.4
Temperature Dependent Zero drift	%	-0.04
Temperature Dependent Span drift	%	-0.25
Cross-sensitivity	%	0.5
Leak	%	0
Calibration Gas Uncertainty	%	<2
Mass Flow Controllers (Dilution) Uncertainty	%	<1
NOx Converter Efficiency	%	95.3
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	9.72
Expanded uncertainty	$mg.m^{-3}$	19.44
Uncertainty corrected to std conds.	$mg.m^{-3}$	36.36
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	7.27
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	36.36
Expanded uncertainty expressed with a level of confidence of 95%	% of value	11.16
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Sulphur Dioxide Quality Assurance

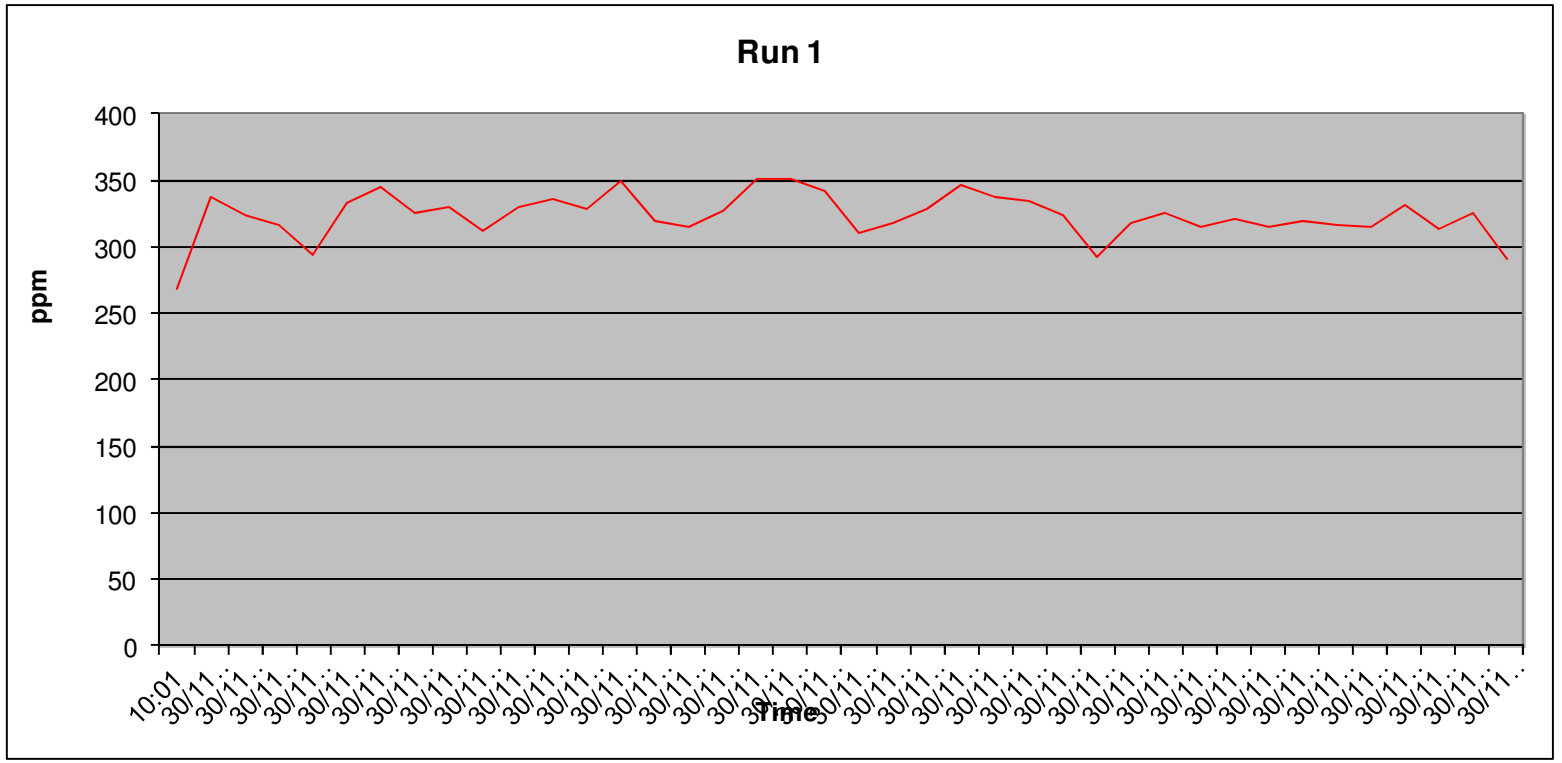
Sampling Details		
Stack ID	E1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	10:00
Sampling Dates	-	30/11/2017
Instrument Range	ppm	1000
Span Gas Value	ppm	552
Acceptable Gas Range	-	Yes
	-	-
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.4
	-	-
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	1
Zero Down Sampling Line (Post)	ppm	8
Zero drift	ppm	7
Allowable Zero Drift	ppm	27
Zero Drift Acceptable	-	Yes
	-	-
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	552
Span Down Sampling Line (Post)	ppm	573
Span Drift	ppm	21
Allowable Span Drift	ppm	27
Span Drift Acceptable (Y/N)	-	Yes
	-	-
Leak Check		
Span Gas Conc.	ppm	552
Recorded Conc. down Line	ppm	552
Leak check acceptable (< 2%)	(Y/N)	Yes
	-	-
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	3

Sulphur Dioxide Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	925.10
Uncertainty	$mg.m^{-3}$	81.88
Mass Emission	kg.h	1.15

General Sampling Information	
Parameter	**Value**
Standard	TGN 21
Technical Procedure	2012
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Date & Result of last converter check	-
Span Gas Reference Number	ASLTM15ING528
Span Gas Expiry Date	Dec-17
Span Gas Start Pressure (bar)	20
Gas Cylinder Concentration (ppm)	552
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	E1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	5

Sulphur Dioxide Trend



Sulphur Dioxide Measurement Uncertainty

	Units	**Run 1**
Measured Quantities		
Certified Range of Analyser	ppm	2.14 to 1000
Operational Range of Analyser	ppm	1000
Measured Reading	ppm	323.46
Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	0.8
Temperature Dependent Zero drift	%	0.8
Temperature Dependent Span drift	%	2
Cross-sensitivity	%	1.5
Leak	%	0
Calibration Gas Uncertainty	%	<2 %
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	12.84
Expanded uncertainty	$mg.m^{-3}$	25.68
Uncertainty corrected to std conds.	$mg.m^{-3}$	81.88
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	81.88
Expanded uncertainty expressed with a level of confidence of 95%	% of value	8.85
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
Stack Emissions Testing Report Commissioned by	Cavan County Council
Facility Name	Corranure Landfill Facility
Contact Person	Michelle Cass
EPA Licence Number	W0077-04
Licence Holder	Corranure Landfill Facility, F1
Stack Reference Number	F1
Dates of the Monitoring Campaign	30/11/2017
Job Reference Number	COLATL1301117 / 20171159
Report Written By	Dr. John Casey
Report Approved by	Dr. Brian Sheridan
Stack Testing Team	Dr. John Casey
Report Date	15/12/2017
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Brian Sheridan Technical Manager

Contents

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1. Executive Summary

I. Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Carbon Monoxide (CO)
Oxides of Nitrogen (NOx) as NO_2
Total Volatile Organic Carbon (TOC)
Sulphur Dioxide (SO_2)
Stack Gas Temperature
Volume ($m^3.h^{-1}$)

Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	$mg.m^{-3}$	$kg.h^{-1}$
CO	50	-
NOx as NO_2	150	-
TOC	10	-
SO_2	-	-
Stack Gas Temperature	-	-
Volume ($m^3.h^{-1}$)	-	-

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	3
Temperature K	273.15
Total Pressure kPa	101.3
Moisture %	Yes

Executive Summary

Overall Results

	Concentration				
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**
Carbon Monoxide (CO)	$mg.m^{-3}$	9.07	2.53	50	Yes
Oxides of Nitrogen (NOx) as NO_2	$mg.m^{-3}$	98.78	7.99	150	Yes
Total Volatile Organic Carbon (VOC)	$mgC.m^{-3}$	3.07	0.59	10	Yes
Sulphur Dioxide (SO_2)	$mg.m^{-3}$	97.46	9.50	-	N/A
Oxygen (%)	% v/v	7.11	0.14	-	N/A
Stack Gas Temperature	K	1294.15	-	-	N/A

Accreditation details

Air Scientific Limited	INAB319T
External Analytical Laboratory	-
Other	-

Executive Summary

Monitoring Dates & Times

Parameter	Run	Location ID	Sampling Dates	Sampling Time On	Sampling Time Off	Duration (mins.)
Carbon Monoxide (CO)	Run 1	F1	30/11/2017	11:04:00	11:35:00	00:31:00
	Run 2					
	Run 3					
Oxides of Nitrogen (NOx) as NO_2	Run 1	F1	30/11/2017	11:04:00	11:35:00	00:31:00
	Run 2					
	Run 3					
Total Volatile Organic Carbon (VOC)	Run 1	F1	30/11/2017	11:03:11	11:35:11	00:32:00
	Run 2					
	Run 3					
Sulphur Dioxide (SO_2)	Run 1	F1	30/11/2017	11:04:00	11:35:00	00:31:00
	Run 2					
	Run 3					
Oxygen (%)		F1	30/11/2017	11:04:00	11:35:00	00:31:00

Executive Summary

Process details

Parameter	
Process status	Normal
Capacity (per/hour) (if applicable)	--
Continuous or Batch Process	Continuous
Feedstock	LFG
Abatement System	No
Abatement Systems Running Status	N/A
Fuel	LFG
Plume Appearance	Yes
Other information	None

Monitoring, Equipment & Analytical Methods

	Monitoring				Analysis	
Parameter	**Standard**	**Technical Procedure**	**Accredited Testing**	**Testing Lab**	**Analytical Technique**	**Analysis Lab**
Carbon Monoxide (CO)	EN15058:2006	SOP 2004	Yes	AirSci	NCIR By Horiba PG-250	AirSci
Oxides of Nitrogen (NOx)	EN14792:2006	SOP 2002	Yes	AirSci	Chemiluminescence	AirSci
Total Volatile Organic Carbon (TOC)	EN12619:2013	SOP 2009	Yes	AirSci	Flame Ionisation Detection	AirSci
Sulphur Dioxide (SO2)	TGN 21	SOP 2012	Yes	AirSci	NDIR Absorption	AirSci
Oxygen (%)	EN14789:2005	SOP 2008	Yes	AirSci	Paramagnetic	AirSci
Stack Gas Temperature	EN16911:2013	SOP 2005	Yes	AirSci	Thermocouple	AirSci

List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM12EQ509	3010 MinfiFID	Signal Instruments	16764
ASLTM12EQ513	Horiba PG2500 Portable Gas Analzer	Horiba	ZVM969TT
ASLTM12EQ517	Testo 400 Gas Pressure Vacumn and Flow	Testo	00828828/305
ASLTM12EQ520	Buhler Sample Gas Cooler	Buhler Technologies	100063602044367-001
ASLTM13EQ509	10 metre industrial heated sample line (Temp controller box 1 & 2)	Neptech	13B088
ASLTM14EQ509	5 metre heated line, filters and temp controller box 1 & 2	Neptech	14A052

Sampling Deviations

Parameter	Deviation
Standard ID	-
Standard ID	-
Standard ID	-
Standard ID	-

Reference Documents

Risk Assessment (RA)	SOP1011
Site Review (SR)	SOP1015
Site Specific Protocol (SSP)	SOP1015

Executive Summary

Suitability of sampling location

General Information	Value
Permanent/Temporary	Temporary
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	No	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling Location / Platform Improvement Recommendations
None

BSEN 15259 Homogeneity Test Requirements
1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack
E.g. Select Option **1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack** **2: Test results were obtained from previous Homogeneity test carried out by ASL** **3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor** **4: Other: Enter Description**

Stack diagram

APPENDICES

II. Appendix I Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	**Name**	John Casey
	Qualifications	PhD. (Eng.), MSc. (Agr.), B. Agr. Sc.
	System approval	Air Scientific Limited Approved
		-

III. Appendix II Stack Details & flow characteristics

Preliminary stack survey calculations

General Stack Details		
Stack details	**Units**	**Value**
Date of survey		30/11/2017
Time of survey		-
Type		Circular
Stack Diameter / Depth, D	m	-
Stack Width, W	m	-
Average Stack Gas Temp., Ta	C	1021
Average Static Pressure, P static	kPa	-
Average Barometric Pressure, Pb	kPa	-
Type of Pitot		-
Are Water Droplets Present ?		-
Average Pitot Tube Calibration Coeff, Cp		-
Negative flow		-
Highly homogeneous flow stream/gas velocity		Yes

Sample Port Size	mm	-
Initial Pitot Leak Check	Pa	-
Final Pitot Leak Check	Pa	-
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		-
Number of Lines Used		-

Sampling Line A						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Sampling Line B						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO_2	-	11.9	-	44.01
Oxygen O_2	-	7.1	-	32
Nitrogen N_2	-	81	-	28.1
Moisture (H_2O)	-	-	-	18.02
Reference Conditions	**Units**	**Numbers**		
Temperature	°C	273.15		
Total Pressure	kPa	101.3		
Moisture	%	-		
Oxygen (Dry)	%	3		

Stack Gas Composition & Molecular Weights								
Component	**Molar Mass M**	**Density Kg/m^3 p**	**Conc. Dry % v/v**	**Dry Volume Fraction r**	**Dry Conc. kg/m^3 pi**	**Conc. wet % v/v**	**Wet Volume Fraction r**	**Wet Conc.kg/m^3 pi**
Carbon Dioxide CO_2	44.01	1.96	11.9	0.119	0.23	11.90	0.12	0.23
Oxygen O_2	32	1.43	7.1	0.071	0.10	7.10	0.07	0.10
Nitrogen N_2	28.1	1.25	81	0.81	1.02	81.00	0.81	1.02
Moisture (H_2O)	18.02	0.80	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

Calculation of Stack Gas Densities		
Determinand	**Units**	**Result**
Dry Density (STP), P STD	$kg.m^{-3}$	1.351
Wet Density (STP), P STW	$kg.m^{-3}$	1.351
Dry Density (Actual), P Actual	$kg.m^{-3}$	-
Average wet Density (Actual), P ActualW	$kg.m^{-3}$	-
Where		
P STD = sum of component concentrations, kg/m3 (excluding water vapour)	-	-
P STW = (P STD + pi of H2O) / (1 + (pi of H2O / 0.8036))	-	-
P actual = P STD x (T STP / (P STP)) x (Pa / Ta)	-	-
P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta)	-	-

Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	-	Pa	>5 Pa	N/A	EN16911:2013
Lowest Gas Velocity	-	m/s	-	N/A	-
Highest Gas Velocity	-	m/s	-	N/A	-
Ratio of Above	-	:1	<3:1	N/A	EN16911:2013
Mean Velocity	-	m/s	-	N/A	-
Angle of flow with regard to duct axis	-	degrees	< 15	N/A	EN16911:2013
No local negative flow	-	-	-	N/A	-
Homogeneous flow stream/gas velocity	-	-	-	N/A	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP) / Density)	-
Where	
Kpt = Pitot tube calibration coefficient	-
Compressibility correction factor, assumed at a constant 0.998	0.998

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flow Rate (Actual)	$m^3.h^{-1}$	-
Gas Volumetric Flow Rate (STP, Wet)	$m^3. h^{-1}$	-
Gas Volumetric Flowrate (STP, Dry)	$m^3. h^{-1}$	-
Gas Volumetric Flowrate REF to Oxygen	$m^3. h^{-1}$	-

IV. Appendix III Individual parameter sampling details and results

Carbon Monoxide Quality Assurance

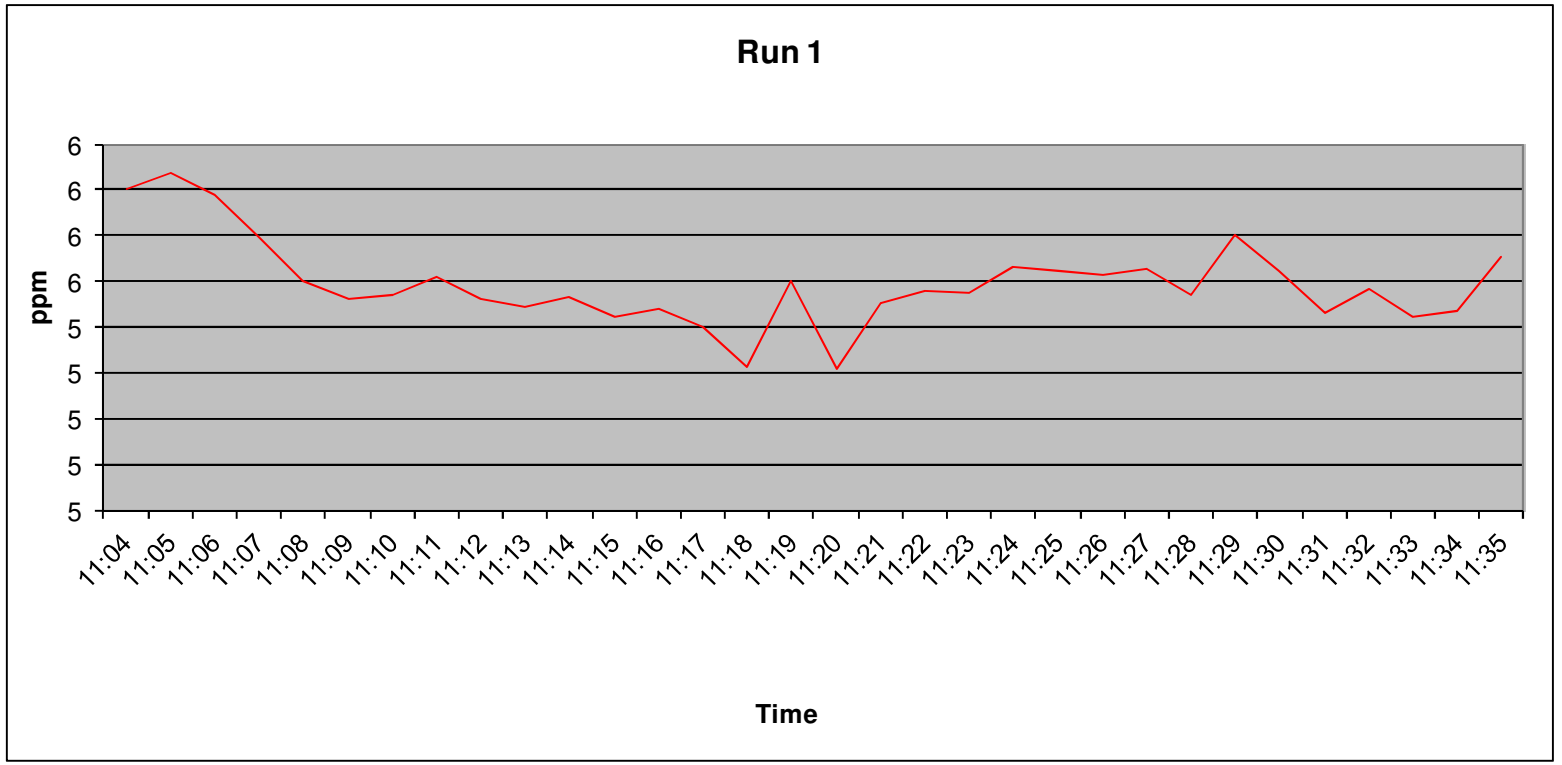
Sampling Details		
Stack ID	F1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	11:04
Sampling Dates	-	30/11/2017
Instrument Range	ppm	200
Span Gas Value	ppm	161
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.4
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.1
Zero drift	ppm	0
Allowable Zero Drift	ppm	3.2
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	161
Span Down Sampling Line (Post)	ppm	161.4
Span Drift	ppm	0.4
Allowable Span Drift	ppm	3.2
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	161
Recorded Conc. down Line	ppm	161
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	7

Carbon Monoxide Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	6.99
Uncertainty	$mg.m^{-3}$	2.53
Mass Emission	kg.h	-

General Sampling Information	
Parameter	**Value**
Standard	EN15058
Technical Procedure	SOP2004
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Span Gas Reference Number	ASLTM15ING534
Span Gas Expiry Date	Dec-18
Span Gas Start Pressure (bar)	20
Gas Cylinder Concentration (ppm)	161
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Carbon Monoxide Trend



Carbon Monoxide Measurement Uncertainty

	Units	**Run 1**
Measured Quantities		
Certified Range of Analyser	ppm	1.36 to 1000
Operational Range of Analyser	ppm	200
Measured Reading	ppm	5.59
Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	0.9
Temperature Dependent Zero drift	%	0.14
Temperature Dependent Span drift	%	-0.12
Cross-sensitivity	%	0.08
Leak	%	0
Calibration Gas Uncertainty	%	<2
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	0.95
Expanded uncertainty	$mg.m^{-3}$	1.90
Uncertainty corrected to std conds.	$mg.m^{-3}$	2.53
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	5.06
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	2.53
Expanded uncertainty expressed with a level of confidence of 95%	% of value	36.23
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Oxides of Nitrogen Quality Assurance

