

# ANNUAL ENVIRONMENTAL REPORT

2012

**Waste Licence No.:** W0029-04

**Licencee:** Offaly County Council.

**Location of Activity:** Derryclure Landfill,  
Derryclure,  
Tullamore,  
Co. Offaly

**Inspector:** Dermot Burke  
Office of Environmental Enforcement  
Environmental Protection Agency  
Seville Lodge  
Callan Road  
Kilkenny

**Submitted by:** John Connelly,  
Senior Executive Engineer,  
Environment & Water,  
Offaly County Council,  
Charleville Road  
Tullamore,  
Co. Offaly

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## **Introduction**

Offaly County Council operates the Derryclure Waste & Recycling Facility under the terms of Waste Licence WL 029-4. This Annual Environmental Report is compiled in accordance with Condition 11.7 and Schedule H of WL 029-4. This report covers the period 1<sup>st</sup> January 2012 to 31<sup>st</sup> December 2012.

Derryclure Landfill is located approximately 5 km from Tullamore town on the Tullamore-Killeigh road (National Secondary Road - N80). The landfill site is located on what was originally a cut-away peatland area. The Northern, Southern and Eastern sides of the landfill are bounded by raised peatlands while the Western side is bounded by pastoral land. Topographically, the Tullamore area is extensively low-lying, and as such is characteristic of the low lands of central Ireland. The land uses of the area are a mixture of peat extraction on the raised peatlands and agricultural use on the pastoral land.

The site has operated under the EPA Licensing regime since the 16 November 1999, when WL29-01 was issued. In October 2010, the EPA issued the Final Decision for WL29-04, which are the conditions under which the site now operates.

Landfilling activities ceased at the site in October 2011, and the works undertaken in 2012 under W0029-04 can be categorised as follows:

- Final capping works completed for cells 1A, 1B & 1C.
- Waste Transfer Area continued to operate at the front of the site, with the only change being the transfer of all waste off site by a private waste contractor, as opposed to its deposition on site, which was the case during landfill activities.
- The Recycling Centre continued to operate on the site – to the South of the weighbridge offices.
- Ongoing gas and leachate management and environmental monitoring. This also included the advancement of a Midlands Landfill Gas Utilisation Project with Laois and Westmeath Co. Co's.

## **Waste Activities undertaken at the facility**

Derryclure Landfill is licensed to accept household waste, commercial waste, industrial non-hazardous solids, sewage sludge and construction and demolition waste in accordance with the third schedule of the Waste Management Act 1996 and waste for recovery per the Fourth Schedule.

The waste activities on the site during 2012 can be divided into two areas:

1. Waste Transfer Area for waste at front of site, where waste is deposited by customers into large skips and compactors, and these are transferred off site for further processing.
2. Recycling Centre/ Civic Amenity Site where segregated recyclable wastes, bio wastes (food and green/garden) and general wastes are accepted from the domestic sector.

## Quantities of Waste received, disposed of and recovered in 2012

### *A. Wastes accepted for disposal:*

Schedule A defines the quantities and categories of waste that may be accepted at the site. In the table below the limits for each waste category and the volumes of each accepted in 2012 are shown

<i>Waste Type</i>	<i>Licence WL 29-04 (t) Limit</i>	<i>Total waste accepted in 2012 (t)</i>
<i>Household Waste</i>	45,500	2558.42*
<i>Commercial Waste</i>	39,500	494.35*
<i>Industrial – non haz</i>	11,000	0.0
<i>Treated Municipal Sludge</i>	2,000	0.00
<i>C &amp; D</i>	2,000	0.00
<b>Total</b>	<b>100,000</b>	<b>3,052.77</b>

\*Recycling Centre Total = 1,404.94 tonnes (domestic sources)

\*Waste Transfer Area Total = 1,647.83 tonnes (this is estimated as 30% commercial sources and 70% domestic sources)

Reference: NWDB Report 2012 for W029-04.

### *B. Waste Accepted for Recovery:*

The wastes accepted for recovery relate to the waste accepted at the Recycling Centre and also the green, timber and C&D waste accepted at the Waste Transfer Area. Volumes for each waste stream are included in Appendix A, an extract from the 2012 PRTR Return in Section 5 “Off site Transfers of Waste”.

## **Remaining capacity of the landfill site**

The landfilling activity ceased at Derryclure landfill in October 2011. This approach was defined by an assessment of the viability of developing a new cell in the current waste market and economic climate. At present there is no built capacity on site, and there are no plans to develop further cells at this time.

## **Waste Handling**

All waste is transferred off site for processing at licensed and permitted facilities, which are listed on various AER/Annual Returns for the site. The range of waste streams are also illustrated in these returns and per Appendix A attached.

## **Summary of Results of Environmental Monitoring**

Monitoring was undertaken in accordance with the requirements of the licence in relation to the following environmental media:

### ***Surface Water***

- Surface Water – quarterly monitoring of six points. Samples taken were compared to the Class A1 limit of Surface Water Regulation.
- One incident reported in Quarter 4 monitoring with an exceedance in ammonia at SW12 – see In-12-08.

### ***Groundwater***

- Groundwater is monitored quarterly at fourteen points, taking a level for the depth to water table and also analysing samples for parameters required under the license.

### ***Landfill Gas***

- Landfill Gas is monitored monthly at eighteen points on the site, some of which are located within the waste body of the capped cell, and others along the perimeter of the site. Each monitoring episode has measured exceedances in the % Methane and/or % Carbon Dioxide at a number of sampling points each month. Incidents were reported to the Agency on each occasion.

### ***Gas Flare***

- Monitoring of the flares was undertaken in accordance with the license requirements.

### ***Dust***

- Dust was monitored in accordance with the license requirements.

### ***Noise***

- A noise survey was undertaken at pre-determined perimeter monitoring points in accordance with the license requirements.

### ***Leachate***

- Under the terms of the licence, the leachate lagoon temperature is monitored quarterly and sampled annually at three leachate wells and the leachate lagoon. All leachate is collected in the leachate lagoon, and tankered to Tullamore Waste Water Treatment Plant.
- One incident was noted relating to an exceedance of the 1m leachate level in Cell 1B in September 2012 – See In-12-04.

### **Volume of leachate produced**

In 2012, 22,404.42 tonnes of leachate were produced on the site. All leachate was tankered off site for treatment at the Tullamore Waste Water Treatment Plant.



### **Development works undertaken during the reporting period:**

- Completed capping of cells 1A, 1B and 1C as per the SEW approved by the Agency, with the only works to be completed in 2013 relating to the seeding of the site.
- No odour complaints have been received since 24 May 2012. The winter period had seen an increase in complaints in previous years – however the works on site addressed any emissions. As a result odour patrols were reduced, and stepped down when capping works were completed in late 2012. Patrols will be undertaken in the event of any issues detected on site or reported to the Council.
- VOC survey in early 2013 has also illustrated the effectiveness of the capping, with no issues detected – attached as Appendix B.
- A Gas Utilisation Project is advancing in conjunction with Laois and Westmeath Co Co's. Tender documents have been prepared and it is the intended to proceed to tender for Gas Utilisation at the Derryclure site in 2013.

### **Summary of Incidents and Complaints**

#### ***Recorded Incidents***

There were eight incidents recorded during 2012, which were reported to the Agency. The breakdown of incidents is as follows:

Gas Monitoring (monthly)	6
Leachate	1
Surface Water	1

All details are available for inspection in the Incident Register, which is located in the Site Manager's Office at the facility.

#### ***Recorded Complaints***

There were 35 complaints were received at the Derryclure facility during 2012. The table below provides a breakdown of complaints during the year.

January	9		July	1
February	11		August	-
March	5		September	-

April	5		October	-
May	4		November	-
June	-		December	-

All details are available for inspection in the Complaints Register, which is located in the Site Manager's Office at the facility.



## **Review of Nuisance Control**

Nuisance control measures continued to be managed in 2012, although the change in activities reduced the issues arising. The key nuisance issues are listed below, and the landfill manager undertook assessments of nuisance control on a routine basis.

### ***Mud***

The use of the wheel wash by all vehicles ensures the facility roads are kept free of mud. A road sweeper is also employed on a regular basis to clean access roads and hard standing areas.

### ***Dust***

A water bowser is used to suppress dust on the site, especially on roads and hard standing areas during extended periods of dry weather.

### ***Noise***

Noise is managed through the regular maintenance of site plant equipment, traffic management with speed restrictions and ramps, and the managed use of the bird control measures.

