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AIR QUALITY IMPACT OF PROPOSED LANDFILL EXTENSION CORRANURE, CO. CAVAN

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ENVIROCON LTD.
OLD ROAD
KILCARN BRIDGE
NAVAN, CO. MEATH
Tel: (046) 9074135
Fax: (046) 9074055
e-mail: info@envirocon.ie

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Report By: Michael L. Bailey

M. L. Bailey

1.0 INTRODUCTION

The existing landfill facility at Corranure, Co. Cavan is to be extended to provide additional capacity for the disposal of municipal waste and non-hazardous commercial/industrial waste from Cavan Town and the surrounding area for the next 8 years. The present landfill is Licenced (No 77-1) under the 1997 Waste Management Licensing Regulations by the Environmental Protection Agency. The proposed extension area is to the northwest of the existing landfill facility. As part of the evaluation of the environmental impact of this proposed development, an assessment of the impact on air quality was undertaken by Envirocon Ltd.

The planned extension area comprises a total area about 4 hectares and filling will commence in 2006 with a projected annual intake rate of 90,000 tonnes. This represents a trebling of the current limit specified in the current Waste Licence, of 30,050 tonnes per year. The extension area provides for additional capacity of about 5 years at the proposed waste disposal rate, with the filling of the extension area expected to be completed by end of 2011. The cells in the extension area will be progressively capped and restored and the landfill gas collected and flared in the landfill gas flare-stack, which is to be installed shortly for the existing cells.

The existing access road into the landfill, reception infrastructure including the weighbridge, wheel-wash and civic amenity disposal area will remain at their present locations. Leachate from the proposed extension will be collected and pumped for treatment to Cavan Wastewater Treatment Plant in Cavan Town.

2.0 EXISTING ENVIRONMENT

2.1 Ambient Air Quality

2.1.1 Dust

Dust deposition monitoring is carried out at four locations near the site boundary for one month over a year as required under Schedule E of the Waste Licence. The four locations, designated D1-D4, are shown in **Figure 1.** Site Dl is located along the existing western boundary, Site D2 is near the northern boundary of the existing site, Site D3 is near the eastern boundary and Site D4 is close to the site entrance.

The method used is the Bergerhoff dust gauge that comprises a plastic container supported on a metal pole, to collect bulk particulate material. The container has an opening of 0.089m, with a collection area of 0.0062m^2 and material falling into the container is collected after exposure over a month and analysed using the German Standard procedure (VDI2119) for determination of dustfall amounts. The method includes both soluble, ie. dissolved salts present in rainwater, as well as undissolved material such as particulate material and biological debris. The dust deposition limit specified in Schedule F.3 of the Waste Licence is 350 mg/m^2.day, expressed as a monthly average over a 30-day period.

Location	Survey Period			
	30/5/02-28/6/02	16/8/-02-14/9/02	26/6/03-25/7/03	9/9/03-8/10/03
D1	NA	136	370	NA
D2	94	71	176	140
D3	212	169	250	287
D4	119	224	315	325

Note: NA – Result unavailable due to biological contamination of sample

Table 1 Dust deposition rates at site boundary (mg/m^2.day)

The results of the dust deposition survey during the past four surveys undertaken in 2002 and 2003 indicate that measured deposition rates are less than the limit specified in the licence, with the exception of location Dl for the June/July 2003 period (Table 1). Engineering works were being carried out near the western boundary during this monitoring period so that the dust deposition rate reported at this location was influenced by this short-term activity.

2.1.2 Odours

Malodorous compounds generated within a landfill include hydrogen sulphide, organic sulphides (mercaptans), amines and other volatile organic compounds, some of which have very low odour detection levels of below 1 part per billion (ppb). These trace gaseous compounds are generated during the anaerobic decomposition of the waste deposited in the landfill cells. When they are released to the atmosphere from borehole vents and other sources the emissions can result in highly pungent malodours within a landfill.