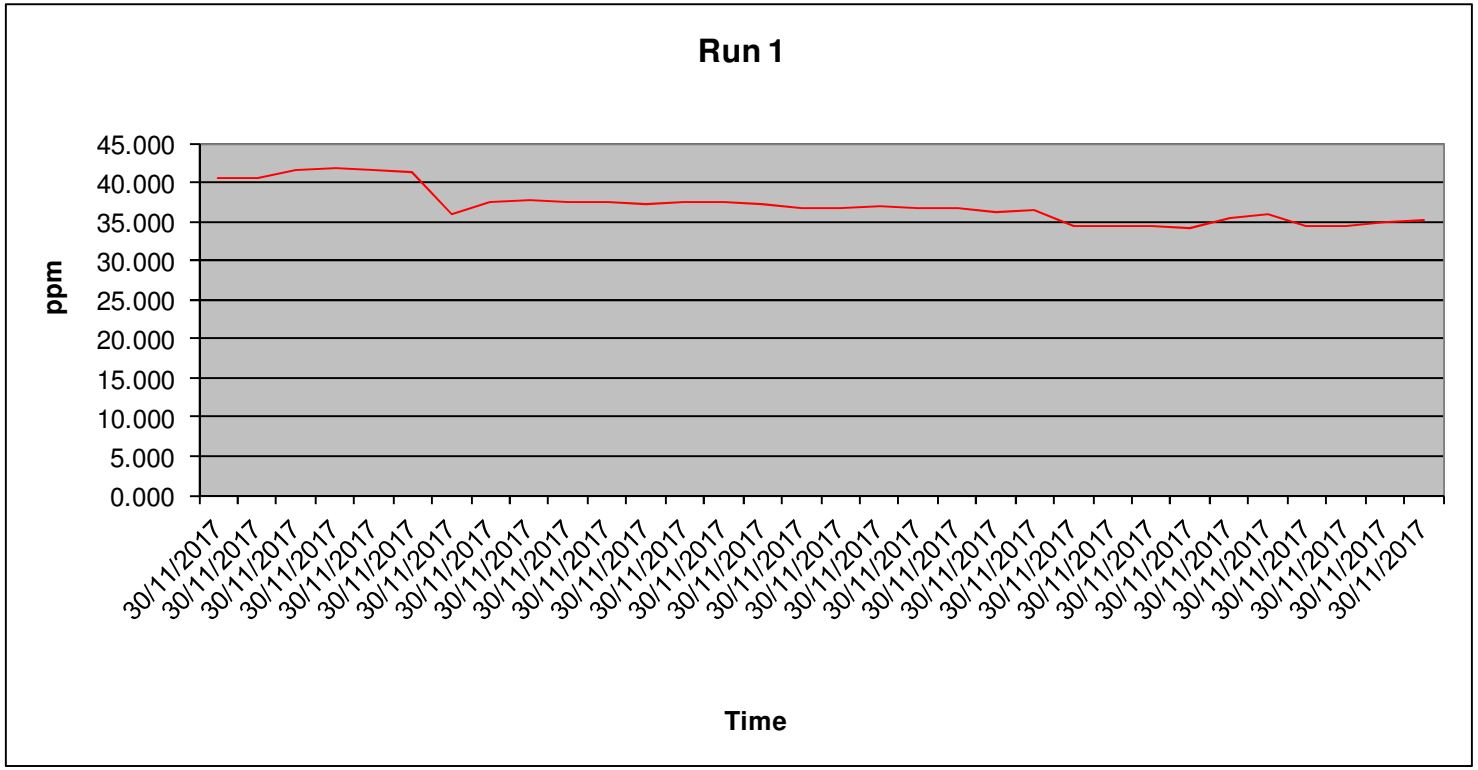
Sampling Details		
Stack ID	F1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	11:04
Sampling Dates	-	30/11/2017
Instrument Range	ppm	250
Span Gas Value	ppm	163
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.4
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.3
Zero drift	ppm	0.2
Allowable Zero Drift	ppm	3.2
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	163
Span Down Sampling Line (Post)	ppm	163.2
Span Drift	ppm	0.2
Allowable Span Drift	ppm	3.2
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	163
Recorded Conc. down Line	ppm	163
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	7
NOx Converter Efficiency	%	95.3

Oxides of Nitrogen Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	76.11
Uncertainty	$mg.m^{-3}$	7.99
Mass Emission	$kg.h^{-1}$	-

General Sampling Information	
Parameter	**Value**
Standard	EN14792
Technical Procedure	SOP2002
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Date & Result of last converter check	95.3 30/09/2017
Span Gas Reference Number	ASLTM16ING513
Span Gas Expiry Date	Jan-18
Span Gas Start Pressure (bar)	20
Gas Cylinder Concentration (ppm)	163
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Oxides of Nitrogen Trend



Oxides of Nitrogen Measurement Uncertainty

Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	1.4
Temperature Dependent Zero drift	%	-0.04
Temperature Dependent Span drift	%	-0.25
Cross-sensitivity	%	0.5
Leak	%	0
Calibration Gas Uncertainty	%	<2
Mass Flow Controllers (Dilution) Uncertainty	%	<1
NOx Converter Efficiency	%	95.3
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	2.39
Expanded uncertainty	$mg.m^{-3}$	4.77
Uncertainty corrected to std conds.	$mg.m^{-3}$	7.99
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	5.33
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	7.99
Expanded uncertainty expressed with a level of confidence of 95%	% of value	10.50
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Total Volatile Organic Carbon Quality Assurance

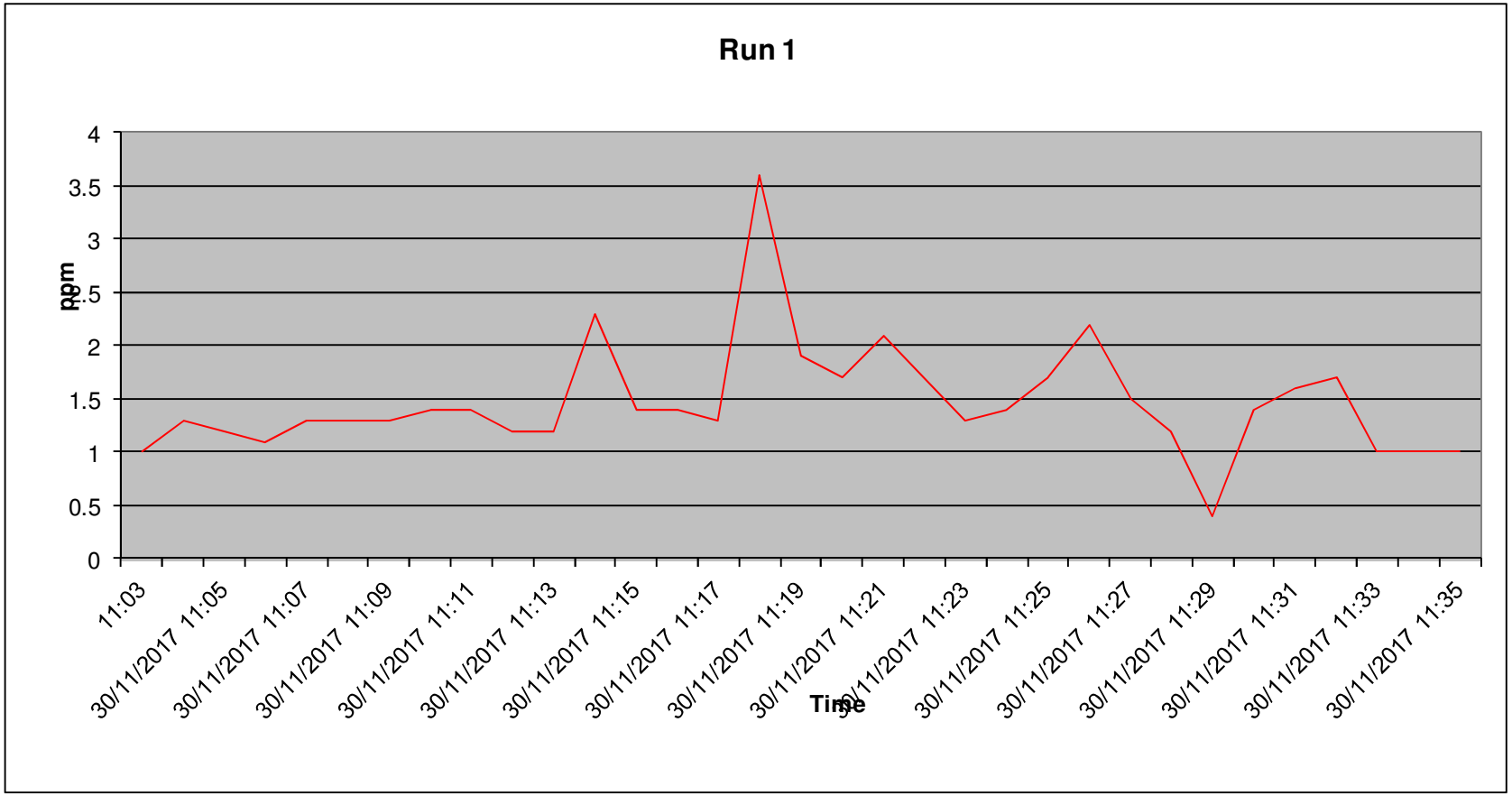
Sampling Details		
Stack ID	F1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	11:03
Sampling Dates	-	30/11/2017
Instrument Range	ppm	100
Span Gas Value	ppm	81.3
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Oven Temperature	C	193
Average Temperature	< C	193
Temperature Acceptable	-	Yes
Sample line temperature	C	190
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.2
Zero Down Sampling Line (Post)	ppm	0.6
Zero drift	ppm	0.4
Allowable Zero Drift	ppm	1.6
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	81.1
Span Down Sampling Line (Post)	ppm	81.8
Span Drift	ppm	0.7
Allowable Span Drift	ppm	1.6
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	81.3
Recorded Conc. down Line	ppm	81.1
Leak check acceptable (< 2%)	(Y/N)	Yes