## **Septic Tank Compliance Report**

Both septic tanks on site at Derryclure Landfill are holding tanks and do not percolate to ground via either a soakway or percolation area. These tanks are emptied on a scheduled basis by contractor and the waste is transferred to Tullamore WWTP.

## **Management of site**

The management structure for Derryclure Landfill during 2012 was as follows:

Director of Services – Sean Murray

Senior Engineer – Tom Shanahan

Executive Scientist - Marian Healy

### **On-site staff:**

Site Manager – Basil Mannion

Staff on site for 2012 were contractors working on the various capping works, or the management of the Waste Transfer Area and Recycling Centre.

**Review of EMP 2012:**

**Schedule of Objectives and Targets for Derryclure Landfill Site for 2012**

1. Conduct operation on site in accordance with the schedules and conditions of the waste license
2. Continue to monitor and reduce odour emissions/impacts from the facility and install an additional gas well as part of the capping contract.
3. Completion of the capping works in Cells 1A, 1B & 1C.
4. Progress the assessment of viability of a Landfill Gas Utilisation Project for the site.

<b>OPERATION</b>	<b>TARGET</b>	<b>OBJECTIVE</b>	<b>Outcome</b>	<b>Responsibility</b>
1. All site activities	To ensure compliance with the Waste License	Conduct operations on site in accordance conditions of the Waste License	Site managed to ensure compliance with WL29-04.	Site Manager
2.All activities, and particularly Cells 1A, 1B & 1C	To minimise any odour impacts from the facility	Complete the lining and capping works, installing an additional gas well during the works.	Works completed per approved SEW	Site Manager & Executive Scientist
3.Gas Extraction System	To ensure optimum performance, particularly in extreme weather conditions	Ongoing management of the gas field and flares, (adjustments based on the sealing impact of the capping works).	Gas extraction infrastructure managed and no issues arose during winter period. Capping works brought further improvements.	Site Manger
5.Health & Safety	Management of Safety in accordance with the Safety Statement	Ongoing Management of the H&S on site, including acting as PSCS for the capping project.	Managed a diverse range of contractors and had clear HAS audits	Site Manger

6. Landfill Gas Utilisation	Development of Landfill Gas Utilisation at the site	Define the viability of the site for the utilisation of landfill gas, and options for energy provision.	Draft tender documents were advanced and will go to the market in 2013.	Executive Scientist
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**EMP for 2013:**

**Schedule of Objectives and Targets for Derryclure Landfill Site for 2013**

- a. Conduct operations on site in accordance with the schedules and conditions of the waste license
- b. Complete seeding works on site
- c. Advance the Landfill Gas Utilisation Project for the site.
- d. Progress the Technical Amendment submission to the EPA re Transfer Activity

<b>OPERATION</b>	<b>TARGET</b>	<b>OBJECTIVE</b>	<b>Timeline</b>	<b>Responsibility</b>
1. All site activities	To ensure compliance with the Waste License	Conduct operations on site in accordance conditions of the Waste License	Ongoing	Site Manager
2 Complete seeding works on site	To complete final aspect of capping works	Complete seeding works, and assess the growth for stability.	Ongoing	Site Manager
3. Gas Utilisation Project	Development of Landfill Gas Utilisation at the site	Publish the tender and assess viability of establishing gas utilization on site.	September 2013	Executive Scientist
5. Waste Transfer Activity proposed	Progress Technical Amendment application with EPA	Gain clarity from EPA on requirements for proposal.	June 2013	Executive Scientist

## **Appendix A**

### **2012 PRTR submission**





Environmental Protection Agency

Guidance on completing the PRTR workbook

# AER Returns Workbook

Version 1.1.18

REFERENCE YEAR 2012

## 1. FACILITY IDENTIFICATION

Parent Company Name	Offaly County Council
Facility Name	Derryclure Landfill
PRTR Identification Number	W0029
Licence Number	W0029-04

### Waste or IPPC Classes of Activity

No.	class_name
3 5	Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
3 1	Deposit on, in or under land (including landfill).
3 11	Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule.
3 13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
3 4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
3 7	#####
4 13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4 2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4 3	Recycling or reclamation of metals and metal compounds.
4 4	Recycling or reclamation of other inorganic materials.
Address 1	Derryclure and Killeigh
Address 2	Tullamore
Address 3	Co. Offaly
Address 4	
	Offaly
Country	Ireland
Coordinates of Location	-6 25685 53 5597
River Basin District	IEGBNISH
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	John Connelly
AER Returns Contact Email Address	jconnelly@offalycoco.ie
AER Returns Contact Position	Senior Executive Engineer
AER Returns Contact Telephone Number	057 9357403
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	
Web Address	

## 2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(d)	Landfills
5(c)	Installations for the disposal of non-hazardous waste
5(d)	Landfills
50.1	General

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

Is it applicable?	No
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) ?	
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This question is only applicable if you are an IPPC or Quarry site

**SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS**

Please enter all quantities in this section in KGs

No. Annex II	POLLUTANT Name	METHODE Method Used	QUANTITY		
			T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01	Methane (CH4)	C OTH Estimated that 15% gas was fugitive emission, with 85% flared. Co2 data calculated on same basis as methane with LFG Survey format. Estimated that 15% gas was fugitive emission, with 85% flared.	0.0	367045.0	0.0
03	Carbon dioxide (CO2)	C OTH Estimated that 15% gas was fugitive emission, with 85% flared.	0.0	870498.0	0.0

**SECTION B : REMAINING PRTR POLLUTANTS**

Please enter all quantities in this section in KGs

No. Annex II	POLLUTANT Name	METHODE Method Used	QUANTITY		
			T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			0.0	0.0	0.0

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

Please enter all quantities in this section in KGs

Pollutant No.	POLLUTANT Name	METHODE Method Used	QUANTITY		
			T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			0.0	0.0	0.0

**Additional Data Requested from Landfill operators**

For the purpose of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilized on their facilities to accompany the figures for total methane generated. Operators should only report their total methane (CH4) emission in the environment under "Total" (only for Section A, Sector specific PRTR pollutants table). Please complete the table below.

Landfill: Dampiera Landfill

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

METHODE Method Used	Method Code	Designation or Description	Facility Total Capacity m3 per hour
C	MAB	Total gas flared is estimated at 85% of total gas generated from 2012 and recent VOC's surveys show no leakage i.e. 100% collected.	N/A
C	MAB	Total gas flared - from LFG.	0.0
C	MAB	Total Net Methane Emission	N/A

Total estimated methane generation (as per site model) 246988.0  
 Methane flared 2076623.0  
 Methane utilized in engine 0.0  
 Net methane emission (as reported in Section A above) 367045.0



**5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE**

PRTR#: W0029 | Facility Name: Derryclure Landfill | Filename: PRTR W0029\_2012 - Final.xls | Return Year: 2012 |

31/05/2013 17:25

**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 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	08 03 18	No	0.06	waste printing toner other than those mentioned in 08 03 17	R5	M	Weighted	Offsite in Ireland	KMK Metals Ltd,WL 184-01	Cappincur Road, Tullamore, Co. Offaly,., Ireland	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	13 02 08	Yes	2.28	other engine, gear and lubricating oils	D9	M	Weighted	Offsite in Ireland	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	20 01 25	No	12.42	edible oil and fat	R3	M	Weighted	Offsite in Ireland	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	15 01 02	No	51.38	plastic packaging	R3	M	Weighted	Offsite in Ireland	Oxygen Environmental Limited,WL 208-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	15 01 04	No	4.22	metallic packaging	R4	M	Weighted	Offsite in Ireland	Oxygen Environmental Limited,WL 208-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	15 01 04	No	11.42	metallic packaging	R4	M	Weighted	Offsite in Ireland	Oxygen Environmental Limited,WL 208-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	15 01 05	No	7.12	composite packaging	R3	M	Weighted	Offsite in Ireland	Oxygen Environmental Limited,WL 208-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	15 01 07	No	43.88	glass packaging	R5	M	Weighted	Offsite in Ireland	Rehab Glasco Ltd,WFP-KE-08-0957-01	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	16 01 03	No	5.72	end-of-life tyres	R5	M	Weighted	Offsite in Ireland	Crumb Rubber Ltd,WFP-LH-10-0005-01	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
To Other Countries	16 06 01	Yes	2.4	lead batteries	R4	M	Weighted	Abroad	KMK Metals Ltd,WL 184-01	Cappincur Road, Tullamore, Co. Offaly,., Ireland	H. J. Enthoven Ltd,Lix # BL 5598,Darley Dale Smelter,South Derbyshire,DE4 2LP,United Kingdom	Darley Dale Smelter,South Derbyshire,DE4 2LP,United Kingdom
Within the Country	17 01 07	No	125.78	01 06 mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 07	R5	M	Weighted	Offsite in Ireland	Oxygen Environmental Limited,WL 208-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	17 02 01	No	0.0	wood	R3	M	Weighted	Offsite in Ireland	Oxygen Environmental Ltd,WFP-10-O-Y-0183-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	17 08 02	No	14.76	gypsum-based construction materials other than those mentioned in 17 08 01	R3	M	Weighted	Offsite in Ireland	Oxygen Environmental Limited,WL 208-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	19 07 03	No	22404.42	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighted	Offsite in Ireland	Tullamore Waste water Treatment Plant,D0039-01	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	20 01 01	No	186.08	paper and cardboard	R3	M	Weighted	Offsite in Ireland	Oxygen Environmental Limited,WL 208-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland
Within the Country	20 01 02	No	14.32	glass	R5	M	Weighted	Offsite in Ireland	Oxygen Environmental Limited,WL 208-02	Enva Ireland Ltd,WL 184-01	Enva Ireland Ltd,WL 184-01	Clonminam Ind Estate,Portlaoise,Co. Laois,., Ireland