As part of the environmental monitoring programme specified in the Waste Licence, regular inspection of certain boundary locations by staff is carried out on a daily basis to assess the presence or absence of odours. An effective qualitative odour survey can be carried out by using the 'sniff sampling approach where a member of staff walks around the site boundary to identify if odours are present. Although somewhat subjective, as no air sample is collected, it still enables the categorising of malodours near the site boundary in broad terms; for example none, slight, moderate, pungent etc. In addition, based on the experience of the personnel it may be possible to characterise the malodour with a particular type of source within the landfill. For example 'sweet' ester odours are associated with recently tipped domestic waste whereas the pungent smell of 'rotten eggs' may be caused by recent disposal of sewage sludge.
Due to the nature of the activity carried out at Corranure, it is not possible to eliminate all sources of malodours from the landfilling operation. However, the incidence of complaints from residents living near the site is very low and over the past 18 months only a small number have been reported and logged at the landfill. Reported odours also tend to be slight in magnitude and transient in duration when experienced within the local community. However, with ongoing improvements being made to reduce and contain potential malodorous emission sources at the landfill, the potential for nuisance complaints at nearby houses will continue to decline.

During the site visit undertaken in June 2003, as part of the EIS report, malodours of a slight to moderate strength were identified on the walkover near the capped area of the existing landfill and along the main haul road to the present active cell. However, no malodours could be detected at the site entrance or near the site boundaries.

2.1.3 Sulphur dioxide and Nitrogen oxides

Ambient concentrations of sulphur dioxide and nitrogen dioxide in the vicinity of the landfill would be similar to those recorded in rural locations elsewhere in Ireland and well below the existing National Air Quality Standards (NAQS) (SI: No 244 of 1987). They would also be well below the more stringent future limit values specified in the Air Quality Standards Regulations 2002 (SI No 271 of 2002). These limit values are based on the requirements contained in the 1999 E.U. Air Quality Directive (1999/30/EC). The 2002 Regulations gives a daily limit value for sulphur dioxide of 125 ug/m^3, expressed as a 99.2 percentile (4^{th} highest daily value of the year) and an hourly value of 350 ug/m^3 (25th highest value over a year). These limit values are to be met by 2005. The corresponding limit values for nitrogen dioxide are 200 ug/m^3 as an hourly 99.8 percentile (19th highest hourly value over the year) and an annual limit of 40 ug/m^3. These limit values are to be met by 2010.

There are no significant emission sources of sulphur dioxide in the area, as houses in the locality would be either low-sulphur distillate oil or peat. Diesel fuel used by road vehicles also has a very low sulphur content. Sulphur dioxide concentrations would be generally less than a daily average of 20 ug/m^3 and an annual level of less than 10 ug/m . These daily concentrations are below 18% of the future limit value.

