Comhairle Cathrach na Gaillimhe
Galway City Council

Halla na Cathrach
Bóthar an Choláiste
Gaillimh
H91 X4K8

City Hall
College Road
Galway
H91 X4K8

02nd May 2017.

To: AER Returns Team, Environmental Protection Agency.

Re: Annual Environment Report 2016 for Carrowbrowne Landfill Facility.
Waste Licence Reference Number W0013-01.

A Chara,

I attach herewith Annual Environmental Report 2016 for Carrowbrowne Landfill Facility.

We recently had changes in staff and I apologise for the delay in submitting same.

You will note from the report that significant works were undertaken last year and that further works are planned for this year.

Please note that I am available to discuss any items contained in this report should you wish.

Mise le meas,

Damien Redington

Mr. Damien Redington,
Executive Engineer,
Environment & Climate Change Directorate


# Annual Environmental Report 2016 for Carrowbrowne Landfill facility.

## Waste License Reference no. W0013-01

*Prepared By:*
*Damien Redington,*
*Executive Engineer – Environment Section*
*Galway City Council.*

Report Contents:

## 1.0 Introduction

Galway City Council was granted a Waste Licence - Landfill for Inert Waste (W0013-01) for Carrowbrowne landfill site on 28th August 2003, which was subsequently amended on 15th January, 2013. The Licence sets out in detail the conditions under which Galway City Council is allowed to operate and manage this facility.

The Licence is for the restoration of the landfill at Carrowbrowne, Headford Rd., Galway. This landfill facility has been closed (and no landfill waste has been accepted) since approx. 1999. Galway City Council is only permitted to accept inert waste for the purposes of restoration of this facility. Activities on site consist of the collection and management of leachate generated from the historical landfilling activities and the management of landfill gas on site.

The Licence also provides for the acceptance of waste at a Civic Amenity facility and the development of composting operations at the facility. The civic amenity site and composting facilities are closed (and no waste has been accepted) since 31st December 2013.

This Annual Environmental Report (AER) is drafted in line with the content requirements as set out under schedule G of the License

## 2.0 Policy

Galway City Council is committed to meeting all conditions as set out in the Licence.

## 3.0 Reporting Period

January 2016 - December 2016

## 4.0 Waste Activities carried out at the facility

No waste was accepted at the landfill facility during the reporting period.

No waste was accepted in the civic amenity or composting facilities during the reporting period, as the acceptance of waste ceased following Galway City Council's cessation of the direct provision of a household waste collection service on 31st December 2013.

The waste accepted up to this date (31st December 2013) was processed in line with License requirements. Contaminants from the material processed at the facility were mechanically removed from the material and dispatched to suitably licensed facilities. All compost produced at the composting facility was utilised to enrich and enhance the topsoil layer of the remediated landfill site contained within the license.

## 5.0 Quantity and Composition of waste accepted, disposed and recovered during the reporting period and each previous year

No waste was accepted at the facility during the reporting period.

Waste emanating from the composting process was issued to Barna recycling in previous reporting periods (see table below). The waste consists of items that are contained in the organic waste accepted but that are not compostable and are therefore removed manually and mechanically as part of the composting process. This waste is categorised as household waste, EWC 20 03 01.

| | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|
| Waste In (Tonnes) | 2429 | 0 | 0 | 0 |
| Waste Out (Tonnes) | 743 | 936 | 0 | 0 |
| Recovered (Tonnes) | 1686 | 0 | 0 | 0 |

## 6.0. Summary report on emissions

Condition 6 of the license details the requirements for the facility with regard to emissions with the emission limit values outlined in Schedule C of the license.

### 6.1 Noise Emissions

Schedule C Section C.1 details the emission limit values (ELV) for noise, as follows:

| Day dB(A)$L_{AEQ}$(30 minutes) | Night dB(A)$L_{AEQ}$(30 minutes) |
|---|---|
| 55 | 45 |

An annual noise survey at the facility was not carried out in the reporting period as the landfill or composting site is no longer in operation. As per previous reporting periods location (N5) was found to be in excess of the ELV as set out. The survey stated that: 'there was no audible noise from the landfill site. All noise recorded at this location was generated from passing traffic on the N84 Headford Rd'. Limits are been exceeded due to traffic on the nearby road rather than the site itself.

### 6.2 Landfill Gas Concentration Limits

Schedule C Section C.2 details the landfill gas concentration limits (measured in any building on or adjacent to the facility), as follows:

| Methane | Carbon Dioxide |
|---|---|
| 20% LEL (1% v/v) | 1.5% v/v |

An alarm with the limits as outlined is in place in the composting facility office. There were no exceedances during the reporting period.

### 6.3 Dust Deposition Limits

Schedule C Section C.3 details the dust deposition limits, as follows:

| Level ($mg/m^2/day$) |
|---|
| 350 |

The dust deposition at the facility is assessed at 4 no. locations (D1-D4) on three occasions in the reporting period of 2016. Results are on the table below:

| Locations | Feb – March ($mg/m^2/day$) | May– June ($mg/m^2/day$) | Aug – Sept ($mg/m^2/day$) |
|---|---|---|---|
| D1 | 31.01 | 48.89 | 137.5 |
| D2 | 64.93 | 204.6 | 479.5 |
| D3 | 91.09 | 78.12 | 569.8 |
| D4 | 97.88 | 91.94 | 310.2 |

Monitoring points D2 & D3 exceeded the limit during the period of August – September 2016.

D2 & D3 are located adjacent to the composting maturation and final storage area of the facility. Galway City Council will discuss these findings further with the service provider as they may be due to infiltration issues.

It is noted that exceedences did not occur in any of the 4 locations in the two initial rounds of sampling in the reporting period.

### 6.4 Surface water

Schedule C Section C.4 details the surface water discharge limits, as follows:

| Parameter | Emission Limit Value (mg/l) |
|---|---|
| Mineral Oils | 5 |

Surface Water discharges at the Carrowbrowne facility are not relevant as it is closed.

### 6.5 Emission Limits for Enclosed Landfill Gas Flare Unit/Utilisation Plant

Schedule C Section C5 details the Emission Limit Values for Enclosed Landfill Gas Flare, as follows:

| Parameter | ELV ($mg/m^3$) Limit | ELV ($mg/m^3$) Measured |
|---|---|---|
| Nitrogen Oxides | 150 | 33 |
| CO | 50 | 15 |
| Particulates | 130 | 56.96 |
| Hydrogen Chlorides | 50 | 7.75 |
| Hydrogen Flouride | 5 | <0.09 |

The analysis of the emissions from the Flare stack outlet has been completed and no emission limit has been exceeded.