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 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	20 01 08	No	303.0	biodegradable kitchen and canteen waste	R3	M	Weighed	Offsite in Ireland	Oxigen Environmental Ltd,WL 152-03	Robinhood Industrial Estate,Robinhood Road,Dublin,22,Ireland 504 A Grants Drive,Greenogue Business Park,Greenogue Ind Estate,Dublin 24,Ireland	KMK Metals Ltd,WL 152-03	Cappincur Road,Tullamore,Co. Wick,Ireland Offaly, Ireland ATM BV, Lic # 827180, Vlasweg 12,PW,Moerdijk,4782,Nethe rlands	Cappincur Road,Tullamore,Co. Wick,Ireland Offaly, Ireland
Within the Country	20 01 10	No	8.28	clothes	R5	M	Weighed	Offsite in Ireland	Textile Recycling Ltd,N/A				
Within the Country	20 01 21	Yes	0.06	fluorescent tubes and other mercury-containing waste	R4	M	Weighed	Offsite in Ireland	KMK Metals Ltd,WL 184-01	Cappincur Road,Tullamore,Co. Wick,Ireland Offaly, Ireland Merrywell Ind Estate,Ballymount Road Lower,Clondalkin,Dublin 22,Ireland	KMK Metals Ltd,WL 184-01	Cappincur Road,Tullamore,Co. Wick,Ireland Offaly, Ireland ATM BV, Lic # 827180, Vlasweg 12,PW,Moerdijk,4782,Nethe rlands	Cappincur Road,Tullamore,Co. Wick,Ireland Offaly, Ireland
To Other Countries	20 01 27	Yes	24.72	paint, inks, adhesives and resins containing dangerous substances	D10	M	Weighed	Abroad	Oxigen Environmental Limited,WL 208-02				
Within the Country	20 01 38	No	130.28	wood other than that mentioned in 20 01 37	R3	M	Weighed	Offsite in Ireland	Ltd,WFP-10-OY-0183-02	Barnan,Daingean,Co. Wick,Ireland Offaly, Ireland Merrywell Ind Estate,Ballymount Road Lower,Clondalkin,Dublin 22,Ireland			
Within the Country	20 01 40	No	57.74	metals	R4	M	Weighed	Offsite in Ireland	Oxigen Environmental Limited,WL 208-02	Lower,Clondalkin,Dublin 22,Ireland			
Within the Country	20 02 01	No	217.99	biodegradable waste	R3	M	Weighed	Offsite in Ireland	Ltd,WFP-10-OY-0183-02	Barnan,Daingean,Co. Wick,Ireland Offaly, Ireland Merrywell Ind Estate,Ballymount Road Lower,Clondalkin,Dublin 22,Ireland			
Within the Country	15 01 02	No	0.42	plastic packaging	R3	M	Weighed	Offsite in Ireland	Oxigen Environmental Limited,WL 208-02	Lower,Clondalkin,Dublin 22,Ireland			
Within the Country	20 03 01	No	321.36	mixed municipal waste	R5	M	Weighed	Offsite in Ireland	Oxigen Environmental Ltd,WL 152-03	Robinhood Industrial Estate,Robinhood Road,Dublin,22,Ireland			
Within the Country	20 03 01	No	1452.9	mixed municipal waste	R5	M	Weighed	Offsite in Ireland	Oxigen Environmental Ltd,WL 152-03	Robinhood Industrial Estate,Robinhood Road,Dublin,22,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](#)

## **Appendix B**

**VOC Survey undertaken on 31<sup>st</sup> January & 1<sup>st</sup> February 2013**



***A FUGITIVE EMISSIONS SURVEY AT  
THE DERRYCLURE LANDFILL  
FACILITY, DERRYCLURE,  
TULLAMORE, CO. OFFALY  
IN COMPLIANCE WITH WASTE  
LICENCE No. W0029-04***

**For the Attention of:** Ms. Marian Healey  
Offaly County Council  
Derryclure Landfill  
Tullamore  
Co. Offaly

**Prepared by:** Mr. Eamonn Lee  
Environmental Scientist

**Reviewed by:** Mr. Peter Coogan  
Monitoring Team Leader

**Report No:** ECS4479

**Monitoring Date:** 31<sup>st</sup> Jan – 1<sup>st</sup> Feb 2013

**Reporting Date:** 19<sup>th</sup> February 2013

This report shall not be reproduced except in full, without the approval of ANUA Environmental. All queries concerning the report or its contents should be forwarded to the Monitoring Team Leader.

### Executive Summary

ANUA Environmental was commissioned by Ms. Marian Healy of Offaly County Council to perform fugitive emission monitoring at the Derryclure Landfill Facility. Subsequently the site was visited by Environmental Scientists from Anua Environmental on the 31<sup>st</sup> of January and 1<sup>st</sup> of February 2013 to perform the on-site survey.

Landfilling operations at the Derryclure site on the outskirts of Tullamore town has been recently ceased. Prior to decommission, the landfill cells were covered with a geo-textile membrane liner and topsoil to ensure all gas and leachate produced from the breakdown of waste within the cells is captured and disposed of in a safe and proper manner.

To evaluate the mitigation of gases at the Derryclure landfill, an investigation was conducted to detect potential areas of landfill gas release/flux from the surface of the landfill cap. The survey involves landfill cap source monitoring using a portable Photo Ionisation Detector (PID) and a portable Flame Ionisation Detector (FID) to detect VOC's and Methane. A portable gas detector, Gas-Tec, with a built-in Global Positioning System (GPS) was used to record the methane and simultaneously mark areas sampled using a grid system. This allowed for the generation of detailed VOC/Methane geo-referenced contour maps of the landfill operational area, plotted upon the facility base map for visual interpretation. The contour map highlights and identifies surface emissions hotspots on the land fill cap.

A total of 501 readings were taken over the three cells. VOC's and Methane were not detected above 1 parts per million (as shown in Appendix 1 results). This displays a notable reduction compared to the previous monitoring survey, conducted in February 2011 (*BNM Report Ref ECS3871*). It may be therefore concluded that the geo-textile membrane has been successful in reducing fugitive emissions to a negligible level at the Derryclure site.

This report details the sampling programme that took place including the sampling and analytical methodologies adopted.

Respectively Submitted,



Mr. Eamonn Lee  
Environmental Scientist



Mr. Peter Coogan  
Monitoring Team Leader

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## 1.0 INTRODUCTION

In compliance with "Surface VOC Emissions Monitoring on Landfill Guidance Note 6 (AG6)", all EPA licensed landfills shall typically be subject to the following conditions;

*Following completion of waste acceptance in any cell/sub-cell, the licensee shall, on a bi-annual basis, arrange for the carrying out of an independent assessment and report on surface VOC emissions at the facility; and in relation to surface emissions from the waste body and identified features, the following shall constitute a trigger level:*

- *VOC greater than or equal to 50ppmv average over capped area*

The trigger levels of 50ppm average and 100ppm instantaneous will apply to permanently capped areas.

- *VOC greater than or equal to 100 ppmv instantaneous reading on open surfaces within the landfill footprint*

The trigger level of 500ppm will apply to features, engineered and otherwise on the landfill. Such features will include but are not limited to: gas and leachate infrastructure including gas wells, gas monitoring points, leachate wells, side-slope risers, gas and leachate collection pipework and any projections off/from the waste body. This applies to all features including those occurring on any final cap area.

