4. AIR QUALITY

4.1 Introduction

This section assesses the potential impacts of the Waste Management Facility on air quality. Air Quality Standards (AQSs) and guidelines have been reviewed for a number of air emissions. An ambient air quality survey has been carried out on site to establish baseline conditions and assess the air quality of the existing environment by comparison to AQSs.

Emissions to air include the flue gases from the waste to energy plant, occasional emissions from the emergency diesel generator and minor dust emissions from the ash silos and the activated carbon storage.

The ash silos will be fitted with high quality dust filters which will effectively eliminate any dust emissions. Ash will be discharged into trucks within enclosed areas and the trucks will be covered to prevent windblown ash emissions.

There will be no emissions to air from the community recycling park or the waste sorting plant.

Air Dispersion Modelling has been carried out to assess the effect of atmospheric emissions from the stack during the operation of the waste to energy plant on ground level concentrations (GLCs) of various air emissions. Mitigation measures are outlined to minimise any significant impacts identified.

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Air Dispersion Modelling is a well developed and approved science, which uses complex equations and detailed meteorological data to calculate predicted ground level concentrations from an emission source.

Basically, the ground level concentration depends on the stack height, proximity to buildings, concentration of substance of interest, temperature of discharge and meteorological conditions. Certain meteorological conditions tend to lead to higher ground level concentrations, for example when there is a large amount of turbulence in the atmosphere, the emissions come to ground quicker and lead to higher concentrations. In contrast, on very stable days the emissions remain at the height of discharge for a large distance and are very dilute when they reach ground. Stable conditions are predominant in Ireland.

4.1.1 Air Quality Standards

Air Quality Standards for the protection of human health and the environment have been developed at European level and implemented into Irish legislation for a number of air emissions. Air Quality Standards (AQSs) set limit values for Ground Level Concentrations (GLCs) of certain emissions for both the short term (hourly, daily) and long term (eg annual averages). Limit values are often expressed as percentiles eg 98 percentile of mean hourly values which means that only 2% of the results obtained during the monitoring period can exceed the stated limit value.

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The following AQSs apply in Ireland:

- The Air Pollution Act, 1987 (Air Quality Standards) Regulations (SI No. 244 of 1987) which implements EU Directive 80/779/EEC on limit and guideline values for sulphur dioxide and suspended particulates, EU Directive 85/203/EEC on limit and guideline values for nitrogen dioxide, EU Directive 82/884/EEC on a limit value for lead in the air.

- EU Directive 99/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air. The limit values specified in this directive are more stringent than the existing limit values and will start to come into effect from July 2001 and onwards.

Emissions to atmosphere from the waste to energy plant will include the emissions covered in the above AQSs. The plant will may also emit a number of substances for which Irish and EU AQS limit values have not been set, namely hydrocarbons (expressed as Total Organic Carbon), hydrogen chloride (HCl), hydrogen fluoride (HF), polychlorinated dibenzo dioxins (PCDD) and polychlorinated dibenzo furans (PCDF), and could potentially emit a number of metals: Cadmium (Cd), Thallium (Tl), Mercury (Hg), Antimony (Sb), Arsenic (As), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V). In order to assess the impact that the emission of these substances could have on human health and the environment the following guidelines were also used in the assessment:

- World Health Organisation (WHO) 1987 & 1999 Air Quality Guidelines for Europe

- The National Authority for Occupational Safety and Health Code of Practice (1999) for the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 1994 (S.I. No. 445 of 1994). Environmental AQS limit values were not available for a number of substances, so occupational exposure limits (OELs) were used as a basis for setting AQSs. One fortieth of the OEL was taken as the AQS limit value.

The various AQS limit values and guidelines are summarised in Table 4.1.

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Table 4.1 Air Quality Standards

Emission	Limit/Guideline	SI No. 244 of 1987 ($\mu g/m^3$)	Directive 99/30/EC ($\mu g/m^3$)	WHO 1987 & 1999 ($\mu g/m^3$)	SI No. 445 of 1994 ($\mu g/m^3$) (1)
NO_2	98th Percentile of a Years Hourly Average	200	-----	-----	-----
NO_2	99.8th percentile of a Years Hourly Average	-----	200	-----	-----
NO_2	Annual Average	-----	30-40 (2)	-----	-----
SO_2	99.7th percentile of a Years Hourly Average	-----	350	-----	-----
SO_2	Daily Average	-----	-----	125	-----
SO_2	98th Percentile of a Years Daily Average	250-350 (3)	-----	-----	-----
SO_2	99.2th percentile of a Years Daily Average	-----	125	-----	-----
SO_2	Annual Average	-----	20 (4)	50	-----
Particulates	98th Percentile of a Years Daily Average	250	-----	-----	-----
Particulates	90th Percentile of a Years Daily Average	-----	50 (5)	-----	-----
Particulates	Annual Average	-----	20 (5)	-----	-----
TOC	Hourly Average	-----	-----	1,000 (6)	-----
HCl	Hourly Average	-----	-----	-----	350
HF	Annual Average	-----	-----	1 (7)	-----
PCDD / PCDF (8)	Hourly Average	-----	-----	-----	-----
	Annual Average	-----	-----	-----	-----
Cd & Tl (9)	Annual Average (Cd)	-----	-----	5×10^{-3}	-----
	Hourly Average (Tl)	-----	-----	-----	2.5
Hg	Annual Average	-----	-----	1	-----
Sum of 9 Heavy Metals (10)	Annual Average (Pb)	2	0.5	0.5	-----
	Hourly Average (Sb)	-----	-----	-----	12.5
	Hourly Average (As)	-----	-----	-----	2.5
	Hourly Average (Cr)	-----	-----	-----	1.25
	Hourly Average (Co)	-----	-----	-----	2.5
	Hourly Average (Cu)	-----	-----	-----	5
	Annual Average (Mn)	-----	-----	0.15	-----
	Hourly Average (Ni)	-----	-----	-----	2.5
	Daily Average (V)	-----	-----	1	-----

