ODOUR & ENVIRONMENTAL ENGINEERING CONSULTANTS

Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath

Tel: +353 46 9437922
Mobile: +353 87 6829011
E-mail: info@odourireland.com
john@odourireland.ie
Website: www.odourireland.com

LANDFILL GAS SURFACE EMISSIONS SURVEY AT CORRANURE LANDFILL, LISMAGRATTY & CORRANURE TOWNLANDS, COOTEHILL ROAD, CAVAN, CO. CAVAN

PERFORMED BY ODOUR MONITORING IRELAND ON BEHALF OF CAVAN COUNTY COUNCIL

PREPARED BY:	Dr. John Casey
ATTENTION:	Ms. Sinead Fox
WASTE LICENCE NUMBER:	Waste licence W077-01
DATE:	04th June 2008
REPORT NUMBER:	2008A138(1)
DOCUMENT VERSION:	Document Ver. 001
REVIEWERS:	Dr. Brian Sheridan

TABLE OF CONTENTS

DOCUMENT AMENDMENT RECORD

Client: ***Cavan County Council***

Title: Landfill Gas Surface emissions Survey at Corranure Landfill, Lismagratty & Corranure Townlands, Cootehill Road, Cavan, Co. Cavan

Project Number: 2008A138(1)			**Document Reference:** Landfill Gas Surface emissions Survey at Corranure Landfill, Lismagratty & Corranure Townlands, Cootehill Road, Cavan, Co. Cavan		
2008A138(1)	Document for review	JWC	BAS	JWC	04/06/2008
Revision	**Purpose/Description**	**Originated**	**Checked**	**Authorised**	**Date**

Record sheet

Report by Odour Monitoring Ireland (OMI) on behalf of Cavan County Council			
Report title: Landfill Gas Surface emissions Survey at Corranure Landfill, Lismagratty & Corranure Townlands, Cootehill Road, Cavan, Co. Cavan			
Facility:	Corranure Landfill	**Report Reference No:**	2008A138(1)
Register No:	W077-01	**OMI Staff on-site:**	Dr. John Casey
Staff met during survey on-site	Ms. Sinead Fox	**Date of survey:**	04th June 2008

Executive Summary

Cavan County Council commissioned Odour Monitoring Ireland to perform a landfill gas surface emissions survey of Corranure landfill facility in order to ascertain any likely sources of landfill gas surface emissions from the operating landfill. Landfill gas surface emissions are the predominant source of odour emissions from landfills in Ireland.

During the surface emissions survey, the following tasks were performed on site:

1. Identification the key mechanisms that lead to the release of landfill gas surface emissions from the site.
2. Identify geographically on a site map, the locations of landfill gas surface emissions in order to perform remediation of the identified surface emissions areas.

The following conclusions were drawn from survey:

- Surface emissions locations C1 appears to be present as a result of insufficient sealing of a leachate chamber. These pipes go directly into the waste body. The leachate chamber should be sealed properly with gaskets to prevent emissions from occurring. Sealing these pipes will be easily achieved and should reduce surface emissions markedly. It should be noted that slight abstraction should be applied when sealing has occurred.
- Surface emissions locations C2, C3, C6, C7, C8, C9 and C10 appeared to be a result of insufficient cover material on flanked areas. If flanked areas are not constructed properly and waste is exposed landfill gas will migrate outwards to atmosphere. All flanked areas should be constructed properly to eliminate surface emissions. Further appropriate landfill gas abstraction should be fitted to the cell to reduce surface emissions as a matter of urgency.
- Surface emissions location C4 appeared to be present as a result of works being carried out in the area. This pipework should be put under abstraction as soon as possible to reduce surface emissions.
- Surface emissions location C5 appeared to be present as a result of insufficient cover material application to the area. Landfill gas surface emissions could also be related to poor landfill gas abstraction from the waste body. Investigation of the levels of gas abstraction should be performed in the short term and adequate gas abstraction installed to prevent the flux of landfill gas to atmosphere.

1. Introduction

1.1. Background to work

Odour Monitoring Ireland was commissioned by Cavan County Council to perform a specified independent Volatile organic compound surface emissions survey at Corranure Landfill Facility. The assessment involved a Volatile organic compound (VOC) surface emissions survey of the landfill facility in order to ascertain the VOC emission points and mark them upon a map for remediation. This report presents a summary of the findings of a VOC surface emissions survey at Corranure Landfill, Lismagratty & Corranure Townlands, Cootehill Road, Cavan, Co. Cavan. The report is based on scientific measurements and observations made during a site visit conducted on the 31st May 2008.