- *VOC greater than or equal to 500 ppmv around all identified features*

The trigger level of 100ppm will apply for the instantaneous monitoring locations in the operational cell. Any area not under final cap, which is also not a feature and is not the working face shall be monitored against the trigger level of 100ppm for instantaneous readings.

Anua Environmental was commissioned to perform the first biannual fugitive emissions survey for 2013 at the Derryclure landfill to determine compliance with the above.

The site was visited by Environmental Scientists from Anua Environmental on the 31<sup>st</sup> of January and 1<sup>st</sup> of February 2013 to perform the on-site survey. All on-site data recorded during each monitoring event was downloaded to a PC at the end of the monitoring day using specialist software.

This report details the sampling programme that took place including the sampling and analytical methodologies adopted.

## 2.0 BACKGROUND

Landfilling operations at the Derryclure site on the outskirts of Tullamore town has been recently ceased. Prior to decommission, the landfill cells were covered with a geo-textile membrane liner and topsoil to ensure all gas and leachate produced from the breakdown of waste within the cells is captured and disposed of in a proper manner.

Weather conditions were monitored as they can have a significant impact on concentrations of methane and VOC recorded at ground level. Weather conditions during the survey have been characterised in terms of wind speed & direction, temperature, rainfall and atmospheric stability as supplied by the Met Éireann from their nearest synoptic weather station located at Gurteen College.

Air quality concentrations and the potential for pollution are affected by the spatial relationships between the source of pollution, the receiver and on the nature of the transport mechanisms between the two. Determining the connectivity between a possible source and the receptor is heavily determined by the current weather conditions and consequently warrant consideration in this study.

Air quality (and concentrations of constituents) are dominated by prevailing weather conditions and vary considerably with time (seasonal, diurnal and momental). These changes in concentrations are largely determined by meteorological factors. The extent to which pollutants are dispersed & diluted is dependent on wind speed, turbulence, mixing depth, topography etc. The principal factors of concern include:

### Wind Speed & Direction

The primary mode of transport of materials in the air is through wind-based dispersion and dilution.

- Wind speed is determined by atmospheric pressure gradients, which are shown on weather charts by isobar lines (i.e. lines of equal pressure). Isobars close together indicate the wind speed will be high – this is due to significant pressure differentials in a short distance. Under such conditions pollutant concentrations are likely to be relatively low. Low wind speeds tend to result in the accumulation of pollutants.
- Higher wind speeds result in a greater level of dilution as any wind parcel is spread further downwind over a greater volume in a given period of time.
- The more turbulent gusty conditions result in greater dispersion or mixing of the substance in the air medium (such fluctuations can be solar-driven or vortex-driven resulting in unstable atmospheric conditions which are conducive to good mixing).
- Wind direction will determine the direction of any pollutant plume and is an important factor in air pollution transport.
- The wind speed on each monitoring day was measured using a portable hand-held wind vane and recorded in field notes.

### Turbulence

The amount of turbulence in the ambient atmosphere has a major effect on the dispersion of air pollution plumes because turbulence increases the entrainment and mixing of unpolluted air into the plume and thereby acts to reduce the concentration of pollutants in the plume (i.e., enhances the plume dispersion). It is therefore important to categorize the amount of atmospheric turbulence present at any given time.



The degree of atmospheric turbulence is easily described using the Pasquill Stability Indices which range from extremely unstable (A) to extremely stable (F). This simple system takes into account the influence of solar radiation during the day and night time cloud cover. Unstable conditions promote the rapid dispersion of atmospheric contaminants and result in lower air concentrations compared with stable conditions.

TABLE 1.1 – PASQUILL STABILITY INDEX		
Pasquill Stability Index	Definition	Comment
A	Very unstable	Most turbulent, excellent mixing
B	Unstable	
C	Slightly unstable	Some mixing
D	Neutral	
E	Slightly stable	
F	Stable	Inversion, ground layer trapped, little dispersion

#### Topography & Surface Roughness

The topography of Derryclure Landfill falls sharply from the top of the capped landfill (approximately 99m above mean sea level relative to Malin Head), to the base of the landfill perimeter (approximately 75m above mean sea level relative to Malin Head). This represents a total height difference of approximately 24 meters from the base of the landfill to the top of the capped landfill site. As such there are few obstacles to deflect wind patterns or cause additional turbulence, so wind driven mixing is considered here as the predominant mode of mixing.

#### Temperature

Temperature may have a less pronounced effect on general air pollution. Usually, within the lower atmosphere (the troposphere) the air near the surface of the Earth is warmer than the air above it, largely because the atmosphere is heated from below as solar radiation warms the earth's surface, which in turn then warms the layer of the atmosphere directly above it. Warm air rises as it is more buoyant and is replaced by adjacent air, and as it rises, it expands and cools. Cooler air gradually sinks and thus vertical convective circulation causes the natural mixing of air. In general, temperature decreases as height from the surface increases up to the tropopause. The rate of temperature change with respect to altitude is known as the Ambient Lapse Rate.

However, the occurrence of a temperature inversion may have a significant impact on ground-level pollutant concentrations. By definition: an 'inversion' exists when warm air overlies cooler air. A warmer air mass moving over a cooler one can 'shut off' or 'cap' any convection, which may be present in the cooler air mass. A temperature inversion results in an elevated bulge in the air temperature / altitude profile so that the lowest portion of the warm air layer forms a lid to the underlying layer of air & constituents. The altitude at which air dispersion could occur is known as the Maximum Mixing Depth. With the ceasing of convection, the air becomes stiller and more stable, hence the air becomes murky because dust & pollutants are no longer lifted away from the earth's surface and dispersed.

Such inversions can be dominated by radiation (day vs. nocturnal influences) and by atmospheric subsidence with air circulating a High Pressure zone in anti-cyclonic conditions. The presence of a temperature inversion significantly inhibits the dispersion of ground level pollutants and consequently ground-level concentrations could become elevated as a result of prevailing meteorological conditions.

### **Portable Real-Time Monitoring**

Two of the most common detectors utilized in portable gas sampling techniques are portable flame ionization detectors FIDs and PIDs. These detectors, used in conjunction or separately, are generally used to give background levels of, Methane, and total VOCs. Portable sampling techniques are used to identify hot spots of CH<sub>4</sub>, or total VOCs within a test locale. Two of the most important attributes of these detectors are their ever-increasing levels of sensitivity and their ability.

### **Gas-Tec**

A portable gas detector, Gas-Tec was used to detect levels of methane within the areas identified. The Gas-Tec has a built-in GPS, which marked each monitoring location. Gas-Tec senses hydrocarbons through the use of Flame Ionisation Detection (FID) offering an extremely fast detection speed of less than 2 seconds. Portable FID's are the fastest, most sensitive and accurate way to detect concentrations of hydrocarbons such as methane, butane or hexane. The FID process uses a hydrogen flame to burn hydrocarbons in an air sample then counting the ions produced by the burnt sample. The instrument then displays an accurate measurement of the concentration of hydrocarbons present in the sample. All samples are destroyed as the measurements are generated. This process takes place in a specially designed chamber.

One of the major advantages of the FID is its lack of response to air and water. Critical data is displayed and logged every second within the concentration range of 0.1-50,000 PPM. This is more than adequate to meet the EPA requirements in accordance with 'surface VOC Emissions Monitoring on Landfill Facilities Guidance Note 6 (AG6) 2010'.

### **MiniRAE 2000PID**

A MiniRAE (PID) was used in conjunction with the MicroFID to detect levels of VOC's at each monitoring location. Portable PIDs operate on the principle of photo ionization. In operation, the gas stream is subjected to a high-intensity beam of UV radiation from a lamp of a particular energy. If the molecule ionization potential is lower than that of the lamp, absorption occurs by the gas molecule, leading to the formation of a positive ion and free electron. The positive ion is collected at the electrode and the resultant current is directly proportional to the analyte concentration. Consequently, the ionization potential of the lamp is very important in the detection of certain classes of compounds. Compounds having a high ionization potential will be less easily detected than those with a lower ionization potential. Thus, a PID can readily detect aromatic hydrocarbons but will not detect aliphatic hydrocarbons having a higher ionization potential. Critical data is displayed and logged in less than three seconds within the concentration range of 0.1-10,000 PPM.

### 3.0 METHODOLOGY

The air pressure on the monitoring day was measured using a portable hand-held wind vane and results were recorded in field notes. The altitude of each monitoring location was recorded using the Gas-Tec instrument.