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Notes to Table 4.1:

(1) Limit value is derived by dividing the Occupational Exposure Limit (OEL) by a factor of 40

(2) Limit value of 30 $\mu g/m^3$ is for the protection of vegetation and limit value of 40 $\mu g/m^3$ is for the protection of human health.

(3) Limit value of 250 $\mu g/m^3$ applies when corresponding percentile of suspended particulates >150 $\mu g/m^3$ and limit value of 350 $\mu g/m^3$ applies when corresponding percentile of suspended particulates ≤ 150 $\mu g/m^3$.

(4) Limit value is for the protection of ecosystems.

(5) Directive 99/30/EC sets limit values for PM_{10} (particulate matter ≤ 10 μm in diameter) rather than all particulate matter. After the limit values have been implemented in Member States they will be reviewed and more stringent limit values may be applied as part of Stage 2 of the Directive.

(6) Limit value is for Toluene which can be used as a standard for measuring Total Organic Carbon (TOC). The limit value is a 1987 WHO guideline and is based on an averaging time of 30 minutes.

(7) The 1999 WHO guideline value is for 'fluorides'.

(8) There are no air quality standard limit values for dioxins and furans. The 1999 WHO guidelines expressed a limit for dioxin like compounds in terms of Tolerable Daily Intake in TEQ/ kg bwd (Toxic Equivalent uptakes per kilogram of body weight per day). The Tolerable Daily Intake for dioxin like compounds is 1-4 TEQ/ kg bwd.

(9) The WHO annual average limit value is for Cd. The hourly average limit value is for Tl and was derived by dividing the Occupational Exposure Limit (OEL) by a factor of 40.

(10) The limit values for all of the heavy metals with the exception of Pb, Mn and V are derived by dividing the Occupational Exposure Limits (OELs) by a factor of 40.

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4.2 Existing Environment

The levels of dioxins in the ambient air and soils on site were determined in a survey carried out by ASEP. A full copy of their report is included in Attachment 3. An ambient air quality survey at the development site was carried out by TMS Environment Ltd and a full copy of their report is included in Attachment 4.

Levels of nitrogen dioxide (NO_2), sulphur dioxide (SO_2), suspended particulates (smoke), hydrogen chloride (HCl), hydrogen fluoride (HF), and a total of nineteen metals were monitored over an 28 day period during June and July 2000. Hourly Average NO_2 concentrations were measured over a 28 day period during September and October 2000.

The results of the ambient air quality survey are summarised in Tables 4.2-4.4 below.

Table 4.2 Ambient Air Concentrations of nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and suspended particulates (smoke)

Average Daily [NO_2] ($\mu g/m^3$)	Average Daily [SO_2] ($\mu g/m^3$)	Average Daily [Smoke] ($\mu g/m^3$)
1.3	1	4.3

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Table 4.3 Ambient Air Concentrations of Hydrogen Chloride (HCl) and Hydrogen Fluoride (HF)

Average Daily [HCl] ($\mu g/m3$)	Average Daily [HF] ($\mu g/m3$)
< 0.0002	<0.0001

Table 4.4 Ambient Air Concentrations of Metals

Metal	Daily Concentration ($\mu g/m^3$)
Cadmium	< 0.002
Thallium	< 0.021
Mercury	< 0.005
Lead	< 0.003 – 0.13
Antimony	< 0.0003 – 0.012
Arsenic	< 0.02
Chromium	<0.003 – 0.12
Cobalt	< 0.001
Copper	< 0.003 – 0.03
Nickel	< 0.003 – 0.069

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Table 4.4 Ambient Air Concentrations of Metals

Metal	Daily Concentration ($\mu g/m^3$)
Vanadium	< 0.001
Zinc	< 0.005 – 0.08
Selenium	< 0.005 – 0.38
Molybdenum	< 0.001 – 0.007
Titanium	< 0.002 – 0.01
Tin	<0.011 – 4.7
Barium	< 0.0002
Boron	< 0.004 – 0.22
Silver	< 0.01

Average daily levels of NO_2 were 1.3 $\mu g/m^3$ and the maximum recorded level was 2.6 $\mu g/m^3$. Although not directly comparable to AQS hourly and annual average limit values of 200 $\mu g/m^3$ and 30-40 $\mu g/m^3$ respectively, it can be seen that the levels recorded are well below these limit values. Annual mean concentrations of nitrogen oxides range from 0-30 $\mu g/m^3$ in rural atmospheres and 20-90 $\mu g/m^3$ in urban atmospheres so the levels recorded fall well within those expected for a rural location. The hourly average NO_2 concentrations averaged 8.1 $\mu g/m^3$, and ranged from <2.1 to 36 $\mu g/m^3$, which are within the range typically expected for a rural environment.