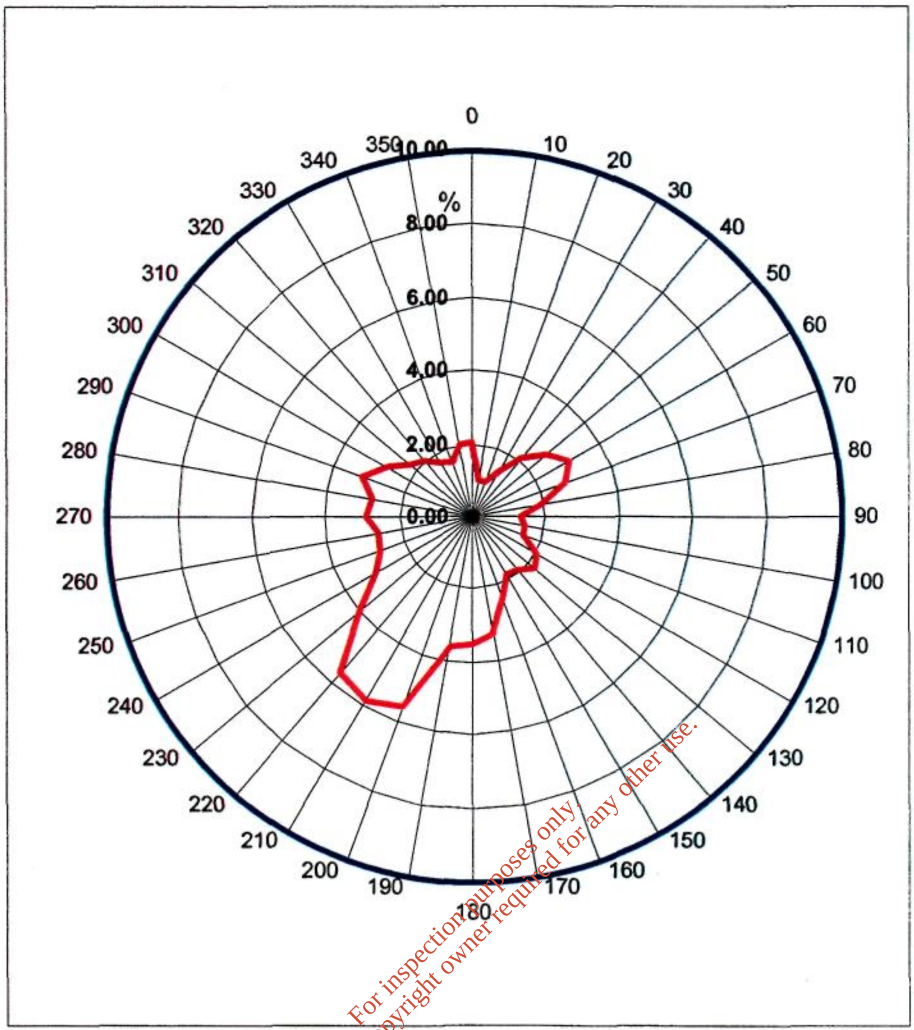
Annual ambient nitrogen dioxide concentrations adjacent to the southern boundary of the site next to the R188 will typically be less than about 15 ug/m^3; which is well below levels likely to exceed the future annual limit specified in the 2002 Regulations. The daily traffic flow along this road out of Cavan is estimated to be about 4,500 vehicles (Two way AADT) based on the results of the traffic survey undertaken for this EIS. Along the other boundaries to the proposed landfill extension ambient average levels of nitrogen dioxide will be generally less than 10 ug/m^3. These concentrations would be comparable to results obtained from background sites operated by the Environmental Protection Agency, which indicate annual nitrogen dioxide levels of less than 10 ug/m^3 (Kilkitt Co. Monaghan, Glashaboy Co. Cork).

2.2 Climate

2.2.1 General

The climate of Co. Cavan is characterised by the frequent passage of Atlantic low-pressure weather systems and associated frontal rain belts from a westerly direction, especially during the winter period. Over the summer months the influence of anticyclonic weather conditions can result in drier continental air, in particular when winds are from the east, interspersed by the passage of Atlantic frontal systems. Occasionally, the establishment of a high pressure area over Ireland and Britain will result in calm conditions and during the winter months these are characterised by clear skies and the formation of low level temperature inversions, with slack wind conditions at night-time. Prolonged dry weather conditions are relatively infrequent but should continental air masses dominate over Ireland a period of drought conditions may occur which could last up to 2 or 3 weeks.

The local climate is an important factor in determining the magnitude and direction of maximum air quality impact due to atmospheric emissions from the operation of the landfill facility at Corranure. The wind speed will affect the rate of dilution of emissions from the various emission sources of dust, PMio and gaseous compounds generated within the landfill. The precipitation pattern of the locality affects the generation of leachate within the landfill and so contributes to the decomposition of waste material in the cell. It is also important in controlling emissions of dust and PM10 from the road surfaces.



HOURLY WIND DIRECTION FREQUENCY - ALL WIND SPEEDS

Direction	Percentage Occurrence of Wind Speeds (m/s)						
	<2	2-3	3-5	6-8	9-11	>11	All
350-10	1.01	1.11	1.31	1.11	0.21	0.0	4.74
20-40	1.31	1.21	1.21	0.71	0.12	0.0	4.55
50-70	2.82	2.92	1.91	0.81	0.03	0.0	8.49
80-100	1.61	1.21	0.91	0.60	0.03	0.0	4.36
110-130	1.31	1.31	1.71	1.11	0.21	0.0	5.76
140-160	0.91	1.01	1.61	1.70	0.71	0.01	6.07
170-190	1.31	1.61	2.72	3.30	1.01	0.03	10.20
200-220	2.72	3.32	4.43	4.00	1.01	0.03	15.64
230-250	2.32	2.92	3.73	3.02	0.6	0.03	12.62
260-280	1.61	1.81	2.22	2.02	0.5	0.02	8.29
290-310	1.31	1.61	2.62	2.32	0.6	0.02	8.59
320-340	1.11	1.31	1.81	1.20	0.3	0.0	5.84
Calms	4.80						4.8
Total	**24.1**	**21.3**	**26.1**	**21.9**	**5.3**	**0.15**	**100.0**