The weather forecast for the monitoring day was observed on the Met Eireann website. This ensured suitable weather conditions to carry out monitoring during the site visit. The temperature was measured using a portable hand-held speed Kestrel anemometer and recorded in field notes.

#### 3.1 Monitoring Locations

Upon first visiting the Derryclure Landfill site, Anua staff planned a walk over route to assess the landfill area to be monitored. This route consisted of a large range of parallel lines approx. 5 meter apart, upon which a sample was taken every 5 meter approx., in accordance with Table 3 of *"the Air Guidance Note 6 (AG6) Surface VOC Emissions Monitoring on Landfill facilities"*. Prior to commencing monitoring, an upwind and downwind monitoring event were performed, this procedure was repeated at the end of the monitoring day.

#### 3.2 Sampling

##### Gas-Tec

The Gas-Tec (FID) used to detect methane was calibrated by Environmental Monitoring Limited prior to the monitoring event. Any previous data was erased from the FID and a new job name was entered (Derryclure Fugitive Emissions). When monitoring on site the FID detector was held approximately 2 inches from the ground. Each measurement was then saved into the data logger according to the grid reference. Field notes of the live feed results display were noted during the monitoring event at regular intervals, to act as backup in the case of electronic data being lost. This procedure was repeated for each monitoring location.

##### MiniRAE 2000PID

The MiniRae (PID) used to detect VOC was calibrated by Environmental Monitoring Limited prior to the monitoring event. Any previous data was erased from the PID and a new job name was entered (Derryclure Fugitive Emissions). When monitoring on site the FID detector was held approximately 2 inches from the ground and allowed to run for a period of approximately 40 seconds. Each measurement was then saved into the data logger. Field notes of the live feed results display were noted during the monitoring event at regular intervals, to act as backup in the case of electronic data being lost. This procedure was repeated for each monitoring location.

#### 4.0 DISCUSSION

Three Cells (Cell 1A, Cell 1B and Cell 1C) within the landfill were monitored. It should be noted that all cells are final capped.

The results of the fugitive emission survey, which was carried out on the 31<sup>st</sup> of January and 1<sup>st</sup> February 2013 at the Derryclure Landfill site are presented in Appendix A and B.

Weather conditions the day of monitoring were calm, dry and overcast with a light air breeze from the south west. Weather conditions from Met Eireann's nearest synoptic weather station are presented in Table 4.1 below.

Table 4.1 Weather Report from Gurteen Weather Station						
Date	Rainfall (mm)	Max temp (°C)	Min temp (°C)	Atmospheric Pressure mbar	Wind Direction	Wind Speed (m/sec)
31-01-11	3.5	9.1	3.5	1006.0	South-West	8.59
01-02-13	0.2	7.7	2.2	997.2	South-West	5.35

*Note: Temperatures are in Centigrade. Wind speeds are in meters per second.*

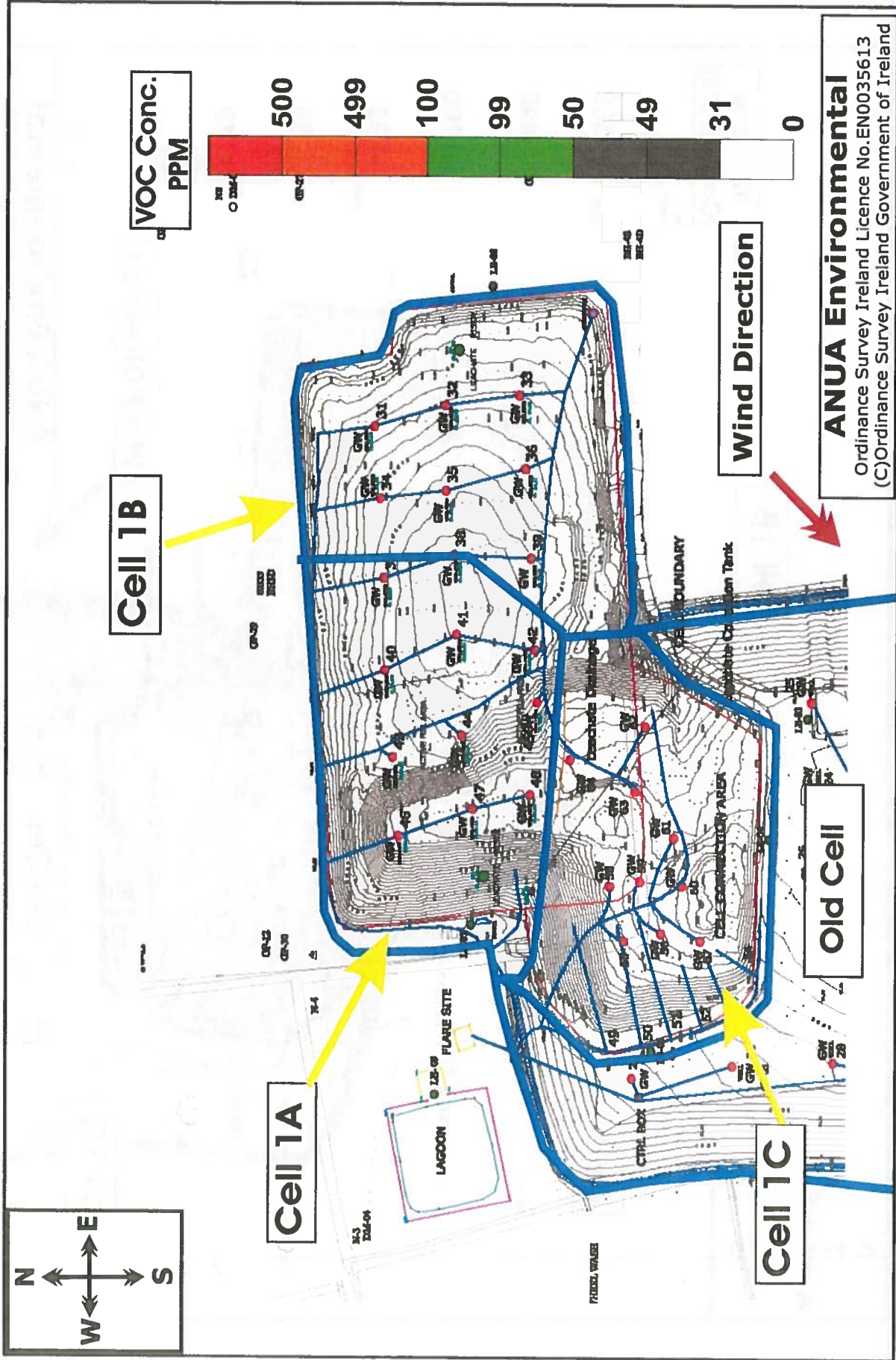
Onsite weather conditions were also monitored using a hand-held Kestrel anemometer instrument, and field notes taken to help interpret results. It was noted that the average on-site wind-speed for 31<sup>st</sup> January was 6.8 m/s; however the survey was halted as the winds increased later in the afternoon. On the 1<sup>st</sup> February, wind speeds were lower (4.9 m/s i.e. a gentle breeze) and more favourable for completing the remainder of the fugitive emission survey. Weather conditions over the duration of the monitoring event are classed as C on the Pasquill stability scale (i.e. slightly unstable as there modest cloud cover).

A total of 501 readings were taken over the three cells. VOC's and Methane were not detected above 1 parts per million (as shown in Appendix 1 results). This displays a notable reduction compared to the previous monitoring survey, conducted in February 2011 (BNM Report Ref ECS3871). It may be therefore concluded that the geo-textile membrane has been successful in reducing fugitive emissions to a negligible level at the Derryclure site.

