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ASSESSMENT OF TOTAL VOLATILE ORGANIC COMPOUND SURFACE EMISSIONS AND LANDFILL GAS MANAGEMENT SYSTEMS FROM NEIPHIN TRADING LTD, KERDIFFSTOWN, NAAS, CO. KILDARE

PERFORMED BY ODOUR MONITORING IRELAND ON BEHALF OF THE ENVIRONMENTAL PROTECTION AGENCY (OFFICE OF ENVIRONMENTAL ENFORCEMENT)

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DOCUMENT AMENDMENT RECORD

Client: ***Environmental Protection Agency (Office of Environmental Enforcement)***

Title: Assessment of Total volatile organic compound surface emissions and landfill gas management systems from Neiphin Trading Ltd, Kerdiffstown, Naas, Co. Kildare

Project Number: 2010A111 (22)			**Document Reference:** Assessment of Total volatile organic compound surface emissions and landfill gas management systems from Neiphin Trading Ltd, Kerdiffstown, Naas, Co. Kildare		
2010A111 (22)	Document for review	JWC	BAS	JWC	12/06/2010
Revision	**Purpose/Description**	**Originated**	**Checked**	**Authorised**	**Date**

Record sheet

Site Inspection **Report by Odour Monitoring Ireland (OMI) on behalf of Office of Environmental Enforcement (OEE)**			
Report title: Assessment of Total volatile organic compound surface emissions and landfill gas management systems from Neiphin Trading Ltd, Kerdiffstown, Naas, Co. Kildare			
Facility:	Neiphin Trading Ltd. Facility	**Inspection Reference No:**	2010A111(22)
Register No:	W0047-02	**OMI Staff on-site:**	Dr. John Casey
Licensee staff met during inspection on-site	--	**EPA Inspectors on-site during inspection**	Mr. Joe Hunter & Mr. Pat Kenny
		Announced visit	No
Date/Time of Inspection:	09th June 2010 09.30hrs. to 13.05 hrs.	**Date of report issue Ver 1:**	14th June 2010
		Date of report issue Ver 2:	--

Executive Summary

The Office of Environmental Enforcement commissioned Odour Monitoring Ireland to perform a survey of landfill gas surface emissions and the landfill gas management system at Neiphin Trading Ltd, Kerdiffstown, Naas, Co. Kildare. The main focus of the survey was to monitor landfill gas surface emissions from the facility and to assess the operation of the landfill gas management system.

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

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

The following conclusions were drawn from the study of the Neiphin Trading Ltd, Kerdiffstown, Naas, Co. Kildare:

1. There is no adequate installed landfill gas infrastructure in operation within the facility.

2. Eighteen sources of landfill gas surface emissions were identified within the two landfill areas surveyed (*see Figures 7.1 and Table 3.1*). Sources identified were VOC leakage at ground surface level. The main sources of landfill gas surface emissions were as a result of the absence of adequate landfill gas infrastructure at the facility as well as the absence of appropriate cover material over the waste deposited in Cell 1A and Cell 1B.

3. Comparison between the surface emission survey map developed in 2009 and 2010 for the landfill demonstrate no improvements in the control of landfill gas surface emissions (*see Figures 7.1 and 7.2*).

1. Introduction

1.1. Background to work

Odour Monitoring Ireland were commissioned by the Office of Environmental Enforcement (OEE) to perform a specified independent detailed assessment of landfill gas (LFG) management systems at a number of EPA licensed landfills on behalf of the Office of Environmental Enforcement (OEE). The independent detailed assessment involves a Volatile organic compound (VOC) surface emissions survey and gas collection survey of licensed landfill facilities in order to ascertain the cause and location of significant VOC emission points located within each landfill facility.

This report presents a summary of the findings of the VOC surface emissions survey and LFG management systems at Neiphin Trading Ltd, Kerdiffstown, Naas, Co. Kildare. The report is based on scientific measurements and observations made during a site visit conducted on the 09th June 2010.