FIG 2: FREQUENCY OF WIND DIRECTION AND WIND SPEED FOR HOURLY OBSERVATIONS AT CLONES, CO. MONAGHAN (1968-97)

2.2.2 Wind

Fugitive dust emissions from a surface occur if the winds are sufficiently strong and turbulent and the surface dry and loose to cause re-suspension from the ground and road surfaces. The surface needs to have a relatively low moisture content for this type of dust emission to take place and any wetting, either by rainfall or sprayers, will greatly reduce the potential for fugitive dust emissions to take place. A wind speed at ground level in excess of about 5 m/s is considered to be the threshold above which resupension of fine-sized material from an exposed surface may take place.

The nearest meteorological station is located at Clones (22km to the NE) and the long-term wind direction and speed statistics are presented in Fig 2 for the period 1968-97 inclusive. It is evident that the prevailing winds are from a southwesterly direction, with 28% of the hourly observations giving a direction of 200-250 degrees. Approximately 60% of winds are from the western sector with an incidence of calm 'slack' wind conditions of about 5%. The annual average wind speed at Clones is 4.4 m/s with less than 6% of the hourly observations recording wind speeds over 9 m/s.

2.2.3 Rainfall

Precipitation data for the nearest long-term climatological stations at Cavan (approx. 5 km to W) and Ballyhaise (3km to N) are given in Table 2 which indicate annual totals of about 900-925mm. Annual rainfall amounts obtained from the on-site climatological station indicate a total of 875mm during the period mid-2002/03.There is no significant difference in the long-term monthly totals recorded during the winter period (Oct-March) compared to the summer period. The precipitation occurring in the winter period is normally associated with more pro-longed Atlantic frontal weather depressions passing over the region compared to the summer when rainfall is more likely to be associated with heavier showery conditions.

The local rainfall pattern is important as it affects the moisture content of the surface of internal haul roads and hence potential for fugitive dust emissions from the road surface.

Table 2 Precipitation rates in locality of Corranure, (mm)

Site	J	F	M	A	M	J	J	A	S	O	N	D	ann
Cavan	89	64	72	57	65	67	58	81	78	95	80	91	895
Ballyhaise	93	68	75	58	66	67	60	83	81	98	85	90	924

Note: Cavan Grid H421055: (1942-93), Ballyhaise Grid H452116 (1932-94)

2.2.4 Air Temperature

Table 3 Long-term mean daily air temperature at Clones, Co. Monaghan (1961-90)

	J	F	M	A	M	J	J	A	S	O	N	D	Ann
Mean	4.0	4.2	5.7	7.5	10.1	12.9	14.5	14.2	12.1	9.8	5.9	4.8	8.8
Maximum	6.7	7.1	9.2	11.6	14.5	17.2	18.6	18.3	16.0	13.1	8.9	7.4	12.4
Minimum	1.3	1.3	2.1	3.4	5.7	8.6	10.4	10.1	8.3	6.5	2.9	2.2	5.2

The pattern of long-term daily temperatures at Clones (1961-90) is presented in Table 3. The climatological records for the landfill indicate a comparable annual mean temperature of 9.0 C during 2002/03 with a maximum hourly temperature reported of 26 C.

3.0 IMPACT OF PROPOSED LANDFILL EXTENSION

3.1 General

Atmospheric emissions from the operation of the proposed landfill extension at Corranure may be categorised as continuous or fugitive (short-term due to the execution of a specific activity). The types of sources are as follows: -

1) Area sources include uncontrolled landfill gas emissions from fissures in completed areas and also from recently tipped waste in operational cells. These areas of the landfill will be sources of dust and trace gaseous compounds. The contribution of this category of emission source to total landfill gas emissions from a landfill will depend mainly on the effectiveness of capping completed cells, covering freshly deposited waste and the efficiency of any installed gas collection system.