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Average daily levels of SO_2 were 1 $\mu g/m^3$ and the maximum recorded level was 7 $\mu g/m^3$. The existing AQS daily limit value is 250-350 $\mu g/m^3$ (98^{th} percentile) and the new limit value is 125 $\mu g/m^3$ (99.2th percentile), so the levels recorded are only a small fraction of the limit values. Annual mean concentrations of sulphur dioxide range from 3-6 $\mu g/m^3$ (5-25) in rural atmospheres and 25-100 $\mu g/m^3$ in urban atmospheres so the levels recorded fall well within those expected for a rural location.

Average daily levels of smoke were 4.3 $\mu g/m^3$ and the maximum recorded level was 11 $\mu g/m^3$. The existing AQS daily limit value for suspended particulates is 250$\mu g/m^3$ (98^{th} percentile) and the new limit value for PM_{10} is 50 $\mu g/m^3$ (90^{th} percentile), so the levels recorded are well below both the existing and new limit values.

Levels of hydrogen fluoride in the air at the site were below the limit of detection of the survey method (< 0.0001 $\mu g/m^3$) and levels of hydrogen chloride were also very low with an average concentration of 0.0002 $\mu g/m^3$ and a maximum concentration of 0.0018 $\mu g/m^3$. Although there are no AQS limit values for HF or HCl the levels were a small fraction of the limit values derived from occupational exposure limits (OELs).

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The results in Table 4.4 show that most of the suite of nineteen metals analysed for were below the limit of detection of the survey method. There are no established AQS limit values for the majority of the nineteen metals, but for those that there are AQS limit values such as cadmium, lead and mercury the recorded levels are well below the limit values. All of the metals are well below their corresponding limit values derived from occupational exposure limits (OELs).

In summary the results of the survey indicate that the existing air quality on the site is good as would be expected of the rural area in which the site is located.

4.3 Construction Impacts and Mitigation

Construction activities on site including excavation and earthmoving could result in the generation of dust. Transportation of loose materials that are not properly contained on or off site could also result in dust generation as would the transfer of mud/soil from the wheels of construction traffic onto surrounding roads. A number of factors will affect the extent of dust generation and potential impacts on air quality including wind speed and direction, the dryness of the soil, and the proximity of sensitive receptors to the site.

The following mitigation measures will be put in place to minimise any dust generation and thus prevent any significant impacts on air quality:

- Good housekeeping and site management including the proper storage of spoil/loose materials on site
- Wheel washing of all vehicles leaving site
- Proper containment of loose materials that are transported on or off site
- Damping of site roads as necessary

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4.4 Operational Impacts and Mitigation

4.4.1 Atmospheric Emissions from the Waste Management facility

(a) Stack Emissions

There will be one main stack on site through which atmospheric emissions will be discharged. The substances emitted from the waste to energy plant will include the following:

- Oxides of nitrogen (NO_x)
- Sulphur dioxide (SO_2)
- Carbon monoxide (CO)
- Particulates (Dust)
- Hydrocarbons (expressed as Total Organic Carbon (TOC))
- Hydrogen Chloride (HCl)
- Hydrogen Fluoride (HF)
- Poly-Chlorinated Dibenzo Dioxins (PCDD) and Poly-Chlorinated Dibenzo Furans (PCDF)

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- Heavy metals: Cadmium (Cd), Thallium (Tl), Mercury (Hg), Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni), Vanadium (V).

The maximum emission concentrations and mass emission rates from the stack are listed in Table 4.5 below.

Table 4.5. Worst Case Emission Data on the basis of Hourly Averages

Emission	Maximum Values		Expected Average Values	
	Emission Concentration (mg/Nm^3)	Emission Rate (g/s)	Emission Concentration (mg/Nm^3)	Emission Rate (g/s)
NO_x (as NO_2)	200	8.389	150	5.25
SO_2	50	2.097	20	0.7
Dust	10	0.419	1	0.035
CO	100	4.2	100	3.5
TOC	10	0.419	1	0.035
HCl	10	0.419	1	0.035
HF	1	0.042	1	0.035
PCDD / PCDF[1] (ng/m^3)	0.1	4.19×10^{-9}	0.01	3.5×10^{-10}
Cd & Tl	0.05	0.002	0.025	0.000875
Hg	0.05	0.002	0.025	0.000875
Sum of 9 Heavy Metals: Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	0.5	0.021	0.25	0.00875

Notes:

1) The emission concentration and emission rate for dioxins is based on the limit value contained in the new EU Directive on incineration. Due to the fact that the proposed plant will be equipped with a two stage dioxin removal process, the actual dioxin emissions are likely to be only 10% of the proposed limit.

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The emission concentrations in the flue gas will be below the limits specified in the new EU Directive on the Incineration of Waste (2000/76/EC).