Total Volatile Organic Carbon Results and Sampling Details

Parameter	Units	Run 1
Concentration	$mgC.m^{-3}$	2.36
Uncertainty	$mgC.m^{-3}$	0.59
Mass Emission	$kg.h^{-1}$	-

General Sampling Information	
Parameter	**Value**
Standard	EN12619
Technical Procedure	SOP2009
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Span Gas Reference Number	ASLTM16ING525
Span Gas Expiry Date	01/09/2021
Span Gas Start Pressure (bar)	60
Gas Cylinder Concentration (ppm)	81.3
Span Gas Uncertainty (%)	<2
Zero Gas Type	Zero Air
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	-
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Total Volatile Organic Carbon Trend



Total Volatile Organic Carbon Measurement Uncertainty

	Units	**Run 1**
Measured Quantities		
Certified Range of Analyser	ppm	0.5 to 1000
Operational Range of Analyser	ppm	100
Measured Reading	ppm	1.47
Measured Quantities	Units	**Run 1**
Nonlinearity	%	0.068
Temperature Dependent Zero drift	%	0.3
Temperature Dependent Span drift	%	0.3
Cross-sensitivity	%	-
Leak	%	<2
Calibration Gas uncertainty	%	<2
Parameter	Units	**Run 1**
Combined uncertainty	$mg.m^{-3}$	0.30
Expanded uncertainty	$mg.m^{-3}$	0.59
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	5.95
Expanded uncertainty expressed with a level of confidence of 95%	% of value	25.18
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	0.59
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Sulphur Dioxide Quality Assurance

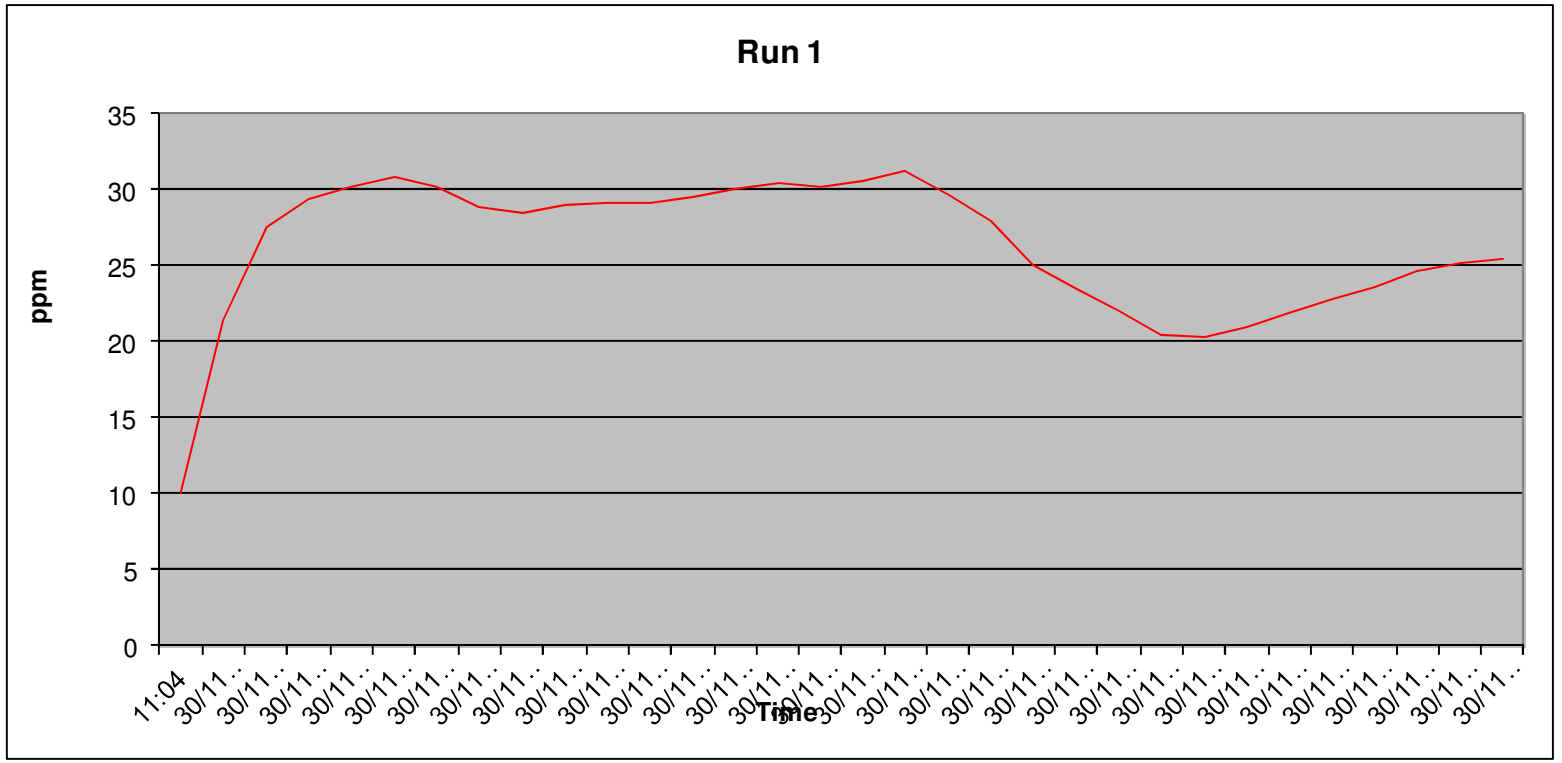
Sampling Details		
Stack ID	F1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	11:04
Sampling Dates	-	30/11/2017
Instrument Range	ppm	1000
Span Gas Value	ppm	552
Acceptable Gas Range	-	Yes
	-	-
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.4
	-	-
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	1
Zero Down Sampling Line (Post)	ppm	2
Zero drift	ppm	1
Allowable Zero Drift	ppm	27
Zero Drift Acceptable	-	Yes
	-	-
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	552
Span Down Sampling Line (Post)	ppm	560
Span Drift	ppm	8
Allowable Span Drift	ppm	27
Span Drift Acceptable (Y/N)	-	Yes
	-	-
Leak Check		
Span Gas Conc.	ppm	552
Recorded Conc. down Line	ppm	552
Leak check acceptable (< 2%)	(Y/N)	Yes
	-	-
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	7