2) Line emission sources are the emissions generated from waste trucks and other vehicles travelling along the access and internal haul roads to the tipping area. Depending on the road surface conditions, fugitive dust and PMio emissions caused by the re-suspension of particulates from the road surface by the vehicles travelling along the road can be significant. If the volume of road traffic is relatively low, with only a small number of trucks travelling along a road during the day, then dust-blow is likely to be short-term and intermittent and so may be referred to as fugitive emissions.

3) Point sources are specific emission points within the landfill extension and include uncapped boreholes and the exhaust stack of landfill gas flares. These types of emissions tend to be relatively continuous. Emissions associated with such sources are methane, carbon dioxide, trace volatile organic compounds and inorganic gases such as hydrogen sulphide associated with landfill gas.

The types of air pollutants emitted from the landfill can be grouped under the following headings:-

- Dust and PMio
- Aerosols
- Odours
- Landfill Gas

3.2 Dust and PMio

Emissions of dust and PMio (particulate material with a mean diameter of < 10 um) will occur within the landfill extension from trucks travelling along the access and internal haul roads and from tipping the waste material into the active face of the cell. Generally, trucks travelling along internal loosely surfaced (unpaved) haul roads are the main source of dust within a landfill. The action of the wheels moving along the surface generates resuspension of loose material from the road surface. A hard-paved road surface such as macadam or compacted rock chippings, substantially reduces the potential for dust emissions compared to an unpaved haul road surface. This latter type of road is normally covered with substantial accumulations of mud, silt and other loose material. The emission rate of dust from a road surface is primarily related to the type of surface cover, number and speed of vehicles and the weight of the trucks.

During dry weather conditions, the haul roads will be sprayed with water from a mobile tanker to control dust emissions. The use of water sprays on roads in the facility is required under Condition *6.6* of the Waste Licence. In the winter months, the surface is likely to be sufficiently damp from rain for much of the time so that spraying is not necessary. However, with higher air temperatures and periods of dry weather more frequent in the summer months, spraying the road surface with water is likely to take place on a regular basis. Typically, a wind speed above 5m/s will result in significant dust-blow from the road surface and the rate of re-suspension of material will increase as the wind speeds rises.

Estimates of emissions from road surfaces and tipping of waste have been made based on the emission factors published by the U.S. Environmental Protection Agency (AP-42 Volume 1, 1998). The procedures allow emission rates in terms of g/VKT (grammes per vehicle kilometre travelled) to be calculated for different types of road surfaces and also a value can be derived based on the quantity of waste being deposited.

The maximum number of vehicles per day entering the landfill when the proposed extension is operating will be about 64 trucks/skips (equivalent to about 130 vehicle movements per day), based on increased intake of 90,000 tonnes/yr. Cars or vans, which currently account for about 72% of traffic movements at the site entrance will be restricted to the civic amenity area near the site office/weighbridge. In any case, smaller vehicles generate much lower quantities of dust compared to the larger waste disposal trucks travelling along internal unpaved roads. The emission factor has been adjusted to take the vehicle composition into account. For paved or macadam roads, the emission rate was estimated to be in the order of 0.001 g/s per VKT and 0.01 g/s for unpaved roads. The paved section from the entrance to north of the wheel wash is about 0.3km with the unpaved haul road section within the extension area of about 0.4km. The total maximum emission rate from vehicle movements within the landfill site was calculated to be about 70 kg/day (0.8 g/s), based on dry weather conditions with no dust control measures.

Emissions of dust from the tipping area are normally minor in comparison to total emissions from a landfill. The disposal of ordinary domestic waste in plastic bags substantially will reduce the quantity of loose refuse that could create visible clouds of dust. The compaction process mixes the waste material and so tends to bind the smaller particulate size fractions in the refuse and so emissions of dust are reduced. Daily covering of the freshly deposited waste take place daily with a hessian sheeting and so dust emissions from the active cell area will be very low. Fine-sized materials such as waste cement, plaster etc. may occasionally be disposed along with the standard municipal waste and this can generate substantial short-term dust emissions as it is deposited.

The projected rate of tipping within the landfill extension is estimated to be about 320 tonnes per day, based on the planned disposal rate of up to 90,000 tonnes per year. This waste includes a high fraction of municipal waste in refuse bags with a relatively low proportion of loose waste material. Overall, emissions of dust and PMio from tipping waste within the extension area are predicted to be minor and typically less than 1 kg/day.