1.2. Tasks completed during inspection

The following tasks were completed during the inspection:

- Landfill surface monitoring of two distinct landfill areas at the facility (i.e. lined Cell 1A, Cell 1B in south east section of facility and unlined section in north west of facility) using continuous kinematic VOC/GPS system to detect areas of potential landfill gas release/flux (it is noted that the lined Cell 1B had no waste in place at the time of a similar assessment carried out by Odour Monitoring Ireland in 2009);
- Geo-referencing of detected landfill gas flux areas and plotting upon basemap for visual interpretation and remediation;
- Assessment of LFG management systems on the facility.

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 comprising a Photo ionisation detector and a Flame ionisation detector, which provides fast and accurate readings of organic and inorganic vapours. A Photo ionisation detector 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 Photo ionisation detector does not respond to methane. A Flame ionisation detector is similar to a flame thermocouple detector, but measures the ions from the flame instead of the heat generated. The Flame ionisation detector detects the methane fraction, which provides greater sensitivity in terms of methane leakage detection but not necessarily odour hence why the Photo ionisation detector data is also interpreted. Both sensors were calibrated using NPL gravimetrically filled certified reference material isobutylene and methane.

Using the continuous kinematic "Odour hog" with integrated GPS, the surfaces of the landfill areas were surveyed for potential leakage areas. Those areas identified were geo-referenced and highlighted for remediation. This technique is useful for comparison in leakage area within the same landfill facility on different surveys but is not for cross comparison of VOC leakage between landfills due to a number of factors including, mass flow of VOC on the day of measurement, relative odourous nature of the detected compounds within individual facilities, etc. The leakage maps generated for the particular facility can be used to assess the effectiveness of implemented mitigation techniques and to semi qualitatively assess the nature of leakage from the facility.

In terms of surface emissions and based on best international guidance, efforts should be made to attain surface emissions <100 ppmv from "open" surfaces (general landfill surfaces e.g. areas with capping or cover material in place) and <500 ppmv around features such as vertical wells, leachate collection sumps, leachate slope risers and other protrusions into the waste body (Casey et al., 2008).

2.2. Assessment of landfill gas management systems

The assessment of landfill gas management systems included an overview of the installed landfill gas infrastructure within the facility provided by the landfill management team.

The assessment of LFG management systems typically utilises the following equipment:

- Landfill gas analyser –GA 2000 plus model
- Differential and Static pressure sensor-Testo 400 handheld and associated pressure sensor.
- L type pitot-Stainless steel

This equipment was not used in this instance for reasons discussed in *Section 3.2* of this report.

2.2.1 Observation survey of existing gas management infrastructure

A walk over observation survey was performed on the facility. Basic visual auditing was performed on gas containment and abstraction techniques, cover material application, operation techniques, etc.

2.3. 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 Neiphin Trading Ltd. facility surface emissions survey.

09th June 2010	
Average wind speed 4.55 m s^{-1}	Wind direction North Easterly
Dry weather	Start of survey 1009 mbar Finish of survey 1009 mbar
Temperature 11.9 ^{O}C	Capping moisture content low

During the surface emissions survey and gas field survey, wind direction deviated from the North East. The moisture content of the surfaces of the landfill areas were low. Moisture in landfill surfaces has the effect of increasing gas retention in the landfill cell because cover material porosity is decreased and therefore the surface emissions of gas are restricted somewhat from the landfill cap. Met data was taken from www.met.ie.

3. Results

3.1. Volatile organic compound surface emissions locations identified within Neiphin Trading Ltd. Facility

Figure 7.1 and Table 3.1 illustrates the results obtained for the landfill surface emissions survey. A total of 18 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.

Table 3.1. VOC surface emissions locations results for landfill surfaces with source identities correlating with *Figure 7.1 (see Appendix I)*.

Location	Easting (m)	Northing (m)	Max. VOC conc. (ppm)	Identification and Mitigation	Recommended limits
K1	291373	222010	1,496	VOC leakage at ground surface level: Cell 1B Open area. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K2	291364	221954	3,392	VOC leakage at ground surface level: Cell 1B Open area. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K3	291409	222032	1,803	VOC leakage at ground surface level: Cell 1A Open area. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K4	291439	221986	3,467	VOC leakage at ground surface level: Cell 1A Open area. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K5	291480	221980	2,900	VOC leakage at ground surface level: Cell 1A Open area. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K6	291359	222287	8,725	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K7	291350	222316	157	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K8	291268	222333	133	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K9	291184	222281	963	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K10	291168	222272	533	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K11	291150	222337	426	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K12	291187	222409	2,564	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv

Table 3.1.continued VOC surface emissions locations results for landfill surfaces with source identities correlating with *Figure 7.1 (see Appendix I)*.