### 6.6 Emission Limits Values for Composting Process

Schedule C Section C6 details the Emission Limit Values for Composting Process, as follows:

| Parameter | ELV ($mg/m^3$) |
|---|---|
| Ammonia | 50 |
| Hydrogen Sulphide | 5 |
| Mercaptans | 5 |

The composting facility was not in operation during the reporting period of 2016. It has been completely closed down with all materials removed by the end of the reporting period of 2015.

The composting facility when operational comprised of 2 no. Biofilters which were monitored quarterly as per the license requirements (Table D.2.3). The bed media and odour are visually inspected daily by facility staff as required. Both filters were monitored quarterly as per the license requirements.

A summary of the findings are detailed below for final readings for the reporting period of 2015 before decommission of same:

| Bed Media | Q1 (24/03/'15) | | Q2(04/06/'15) | | Q3(23/09/'15) | | Q4 (18/11/'15) | |
|---|---|---|---|---|---|---|---|---|
| | Reception filter | ASP filter | Reception filter | ASP filter | Reception filter | ASP filter | Reception filter | ASP filter |
| pH | 5.1 | 4.0 | 4.4 | 5.7 | 4.1 | 5.0 | 4.4 | 6.0 |
| Ammonia Mg/Kg of N | 6.31 | 8.82 | 4.17 | 4.08 | 8.1 | 9.13 | 6.62 | 6.62 |
| TVC | 5,800 | 19,400 | 240,000 | 430,000 | 930,000 | 3,600,000 | 750,000 | 256,000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| @22C/72H | | | | | | | | |
| TVC @37C/48H | 4,400 | 1,250 | 102,000 | 5,200 | 100,000 | 46,000 | 128,000 | 7,000 |

| Inlet and outlet gas | Q1 (24/03/'15) | | | | Q2(04/06/'15) | | | | Q3(23/09/'15) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rec in | Rec out | Asp in | Asp out | Rec in | Rec out | Asp in | Asp out | Rec in | Rec out | Asp in | Asp out |
| Ammonia ppm | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Hydrogen Sulphidepm | <.2 | <.2 | <.2 | <.2 | <.2 | <.2 | <.2 | <.2 | <.2 | <.2 | <.2 | <.2 |
| Mercaptans ppm | <.5 | <.5 | <.05 | <.5 | <.5 | <.5 | <.05 | <.5 | <.5 | <.5 | <.5 | <.5 |

The results indicate no exceedances of the ELV's.

## 7.0 Summary of results and interpretation of environmental monitoring

The licence requires that monitoring of surface water, ground water and leachate is carried out at Carrowbrowne in line with Table D.4.4. of the licence.

### 7.1 Surface Water Monitoring

#### 7.1.1 Surface Water – Quarterly Monitoring

As per Table D4.4 Monitoring is required Quarterly for the following parameters:

- Ammoniacal Nitrogen
- BOD (mg/l $O_2$)
- COD (mg/l $O_2$)
- Chloride (mg/l Cl)
- Dissolved Oxygen (% Saturation)
- Electrical Conductivity (µS/cm)
- pH
- Total Suspended Solids (mg/l)
- Temperature (°C)

Monitoring took place at 7 locations: G12s, G21s, G22s, G23s ,G24s,G37s and G38s.

Quarterly monitoring was undertaken in: Q1 on 17th February, Q2 on 6th May, Q3 on 26th August and Q4 on 15th December in the monitoring period of 2016.

The tables below summarises the results:

| Parameter | Q | G12s | G21s | G22s | G23s | G24s | G37s | G38s |
|---|---|---|---|---|---|---|---|---|
| Ammoniacal Nitrogen (mg/l N) | 1 | 0.083 | 0.077 | 0.523 | 0.016 | 1.94 | 0.99 | 0.088 |
| | 2 | 5.63 | 0.026 | 0.072 | <0.01 | 0.674 | 2.14 | <0.01 |
| | 3 | 1.61 | 0.049 | 0.353 | 0.036 | 1.22 | 1.42 | 1.40 |
| | 4 | 2.23 | 0.246 | 0.62 | <0.01 | 0.97 | 1.80 | <0.01 |
| BOD (mg/l $O_2$) | 1 | <2 | <2 | <2 | 4 | 12 | 19 | 10 |
| | 2 | <2 | 6 | <2 | <2 | <2 | <2 | <2 |
| | 3 | 12 | 41 | 14 | 25 | 45 | 20 | 21 |
| | 4 | <2 | 28 | <2 | <2 | 20 | <2 | 8 |
| Chloride (mg/l Cl) | 1 | 24.09 | 24.39 | 27.27 | 23.55 | 27.34 | 27.49 | 24.18 |
| | 2 | 26.88 | 23.93 | 23.69 | 26.12 | 26.24 | 22.78 | 27.92 |
| | 3 | 26.89 | 22.18 | 21.94 | 19.18 | 23.13 | 21.34 | 21.58 |
| | 4 | 34.44 | 24.52 | 22.28 | 19.82 | 24.49 | 23.39 | 18.68 |
| COD (mg/l $O_2$) | 1 | 34 | 35 | 62 | 42 | 95 | 53 | 33 |
| | 2 | 48 | 69 | 39 | 41 | 46 | 57 | 51 |
| | 3 | 44 | 43 | 50 | 76 | 51 | 62 | 58 |
| | 4 | 30 | 34 | 46 | 45 | 51 | 45 | 73 |
| Electrical Conductivity (µS/cm) | 1 | 454 | 452 | 267 | 171.2 | 570 | 178.3 | 456 |
| | 2 | 678 | 556 | 533 | 181.3 | 511 | 422 | 99.5 |
| | 3 | 595 | 52 | 458 | 148 | 489 | 271 | 281 |
| | 4 | 612 | 580 | 523 | 163.2 | 556 | 482 | 108 |
| Dissolved Oxygen (% Saturation) | 1 | 38.7 | 34.1 | 31.8 | 59.3 | 44.3 | 35.7 | 29.3 |
| | 2 | 48.7 | 51.6 | 65.1 | 55.2 | 63.7 | 58.0 | 57.3 |
| | 3 | 99 | 104.0 | 106.0 | 101.0 | 95.0 | 105.0 | 108.0 |
| | 4 | 27.6 | 15.6 | 28.8 | 41.8 | 25.4 | 29.5 | 45.1 |
| pH | 1 | 7.1 | 7.2 | 7.0 | 7.5 | 7.2 | 7.0 | 7.0 |
| | 2 | 7.5 | 7.5 | 7.6 | 7.7 | 7.7 | 7.5 | 7.4 |
| | 3 | 7.0 | 7.1 | 7.1 | 7.2 | 7.0 | 7.1 | 7.2 |
| | 4 | 7.3 | 7.2 | 7.3 | 7.2 | 7.3 | 7.4 | 7.1 |
| Suspended Solids (mg/l) | 1 | 3 | <2 | <2 | 3 | 38 | 4 | 4 |
| | 2 | 22 | 21 | 5 | 12 | 11 | 6 | 8 |
| | 3 | <2 | 62 | 7 | 44 | 13 | 2 | 7 |
| | 4 | <2 | 8 | <2 | <2 | 6 | <2 | 13 |
| Temperature (°C) | 1 | 3.9 | 4.1 | 3.7 | 10.8 | 11.4 | 2.7 | 3.4 |
| | 2 | 14.1 | 13.1 | 14.6 | 14.8 | 13.8 | 14.5 | 14.7 |
| | 3 | 15.8 | 15.5 | 15.3 | 16.1 | 15.7 | 15.2 | 15.9 |
| | 4 | 9.6 | 10.7 | 10.2 | 9.5 | 10.1 | 9.9 | 9.5 |