Emissions generated during the tipping of waste and compacting will be below the top of the boundary berm around the edge of the new cells and so this feature of cell design will act as a barrier to dust emissions released within the cell. In addition, there will be a substantial reduction in dust and PMio emissions from the haul road by spraying the surface with water using a mobile tanker during dry weather conditions. The dust and PMio emission rates given above represent an indication of the 'worst-case' maximum levels that could occur under dry weather conditions without active dust suppression.

The condition of the entrance and the access road macadam surface is well maintained. A water tanker is regularly used to spray the haul road to the tipping area during dry weather conditions. During the site visit in June 2003 there was no significant accumulations of silt on the road surface with minimal evidence of drag-out of silt onto the public road at the site entrance.

With the implementation of the dust measures outlined in Section 4 emissions of dust and PMio will be adequately controlled within the landfill facility. Overall, the emissions of total airborne particulates from tipping waste are predicted to be slight or imperceptible.

3.3 **Aerosols**

Aerosols are defined as fine particulate material, water droplets and microbial emissions from the activities carried out at the landfill. They are typically particles which remain airborne for a reasonable length of time and generally range in size from less than 0.1 um to about 100 um. Small sized particles, including PMio, have potential health implications, as they may be inhaled and enter the lower respiratory tract. Airborne particles greater than about 30-50 um will tend to remain airborne for only a few tens of metres downwind of the emission source, whereas the finer-sized fraction can travel a significant distance under windy conditions.

The primary source of particulate aerosols within the proposed landfill extension will be from the haul roads such as unpaved sections or where silt has accumulated on the road surface. The impact of these emission sources is dealt with in the previous section. There is no on-site leachate treatment system, with the leachate collected in a lagoon and pumped via a rising main to Cavan Wastewater Treatment Plant so droplet aerosol formation from the landfill will not take place.

Close contact with aerosols from landfill refuse or leachate will increase the risk of certain infections due to the presence of various microorganisms present in the refuse/clay material. These could present a health risk for on-site workers, if certain health and safety conditions are not enforced. However, the risk of infection beyond the site boundary due to aerosols from the landfill dispersing downwind is very low. Based on the proposed operation of the landfill extension at Corranure no significant impact on the health of the local community or environment is predicted.

3.4 Odours

Odours from a municipal landfill are caused by certain trace organic and inorganic compounds generated within the landfill during the waste decomposition stage. The Environmental Agency in the UK has identified over 500 trace organic and inorganic compounds generated from deposited municipal waste. However only a small number of these compounds are likely to cause a potential odour problem at ambient concentrations experienced beyond the site boundary. Some of these trace gases may be less than 0.00005% of the total landfill gas volume. However, in the case of organo-sulphur compounds such as mercaptans, dimethyl sulphide as well as hydrogen sulphide, these compounds are highly pungent with extremely low odour detection thresholds. Sulphurous compounds are generated during the anaerobic decomposition of the waste deposited in the landfill cells and when they are released to the atmosphere from borehole vents and other sources can result in highly pungent malodours within a landfill. Mercaptans and dimethyl sulphide have odours typically characteristic of rotten vegetables/garlic and hydrogen sulphide has the characteristic odour of 'rotten eggs'.

The impact of odours on the ambient air quality will depend on the emission rate, the distance downwind to the sensitive receptor location and the dispersive properties of the lower air layers. The distance downwind at which the 'odour detection' concentration is reached may be within a few metres of the odour source if the rate of emission is low or a considerable distance if the emission rate is very strong. The wind speed and direction are also major factors in determining whether emissions from the landfill will cause a community nuisance beyond the site boundary.

The management of the proposed landfill extension includes daily cover of compacted waste and this will significantly reduce the potential for malodorous emissions from the surface of the active cell. The two cells within the planned extension will be lined with an HDPE liner with a gas collection network also installed as the cells are developed. The liner will prevent lateral migration of landfill gas and so reduce the

the surface of a landfill cell, even during slack wind conditions. The distance to the boundary of the landfill will result in a further substantial reduction in the ambient concentration, due to natural dispersion mechanisms.