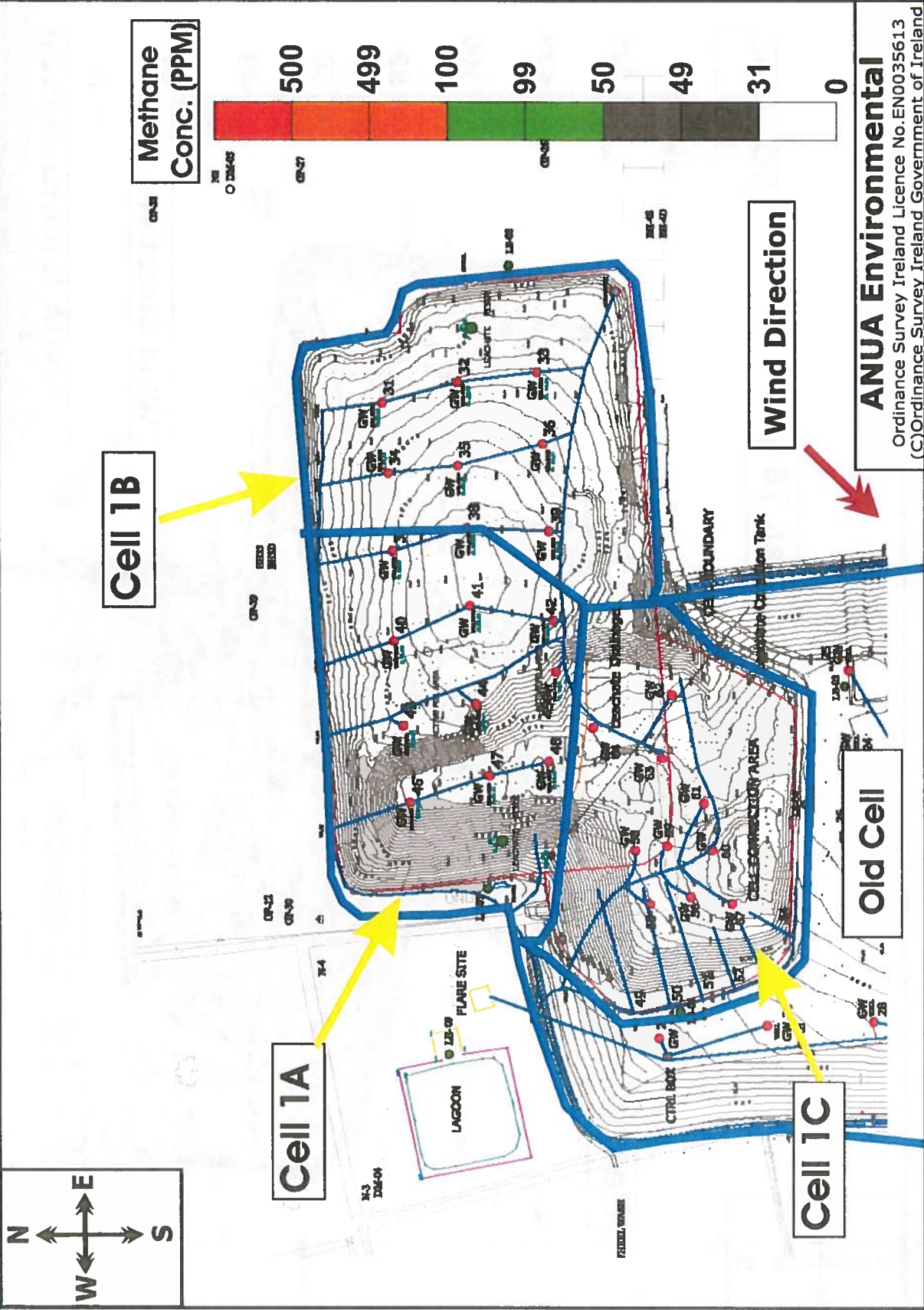
## **Appendix A**

### **Contour Map Image of VOC/Methane Concentration**









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## **Appendix B**

### **Results of VOC/Methane Monitoring**

Table A – Results of VOC and Methane Concentration in PPM

Waypoint	Grid Ref.	CH4	VOC	Waypoint	Grid Ref.	CH4	VOC	Waypoint	Grid Ref.	CH4	VOC
1	IN 35364	<1	<1	33	IN 35461 20625	<1	<1	65	IN 35573 20646	<1	<1
2	IN 35354	<1	<1	34	IN 35465 20628	<1	<1	66	IN 35577 20645	<1	<1
3	IN 35346	<1	<1	35	IN 35469 20634	<1	<1	67	IN 35582 20645	<1	<1
4	IN 35339	<1	<1	36	IN 35482 20639	<1	<1	68	IN 35587 20645	<1	<1
5	IN 35338	<1	<1	37	IN 35489 20639	<1	<1	69	IN 35592 20646	<1	<1
6	IN 35332	<1	<1	38	IN 35488 20640	<1	<1	70	IN 35594 20648	<1	<1
7	IN 35331	<1	<1	39	IN 35491 20639	<1	<1	71	IN 35601 20650	<1	<1
8	IN 35332	<1	<1	40	IN 35492 20639	<1	<1	72	IN 35603 20652	<1	<1
9	IN 35336	<1	<1	41	IN 35494 20637	<1	<1	73	IN 35604 20653	<1	<1
10	IN 35336	<1	<1	42	IN 35496 20639	<1	<1	74	IN 35605 20655	<1	<1
11	IN 35332	<1	<1	43	IN 35499 20639	<1	<1	75	IN 35605 20659	<1	<1
12	IN 35338	<1	<1	44	IN 35499 20639	<1	<1	76	IN 35602 20666	<1	<1
13	IN 35339	<1	<1	45	IN 35502 20638	<1	<1	77	IN 35602 20669	<1	<1
14	IN 35343	<1	<1	46	IN 35505 20639	<1	<1	78	IN 35602 20670	<1	<1
15	IN 35348	<1	<1	47	IN 35510 20640	<1	<1	79	IN 35602 20673	<1	<1
16	IN 35377	<1	<1	48	IN 35512 20639	<1	<1	80	IN 35601 20675	<1	<1
17	IN 35384	<1	<1	49	IN 35514 20640	<1	<1	81	IN 35600 20684	<1	<1
18	IN 35392	<1	<1	50	IN 35517 20640	<1	<1	82	IN 35600 20694	<1	<1
19	IN 35402	<1	<1	51	IN 35519 20641	<1	<1	83	IN 35600 20697	<1	<1
20	IN 35401	<1	<1	52	IN 35523 20642	<1	<1	84	IN 35599 20702	<1	<1
21	IN 35400	<1	<1	53	IN 35526 20642	<1	<1	85	IN 35598 20708	<1	<1
22	IN 35400	<1	<1	54	IN 35530 20642	<1	<1	86	IN 35597 20714	<1	<1
23	IN 35408	<1	<1	55	IN 35537 20643	<1	<1	87	IN 35596 20728	<1	<1
24	IN 35424	<1	<1	56	IN 35542 20644	<1	<1	88	IN 35592 20735	<1	<1
25	IN 35429	<1	<1	57	IN 35543 20645	<1	<1	89	IN 35583 20735	<1	<1
26	IN 35442	<1	<1	58	IN 35543 20650	<1	<1	90	IN 35578 20735	<1	<1
27	IN 35449	<1	<1	59	IN 35544 20645	<1	<1	91	IN 35576 20737	<1	<1
28	IN 35452	<1	<1	60	IN 35546 20644	<1	<1	92	IN 35576 20740	<1	<1
29	IN 35453	<1	<1	61	IN 35550 20645	<1	<1	93	IN 35574 20748	<1	<1
30	IN 35455	<1	<1	62	IN 35555 20644	<1	<1	94	IN 35574 20755	<1	<1
31	IN 35454	<1	<1	63	IN 35560 20645	<1	<1	95	IN 35574 20761	<1	<1
32	IN 35458	<1	<1	64	IN 35569 20645	<1	<1	96	IN 35574 20766	<1	<1