Location	Easting (m)	Northing (m)	Max. VOC conc. (ppm)	Identification and Mitigation	Recommended limits
K13	291152	222374	529	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K14	291083	222360	877	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K15	291082	222362	1,249	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K16	291070	222415	454	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K17	291145	222434	698	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv
K18	290988	222461	661	VOC leakage at ground surface level: Surface of material fill area in north west section of facility. Investigate and remediate the cause of the surface emissions having regard to the recommendations within this report.	<100 ppmv

Eighteen sources of landfill gas surface emissions were identified within the landfill (*see Figures 7.1 and Table 3.1*).

Surface emission locations K1, K2, K3, K4 and K5 are a result of landfill gas emissions from the lined Cell 1A and Cell 1B. Surface emissions from locations K1, K2, K3, K4 and K5 are present due to inadequate cover material application and the absence of adequate landfill gas infrastructure.

Surface emission locations K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, K16, K17 and K18 are a result of landfill gas surface emissions from the material fill area in the North West section of the facility. Surface emissions from locations K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, K16, K17 and K18 are present due to the absence of adequate landfill gas infrastructure.

3.2. Results from LFG management systems survey

3.2.1 Observation survey

During the site visit carried out on the 09th June 2010, a general walkover observation survey was completed. The following items were noted during the site observation survey:

- There was no adequate installed landfill gas infrastructure to audit on the facility.
- It was noted that there was waste exposed on a large proportion of Cell 1B without appropriate cover material.

3.2.2 Flare system and gas collection system

- There is no adequate installed landfill gas infrastructure on the facility.

- Results from the surface emissions survey indicate that landfill gas infrastructure is required at the facility.

4. Conclusions

The surface emissions contour map generated from the kinematic Volatile organic compound (VOC) survey illustrated 18 separate surface areas of landfill gas surface emissions within the operating facility. A number of key issues requiring immediate attention identified from the survey of the facility are detailed below.

1. There is no adequate installed landfill gas infrastructure in operation within the facility.

2. Eighteen sources of landfill gas surface emissions were identified within the two landfill areas surveyed (*see Figures 7.1 and Table 3.1*). Sources identified were VOC leakage at ground surface level. The main sources of landfill gas surface emissions were as a result of the absence of adequate landfill gas infrastructure at the facility as well as the absence of appropriate cover material over the waste deposited in Cell 1A and Cell 1B.

3. Comparison between the surface emission survey map developed in 2009 and 2010 for the landfill demonstrate no improvements in the control of landfill gas emissions (*see Figures 7.1 and 7.2*).

5. Recommendations

The following recommendations are made:

- Implement the mitigation measures identified in *Section 3* of this report,
- Install and operate appropriate landfill gas management infrastructure at the facility,
- Provide appropriate cover material to waste deposited in Cell 1A and Cell 1B.

6. References

1. Casey, J.W., Sheridan, B.A., Henry, M., Reynolds, K., (2008). Effective tools for managing odours from landfill facilities. International Conference on Environmental Odour Monitoring and Control**,** Rome, Italy**,** July 6-8, 2008**.**

7. *Appendix I* - Volatile organic compound surface emissions contour maps.

Figure 7.1. Landfill gas surface emissions monitoring within the operating landfill facility (colour scale area indicating TVOC gas colour scale).