Table 4 Typical composition of a landfill gas

Component	**Typical vol** (%)	**Max vol** (%)
Methane	63.8	88.0
Carbon Dioxide	33.6	89.3
Oxygen	0.16	20.9
Nitrogen	2.4	87.0
Hydrogen	0.05	21.1
Carbon Monoxide	0.001	0.09
Ethane	0.005	0.0139
Ethene	0.018	-
Acetaldehyde	0.005	-
Propane	0.002	0.0171
Butanes	0.003	0.023
Helium	0.00005	-
Higher Alkanes	<0.05	0.07
Unsaturated Hydrocarbons	0.009	0.048
Halogenated Hydrocarbons	0.00002	0.032
Hydrogen Sulphide	0.00002	35.0
Organosulphur compounds	0.00001	0.028
Alcohols	0.00001	0.0127
Others	0.00005	0.023

Source: U.K. Dept of Environment Waste Management Paper No 27 (1989)

3.5.2 Landfill gas recovery and emissions

A landfill gas collection system is being designed as specified in Condition 4.16 of the present waste licence, which will connect a number of boreholes within the capped area of the present landfill to an enclosed flare stack installation. The gas collection network installed within the planned extension area will be linked into the overall site network. When sufficient landfill gas has been generated within the cells within the extension area, it will also be collected and flared in the flare stack.

Landfill gas collection efficiencies can vary significantly, from less than about 50% to 85%, depending on the extent of the pipeline collection system installed to extract the gas from the cells. Where the cells are unlined there are normally high losses to atmosphere from lateral migration as well as vertical diffusion through fissures in the completed cell capping which will greatly reduce the effectiveness of a gas collection/flare system. However, the new cells in the extension area will be lined and so uncontrolled losses through lateral migration and venting to atmosphere from fissures in the ground will be greatly reduced.

When landfill gas is flared, removal or destruction efficiency rates of Non-Methane Volatile Organic Compounds (NMVOC's) are generally in the order of 85-99.5%,

when the flame temperature is at least 1000 °C. This will result in the concentrations of the trace compounds in exhaust gases of less than 1% of the levels found in the original landfill gas given in Table 4 above.

Other pollutants present in flares are methane, nitrogen dioxide, carbon monoxide, sulphur dioxide, water vapour and carbon dioxide. The concentration of these pollutants in the emissions from the flare-stack depend on the design of the flare burner, such as burner flame temperature, gas flow rate, moisture content of feed gas etc. The presence of other compounds including sulphur, chlorine and fluorine compounds in the exhaust gas largely depends on the quality of the landfill gas being flared.

3.5.3 **Impacts on the local environment and community health**

There is no scientific evidence providing a causal link between emissions of landfill gas and significant adverse impacts on the flora/fauna, livestock and community health in the locality of properly managed municipal landfills. A detailed review of published studies was carried out recently by the Health Review Board (Health and Environmental Effects of Landfilling and Incineration of Waste, 2003). This report concluded that "although a great number of studies have been carried out, evidence of a causal relationship between specific health outcomes and landfill exposure is still inconclusive". No evidence to demonstrate a clear link between cancer, respiratory, skin or gastro-intestinal illnesses and exposure to emissions of landfill gas was found.

The risk to ill health is related to the concentration of pollutant present at a particular location and the length of exposure; in other words, the dosage experienced by an individual. Landfill gas emissions and associated potential health risks will therefore decline further with the development of a landfill gas collection network and flaring.

Due to the nature of the waste handling operation carried out at the Corranure landfill, it is impossible to eliminate all incidents of malodours being occasionally detected beyond the site boundary. However, continuing improvements in the management of the site will help to reduce the incidence of malodours from the waste facility being detected beyond the site boundary. These measures should ensure that such impacts on local air quality are short-term and infrequent with no significant impact on local community health.

In terms of potential toxic health effects from air pollutants emitted from a flare-stack, it is continuous, long-term or annual exposure, which is important. Although short-term peak ground level concentrations can occur downwind of the flare stack, the potential health impacts will be negligible due to the small period of exposure. Long-term impacts due to emissions from the gas flare will result in ground level concentrations within the locality well below those associated with a significant impact on human health or adverse impact on the environment.