Table A Contd... Results of VOC and Methane Concentration in PPM

Waypoint	Grid Ref.	CH4	VOC	Waypoint	Grid Ref.	CH4	VOC	Waypoint	z	CH4	VOC
97	IN 35572	<1	<1	129	IN 35366 20737	<1	<1	161	IN 35343 20615	<1	<1
98	IN 35566	<1	<1	130	IN 35367 20730	<1	<1	162	IN 35346 20607	<1	<1
99	IN 35559	<1	<1	131	IN 35369 20722	<1	<1	163	IN 35347 20602	<1	<1
100	IN 35548	<1	<1	132	IN 35369 20717	<1	<1	164	IN 35352 20594	<1	<1
101	IN 35541	<1	<1	133	IN 35371 20705	<1	<1	165	IN 35355 20592	<1	<1
102	IN 35529	<1	<1	134	IN 35373 20696	<1	<1	166	IN 35362 20591	<1	<1
103	IN 35514	<1	<1	135	IN 35372 20690	<1	<1	167	IN 35368 20593	<1	<1
104	IN 35500	<1	<1	136	IN 35375 20685	<1	<1	168	IN 35374 20592	<1	<1
105	IN 35489	<1	<1	137	IN 35376 20681	<1	<1	169	IN 35382 20592	<1	<1
106	IN 35475	<1	<1	138	IN 35376 20678	<1	<1	170	IN 35386 20591	<1	<1
107	IN 35459	<1	<1	139	IN 35373 20680	<1	<1	171	IN 35390 20592	<1	<1
108	IN 35453	<1	<1	140	IN 35369 20675	<1	<1	172	IN 35395 20592	<1	<1
109	IN 35450	<1	<1	141	IN 35357 20674	<1	<1	173	IN 35398 20592	<1	<1
110	IN 35439	<1	<1	142	IN 35379 20701	<1	<1	174	IN 35402 20591	<1	<1
111	IN 35432	<1	<1	143	IN 35381 20698	<1	<1	175	IN 35404 20591	<1	<1
112	IN 35425	<1	<1	144	IN 35380 20694	<1	<1	176	IN 35407 20591	<1	<1
113	IN 35426	<1	<1	145	IN 35381 20690	<1	<1	177	IN 35410 20591	<1	<1
114	IN 35424	<1	<1	146	IN 35383 20684	<1	<1	178	IN 35415 20591	<1	<1
115	IN 35421	<1	<1	147	IN 35383 20679	<1	<1	179	IN 35418 20591	<1	<1
116	IN 35420	<1	<1	148	IN 35381 20672	<1	<1	180	IN 35441 20595	<1	<1
117	IN 35420	<1	<1	149	IN 35380 20672	<1	<1	181	IN 35440 20595	<1	<1
118	IN 35416	<1	<1	150	IN 35373 20671	<1	<1	182	IN 35441 20606	<1	<1
119	IN 35412	<1	<1	151	IN 35365 20668	<1	<1	183	IN 35441 20613	<1	<1
120	IN 35406	<1	<1	152	IN 35359 20667	<1	<1	184	IN 35442 20619	<1	<1
121	IN 35402	<1	<1	153	IN 35349 20663	<1	<1	185	IN 35444 20622	<1	<1
122	IN 35396	<1	<1	154	IN 35345 20661	<1	<1	186	IN 35447 20626	<1	<1
123	IN 35390	<1	<1	155	IN 35340 20657	<1	<1	187	IN 35450 20629	<1	<1
124	IN 35388	<1	<1	156	IN 35336 20650	<1	<1	188	IN 35452 20635	<1	<1
125	IN 35374	<1	<1	157	IN 35334 20643	<1	<1	189	IN 35452 20636	<1	<1
126	IN 35368	<1	<1	158	IN 35336 20638	<1	<1	190	IN 35453 20642	<1	<1
127	IN 35364	<1	<1	159	IN 35338 20633	<1	<1	191	IN 35459 20643	<1	<1
128	IN 35365	<1	<1	160	IN 35341 20625	<1	<1	192	IN 35462 20644	<1	<1

Table A Contd... Results of VOC and Methane Concentration in PPM

Waypoint	Grid Ref.	CH4	VOC	Waypoint	Grid Ref.	CH4	VOC	Waypoint	Grid Ref.	CH4	VOC	Waypoint	Grid Ref.	CH4	VOC
193	IN 35468 20643	<1	<1	225	IN 35596 20691	<1	<1	257	IN 35502 20766	<1	<1	<1	IN 35502 20766	<1	<1
194	IN 35470 20642	<1	<1	226	IN 35594 20698	<1	<1	258	IN 35496 20766	<1	<1	<1	IN 35496 20766	<1	<1
195	IN 35470 20642	<1	<1	227	IN 35594 20699	<1	<1	259	IN 35488 20766	<1	<1	<1	IN 35488 20766	<1	<1
196	IN 35473 20643	<1	<1	228	IN 35594 20700	<1	<1	260	IN 35483 20766	<1	<1	<1	IN 35483 20766	<1	<1
197	IN 35477 20642	<1	<1	229	IN 35593 20701	<1	<1	261	IN 35478 20762	<1	<1	<1	IN 35478 20762	<1	<1
198	IN 35479 20645	<1	<1	230	IN 35593 20703	<1	<1	262	IN 35474 20761	<1	<1	<1	IN 35474 20761	<1	<1
199	IN 35486 20646	<1	<1	231	IN 35592 20707	<1	<1	263	IN 35473 20761	<1	<1	<1	IN 35473 20761	<1	<1
200	IN 35491 20647	<1	<1	232	IN 35591 20712	<1	<1	264	IN 35466 20759	<1	<1	<1	IN 35466 20759	<1	<1
201	IN 35496 20648	<1	<1	233	IN 35591 20715	<1	<1	265	IN 35461 20759	<1	<1	<1	IN 35461 20759	<1	<1
202	IN 35502 20648	<1	<1	234	IN 35590 20721	<1	<1	266	IN 35452 20755	<1	<1	<1	IN 35452 20755	<1	<1
203	IN 35505 20649	<1	<1	235	IN 35589 20727	<1	<1	267	IN 35436 20753	<1	<1	<1	IN 35436 20753	<1	<1
204	IN 35508 20649	<1	<1	236	IN 35581 20729	<1	<1	268	IN 35428 20753	<1	<1	<1	IN 35428 20753	<1	<1
205	IN 35513 20650	<1	<1	237	IN 35579 20729	<1	<1	269	IN 35424 20755	<1	<1	<1	IN 35424 20755	<1	<1
206	IN 35519 20651	<1	<1	238	IN 35575 20730	<1	<1	270	IN 35423 20756	<1	<1	<1	IN 35423 20756	<1	<1
207	IN 35525 20651	<1	<1	239	IN 35574 20734	<1	<1	271	IN 35417 20756	<1	<1	<1	IN 35417 20756	<1	<1
208	IN 35528 20651	<1	<1	240	IN 35571 20738	<1	<1	272	IN 35411 20755	<1	<1	<1	IN 35411 20755	<1	<1
209	IN 35533 20651	<1	<1	241	IN 35568 20745	<1	<1	273	IN 35404 20754	<1	<1	<1	IN 35404 20754	<1	<1
210	IN 35540 20652	<1	<1	242	IN 35569 20753	<1	<1	274	IN 35398 20753	<1	<1	<1	IN 35398 20753	<1	<1
211	IN 35549 20654	<1	<1	243	IN 35569 20761	<1	<1	275	IN 35391 20751	<1	<1	<1	IN 35391 20751	<1	<1
212	IN 35556 20655	<1	<1	244	IN 35566 20766	<1	<1	276	IN 35385 20750	<1	<1	<1	IN 35385 20750	<1	<1
213	IN 35561 20655	<1	<1	245	IN 35558 20767	<1	<1	277	IN 35380 20749	<1	<1	<1	IN 35380 20749	<1	<1
214	IN 35568 20655	<1	<1	246	IN 35551 20768	<1	<1	278	IN 35377 20747	<1	<1	<1	IN 35377 20747	<1	<1
215	IN 35572 20655	<1	<1	247	IN 35550 20767	<1	<1	279	IN 35373 20737	<1	<1	<1	IN 35373 20737	<1	<1
216	IN 35576 20657	<1	<1	248	IN 35545 20769	<1	<1	280	IN 35375 20732	<1	<1	<1	IN 35375 20732	<1	<1
217	IN 35582 20657	<1	<1	249	IN 35544 20766	<1	<1	281	IN 35376 20728	<1	<1	<1	IN 35376 20728	<1	<1
218	IN 35588 20658	<1	<1	250	IN 35540 20766	<1	<1	282	IN 35375 20725	<1	<1	<1	IN 35375 20725	<1	<1
219	IN 35598 20659	<1	<1	251	IN 35537 20765	<1	<1	283	IN 35376 20718	<1	<1	<1	IN 35376 20718	<1	<1
220	IN 35600 20661	<1	<1	252	IN 35532 20765	<1	<1	284	IN 35376 20717	<1	<1	<1	IN 35376 20717	<1	<1
221	IN 35598 20671	<1	<1	253	IN 35522 20765	<1	<1	285	IN 35377 20711	<1	<1	<1	IN 35377 20711	<1	<1
222	IN 35598 20677	<1	<1	254	IN 35519 20766	<1	<1	286	IN 35376 20706	<1	<1	<1	IN 35376 20706	<1	<1
223	IN 35597 20681	<1	<1	255	IN 35516 20766	<1	<1	287	IN 35376 20707	<1	<1	<1	IN 35376 20707	<1	<1
224	IN 35596 20688	<1	<1	256	IN 35507 20767	<1	<1	288	IN 35375 20703	<1	<1	<1	IN 35375 20703	<1	<1