In fact it is expected that the emission concentrations will be significantly below those contained in the Directive for all parameters. This has been the experience of Indaver's plant in Beveren, where, for example, the average heavy metal concentrations are only 10% of the limit values.

(a) Other Emissions to Air

Another source of potential air emissions from the facility would be odours from the waste collection areas. The waste bunker which will receive all incoming waste to be treated in the waste to energy plant will be maintained under negative pressure to prevent any odorous emissions by treating them in the waste to energy plant.

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The Waste Community Recycling Park will provide a collection area for a number of wastes including paper, plastics, glass, waste oils, used batteries etc. from members of the public. The Waste Community Recycling Park will not provide for the collection of any organic / putrescible waste which could give rise to odours. The area will be properly maintained and good housekeeping will minimise the potential for the generation of odours.

The construction and operational phases of the development will generate additional traffic on the surrounding road network. Traffic can contribute to ground level concentrations of certain substances, particularly NO_X. However the amount of additional traffic generated will not be significant (refer to Section 7.0 on Traffic) and therefore emissions from traffic will not have a significant impact on air quality.

4.4.2 Air Dispersion Modelling

Air dispersion modelling was carried out to determine effects of atmospheric emissions from the waste to energy plant on GLCs of air emissions. A screening exercise was first carried out to determine a stack height which would adequately disperse the atmospheric emissions without creating any undue impact. A detailed assessment of the impacts of atmospheric emissions from the chosen stack height was then carried out. Finally the cumulative impact of emissions from the waste to energy plant and two other developments in the vicinity was assessed using the dispersion model.

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A full copy of the Air Dispersion Modelling report is included in Attachment 5.

The Industrial Source Complex (ISC 3) computer model was used to carry out the dispersion modelling. ISC 3 is a Gaussian dispersion model, which represents the emission plume as having a normal distribution in both the horizontal and vertical directions. The model is USEPA approved and is the model which the Irish EPA accept when assessing impacts from point source emissions.

The short term model (ISCST 3) model uses hourly meteorological data and calculates a range of hourly, daily and annual average concentrations from which percentiles of hourly and daily concentrations can be calculated for comparison to all relevant ambient AQS limit values. The meteorological data required by the dispersion model is wind speed, wind direction, Pasquill-Gifford stability category, boundary layer height and ambient temperature. The most recent available five years (1993-1997) of meteorological data for Dublin Airport was used in the model.

The model takes all known factors which influence dispersion of plumes into account, such as building downwash, stack tip downwash, terrain effects etc. The most significant of these is building downwash whereby the turbulence created by buildings tends to increase the ground level concentrations experienced. The main buildings on the site were therefore incorporated into the Building Profile Input Program (BPIP) module of ISCST3.

Elevated terrain may increase the ground level concentrations by reducing the vertical dimension within which the plume can disperse. In this case since the change in terrain within the vicinity of the site is not significant enough to influence plume dispersion, terrain has been considered flat for the model.

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This is in accordance with the USEPA guidelines where it is recommended that terrain be considered simple (or flat) if the ground level does not exceed the height of the stack within the vicinity of the stack. In order to ensure that the slope of the ground on the site does not influence dispersion of the emissions, a check run was carried out where the stack and buildings are 10m below the surrounding levels. This yielded identical results as for flat terrain, and confirms that the slope of the site does not affect dispersion of emissions.

To calculate ground level concentrations, either rural or urban dispersion parameters must be specified for the model. USEPA guidelines were used to determine whether the area is urban or rural. According to these guidelines if the land use categories within a circle of 3 km radius comprise less than 50% of the following categories: heavy or medium industrial, commercial or multi family residential, the area should be classified as rural. It was found that this is the case at the proposed site and rural dispersion parameters were chosen.

The receptor grid used in the dispersion model is a 3.5km (east) by 2.5km (north) grid. The grid has the stack located approximately in the centre and consists of over 3,640 receptor points spaced at 50 m intervals, maximising the resolution and accuracy of the modelling.

4.4.3 Stack Height Determination

Dispersion modelling was carried out for stack heights at 5m intervals from 35m to 45m. The highest concentration of any emission from the stack will be NO_X (modelled as NO_2) and therefore the stack height determination was carried out with respect to NO_X emissions. The maximum 99.8th percentile hourly average ground level NO_2 concentrations were calculated for the range of stack heights.

The results are shown in Figure 4.1. The new 99.8th percentile (not to be exceeded for more than 18 hours per annum) limit value as per EU Directive 99/30/EC is also indicated on Figure 4.1 for reference.