**Table: Results of Quarterly Monitoring of Surface Waters**

The results show the following:

•Ammonia levels at G12s in Q2 & Q4 were outside the levels as outlined in the EPA parameters of water quality document for A3 waters.

•BOD levels were exceeded in 11 samples during the reporting period with all other test results within the limits as outlined in the reference document.
•Chlorine levels were within acceptable parameters in all quarterly samples.
•COD levels were exceeded in 22 samples during the reporting period with all other test results within the limits as outlined in the reference document.
•Conductivity levels were within acceptable parameters in all quarterly samples.
•Dissolved oxygen levels were exceeded in all monitoring points in Q4.
•All pH levels are all within the parameters for A1 waters (5.5-8.5)
•Suspended solids levels were exceeded in 1 samples taken. All other levels were below the 50mg/l limit for A1 waters.
•All Temperature samples were below the 25 °C limit set for A3 waters.

### 7.1.2 Surface Water – Annual Monitoring

Monitoring took place at 7 locations: G12s, G21s, G22s,G23s ,G24s,G37s and G38s for the following parameters:

•Sulphate (mg/l $SO_4$)
•Total Alkalinity (mg/l $CaCO_3$)
•Total Phosphorous/orthophosphate (mg/l P)
•Total Oxidised Nitrogen (mg/l N)
•Metals and non-metals
•Mercury (µg/l)
•Biological Assessment

The monitoring was carried out on 26th August 2016 and the results are on the table below:

| Parameter (mg/L unless stated) | Units | location | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | G12s | G21s | G22s | G23s | G24s | G37s | G38s | Env quality standard |
| Alkalinity | Mg/L CaCO3 | 265.54 | 258.2 | 227.35 | 58.34 | 238.95 | 21.81 | 22.56 | Not specified |
| Boron | µ g/L | | <5.51 | | | <5.51 | | | Not specified |
| Cadmium | µ g/L | | <0.01 | | | <0.01 | | | 0.08 |
| Calcium | mg/L | | 95.72 | | | 82.11 | | | Not specified |
| Chromium | µ g/L | | 0.795 | | | 1.714 | | | 0.6 |
| Copper | µ g/L | | <0.21 | | | <0.21 | | | 5 |
| Iron | µ g/L | | 175.8 | | | 221.5 | | | Not specified |
| Lead | µ g/L | | 1.181 | | | <0.02 | | | 7.2 |
| Magnesium | mg/L | | 4.607 | | | 3.691 | | | Not specified |
| Manganese | µ g/L | | 26.36 | | | 11.45 | | | Not specified |
| Mercury | µ g/L | 0.107 | 0.177 | 0.483 | <0.03 | <0.03 | <0.03 | 0.043 | 0.05 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nickel | µ g/L | | 1.363 | | | 1.188 | | | 20 |
| Total oxidised Nitrogen | mg/L as N | 0.25 | 0.12 | 0.38 | <0.07 | 0.12 | <0.07 | <0.07 | Not specified |
| Phosphate (ortho) | mg/L as P | 0.14 | 0.039 | 0.019 | 0.007 | 0.025 | 0.014 | 0.009 | 0.035 |
| Potassium | mg/L | | 3.232 | | | 2.382 | | | Not specified |
| Sodium | µ g/L | | 10.77 | | | 9.517 | | | Not specified |
| Sulphate | mg/L | 56.95 | 34.85 | 16.52 | <0.72 | 30.85 | <0.72 | <0.72 | Not specified |
| Zinc | µ g/L | | 27.22 | | | 12.63 | | | 40 |

**Table: Results of Annual Monitoring of Surface Waters**

The results of the monitoring are:

- Levels of Mercury and Phosphate exceeded parameters at Location G12s
- Levels of Chromium, Mercury and Phosphate exceeded paramaters at Location G21s.
- Levels of mercury exceeded parameters at Locations G22s.
- All other parameters were within the guidance levels.

## 7.2 Ground Water Monitoring

### 7.2.1 Ground Water – Quarterly Monitoring

There are 12 sampling locations: G1A, G1AP, G4AP, G9AP, G10AP 108A, G108AP, G1A, G2A, G4A, G10A, 105A, 106A and 116A.

The above locations are monitored for the following parameters:

- Visual inspection/odour
- groundwater level
- Ammoniacal Nitrogen (mg/l N)
- Chloride (mg/l Cl)
- Electrical Conductivity (µS/cm)
- pH
- Total Organic Carbon

Quarterly monitoring took place on: 22nd March, 7th June, 26th August and 15th December in the monitoring period of 2016.