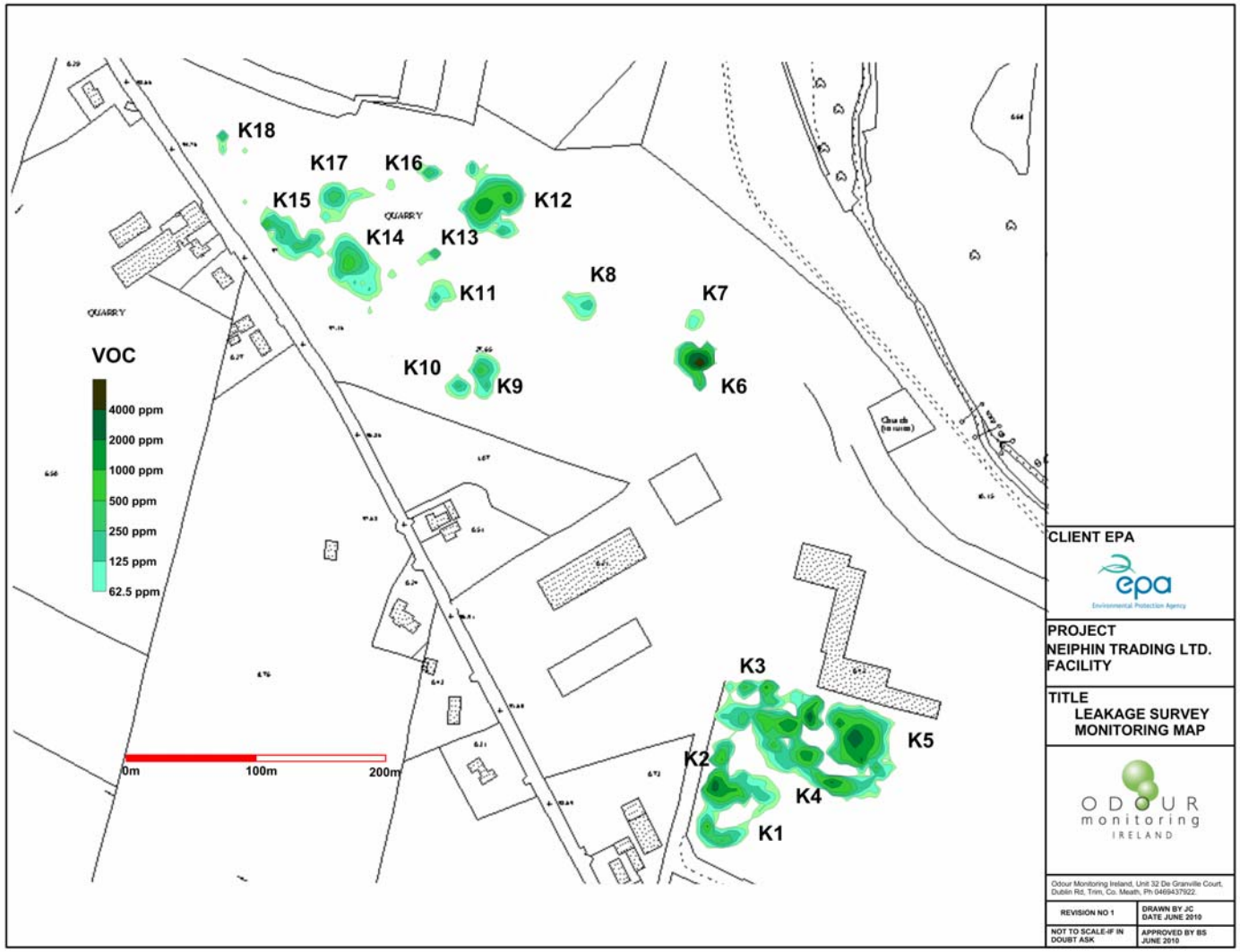
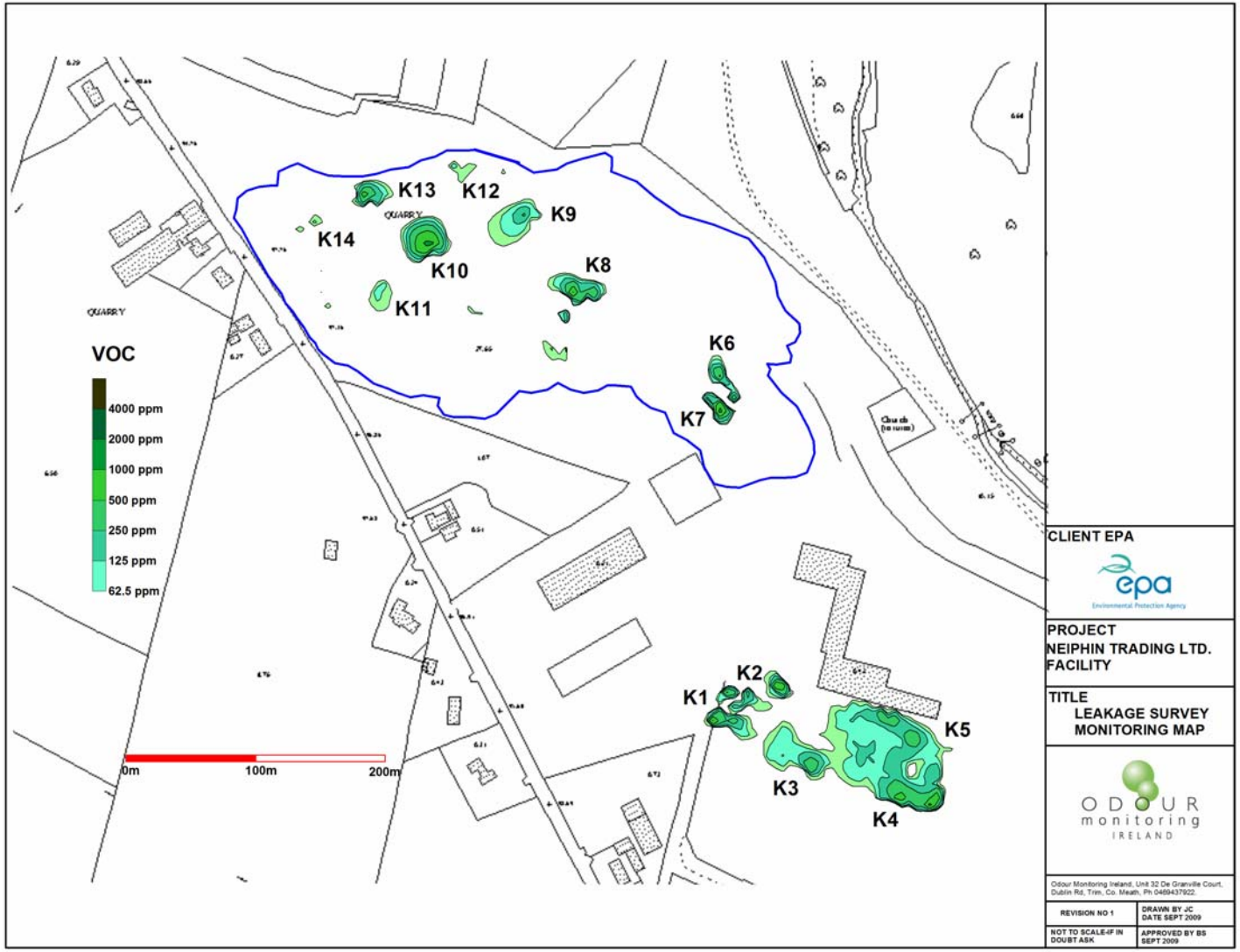