Sulphur Dioxide Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	75.09
Uncertainty	$mg.m^{-3}$	9.50
Mass Emission	kg.h	-

General Sampling Information	
Parameter	**Value**
Standard	TGN 21
Technical Procedure	2012
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Date & Result of last converter check	-
Span Gas Reference Number	ASLTM15ING528
Span Gas Expiry Date	Dec-17
Span Gas Start Pressure (bar)	20
Gas Cylinder Concentration (ppm)	552
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Sulphur Dioxide Trend



Sulphur Dioxide Measurement Uncertainty

	Units	**Run 1**
Measured Quantities		
Certified Range of Analyser	ppm	2.14 to 1000
Operational Range of Analyser	ppm	1000
Measured Reading	ppm	26.26
Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	0.8
Temperature Dependent Zero drift	%	0.8
Temperature Dependent Span drift	%	2
Cross-sensitivity	%	1.5
Leak	%	0
Calibration Gas Uncertainty	%	<2 %
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	3.06
Expanded uncertainty	$mg.m^{-3}$	6.11
Uncertainty corrected to std conds.	$mg.m^{-3}$	9.50
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	9.50
Expanded uncertainty expressed with a level of confidence of 95%	% of value	12.66
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Odour Monitoring Ireland Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
Stack Emissions Testing Report Commissioned by	Cavan County Council
Facility Name	Corranure Landfill Facility
Contact Person	Jim Dowdall
EPA Licence Number	W0077-04
Licence Holder	Corranure Landfill Facility, Inlet
Stack Reference Number	Inlet
Dates of the Monitoring Campaign	30/11/2017
Job Reference Number	COLATL1301117 / 20171159
Report Written By	Dr. John Casey
Report Approved by	Dr. Brian Sheridan
Stack Testing Team	Dr. John Casey
Report Date	15/12/2017
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Brian Sheridan Technical Manager

Contents

1. Executive Summary

I. Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Total Sulphur

Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	$mg.m^{-3}$	$kg.h^{-1}$
Total Sulphur	-	-

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	No Oxygen Ref
Temperature K	273.15
Total Pressure kPa	101.3
Moisture %	Yes

Executive Summary

Overall Results

	Concentration				
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**
Total Sulphur	$mg.m^{-3}$	378.79	0.00	-	N/A

Accreditation details

Odour Monitoring Ireland Limited	-
External Analytical Laboratory	UKAS1549
Other	-

Executive Summary

Monitoring Dates & Times

Parameter	Run	Location ID	Sampling Dates	Sampling Time On	Sampling Time Off	Duration (mins.)
Total Sulphur	Run 1	Inlet	30/11/2017	12:35:00	13:05:00	00:30:00
	Run 2					
	Run 3					

Executive Summary

Process details

Parameter	
Process status	Normal
Capacity (per/hour) (if applicable)	N/a
Continuous or Batch Process	Continuous
Feedstock	None
Abatement System	None
Abatement Systems Running Status	N/A
Fuel	LFG
Plume Appearance	None
Other information	None

Executive Summary

Monitoring, Equipment & Analytical Methods

	Monitoring				Analysis	
Parameter	**Standard**	**Technical Procedure**	**Accredited Testing**	**Testing Lab**	**Analytical Technique**	**Analysis Lab**
Total Sulphur	USEPA M16a	SOP 2033	No	AirSci	Ion Chromatography	SAL

List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM15EQ505	Mass flow meter	Siargo	A1K05286

Sampling Deviations

Parameter	Deviation
Standard ID	Absorption eff. Not attained Total Sulphur
Standard ID	-
Standard ID	-
Standard ID	-

Reference Documents

Risk Assessment (RA)	SOP1011
Site Review (SR)	SOP1015
Site Specific Protocol (SSP)	SOP1015

Executive Summary

Suitability of sampling location

General Information	Value
Permanent/Temporary	Temporary
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	No	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling Location / Platform Improvement Recommendations
None

BSEN 15259 Homogeneity Test Requirements
1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack
E.g. Select Option **1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack** **2: Test results were obtained from previous Homogeneity test carried out by ASL** **3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor** **4: Other: Enter Description**

Executive Summary

Stack diagram

2. APPENDICES

II. Appendix I Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	**Name**	John Casey
	Qualifications	PhD. (Eng.), MSc. (Agr.), B. Agr. Sc.
	System approval	Odour Monitoring Ireland Approved
		-

III. Appendix II Stack Details & flow characteristics

Preliminary stack survey calculations

General Stack Details		
Stack details	**Units**	**Value**
Date of survey		30/11/2017
Time of survey		-
Type		Circular
Stack Diameter / Depth, D	m	-
Stack Width, W	m	-
Average Stack Gas Temp., Ta	C	-
Average Static Pressure, P static	kPa	-
Average Barometric Pressure, Pb	kPa	-
Type of Pitot		-
Are Water Droplets Present ?		-
Average Pitot Tube Calibration Coeff, Cp		-
Negative flow		-
Highly homogeneous flow stream/gas velocity		Yes

Sample Port Size	mm	-
Initial Pitot Leak Check	Pa	-
Final Pitot Leak Check	Pa	-
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		1
Number of Lines Used		1

Sampling Line A						
Point	**Distance to duct (m)**	**Pa**	**Temp ºC**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Sampling Line B						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO_2	-	-	-	44.01
Oxygen O_2	-	-	-	32
Nitrogen N_2	-	-	-	28.1
Moisture (H_2O)	-	-	-	18.02

Reference Conditions	Units	Numbers
Temperature	°C	273.15
Total Pressure	kPa	101.3
Moisture	%	-
Oxygen (Dry)	%	No Oxygen Ref

Stack Gas Composition & Molecular Weights								
Component	**Molar Mass M**	**Density Kg/m^3 p**	**Conc. Dry % v/v**	**Dry Volume Fraction r**	**Dry Conc. kg/m^3 pi**	**Conc. wet % v/v**	**Wet Volume Fraction r**	**Wet Conc.kg/m^3 pi**
Carbon Dioxide CO_2	44.01	1.96	-	-	-	-	-	-
Oxygen O_2	32	1.43	-	-	-	-	-	-
Nitrogen N_2	28.1	1.25	-	-	-	-	-	-
Moisture (H_2O)	18.02	0.80	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

Calculation of Stack Gas Densities		
Determinand	**Units**	**Result**
Dry Density (STP), P STD	$kg.m^{-3}$	-
Wet Density (STP), P STW	$kg.m^{-3}$	-
Dry Density (Actual), P Actual	$kg.m^{-3}$	-
Average wet Density (Actual), P ActualW	$kg.m^{-3}$	-
Where		
P STD = sum of component concentrations, kg/m3 (excluding water vapour)	-	-
P STW = (P STD + pi of H2O) / (1 + (pi of H2O / 0.8036))	-	-
P actual = P STD x (T STP / (P STP)) x (Pa / Ta)	-	-
P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta)	-	-

Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	-	Pa	>5 Pa	N/A	EN16911:2013
Lowest Gas Velocity	-	m/s	-	N/A	-
Highest Gas Velocity	-	m/s	-	N/A	-
Ratio of Above	-	:1	<3:1	N/A	EN16911:2013
Mean Velocity	-	m/s	-	N/A	-
Angle of flow with regard to duct axis	-	degrees	< 15	N/A	EN16911:2013
No local negative flow	-	-	-	N/A	-
Homogeneous flow stream/gas velocity	-	-	-	N/A	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP) / Density)	-
Where	
Kpt = Pitot tube calibration coefficient	-
Compressibility correction factor, assumed at a constant 0.998	0.998

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flow Rate (Actual)	$m^3.h^{-1}$	-
Gas Volumetric Flow Rate (STP, Wet)	$m^3. h^{-1}$	-
Gas Volumetric Flowrate (STP, Dry)	$m^3. h^{-1}$	-
Gas Volumetric Flowrate REF to Oxygen	$m^3. h^{-1}$	-

IV. Appendix III Individual parameter sampling details and results

Total Sulphur Sampling Details & Results

Stack ID	Inlet	**Run 1**
Sample ID	CO TS	**mls**
Impinger 1 ID	COTS 1+2	120
Impinger 2 ID	-	-
Impinger 3 ID	CO TS 3	130
Time on	12:35	
Time off	13:05	
Leak Check Results		
Prior to test:	0.01	l/min
Post Test:	0.01	l/min
Sample Volume Flow Rate:	1.1	l/min
Standard Requirement:	<2	%
Test Result:	0	%
Test Status	Pass	
Calibration Details		
Pump Number:	-	
Calibration Unit:	ASLTM15EQ505	
Calibration Rate Before Test:	1.2	litres per minute
Calibration Rate After Test:	1.1	litres per minute
Average sample Volume:	1.1	litres per minute
Sample Test Time:	30	minutes
Pump Gas Temperature:	0	^{O}C
Pump Sample Pressure:	101.3	kPa
Actual Sample Volume:	0.03300	m^3
Normalised Gas Volume:	0.03300	Nm^3

Total Sulphur Quality Assurance

Stack ID	Inlet	-
Date	30/11/2017	-
Start time	-	12:35:00
Finish Time	-	13:05:00
	Units	**Run 1**
Leak test results		
Mean Sampling Rate	l/min	1.1
Pre-sampling leak rate	l/min	0.01
Post-sampling leak rate	l/min	0.01
Leak rate	l/min	0
Acceptable leak rate (<2%)	Y/N	Yes
Filtration		
Filter Material	-	N/A
Filter Size	mm	N/A
Max. Filter Temp	degrees	N/A
Absorbers Type	Glass/PTFE/ Other	PTFE
Absorption Solution	-	H2O2
Absorption Efficiency		
Total Imp1 + Imp 2 + Imp 3	ug	12500
Impinger 3	ug	6500
Absorption efficiency	%	48
Acceptable Absorption Eff.	>95% (Y/N)	N
Blank sample		
Blank sample ID	-	CO TSB
Blank result	mg/m^3	<212
Acceptable Blank	<10% ELV (Y/N)	Y
Testing laboratory		
Laboratory Name	-	UKAS1549
Test certificate Number	-	702197

Total Sulphur Results & Measurement Uncertainty

Stack ID	Inlet	**Run 1**
Date	-	
Start time	12:35	
Finish Time	13:05	
Results		
Laboratory Result	<12500	µg/ml
Impinger final Volume	250	ml
Concentration	12.50	mg
Sample Volume	0.033	Nm^3
Emissions Concentration	<378.79	$mg.m^{-3}$
Mass Emissions	-	$kg.h^{-1}$

	Units	**Run 1**
	Units	Run 1
Parameter		
Combined Uncertainty	$mg.m^{-3}$	0.001
Expanded uncertainty as percentage of measured value	% of measured value	6.91
Expanded uncertainty in units of measurement	$mg.m^{-3}$	0.002
Expanded uncertainty as percentage of limit value	% Of ELV	-

APPENDIX 6

TOPOGRAPHICAL SURVEY

Output Format:
==========
DWG_35_LEVEL

Output File:
==========
V_00_25310612_00000001.DWG

Map Series:
==========
1:2500

1616-D
REVISION DATE = 14-Feb-2014
SURVEY DATE = 30-Nov-2001

1:5000

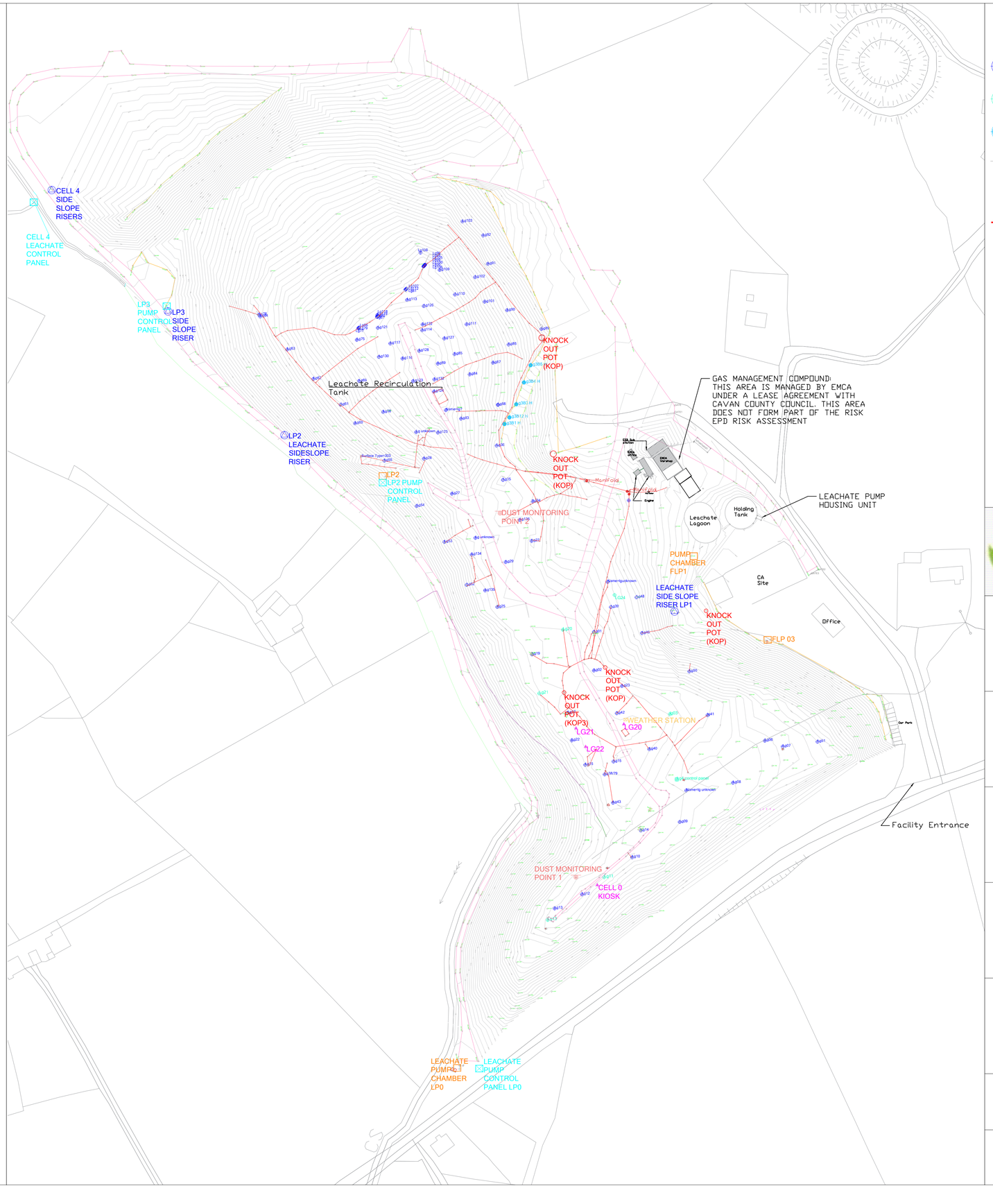
1617
REVISION DATE = 14-Feb-2014
SURVEY DATE = 31-Jul-2000