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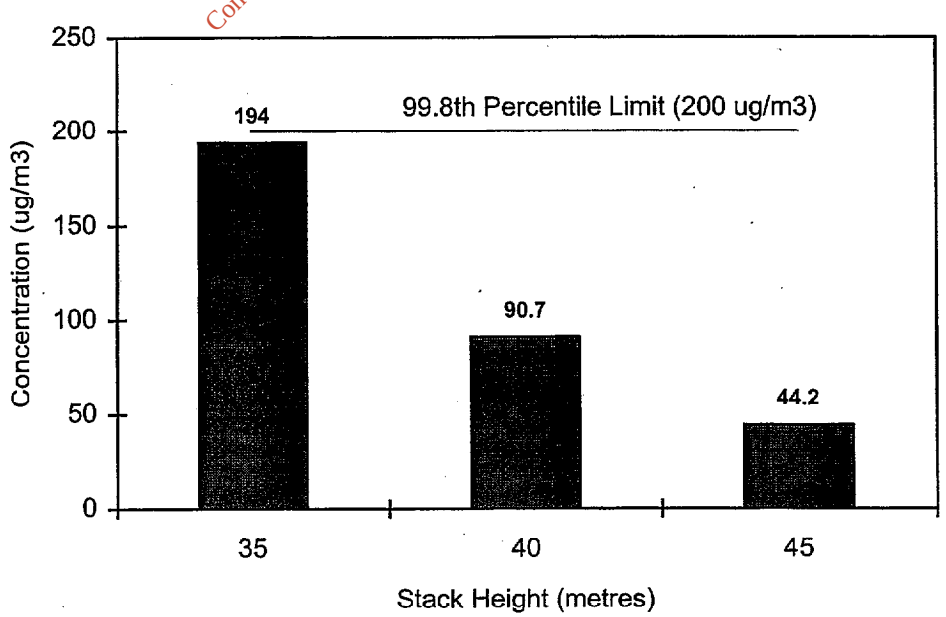

Figure 4.1: Maximum 99.8th Percentile Hourly Average Ground Level Concentrations of NO_2

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The maximum ground level concentration of NO_2 decreases steadily as the stack height increases. At forty metres the maximum ground level concentration is less than half of that for a 35m stack. It is also well below the 200 $\mu g/^{m3}$ limit value. Although the concentrations arising from a 45m stack are lower again, the criteria for choosing a stack height are based on providing adequate emission dispersion without creating any undue visual impact, and therefore a 40m stack height was chosen for the waste to energy plant.

4.4.4 Potential Effects of Emissions via a 40m Stack

Atmospheric emissions can have adverse impacts on human health, if present at a sufficiently high concentration. This section outlines the principal effects on human health, both acute and chronic, that the emissions from the waste to energy plant can have. Exposure to the emissions could be as a result of:

- direct inhalation,
- skin absorption (of little importance)
- ingestion through water and food intake as a result of contamination of surface water, soil or crops

A large amount of research has been carried out on the potential health effects of exposure to high concentrations of emissions, most notably by the WHO. This research has enabled the AQSs listed in Section 4.1 to be devised and set at a level to eliminate potential health effects. The following sections summarise the potential effects of all substances emitted from the plant, when present at high concentrations.

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(a) Dispersion Modelling Results

The maximum predicted Ground Level Concentrations (GLCs) of emissions and the relevant air quality standards are presented in Table 4.8. Contour plots of the dispersion modelling results are included in the Dispersion Modelling Report.

The maximum predicted ground level concentrations of emissions generally occur approximately 200m north-east of the stack. The prevailing wind is from a south-westerly direction however occasionally when the wind is blowing from the opposite direction the maximum ground level concentrations can also occur 400m south-west of the stack. The results are discussed in more detail in the following Sections.

(b) Acid Gases and Suspended Particulates

Nitrogen dioxide can act as a respiratory irritant at elevated concentrations, and it has been noted that the incidence of asthma and bronchitis is increased by exposure to NO_2 at high concentrations. As with NO_2, sulphur dioxide (SO_2) can affect the respiratory system, primarily by causing the bronchi to constrict, and very high concentrations of SO_2 have been linked with increased hospital admissions.

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Only fine suspended particulate matter (SPM) such as PM_{10} (< 10μm, 1μm = 0.001 mm) or $PM_{2.5}$ (< 2.5μm) can penetrate deeply into the lung and therefore the health effects of SPM in humans depends very much on particle size and concentration. As with NO_2 and SO_2, fine particulates can irritate the respiratory system.

The EU limit values and WHO guideline values for NO_2, SO_2 and particulates have been set at levels which ensure that no such health effects would occur.

The maximum predicted NO_2 GLC is only 45% of the EU hourly limit value and is only 17% of the EU annual limit. Predicted SO_2 concentrations are 9% of the most stringent limit value and are only 6% of the EU limit value. Based on the conservative assumption that all particulate emissions from the plant will be in the form of PM_{10} the predicted GLC is no more than 2% of any AQS.

HCl and HF can also cause irritation of the respiratory system and can also cause irritation of the eyes, nose and throat. While there are no EU or Irish limit values for these substances, the WHO have set a guideline limit value for HF of 3 μg/m^3 for the protection of human health. The National Authority for Occupational Safety and Health Code of Practice (1999) for the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 1994 (S.I. No. 445 of 1994) has set a limit value for exposure to HCl over an eight hour period of 14,000 μg/m^3 for the protection of the health of workers. As a conservative assumption, 1/40 of this limit has been set as a AQS (maximum hourly average) for this assessment.

The predicted HF concentration is only 3% of the WHO guideline value and the predicted HCl concentration is only 2% of the derived AQS (or 0.05% of the 8hr OEL).

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(c) Hydrocarbons

It is difficult to generalise the potential effects of hydrocarbons due to the wide range of substances covered. It is usual to make the conservative assumption that all hydrocarbon emissions are Toluene (among the most hazardous hydrocarbons). The WHO have set a guideline value of 1,000 μg/m^3 of Toluene for the protection of human health.