The monitoring results are shown on the table below:

| Parameter | Quarter | Locations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | G1A | G1AP | G4A | G4AP | G9AP | 108A | G108AP | G10AP |
| Visual inspection/ odour | 1 | ok | ok | ok | ok | ok | Well dry | Well Dry | ok |
| | 2 | ok | ok | ok | ok | ok | ok | ok | Well Dry |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | ok | ok | ok | ok | ok | ok | ok | Well Dry |
| | 4 | ok | ok | ok | ok | ok | ok | ok | Well Dry |
| Static Water level (m) | 1 | 0.7 | 1.4 | 1.35 | 1.0 | 1.3 | 2.5 | 1.8 | - |
| | 2 | 0.8 | 1.5 | 1.45 | 1.25 | 1.5 | 0.9 | 1.8 | - |
| | 3 | 0.85 | 1.5 | 1.1 | 1.3 | 1.65 | 1.75 | 2.25 | - |
| | 4 | 1.0 | 1.4 | 1.35 | 1.1 | 1.4 | 2.2 | 1.8 | - |
| Electrical Conductivity (µS/cm) | 1 | 629 | 890 | 757 | 826 | 799 | 670 | 597 | - |
| | 2 | 626 | 867 | 708 | 887 | 1255 | 724 | 627 | - |
| | 3 | 623 | 825 | 752 | 691 | 1081 | 562 | 787 | - |
| | 4 | 625 | 873 | 690 | 1209 | 709 | 506 | 764 | - |
| pH | 1 | 7.1 | 6.9 | 7.0 | 6.9 | 7.2 | 7.6 | 7.2 | - |
| | 2 | 7 | 6.6 | 7 | 6.7 | 6.9 | 6.7 | 7.2 | - |
| | 3 | 7 | 6.3 | 6.5 | 6.6 | 6.9 | 7 | 7 | - |
| | 4 | 6.9 | 6.8 | 7.0 | 7.9 | 7.3 | 7.1 | 7.0 | - |
| Ammoniacal Nitrogen (mg/l N) | 1 | 4.52 | 7.79 | 13.98 | 0.098 | 12.90 | <0.01 | 4.5 | - |
| | 2 | 3.6 | 7.58 | 11.37 | 0.745 | 44.36 | 3.57 | 6.99 | - |
| | 3 | 3.76 | 7.70 | 7.17 | 11.05 | 39.82 | 5.89 | 1.41 | - |
| | 4 | 3.6 | 7.39 | 10.22 | 0.241 | 12.28 | 3.59 | 0.295 | - |
| Chloride (mg/l Cl) | 1 | 20.45 | 25.16 | 35.87 | 22.11 | 62.69 | 42.33 | 26.77 | - |
| | 2 | 20.28 | 25.17 | 29.6 | 22.31 | 89.51 | 21.4 | 26.07 | - |
| | 3 | 21.21 | 24.33 | 25.49 | 27.73 | 71.75 | 26.65 | 18.44 | - |
| | 4 | 20.39 | 25.14 | 27.68 | 19.06 | 44.39 | 22.48 | 10.06 | - |
| Total Organic Carbon (mg/l) | 1 | 7.97 | 82.48 | 7.48 | 13.50 | 5.0 | 0.94 | 12.68 | - |
| | 2 | 8.16 | 79.82 | 5.01 | 16.93 | 20.99 | 10.09 | 12.02 | - |
| | 3 | 6.64 | 92.74 | 12.04 | 4.02 | 50.30 | 15.04 | 23.58 | - |
| | 4 | 9.02 | 83.51 | 4.26 | 14.75 | 11.85 | 11.34 | 8.53 | - |

**Table: Results of Quarterly Monitoring of Ground Waters**

The above tabular results show:

•Ammonia levels are above the limit as outlined in the reference document *Reference document EPA Interim report 'towards setting guideline values for the protection of groundwater in ireland' whereby they exceed the Guidance Threshold Value (GTV) of 0.136 mg/L, except well 108A in Q1.*

•Monitoring wells G4A, G9AP, 108A in Q1 exceeded limit for Chlorine.

•Electrical conductivity results were within the GTV value set in the above reference document

•pH levels of all samples were within the range detailed in the reference document

•There is no GTV stated for Total Organic Carbon in the reference document. In the main there is no obvious abnormal change in the results obtained during the reporting period.

### 7.2.2 Ground Water – Annual Monitoring

Monitoring took place at 7 locations: G4A, G4AP, G9AP, G1A , G1AP, G108A and G108AP for the following parameters:

- Cyanide (mg/l CN)
- Fluoride (mg/l F)
- Sulphate (mg/l $SO_4$)
- Total Alkalinity (mg/l $CaCO_3$)
- Ortho-Phosphate (mg/l P)
- Total Oxidised Nitrogen (mg/l N)
- Faecal Coliforms (No. /100ml)
- Total Coliforms (No./100ml)
- Metals and non metals
- Mercury (µg/l Hg)
- List I and List II organic substances

The monitoring was carried out on 26th August 2016 and the results are on the table below:

| Parameter | Units | location | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | G4A | G4AP | G9AP | G1A | G1AP | G108A | G108AP | threshold |
| Boron | µ g/L | <4.33 | | 400.9 | | <4.33 | | | 750 |
| Cadmium | µ g/L | <0.09 | | <0.09 | | <0.09 | | | 3.75 |
| Calcium | Mg/L | 277 | | 94.54 | | 129.5 | | | |
| Chromium | µ g/L | <2.14 | | <2.14 | | 4.19 | | | 37.5 |
| Faecal coliforms | Cfu/100ml | 20 | <10 | <10 | <10 | <10 | 620000 | 750 | Not specified |
| Total Coliforms | Cfu/100ml | 60 | <10 | 20 | <10 | <10 | 810000 | 9500 | Not specified |
| Copper | µ g/L | <0.11 | | <0.11 | | <0.11 | | | 1500 |
| Cyanide | µ g/L | <5 | <5 | <5 | <5 | <5 | <5 | <5 | 37.5 |
| Flouride | Mg/L | 0.39 | 0.85 | 0.76 | 0.56 | 0.45 | 0.52 | 0.52 | Not specified |
| Iron | µ g/L | 21840 | | 4418 | | 18570 | | | Not specified |
| Lead | µ g/L | <0.02 | | 0.487 | | <0.02 | | | 18.75 |
| Magnesium | Mg/L | 5.42 | | 16.49 | | 8.076 | | | Not specified |
| Manganese | µ g/L | 974.8 | | 172.8 | | 1921 | | | Not specified |
| Mercury | µ g/L | <0.04 | <0.04 | <0.04 | 0.051 | <0.04 | <0.04 | 0.09 | .75 |
| Nickel | µ g/L | 3.011 | | 1.03 | | 5.095 | | | 15 |
| Total oxidised Nitrogen | Mg/L as N | <0.28 | <0.28 | 0.47 | <0.28 | <0.028 | <0.28 | <0.28 | Not specified |
| Total Alkalinity | Mg/L CaCO3 | 432.75 | 356.6 | 535.06 | 329.64 | 482.72 | 298.85 | 429.82 | Not specified |
| Phosphate (ortho) | Mg/L as P | <0.005 | <0.005 | 0.063 | 0.03 | 0.243 | <0.005 | <0.005 | 35 |
| Potassium | Mg/L | 2.624 | | 36.38 | | 7.644 | | | Not specified |
| Semi volotile organic compounds | µ g/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | Not specified |
| Sodium | Mg/L | 14.43 | | 56.46 | | 64.89 | | | 150 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sulphate | Mg/L | <0.75 | <0.75 | <0.75 | <0.75 | 1.62 | <0.75 | 23.75 | 187.5 |
| Temperature on site | Degree C | 9.5 | 9.4 | 9.2 | 9.3 | 9.6 | 9.3 | 9.2 | Not specified |
| VOCs | µ g/L | <5 | <5 | <5 | <5 | <5 | <5 | <5 | Not specified |
| Water level | m | 1.1 | 1.3 | 1.65 | 0.85 | 1.5 | 1.75 | 2.25 | Not specified |
| Zinc | µ g/L | 3.105 | | 15.99 | | 1.981 | | | Not specified |

**Table: Results of Annual Monitoring of Ground Water**

All parameters were analysed and compared against the threshold values as set out in the european communities environmental objectives (ground waters) regulations 2009. All parameters were found to be within these limits.