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289	IN 35377	<1	<1	<1	321	IN 35376 20601	<1	<1	<1	353	IN 35579 20704	<1	<1
290	IN 35380	<1	<1	<1	322	IN 35385 20601	<1	<1	<1	354	IN 35585 20708	<1	<1
291	IN 35384	<1	<1	<1	323	IN 35392 20600	<1	<1	<1	355	IN 35579 20706	<1	<1
292	IN 35386	<1	<1	<1	324	IN 35404 20598	<1	<1	<1	356	IN 35569 20708	<1	<1
293	IN 35385	<1	<1	<1	325	IN 35422 20602	<1	<1	<1	357	IN 35565 20718	<1	<1
294	IN 35385	<1	<1	<1	326	IN 35425 20604	<1	<1	<1	358	IN 35563 20724	<1	<1
295	IN 35386	<1	<1	<1	327	IN 35428 20609	<1	<1	<1	359	IN 35562 20731	<1	<1
296	IN 35387	<1	<1	<1	328	IN 35430 20616	<1	<1	<1	360	IN 35560 20736	<1	<1
297	IN 35387	<1	<1	<1	329	IN 35431 20627	<1	<1	<1	361	IN 35560 20741	<1	<1
298	IN 35387	<1	<1	<1	330	IN 35432 20633	<1	<1	<1	362	IN 35559 20746	<1	<1
299	IN 35384	<1	<1	<1	331	IN 35433 20638	<1	<1	<1	363	IN 35556 20751	<1	<1
300	IN 35380	<1	<1	<1	332	IN 35433 20642	<1	<1	<1	364	IN 35547 20748	<1	<1
301	IN 35378	<1	<1	<1	333	IN 35434 20646	<1	<1	<1	365	IN 35546 20742	<1	<1
302	IN 35371	<1	<1	<1	334	IN 35439 20654	<1	<1	<1	366	IN 35535 20741	<1	<1
303	IN 35368	<1	<1	<1	335	IN 35448 20661	<1	<1	<1	367	IN 35527 20740	<1	<1
304	IN 35362	<1	<1	<1	336	IN 35454 20664	<1	<1	<1	368	IN 35514 20740	<1	<1
305	IN 35365	<1	<1	<1	337	IN 35459 20666	<1	<1	<1	369	IN 35507 20739	<1	<1
306	IN 35377	<1	<1	<1	338	IN 35466 20667	<1	<1	<1	370	IN 35496 20739	<1	<1
307	IN 35385	<1	<1	<1	339	IN 35473 20669	<1	<1	<1	371	IN 35485 20740	<1	<1
308	IN 35368	<1	<1	<1	340	IN 35482 20665	<1	<1	<1	372	IN 35476 20740	<1	<1
309	IN 35354	<1	<1	<1	341	IN 35490 20661	<1	<1	<1	373	IN 35466 20740	<1	<1
310	IN 35347	<1	<1	<1	342	IN 35502 20662	<1	<1	<1	374	IN 35459 20739	<1	<1
311	IN 35344	<1	<1	<1	343	IN 35514 20666	<1	<1	<1	375	IN 35453 20740	<1	<1
312	IN 35346	<1	<1	<1	344	IN 35519 20666	<1	<1	<1	376	IN 35442 20738	<1	<1
313	IN 35347	<1	<1	<1	345	IN 35527 20669	<1	<1	<1	377	IN 35433 20737	<1	<1
314	IN 35348	<1	<1	<1	346	IN 35541 20670	<1	<1	<1	378	IN 35427 20739	<1	<1
315	IN 35349	<1	<1	<1	347	IN 35548 20670	<1	<1	<1	379	IN 35416 20736	<1	<1
316	IN 35350	<1	<1	<1	348	IN 35558 20671	<1	<1	<1	380	IN 35397 20730	<1	<1
317	IN 35352	<1	<1	<1	349	IN 35566 20673	<1	<1	<1	381	IN 35402 20720	<1	<1
318	IN 35352	<1	<1	<1	350	IN 35570 20675	<1	<1	<1	382	IN 35405 20711	<1	<1
319	IN 35360	<1	<1	<1	351	IN 35575 20685	<1	<1	<1	383	IN 35425 20710	<1	<1
320	IN 35370	<1	<1	<1	352	IN 35577 20698	<1	<1	<1	384	IN 35438 20710	<1	<1
385	IN 35445	<1	<1	<1	417	IN 35435 20688	<1	<1	<1	450	IN 35359 20683	<1	<1

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386	IN 35470	<1	<1	418	IN 35457 20695	<1	<1	451	IN 35369 20701	<1	<1
387	IN 35474	<1	<1	419	IN 35481 20700	<1	<1	452	IN 35387 20698	<1	<1
388	IN 35480	<1	<1	420	IN 35509 20700	<1	<1	453	IN 35520 20653	<1	<1
389	IN 35486	<1	<1	421	IN 35526 20698	<1	<1	454	IN 35541 20648	<1	<1
390	IN 35493	<1	<1	422	IN 35539 20698	<1	<1	455	IN 35595 20669	<1	<1
391	IN 35501	<1	<1	423	IN 35553 20697	<1	<1	456	IN 35594 20688	<1	<1
392	IN 35509	<1	<1	424	IN 35569 20685	<1	<1	457	IN 35566 20689	<1	<1
393	IN 35517	<1	<1	425	IN 35559 20681	<1	<1	458	IN 35580 20710	<1	<1
394	IN 35521	<1	<1	426	IN 35540 20679	<1	<1	459	IN 35601 20711	<1	<1
395	IN 35527	<1	<1	427	IN 35529 20677	<1	<1	460	IN 35569 20738	<1	<1
396	IN 35535	<1	<1	428	IN 35507 20675	<1	<1	461	IN 35549 20769	<1	<1
397	IN 35547	<1	<1	429	IN 35494 20675	<1	<1	462	IN 35513 20766	<1	<1
398	IN 35561	<1	<1	430	IN 35467 20674	<1	<1	463	IN 35384 20693	<1	<1
399	IN 35556	<1	<1	431	IN 35452 20677	<1	<1	464	IN 35488 20764	<1	<1
400	IN 35538	<1	<1	432	IN 35432 20669	<1	<1	465	IN 35453 20763	<1	<1
401	IN 35526	<1	<1	433	IN 35420 20668	<1	<1	466	IN 35426 20762	<1	<1
402	IN 35501	<1	<1	434	IN 35413 20655	<1	<1	467	IN 35395 20761	<1	<1
403	IN 35480	<1	<1	435	IN 35402 20646	<1	<1	468	IN 35401 20734	<1	<1
404	IN 35472	<1	<1	436	IN 35394 20643	<1	<1	469	IN 35434 20736	<1	<1
405	IN 35465	<1	<1	437	IN 35386 20641	<1	<1	470	IN 35463 20739	<1	<1
406	IN 35451	<1	<1	438	IN 35359 20620	<1	<1	471	IN 35497 20740	<1	<1
407	IN 35445	<1	<1	439	IN 35361 20612	<1	<1	472	IN 35529 20740	<1	<1
408	IN 35441	<1	<1	440	IN 35383 20620	<1	<1	473	IN 35450 20634	<1	<1
409	IN 35438	<1	<1	441	IN 35409 20618	<1	<1	474	IN 35554 20744	<1	<1
410	IN 35419	<1	<1	442	IN 35415 20622	<1	<1	475	IN 35563 20711	<1	<1
411	IN 35408	<1	<1	443	IN 35429 20650	<1	<1	476	IN 35550 20712	<1	<1
412	IN 35407	<1	<1	444	IN 35357 20764	<1	<1	477	IN 35528 20716	<1	<1
413	IN 35410	<1	<1	445	IN 35501 20777	<1	<1	478	IN 35503 20713	<1	<1
414	IN 35413	<1	<1	447	IN 35507 20710	<1	<1	479	IN 35473 20711	<1	<1
415	IN 35412	<1	<1	448	IN 35477 20683	<1	<1	480	IN 35440 20714	<1	<1
416	IN 35417	<1	<1	449	IN 35378 20669	<1	<1	481	IN 35411 20707	<1	<1
<b>Waypoint</b>	<b>Grid Ref.</b>	<b>CH4</b>	<b>VOC</b>	<b>Waypoint</b>	<b>Grid Ref.</b>	<b>CH4</b>	<b>VOC</b>	<b>Waypoint</b>	<b>Grid Ref.</b>	<b>CH4</b>	<b>VOC</b>
482	IN 35415	<1	<1								
483	IN 35458	<1	<1								

Table A Contd. - Results of VOC and Methane Concentration in PPM