The maximum hourly average GLC of hydrocarbons (Total Organic Carbons or TOC) is only 1% of the WHO guideline for toluene.

(d) Heavy Metals

The waste to energy plant will not produce heavy metals but can emit heavy metals if present in the waste stream. Notwithstanding this, the modelling was carried out based on the assumption that heavy metals are continuously emitted at the EU emission limit value.

For the sum of nine heavy metals which are aggregated in the new EU Directive (2000/76/EC), as an extremely conservative assessment the maximum GLC for each heavy metal was predicted based on the assumption that that metal alone is emitted at the concentration limit for the sum of all nine metals.

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Even based on this conservative assessment, the predicted GLCs are significantly lower than the AQS limit values for all heavy metals. Furthermore, unless particular wastes (containing individual heavy metals) are present in the waste stream, individual heavy metals will rarely be emitted at significant concentrations.

Exposure to high levels of cadmium primarily affects the kidneys. The International Agency for Research on Cancer (IARC) has classified cadmium as a Group 2B carcinogen on the basis that there was sufficient evidence of it being carcinogenic in animals and there is limited evidence of cadmium being a human carcinogen. The WHO has set a guideline value of 0.005 $\mu g/m^3$ as an annual average limit under which cadmium has no effect on human health. The maximum predicted cadmium GLC is only 20% of this guideline value.

Acute exposure to thallium can cause gastrointestinal effects (abdominal pain, vomiting, diarrhoea). There are no guideline values for exposure to thallium other than the 8hr OEL of 100 $\mu g/m^3$. The maximum predicted GLC is only 0.03% of this OEL and is only 1% of the derived AQS.

Exposure to high concentrations of mercury vapour can damage the nervous system, and also the oral mucosa and the kidneys. The WHO has set a guideline value of 1 $\mu g/m^3$ as an annual average for mercury. The predicted GLCs from the plant are only 0.001% of this guideline value.

Arsenic is a cellular and tissue poison. Acute exposure to arsenic can result in irritation of the respiratory system and skin, gastrointestinal effects (nausea, vomiting, abdominal pain, diarrhoea) and circulatory effects. Arsenic is also classified as a human carcinogen. There are no EU or Irish AQSs for Arsenic and the WHO has not set a guideline value. The OEL for exposure to Arsenic is 100 $\mu g/m^3$, based on a 8hr exposure period. The maximum predicted GLC of 0.37 $\mu g/m^3$ is less than 0.5% of this OEL and is only 15% of the derived AQS.

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Acute exposure to antimony can cause abdominal pain, vomiting and weakness. Antimony is not a proven human carcinogen but inhalation of high levels has been shown to cause lung cancer in animal studies. The 8 hour OEL for Antimony is 500 $\mu g/m^3$. The maximum predicted GLC is negligible in comparison to this and is 3% of the derived AQS.

Acute exposure to certain chromium compounds causes irritation of the eyes, respiratory system (breathing difficulties) and skin as well as liver and kidney damage. Certain chromium compounds are thought to be human carcinogens. There are no EU or Irish or EU limits for ambient Cr concentrations nor do the WHO set a guideline value. The maximum predicted Cr concentration is less than 1% of the 8 hour OEL and is only 30% of the derived AQS.

Acute exposure to cobalt can irritate the respiratory system and skin. While there are no AQSs published by the EU or WHO the maximum predicted concentration is only 15% of an AQS derived from the OEL.

Exposure to copper dusts can irritate the eyes, nose and mouth and may cause headaches, dizziness, nausea and diarrhoea. However, at the maximum predicted GLC of 0.37 $\mu g/m^3$, or 7% of an AQS derived from the OEL no such effects would occur.

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The toxicity of lead may be attributed to its interference with different enzyme systems. Because of this almost all organs may be considered potential targets for lead and a wide range of biological effects of lead have been documented. Exposure to high levels is linked to cognitive dysfunctions in children such as IQ deficit, impairment of eye-hand co-ordination and attention details. According to IARC evidence of carcinogenicity of lead and lead compounds in humans is inadequate. The WHO have set a guideline value for lead concentration of 0.5 $\mu g/m^3$ as an annual average which has been adopted by the EU as a limit value. The maximum predicted GLC is only 2% of this limit value.

Exposure to manganese can result in effects on the lungs (leading to coughing and breathing difficulties) and effects on the nervous system. The WHO have set a guideline limit of 0.01 $\mu g/m^3$ as an annual average. The maximum predicted GLC is only 7% of the limit.

Exposure to nickel can cause skin irritation and dermatitis (due to sensitisation), and skin ulcers. Nickel and certain nickel compounds are probable human carcinogens of the lung and nasal passages. There are no WHO or EU AQSs for nickel but the maximum predicted GLC is only 15% of the AQS derived from the OEL.

Exposure to vanadium can result in irritation of the respiratory system, mucous membranes, eyes and skin. The maximum predicted GLC from the plant is only 14% of the WHO guideline limit value.

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(e) Summary

In summary, at sufficiently high concentrations the emissions from the waste to energy plant can have a wide variety of toxic effects and could impact on human health either as a result of direction inhalation or ingestion of water and food sources. However, due to the sophisticated flue gas cleaning systems at the plant and dispersion of the emissions from the stack, these substances will pose no threat to human health or the environment.