### 7.3 Leachate Monitoring

It was agreed with the agency in 2007/2008 that the monitoring of the leachate at locations L1, L3 and L4 entering the leachate treatment system and location L2 exiting the leachate treatment system would be sufficient for the purposes of leachate monitoring and management in accordance with licence no. 13-1. Signs have been installed to clearly identify each inlet pipe and the outlet pipe in this regard.

#### 7.3.2 Leachate – Weekly Monitoring

The level of leachate in the leachate treatment system is required to be monitored weekly. This is recorded via a digital reader on site and also a manual site visual inspection.

#### 7.3.2 Leachate – Quarterly Monitoring & 7.3.3 Leachate – Annual Monitoring

In 2015 the leachate lagoon was by-passed and the leacahate is pumped directly via Rising Main to Mutton Island wastewater treatment plant.

No quarterly or annual monitoring was undertaken as the points were inaccessible.

## 8.0 Resource and energy consumption summary

The fuel source is Gas oil and there are 3 MPRN electricity points on site

Gas Oil used was for the VOLVO Shovel Loader at Composting, which was not operational for the reporting period of 2016, as follows:

| Fuel source | Site | Consumption (KWh) |
|---|---|---|
| Gas oil - SFGO | Carrowbrowne composting facility | 0 |

There are 3 MPRN electricity points on the site; the consumption for the reporting period of 2016 is as follows:

| MPRN | Sites | Consumption (KWh) |
|---|---|---|
| 10010866161 | Carrowbrowne, Leachate Treatment Lagoons | 66, 387 |
| 10018686632 | Carrowbrowne, Compost 1. Foul Water Pumps | 57, 001 |
| 10304176356 | Carrowbrowne, Compost 2. Composting Facility | 20, 900 |
| | Total | 144, 288 |

All electricity data is verifiable through the SEAI Monitoring and Reporting system for which Galway City Council have given EPA shared access to all inputted data.

## 9.0 Volume of leachate produced and volume of leachate transported/discharged off- site

A new flow meter to record leachate quantity was installed on the outlet from the facility on 1st August 2014. Information was provided for August to December for the reporting period of 2014 and the flow for the full year of 2015 and of this reporting period (2016) is as follows:

| Period | Flow ($m^3$) |
|---|---|
| Aug-Dec 2014 | 8,789 $m^3$ |
| Jan-Nov 2015 | 49,447 $m^3$ |
| Jan-Dec 2016 | 50, 836 $m^3$ |

Leachate at the facility is collected and is pumped via a rising main to the waste water treatment plant at Mutton Island for final treatment.

## 10.0 Report on development works undertaken during the reporting period, and a timescale for those proposed during the coming year

In 2015 the leachate lagoon was by-passed and the leacahate is pumped directly via Rising Main to Mutton Island wastewater treatment plant.

This measure was undertaken to ensure there were no overflows at site. This measure is working well.

There has been gradual removal of material from retention lagoon via storm water pump carried out also via outlet pumping station to empty retention lagoon.

The main storm pump was removed, overhauled and replaced in August/Sept. of 2015.

An assessment of the material from the lagoon took place and it was found to be detrimental to pump system due to 'grit like' material.

Galway City Council has also submitted a proposal to EPA for permanent decommissioning of lagoons and further discussion on same is required. Should this be approved Galway City Council will develop an agreed procedure for same.
Galway City Council commenced works upgrading areas around manholes inclusive of identification markers and concrete surrounds due to be complete in 2017.

## 11.0 Report on restoration

The restoration and capping of the landfill was completed in 2009. In 2014 additional compost from the composting facility was spread across parts of the site that were affected by the gas network rehabilitation works to enhance the re growth of grass on site.

No further works were undertaken in the reporting period of 2016.

## 12.0 Site survey showing existing levels of the facility at the end of the reporting period

A topographical survey of the facility was carried out during the reporting period of 2014. The drawing is maintained on the site files.

No further surveys were carried out in 2016.

## 13.0 Estimated annual and cumulative quantities of landfill gas emitted from the facility

Automatic Flare System (AFS) are contracted by Galway City Council to manage and maintain the flare system at the site.

In addition to this, weekly checks/monitoring is undertaken by the Executive Engineer in Galway City Council and the Waste Operations Supervisor visits/is on site generally daily.

The table below was generated by AFS for the purposes of the landfill gas return and for this report for the reporting period of 2016.

| Mont | Method M/C/E | Total runtime hrs/month | Average Inlet Pressure (mbg) | Average Inlet Temp ◦ C | Average Flow Rate ($m^3$/hr) | Average $CH_4$ %v/v | Average $CO_2$ %v/v | Average $O_2$ %v/v | Combustion efficiency (%) | Total $CH_4$ $m^3$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan | M | 360 | -16 | 10 | 240 | 37.50 | 25.40 | 1.20 | 98.0 | 31,752 |
| Feb | M | 276 | -16 | 10 | 175 | 38.30 | 28.10 | 2.60 | 98.0 | 18,129 |
| Mar | M | 264 | -16 | 10 | 237 | 35.70 | 23.70 | 1.70 | 98.0 | 21,890 |
| Apr | M | 348 | -16 | 10 | 218 | 39.10 | 28.50 | 1.00 | 98.0 | 29,070 |
| May | M | 328 | -16 | 10 | 175 | 37.50 | 28.70 | 1.50 | 98.0 | 21,095 |
| Jun | M | 317 | -16 | 10 | 174 | 36.40 | 29.00 | 1.50 | 98.0 | 19,619 |
| July | M | 312 | -16 | 10 | 215 | 35.10 | 27.40 | 2.00 | 98.0 | 23,074 |
| Aug | M | 296 | -26 | 10 | 215 | 42.60 | 28.00 | 2.10 | 98.0 | 26,568 |
| Sep | M | 286 | -23 | 10 | 215 | 33.50 | 26.60 | 2.80 | 98.0 | 20,187 |
| Oct | M | 328 | -25 | 10 | 215 | 43.40 | 28.00 | 2.30 | 98.0 | 29,994 |
| No | M | 286 | -25 | 10 | 205 | 35.10 | 25.00 | 3.40 | 98.0 | 20,168 |
| Dec | M | 296 | -25 | 10 | 205 | 38.70 | 26.20 | 3.40 | 98.0 | 23,013 |
| Total | | 3,697 | | | | | | | | 284,559 |

**Table: Carrowbrowne Annual Environmental Returns Report 2016 (Source AFS)**

Please note that the above figures are approximated figures for the reporting period of 2016 and should be used as a guide only.