1.2. Scope of work

The main aims of the survey included:

- Capping source monitoring using continuous kinematic VOC/GPS system to detect areas of potential landfill gas release/flux;
- Geo-referencing of detected landfill gas flux areas and plotting upon basemap for visual interpretation and remediation;
- Discussion meeting with landfill manager once survey was complete in order to communicate main surface emissions areas for immediate remediation, where necessary.
- Identification of short-term mitigation measured to be implemented within the operating landfill to reduce surface emissions.

This methodology has been used by Odour Monitoring Ireland as a means of continuous odour and VOC surface emissions surveying on a number of licensed Irish landfills.

2. Techniques used

This section describes the techniques used throughout the study.

2.1. "Odour hog" monitoring within the landfill

The "Odour hog" VOC analyser is a portable, intrinsically safe, survey VOC dual monitor, which provides fast and accurate readings of organic and inorganic vapours. A Photo ionisation detector (PID) uses an Ultraviolet (UV) light source (*photo*) to ionise a gas sample and detect its concentration. Ionisation occurs when a molecule absorbs the high energy UV light, ejecting a negatively charged electron and forming of positively charged molecular ion. The gas becomes electrically charged. These charged particles produce a current that is easily measured at the sensor electrodes. Only a small fraction of the VOC molecules are ionised. A PID does not respond to methane. A FID is similar to a flame thermocouple detector, but measures the ions from the flame instead of the heat generated. The FID detects the methane fraction, which provides greater sensitivity in terms of methane surface emissions detection but not necessarily odour hence why the PID data is also interpreted. The FID/PID analyser was calibrated with certified reference material isobutylene and methane before commencement of the survey. The calibration readings were rechecked following completion of the survey.

Using the continuous kinematic "Odour hog" with integrated GPS, the capping of the landfill was surveyed for potential surface emissions areas. Those areas identified were geo-referenced and highlighted for remediation. This technique is useful for comparison in surface emissions area within the same landfill facility on different survey's. The surface emissions maps generated for the particular facility can be used to assess the effectiveness of implemented mitigation techniques and to qualitatively assess the nature of surface emissions from the facility.

2.2. Meteorological conditions

Table 2.1 illustrates the predominant wind direction during the monitoring exercise. The meteorological conditions were characterised for the day of monitoring and were as follows:

Table 2.1. Meteorological conditions during Corranure landfill facility TVOC survey.

Day 1-31st May 2008	
Average wind speed 2.0 m s^{-1}	Wind direction Southerly
Cloud cover 2 to 3 octaves	1012 mbar
Temperature 20.5^{0}C	Relative humidity 60-70%
Sunny day	Capping moisture content low

During the TVOC and gas field survey, wind deviated from a Southerly direction. Capping moisture content was low.

3. Results

3.1. Volatile organic compound surface emissions locations identified within Corranure landfill facility

Figure 6.1 and Table 3.1 illustrates the results obtained for the capping surface emissions survey. A total of 10 individual surface emissions zones were identified. Each surface emissions zone is discussed separately in this manner in order to allow for the development of remediation strategies to mitigate the individual surface emissions areas. Remediation of these sources should be performed using adequate techniques of sloped / flank construction, cover material placement and gas infrastructure installation.

Table 3.1. Capping VOC surface emissions locations results with source identities correlating with *Figure 6.1 (see Appendix I)*.

Location ID	Easting (m)	Northing (m)	Range VOC conc. (ppm)	Identification and Mitigation
C1	244413	307732	4000	Localised source: Leachate chamber should be sealed. Gas abstraction should be applied. All emission points should be appropriately sealed to prevent the flux of landfill gas to atmosphere while careful consideration should be given to the influx of Oxygen in to the cap in this area.
C2	244113	307951	31 to 114	Diffuse source: Sloped flanked area. Area requires tracking and adequate construction of flanks. Adequate gas abstraction should be applied to cell to aid in the containment of landfill gas. Careful consideration should be given to the influx of Oxygen into the intermediate cap flanks in this area when abstraction is applied.
C3	244092	307960	31 to 10108	Diffuse source: Sloped flanked area. Area requires tracking and adequate construction of flanks. Adequate gas abstraction should be applied to cell to aid in the containment of landfill gas. Careful consideration should be given to the influx of Oxygen into the intermediate cap flanks in this area when abstraction is applied.
C4	244151	307940	31 to 2211	Localised source: Hole in waste. Pipes protruding into waste body should be capped and put under abstraction.
C5	244177	307968	31 to 164	Localised source: Open area requires adequate cover material application.
C6	244171	308008	31 to 530	Diffuse source: Sloped flanked area. Area requires tracking and adequate construction of flanks. Adequate gas abstraction should be applied to cell to aid in the containment of landfill gas. Careful consideration should be given to the influx of Oxygen into the intermediate cap flanks in this area when abstraction is applied.
C7	244150	308029	31 to 2512	Diffuse source: Sloped flanked area. Area requires tracking and adequate construction of flanks. Adequate gas abstraction should be applied to cell to aid in the containment of landfill gas. Careful consideration should be given to the influx of Oxygen into the intermediate cap flanks in this area when abstraction is applied.
C8	244103	308033	31 to 182	Diffuse source: Sloped flanked area. Area requires tracking and adequate construction of flanks. Adequate gas abstraction should be applied to cell to aid in the containment of landfill gas. Careful consideration should be given to the influx of Oxygen into the intermediate cap flanks in this area when abstraction is applied.
C9	244148	308058	31 to 1661	Diffuse source: Sloped flanked area. Area requires tracking and adequate construction of flanks. Adequate gas abstraction should be applied to cell to aid in the containment of landfill gas. Careful consideration should be given to the influx of Oxygen into the intermediate cap flanks in this area when abstraction is applied.
C10	244186	308084	31 to 2439	Diffuse source: Sloped flanked area. Area requires tracking and adequate construction of flanks. Adequate gas abstraction should be applied to cell to aid in the containment of landfill gas. Careful consideration should be given to the influx of Oxygen into the intermediate cap flanks in this area when abstraction is applied.