4.4.5 Potential Impacts of Dioxin Emissions

Dioxins refer to a large group of structurally similar compounds which include both dioxins are furans. The polychlorinated-dibenzo-dioxins (PCDDs) include 75 individual compounds and the polychlorinated-dibenzo-furans (PCDFs) include 135 different compounds. These individual compounds are referred to as congeners. The most toxic of these compounds and also the most widely researched is 2,3,7,8-tetra-chloro-dibenzo-dioxin (TCDD). The toxicity of the other congeners is assessed relative to TCDD which is used as a reference compound. Only 7 of the 75 congeners of CDDs and only 10 of the 135 congeners of CDFs are thought to have dioxin like toxicity.

Very little of the toxicity data available for dioxins relates to exposure through inhalation and the majority of studies carried out have been for oral exposure in animals. These data indicate that TCDD is one of the most toxic compounds known and it produces a wide spectrum of toxic effects following both short-term and long-term exposure.

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The most noted health effect in people exposed to large amounts of dioxin is chloracne which is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other effects of exposure to large amounts of dioxin include skin rashes, skin discoloration, excessive body hair, and possibly mild liver damage. TCDD is a human carcinogen and long term exposure may result in a number of different cancers. Studies have also shown dioxins to have a number of other effects including include dermal toxicity, immunotoxicity, endocrine disruption, reproductive effects and teratogenicity. Reproductive or developmental effects have not been seen in human studies however there is concern that exposure to low levels of dioxins over long periods might result in these effects including weakened immune responses and behaviour changes in offspring.

The emissions of dioxins from incineration processes is often the most controversial element associated with the project. It is worth considering here the position adopted by the World Health Organisation (WHO) in their publication Waste Incineration, namely:

- Dioxins is a generic name used to describe a family of 75 polychlorinated dibenzo-p-dioxins (PCDDs). There are also 135 structurally similar compounds of polychlorinated dibenzofurans (PCDFs).
- Dioxins and furans are physically and biologically stable. None is deliberately manufactured but they occur as trace elements in a number of organic chemicals and in the ash and emissions from most combustion processes. These combustion processes include garden bonfires, steel mills, crematoria and waste incinerators. Traces of dioxins have also been found in paper made from pulp which was bleached by chlorine.
- The majority of dioxins are not toxic at the concentration at which they would be found in the environment of waste incinerators.
- The concern about dioxins is mostly about one known as 2,3,7,8 TCDD which in certain animal species has been shown to be fatal at low dosages.
- Sweden's Environmental Protection Board has estimated that dioxin levels in the environment are contributed in equal quantities by car exhausts, steel mills and municipal waste incinerators to air, and by sewage sludge and pulp mills to water.
- There is no record of human fatality linked to dioxin, and the most severe case of exposure – following an industrial accident at Seveso, Italy – resulted in a skin condition called chloroacne, which was not permanent.
- In waste incineration, processes to limit the production of dioxins include burning at high temperature, the use of sufficient air, and the rapid cooling of exhaust gases.

While dioxins were always present as combustion by-products from the burning of wood and coal, the end of the 19th Century saw the development of chlorine based chemistry in Germany, in particular the manufacture of trichlorophenol, a wood preservative. Workers involved in this chemical manufacturer started to develop chloroacne. This was latter traced to exposure to dioxins. A large number of similar dioxin exposures have occurred in the intervening period.

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The largest such exposure was the Seveso accident in 1976, in which a runaway chemical reaction discharged dioxins to the general environment. A total of 5,000 people were exposed and 193 displayed symptoms of chloroacne, though no other adverse health effects were experienced. These data are given in detail in the WHO publication 'Polychlorinated Dibenzo-para-dioxins and Dibenzofurans' and the US EPA publication 'Dioxins'.

While experience with accidental human exposure to dioxins over the last 100 years has not indicated an acute toxicity to humans, the experience with animal studies has shown a high level of toxicity. For example the toxic dose for guinea pigs is as low as 0.6 parts per billion body weight. Carcinogenic and mutagenic properties have also been observed in animal testing. It is the extrapolation of this data to humans, which has often led to the controversy associated with these compounds. However dioxins, and dioxin-like compounds which may have similar effects, are found in all environmental compartments, are persistent and, being fat soluble, tend to accumulate in higher animals, including humans. They are also resistant to degradation. By far the majority of toxicologists are of the opinion that entry of dioxins and furans into the environment and subsequently into the human food chain needs to be reduced as a precautionary measure. Over the past two decades the European Commission has implemented wide ranging legislation aimed at directly or indirectly reducing or controlling the release of dioxins into the environment, with the objective of reducing human exposure and protecting human health. In particular the '5th European Programme of Policy and Action in Relation to the Environment and Sustainable Development' aims to reduce the emissions of dioxins by 90% by 2005 based on 1985 levels. The WHO have also recommended a Tolerable Daily Intake of 1-4 pg TEQ/kg body weight (including dioxin-like PCBs). The proposed project will comply with all WHO and EU standards.