## 14.0 Estimated annual and cumulative quantity of indirect emissions to groundwater

Potential sources of indirect emissions to groundwater are leachate and runoff from the landfill capping layer.

### 14.1 Leachate

A leachate containment system is in place at the facility which consists of the following:

•HDPE Cut-off Wall/Liner installed around the perimeter of the landfill, adjacent to the site perimeter road. The liner has been bedded into the marl layer underneath the site

•200mm slotted HDPE Pipe installed inside the cut-off liner to collect leachate from the waste mound. The slotted pipe has been placed at an approximate depth of 2.5m (on top of the marl layer). The collected leachate is then conveyed to the aeration lagoon (see note previously)

•The excavated trench is backfilled with free Draining Material to allow for the ease of collection of runoff water.

The collected leachate is treated in the onsite Leachate Treatment Compound, which consists of surface aeration via 2No. surface aerators in a large leachate lagoon, aeration basin, followed by

settlement in settlement lagoon and final pumping to Mutton Island Wastewater Treatment Facility via wastewater pumping stations. There is also sludge draw-off to a sludge lagoon and sludge recirculation.

This treatment system is currently by-passed with leachate pumped directly to Mutton Island wastewater treatment plant.

### 14.2 Capping Layer

The capping layer in place at Carrowbrowne comprises:

- 100mm topsoil layer
- 300-400mm subsoil layer
- Surface water drainage layer entailing mole drains with a hydraulic conductivity, $k > 1x10^{-4}$ m/s;
- Barrier layer consisting of at least 700mm of compacted clay with a hydraulic conductivity, $k < 1x10^{-9}$ m/s; and,

As the landfill is contained by the provisions as outlined the risk of indirect emissions to ground water is greatly minimised.

## 15.0. Annual water balance calculation and interpretation

The landfill facility has not accepted waste since 1998 and final restoration was completed in 2007 and therefore an annual water balance calculation and interpretation is not necessary for the purposes of this report.

## 16.0 Report on the progress towards achievement of the Environmental Objectives and Targets contained in the previous year's report

| Objective 2016 | Progress 2016 | Result |
|---|---|---|
| Carry out further ground water assessment | Complete and ongoing. | Good |
| Assess and consider removal of lagoon system (based on above) | Ongoing monitoring of facility weekly by Engineer and daily by Supervisor | Good |
| Engage consultants to assess outsourcing composting facility and tender for Expressions of Interest of same. | Consultant has been engaged and further consultation to take place in Q2-3 2016. | Good |

## 17.0 Schedule of environmental Objectives and Targets for the forthcoming year

| Objective 2017 | Target 2017 |
|---|---|
| Continue to improve routine monitoring and maintenance | Quarter 4 of 2017 |
| Complete upgrade of access to monitoring locations. Raise manhole lids, concrete surround, identification markers to same. | Quarter 3 of 2017 |
| Consultation with EPA on the permanent removal of lagoon system | Quarter 3-4 of 2017 |
| Review consultant's assessment on outsourcing composting facility and tender for Expressions of Interest of same. | Quarter 3-4 of 2017 |
| Install upgraded compressor to reduce flare downtime and increase efficiency | Quarter 2 2017 |

## 18.0 Full title and written summary of any procedures developed by the licensee in the year which relates to the facility operation

A full revision of the routine monitoring requirements at the facility was conducted during the reporting period of 2014. This process resulted in revised monitoring arrangements and revised monitoring forms for the facility.

These are completed for the reporting period of 2016 and retained by the licensee for Inspection.

## 19.0 Tank, pipeline and bund testing inspection report.

Visual inspections of the lagoon and fuel bunds on site took place during the reporting period of 2016. No expert reports were generated for same.

A level survey of the leachate lagoon system was undertaken over a 5-day period with inlets and outlets closed in the reporting period of 2014. It was found that the level in the lagoon system remained relatively constant throughout the survey period indicating a sound liner system in place.

No further surveys were undertaken in the current reporting period of 2016.

## 20.0 Reported incidents and complaints summaries

On two occasions the flare shut off due to faults which were reported through the EPA EDEN portal. Further investigation and potential upgrade of same is to be completed in 2017.

## 21.0 Review of nuisance controls

The composting facility was not operational for the reporting period of 2016.

The landfill area of the site is assessed weekly and any additional cleaning that is required is carried out.

A pest control company is contracted to carry out vermin control at the facility. There was no issue with litter, birds, flies, vermin or odour at the facility during the reporting period.

## 22.0 Reports on financial provision made under the license, management and staffing structure for the facility, and a programme for public information

### 22.1 Financial provision

The budgetary allocation for the facility for this (2016) and previous (2015) and (2014) reporting periods: follows:

| Title | 2014 Amount (€) | 2015 Amount (€) | 2016 Amount (€) |
|---|---|---|---|
| Landfill – operation, aftercare and maintenance | 298,299.00 | 58,297.28 | 214,117.00 |
| Composting facility | 451,475.00 | 412,628.07 | 20,000.00 |
| **Total** | **749,774.00** | **470,925.35** | **234,117.00** |

### 22.2 Management and staffing during the reporting period

The following table details the management and staffing for the reporting period of 2016:

| Name(s) | Position | Responsibility |
|---|---|---|
| Senior management team | Senior management | Ensuring that budget and staffing needs are in place |
| Tom Connell | Director of Services | Overall management |
| Joe Tansey | Senior Engineer | Management of the facility |
| Eithne Murphy | Executive Engineer | Management of the facility |
| Jim O Connor | Waste Operations Supervisor | Landfill management including daily inspection and monitoring |
| Mike Maloney & Michael Cooley | General operatives | Site maintenance |

### 22.3 Programme for public information

There is no programme for public information.