K18
K17
K16
K15
K12
QUARRY
K14
K13
K8
K11
K7
QUARRY
VOC
4000 ppm
2000 ppm
1000 ppm
500 ppm
250 ppm
125 ppm
62.5 ppm
K10
K9
K6
K3
K5
K2
K4
K1
0m
100m
200m
CLIENT EPA
epa
Environmental Protection Agency
PROJECT
NEIPHIN TRADING LTD.
FACILITY
TITLE
LEAKAGE SURVEY
MONITORING MAP
ODOUR
monitoring
IRELAND
Odour Monitoring Ireland, Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath, Ph 0469437922.
REVISION NO 1
DRAWN BY JC
DATE JUNE 2010
NOT TO SCALE-IF IN DOUBT ASK
APPROVED BY BS
JUNE 2010

Figure 7.2. Landfill gas surface emissions monitoring within the operating landfill facility (colour scale area indicating TVOC gas colour scale) in 2009. (From report 2009.A222(22)


K13
K12
K9
K14
K10
K8
K11
K6
K7
K2
K1
K5
K3
K4
QUARRY
QUARRY
VOC
4000 ppm
2000 ppm
1000 ppm
500 ppm
250 ppm
125 ppm
62.5 ppm
0m
100m
200m
CLIENT EPA
epa
Environmental Protection Agency
PROJECT
NEIPHIN TRADING LTD.
FACILITY
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LEAKAGE SURVEY
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SEPT 2009