Clip Extent:
==========
LLX,LLY = 643896,807373
LRX,LRY = 644471,807373
ULX,ULY = 643896,808296
URX,URY = 644471,808296

Projection:
==========
ITM

ITM Centre Point Co-ordinate:
==========
X,Y = 644184,807834

Extraction Date:
==========
17-Oct-2017



Legend:

- Lg00 Landfill Gas Well
- Lg00 Leachate Well
- Lg00 Horizontal Gas Well
- 123.994 Spot Level
- Infrastructure
- Pipe Network
- Leachate Riser
- Dust Monitoring Point
- Pump Chamber
- Knock Out Pot
- Control Panel
- Manifold

enviroguide consulting

Project Name:
Topographical Survey
Corranure Landfill

Client:
Cavan County Council

Facility Address:
Corranure Landfill
Cootehill Road,
County Cavan

Drawing Detail:
Locations of potential explosive atmospheres

Drawing Reference:
Drawing Number CL01

Scale:
1:1250 @ A1

Date:
28/11/17

Easting	Northing	Elevation	ID
644139.818	807991.606	129.888	LG114
644140.1	807994.999	129.617	LG122
644113.561	808000.409	128.346	LG118
644183.669	807923.723	123.965	LG36
644184.41	807947.783	124.104	LG88
644181.45	807972.506	125.297	LG87
644190.7	807983.174	122.487	LG86
644165.996	807995.084	127.148	LG111
644159.143	808012.618	126.591	LG110
644150.151	808027.061	126.176	LG109
644171.015	808022.828	122.132	LG102
644178.508	808030.668	118.232	LG91
644175.671	808047.329	116.224	LG92
644163.561	808055.635	117.252	LG103
644176.623	808008.387	122.596	LG101
644189.832	808003.386	120.174	LG90
644158.893	807977.534	128.913	LG85
644152.872	807986.789	129.379	LG127
644140.821	808005.793	129.047	LG126
644130.962	808009.394	128.367	LG113
644162.731	807939.574	129.595	LG83
644184.516	807947.73	124.032	LG88
644191.225	807940.288	122.294	LG3B12 H
644188.292	807936.411	122.554	LG3B1 H
644195.201	807948.055	121.411	LG3B3 H
644199.755	807960.893	119.928	LG3B4 H
644203.688	807971.005	118.627	LG3B5 H
644210.054	807992.363	116.504	LG89
644149.045	807971.98	130.316	LG89
644138.012	807979.454	130.92	LG128
644146.791	807955.509	131.319	LG124
644147.037	807962.669	131.158	LG132
644167.777	807965.631	127.872	LG84
644141.615	808030.232	127.141	LG96
644141.456	808030.091	127.196	LG98
644141.298	808029.927	127.183	LG105
644141.19	808029.69	127.204	LG99
644140.9	808029.415	127.208	LG100
644140.757	808029.242	127.243	LG106
644140.614	808029.129	127.257	LG95
644138.88	808037.251	126.094	LG108
644129.979	808015.489	127.824	LG81
644130.288	808015.72	127.846	LG112
644130.639	808016.125	127.854	LG107
644113.562	808000.63	128.282	LG118
644113.89	807999.881	128.361	LG119
644113.354	807999.651	128.33	LG80
644113.252	807999.538	128.353	LG67
644102.729	807993.255	128.362	LG66
644102.604	807992.89	128.397	LG79
644102.215	807992.708	128.344	LG77
644044.571	807999.666	118.575	LG64
644043.805	808000.76	118.626	LG78
644060.447	807980.281	119.997	LG63
644075.861	807962.997	121.087	LG62
644091.91	807947.776	121.872	LG61
644100.336	807936.843	122.162	LG60
644113.751	807993.008	129.002	LG121
644101.388	807985.938	128.042	LG75
644121.095	807983.83	129.419	LG117
644128.275	807974.948	129.711	LG116
644114.381	807975.939	129.02	LG130
644134.486	807961.615	130.273	LG123
644116.901	807943.522	126.106	LG68
644136.308	807931.678	127.333	lg?
644149.104	807931.408	128.482	LG125
644140.839	807916.101	125.068	LG28
644117.608	807914.902	120.573	LG55
644213.723	807644.664	124.118	lg13
644217.835	807651.454	124.154	lg13 not kiosk
644233.913	807659.707	124.963	lg12
644246.979	807669.834	124.509	lg11
644263.409	807681.51	124.051	lg10
644268.557	807697.353	123.659	lg14
644291.442	807702.306	123.513	lg09
644260.898	807896.979	117.052	manifold
644261.415	807891.523	117.126	cell0&1
644223.387	807778.551	124.459	kop\3
644372.515	807749.531	120.026	lg51
644307.799	807765.186	123.565	lg41
644289.744	807727.428	123.363	lg4 control panel
644295.292	807720.859	123.45	lg?
644322.752	807725.402	122.587	lg08
644352.061	807746.699	121.242	lg07
644341.53	807750.136	121.733	lg06
644252.176	807713.641	124.512	lg43
644247.252	807730.313	124.924	lg38/79
644252.468	807737.888	125.507	lg15
644235.828	807735.931	124.021	lg16
644227.847	807750.284	124.178	lg22
644225.535	807766.517	124.45	lg17
644208.724	807777.995	123.939	lg21
644204.519	807800.926	124.072	lg19
644184.101	807828.813	124.542	lg25
644254.37	807766.259	125.265	lg42
644273.515	807745.113	125.024	lg40
644285.588	807765.718	124.976	lg03
644297.065	807790.89	120.517	lg50
644269.189	807813.431	119.847	lg?
644266.005	807834.495	119.567	lg48
644249.013	807843.545	121.123	lg?
644250.93	807828.716	121.533	lg39
644240.898	807814.082	123.168	lg01
644240.914	807791.434	124.277	lg02
644257.418	807782.299	124.838	lg23
644222.671	807815.381	124.518	lg20
644168.975	807859.586	124.358	lg134
644166.046	807841.811	121.955	lg52
644176.892	807838.562	123.893	lg135
644157.339	807895.416	124.071	lg27
644136.633	807888.207	120.427	lg54
644152.934	807867.061	121.195	lg53
644171.184	807869.445	124.549	lg?
644187.412	807903.532	122.957	lg35
644204.924	807890.957	122.623	lg34
644197.324	807879.996	124.263	lg136
644204.238	807867.633	122.824	lg27
644188.995	807855.202	124.844	lg29
644102.621	807961.675	125.675	lg69
644153.814	807944.572	131.395	lg?