## 23.0 Report on training of staff

Staff were trained in Health and Safety as required throughout the year. This training took the form of site tool box talks and staff briefings.

The Executive Engineer for the reporting period of 2016 undertook training in 'Irish and EU Waste legislation" run by Environmental Training Solutions.

## 24.0 Any other items

### 24.1 Annual $PM_{10}$ Monitoring Report

Particulate matter $PM_{10}$ was monitored at 3 locations during the reporting period of 2016.

The $PM_{10}$ trigger level set out in the Waste Licence W0013-01 is less than 50 $\mu g/m^3$ for a daily sample.

The samples at the three monitoring points gave a value which are below the limits of detection.

### 24.2 Biological Monitoring of Surface Water Quality

As part of the monitoring of water quality in the vicinity of Carrowbrowne Landfill Site, Conservation Services, Ecological & Environmental Consultants were commissioned to carry out biological sampling and water quality assessment in accordance with EPA Q-rating methodology at three locations adjacent to the landfill site. Sampling was carried out on 21st September 2016.

Monitoring results were recorded and compared to previous years, as shown below:

| | G22S | G24S | G12S |
|---|---|---|---|
| **2004** | Q2/0 | Q2/0 | Q1-2 |
| **2005** | Q2/0 | Q2/0 | Q1 |
| **2006** | Q1-2/0 | Q1-2 | Q1-2 |
| **2007** | Q1-2 | Q1-2/0 | Q1 |
| **2008** | Q1-2/0 | Q2 | Q1-2 |
| **2014** | Q3 | Q2-3/0 | No invertebrates recorded |
| **2015** | Q2-3 | Q2 | Q1-2 |
| **2016** | Q2 | Q2 | Q1-2/0 |
| **Quality Status** | Seriously Polluted | Seriously Polluted | Seriously Polluted |
| **Water Framework Directive Ecological Quality** | Bad | Bad | Bad |

Note; Due to sub-optimal conditions for Q-rating all Q-values are tentative.

### 24.3 Cover Letter attached to this report

Please see cover letter attached to this Report.

Environmental Protection Agency

Guidance to completing the PRTR workbook

# PRTR Returns Workbook

Version 1.1.19

| REFERENCE YEAR | 2016 |
|---|---|

## 1. FACILITY IDENTIFICATION

| | |
|---|---|
| Parent Company Name | Galway City Council |
| Facility Name | Carrowbrowne Landfill Site |
| PRTR Identification Number | W0013 |
| Licence Number | W0013-01 |

Classes of Activity

| No. | class_name |
|---|---|
| - | Refer to PRTR class activities below |

| | |
|---|---|
| Address 1 | Carrowbrowne |
| Address 2 | Headford Road |
| Address 3 | Galway |
| Address 4 | |
| | |
| | Galway |
| Country | Ireland |
| Coordinates of Location | -9.01465 53.3292 |
| River Basin District | IEWE |
| NACE Code | 3821 |
| Main Economic Activity | Treatment and disposal of non-hazardous waste |
| **AER Returns Contact Name** | Damien Redington |
| **AER Returns Contact Email Address** | damien.redington@galwaycity.ie |
| **AER Returns Contact Position** | Executive Engineer |
| **AER Returns Contact Telephone Number** | 091 536463 |
| **AER Returns Contact Mobile Phone Number** | |
| **AER Returns Contact Fax Number** | |
| **Production Volume** | 0.0 |
| **Production Volume Units** | |
| **Number of Installations** | 0 |
| **Number of Operating Hours in Year** | 0 |
| **Number of Employees** | 2 |
| **User Feedback/Comments** | Composting Facility did not receive any waste in 2016. No gas prediction model for the site exists, No accurate fugitive figure can be ascertained. Consultant engineers to be engaged in the future to create an accurate model |
| **Web Address** | |

## 2. PRTR CLASS ACTIVITIES

| Activity Number | Activity Name |
|---|---|
| 5(a) | Installations for the recovery or disposal of hazardous waste |
| 5(c) | Installations for the disposal of non-hazardous waste |
| 50.1 | General |

## 3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

| | |
|---|---|
| Is it applicable? | |
| Have you been granted an exemption ? | |
| If applicable which activity class applies (as per Schedule 2 of the regulations) ? | |
| Is the reduction scheme compliance route being used ? | |

## 4. WASTE IMPORTED/ACCEPTED ONTO SITE

Guidance on waste imported/accepted onto site

| | |
|---|---|
| Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ? | |

This question is only applicable if you are an IPPC or Quarry site

## 4.1 RELEASES TO AIR

Link to previous years emissions data



### 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) | Methane | E | | | 36150.356 | 36150.356 | 0.0 | 0.0 |

* 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 | T (Total) KG/Year | A (Accidental) KG/Year | F (Fugitive) KG/Year |
| | | | | | | 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:** Carrowbrowne Landfill Site

**Please enter summary data on the quantities of methane flared and / or utilised**

| | T (Total) kg/Year | M/C/E | Method Used: Method Code | Method Used: Designation or Description | Facility Total Capacity m3 per hour | |
|---|---|---|---|---|---|---|
| Total estimated methane generation (as per site model) | 36150.356 | E | ESTIMATE | | N/A | |
| Methane flared | 36150.356 | E | ESTIMATE | | 0.0 | (Total Flaring Capacity) |
| Methane utilised in engine/s | 0.0 | | | | 0.0 | (Total Utilising Capacity) |
| Net methane emission (as reported in Section A above) | 0.0 | | | | N/A | |

## 5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : W0013 | Facility Name : Carrowbrowne Landfill Site | Filename : W0013_2016 PRTR.xls | Return Year : 2016 |

Please enter all quantities on this sheet in Tonnes

| Transfer Destination | European Waste Code | Hazardous | Quantity (Tonnes per Year) | Description of Waste | Waste Treatment Operation | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | M/C/E | Method Used | | | | | |
| Within the Country | 19 07 03 | No | 50836.0 | landfill leachate other than those mentioned in 19 07 02 | D8 | E | Volume Calculation | Offsite in Ireland | mutton island waste water treatment plant,D0050-01 | grattan rd,salthill,.,galway,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

Environmental Protection Agency

# A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2016

| | |
|---|---|
| Please choose from the drop down menu the license number for your site | W0013 |
| Please choose from the drop down menu the name of the landfill site | Carrowbrowne |
| Please enter the number of flares operational at your site in 2016 | 1 |
| Please enter the number of engines operational at your site in 2016 | 0 |
| Total methane flared | 192,645 kg/year |
| Total methane utilised in engines | 0 kg/year |

**Please note that the closing date for reciept of completed surveys is 31/03/2017**

**Introduction**

The Office of Environmental Sustainability (OES) of the Environmental Protection Agency acts as the inventory agency in Ireland with responsibility for compiling and reporting national greenhouse gas inventories to the European Commission and the United Nations Framework Convention on Climate Change. In addition to meeting international commitments Ireland's national greenhouse gas inventory informs national agencies and Government departments as they face the challenge to curb emissions and meet Ireland's emission reduction targets under the Effort Sharing Decision (No. 406/2009/EC). The national inventory also informs data suppliers, making them aware of the importance of their contributions to the inventory process and a means of identifying areas where input data may be improved.