Ten sources of landfill gas surface emissions were identified (*see Figures 6.1 and Table 3.1*) within the landfill.

Surface emissions locations C1 appears to be present as a result of inadequate sealing of a leachate chamber. These pipes go directly into the waste body. The leachate chambers should be sealed adequately and put under a slight negative vacuum. This source of emissions is localised and less significant in comparison to surface emission points C2 to C10.

Surface emissions locations C2, C3, C6, C7, C8, C9 and C10 appeared to be a result of inadequate cover material applied to sloped/flanked areas. All flanked areas should be constructed adequately and the application of adequate gas abstraction should be applied to prevent the emissions of landfill gas to atmosphere. Surface emissions from flanked areas should be mitigated immediately using appropriate techniques.

Surface emissions location C4 appeared to be present as a result of works being carried out in this area. This pipework should be put under abstraction to reduce surface emissions. When abstraction is not possible in a working day, the pipework should be sealed adequately to prevent the free fluxing of landfill gas to atmosphere.

Surface emissions location C5 appeared to be present due to inadequate cover material application and inadequate gas abstraction. The application of and tracking of adequate levels of cover material coupled with sufficient gas abstraction will minimise this source of landfill gas emissions.

3.4. Close out meeting with landfill manager

Following completion of the surface emissions audit, the surface emissions team and landfill manager discussed all aspects and general conclusions of the survey. The landfill manager was informed of the potential areas of surface emissions.

4. Conclusions

The following conclusions were drawn from the survey of Corranure Landfill facility. The surface emissions contour map generated from the kinematic Volatile organic compound (VOC) survey illustrated surface areas of landfill gas surface emissions. This was a result of the following:

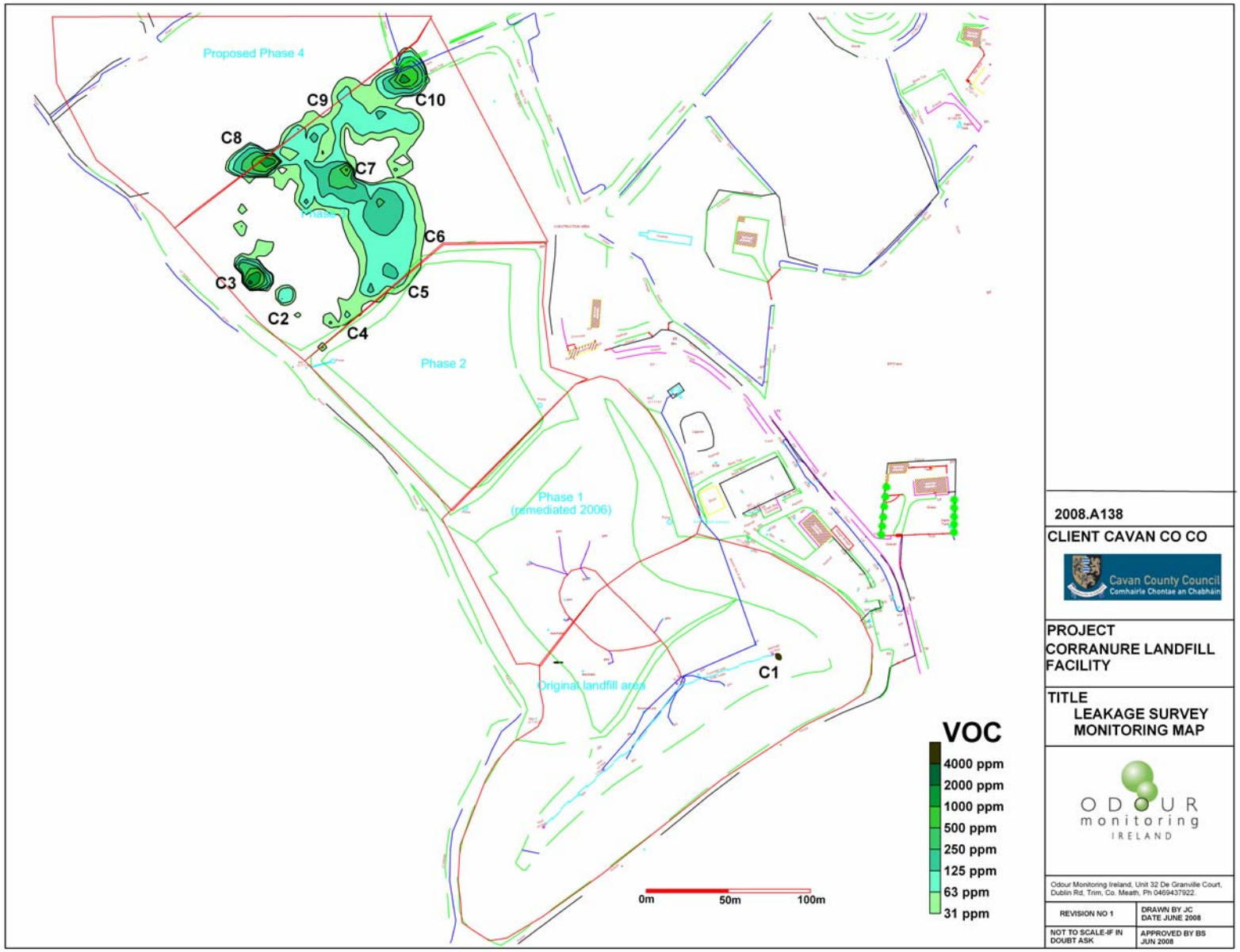
- Surface emissions locations C1 appears to be present as a result of insufficient sealing of a leachate chamber. These pipes go directly into the waste body. The leachate chamber should be sealed properly with gaskets to prevent emissions from occurring. Sealing these pipes will be easily achieved and should reduce surface emissions markedly. It should be noted that slight abstraction should be applied when sealing has occurred.
- Surface emissions locations C2, C3, C6, C7, C8, C9 and C10 appeared to be a result of insufficient cover material on flanked areas. If flanked areas are not constructed properly and waste is exposed landfill gas will migrate outwards to atmosphere. All flanked areas should be constructed properly to eliminate surface emissions. Further appropriate landfill gas abstraction should be fitted to the cell to reduce surface emissions as a matter of urgency.
- Surface emissions location C4 appeared to be present as a result of works being carried out in the area. This pipework should be put under abstraction as soon as possible to reduce surface emissions.
- Surface emissions location C5 appeared to be present as a result of insufficient cover material application to the area. Landfill gas surface emissions could also be related to poor landfill gas abstraction from the waste body. Investigation of the levels of gas abstraction should be performed in the short term and adequate gas abstraction installed to prevent the flux of landfill gas to atmosphere.

5. References

1. Turner, D. B., (1996). Workbook of Atmospheric Dispersion Estimates, CRH Press, New York, U.S.A.
2. Van Langenhove, H., van Broeck, G., (2001). Applicability of sniffing team observations: experiences of field measurements. Proceedings of the first IWA international conference on odour and VOC measurement, regulation and control techniques. The University of NSW, Sydney, Australia.

6. *Appendix I*-Volatile organic compound surface emissions contour map.

Figure 6.1. Landfill gas surface emissions monitoring within the operating landfill facility (colour scale area indicating TVOC gas colour scale).


Proposed Phase 4
C9
C10
C8
C7
C6
C3
C5
C2
C4
Phase 2
Phase 1
(remediated 2006)
Original landfill area
C1
VOC
4000 ppm
2000 ppm
1000 ppm
500 ppm
250 ppm
125 ppm
63 ppm
31 ppm
0m
50m
100m
2008.A138
CLIENT CAVAN CO CO
Cavan County Council
Comhairle Chontae an Chabháin
PROJECT
CORRANURE LANDFILL FACILITY
TITLE
LEAKAGE SURVEY MONITORING MAP
ODOUR monitoring IRELAND
Odour Monitoring Ireland, Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath. Ph 0469437922.
REVISION NO 1
DRAWN BY JC
DATE JUNE 2008
NOT TO SCALE-IF IN DOUBT ASK
APPROVED BY BS
JUN 2008