It is on this basis that the Environmental Protection Agency is asking landfill operators to partake in this survey so that the most uptodate information on methane flaring and recovery in utilisation plants at landfills sites is used in calculating the contribution of the landfill sector to national greenhouse gas emissions

The Environmental Protection Agency wishes to thank you for partaking in this survey. If you have any questions about the survey and how to complete it please view the "Help sheet" worksheet. If however, your query is not answered by viewing the "Help sheet" worksheet please contact:
LFGProject@epa.ie

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2015) to:
LFGProject@epa.ie

| | to be filled in by licensee | | calculated by spreadsheet | |
|---|---|---|---|---|

**Flare No. 1**

| | | | |
|---|---|---|---|
| **Flare type ?** | AFS HT1000 | **If "other" enter flare description here** | |
| **Is the flare an open or enclosed flare ?** | Enclosed | **Rated flare capacity ?** | 1000 m3/hr |
| **Month /year comissioned ?** | April 2004 | | |
| **Month decomissioned if decomissioned in 2016 ?** | Select | | |
| **What is the function of the flare ?** | Extraction from capped area | | |

| Monthly | Method M/C/E | Runtime days/month | Runtime hrs/day | Downtime hrs | Total runtime hrs/month | Average Inlet Pressure (mbg) | Average Inlet Temp ◦ C | Average Flow Rate ($m^3$/hr) | Average $CH_4$ %v/v | Average $CO_2$ %v/v | Average $O_2$ %v/v | Combustion efficiency (%) | Total $CH_4$ $m^3$ | Total $CH_4$ kgs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | M | 31 | 12.0 | 12.0 | 360 | -16 | 10 | 240 | 37.50 | 25.40 | 1.20 | 98.0 | 31,752 | 21,577 |
| February | M | 29 | 10.0 | 14.0 | 276 | -16 | 10 | 175 | 38.30 | 28.10 | 2.60 | 98.0 | 18,129 | 12,319 |
| March | M | 31 | 9.0 | 15.0 | 264 | -16 | 10 | 237 | 35.70 | 23.70 | 1.70 | 98.0 | 21,890 | 14,875 |
| April | M | 30 | 12.0 | 12.0 | 348 | -16 | 10 | 218 | 39.10 | 28.50 | 1.00 | 98.0 | 29,070 | 19,754 |
| May | M | 31 | 11.0 | 13.0 | 328 | -16 | 10 | 175 | 37.50 | 28.70 | 1.50 | 98.0 | 21,095 | 14,335 |
| June | M | 30 | 11.0 | 13.0 | 317 | -16 | 10 | 174 | 36.40 | 29.00 | 1.50 | 98.0 | 19,619 | 13,332 |
| July | M | 31 | 10.5 | 13.5 | 312 | -16 | 10 | 215 | 35.10 | 27.40 | 2.00 | 98.0 | 23,074 | 15,680 |
| August | M | 31 | 10.0 | 14.0 | 296 | -26 | 10 | 215 | 42.60 | 28.00 | 2.10 | 98.0 | 26,568 | 17,873 |
| September | M | 30 | 10.0 | 14.0 | 286 | -23 | 10 | 215 | 33.50 | 26.60 | 2.80 | 98.0 | 20,187 | 13,622 |
| October | M | 31 | 11.0 | 13.0 | 328 | -25 | 10 | 215 | 43.40 | 28.00 | 2.30 | 98.0 | 29,994 | 20,198 |
| November | M | 30 | 10.0 | 14.0 | 286 | -25 | 10 | 205 | 35.10 | 25.00 | 3.40 | 98.0 | 20,168 | 13,581 |
| December | M | 31 | 10.0 | 14.0 | 296 | -25 | 10 | 205 | 38.70 | 26.20 | 3.40 | 98.0 | 23,013 | 15,498 |
| Total | | | | | 3,697 | | | | | | | | 284,559 | 192,645 |

Please note: Only fill the "Yearly" table if data is not availabe or cannot be calculated nor estimated on a monthly basis

| Yearly | Method M/C/E | Runtime days/year | Runtime hrs/day | Downtime hrs | Total runtime hrs/year | Average Inlet Pressure (mbg) | Average Inlet Temp ◦ C | Average Flow Rate $m^3$/hr | Average $CH_4$ %v/v | Average $CO_2$ %v/v | Average $O_2$ %v/v | Combustion efficiency (%) | Total $CH_4$ $m^3$ | Total $CH_4$ kgs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | | | | | 0 | | | | | | | | 0 | 0 |

**Workings based on 2016 Flare Emissions Testing**

| (Stack 1) | Corrected conc (mg/Nm3 ref 3%) | Vol corrected (Nm3/hr ref 3%) | Average Annual Flow (As Per Landfill Gas Survey) | Emission (mg/hr) | Emission (mg/yr) | Emissions (kg/hr) | Total Hours of operation (As Per Landfill Gas Survey) | Altered Total Hours of operation (to regularise flow vol during testing with ave annual flow vol) | Total mass emisisons (kg/yr) |
|---|---|---|---|---|---|---|---|---|---|
| TOC | | | | 0 | #DIV/0! | 0.00 | | #DIV/0! | #DIV/0! |
| Nox | 33.00 | 207 | 207 | 6831 | 25254207 | 0.01 | 3697 | 3697.0 | 25.25 |
| HCL | 7.75 | 207 | 207 | 1604.25 | 5930912 | 0.00 | 3697 | 3697.0 | 5.93 |
| HF | 0.09 | 207 | 207 | 18.63 | 68875 | 0.00 | 3697 | 3697.0 | 0.07 |
| CO | 15.00 | 207 | 207 | 3105 | 11479185 | 0.00 | 3697 | 3697.0 | 11.48 |
| SO2 | 27.00 | 207 | 207 | 5589 | 20662533 | 0.01 | 3697 | 3697.0 | 20.66 |
| CO2 | | | | 0 | #DIV/0! | 0.00 | | #DIV/0! | #DIV/0! |