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(a) Emissions of Dioxins to Air

The proposed plant will meet EU legislation for the control of dioxin emissions. Namely a minimum combustion temperature of 850 C for waste with a halogenated organic content (expressed as chlorine) of less than 1%, maintained for at least 2 seconds in the presence of at least 6% oxygen. These conditions for the combustion of waste will minimise the formation of dioxins. For the stack emissions the EU has set an emission discharge limit of 0.1 ng I-TEQ/m3, where 1 nanogramme (ng) is equal to 1/ 1,000,000,000 of a gramme. The I-TEQ or International Toxic Equivalent is a means of ranking the complex mixtures of dioxin compounds based on their relative toxicity.

Incinerator dioxin emissions were in the past one of the major sources of dioxin releases to the environment. While this technology is over a hundred years old, early units were little more than covered bonfires with resultant high emission values. Due to growing awareness of the environmental impacts of these compounds in 1989 the EU introduced directives 89/369/EEC and 89/429/EEC for the control of emissions from existing and new municipal waste incineration plants. These directed member states, in the absence of a community directive on dioxin emissions, to set a dioxin limit.

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The German authorities implemented through their incineration regulations BImSchV 17 of 1990 the limit of 0.1 ng I-TEQ/m3. In 1994 the EU introduced a further directive 94/67/EC on incineration of hazardous waste, which set the same limit of 0.1 ng/m3 to be implemented by 1 January 1997. The new EU directive for waste incineration (2000/76/EC) has made the 0.1 ng/m^3 emission level mandatory, and it is on this basis that the proposed plant has been designed. Indeed it is anticipated that the proposed plant will emit only 10% of the new emission limit value.

Prior to the implementation of this legislation in 1989, the German authorities estimated that average municipal incinerator dioxin emissions were 80 times the new limits, giving a total estimated discharged from municipal incinerators in West Germany of 400 g I-TEQ/a. A programme of upgrading incineration facilities has occurred in Europe since 1989, leading to the closure of a number of older and often smaller incineration plants, and the shift to larger newer or upgraded facilities. It is estimated in Germany that dioxin emissions from municipal incineration as a result of the implementation of this legislation has been reduced below 4 g I-TEQ/a. These emissions are now considered by German authorities to be of reduced relevance with regard to other sources of dioxin release to atmosphere.

In October 1999 the EU produced a summary report on the Compilation of EU Dioxin Exposure and Health Data. The report concluded that dioxin exposure is decreasing within the EU, and regulatory activity already applied to the stack emissions of waste incinerators, is now moving towards industrial processes, such as ferrous and non ferrous metal production processes and other sources.

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As part of this work for the EU Commission, the German State Environment Agency of North Rhine-Westphalia produced an inventory of dioxin air emissions in 1997. This report was the outcome of a two year research programme which is currently being extended to include all dioxin emissions in addition to those to air. The report collected information for the 15 EU members and Norway and Switzerland for the reference period 1993 to 1995 and concluded that an annual PCDD/F air emission of 6,500 g I-TEQ/a is released by all known sources in the 17 countries considered. The selected most relevant sources, which represent about 90% of the actual total emissions are tabulated below.

With regard to emissions from incineration facilities the report concluded that these could be decreased to near zero level by burning the waste entirely in plants complying to the 0.1 ng I-TEQ/m3 limit. This limit is currently being phased in throughout Europe and when the updated dioxin inventory is published at the end of 2000, the revised figures should show this reduction. For the proposed project the annual dioxin emissions would be 0.1 g I-TEQ/a based on the 0.1 ng/m3 limit and 0.01 g I-TEQ/a based on the expected emission concentration of 0.01 ng/m^3.

This is a small fraction of the total figure above and well below that given to non-industrial sources such as domestic wood combustion and accidental fires, which can only be reduced to a limited extent and are therefore likely to form an unavoidable 'background' level.

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Table 4.6 Dioxin Sources in the EU (1993 – 1995)

(Summary of the PCDD/F air emission rates in g I-TEQ gained by using default emission factors and activity data – data for incineration based on emissions prior to Directive 94/67/EC and new incineration Directive)

Source	Aggregate Emissions	% of Total Emissions
Residential combustion (Wood): Boilers, stoves, fireplaces	945.0	16.4
Residential combustion (coal/lignite): Boilers, stoves, fireplaces	30.5	0.5
Combustion in Industry, boilers, gas turbines, stationary engines	20.9	0.4
Sinter plants	1010.1	17.6
Secondary zinc production	19.9	0.3
Secondary copper production	76.9	1.3
Secondary aluminium production	39.0	0.7
Cement	20.4	0.4
Lime	0.0	0.0
Other: Metal reclamation from cables	1.7	0.0
Electric furnace steel plant	83.4	1.5
Other: Non-ferrous metal foundries	3.0	0.1
Other: Sintering of special materials and drossing facilities	115.0	2.0
Preservation of wood	381.4	6.6
Road transport	111.1	1.9
Incineration of domestic or municipal waste (legal)	1467.1	25.5
Incineration of domestic or municipal waste (illegal)	173.9	3.0
Incineration of industrial wastes	37.5	0.7
Incineration of hospital wastes	815.6	14.2
Cremation of corpses	16.8	0.3
Fires	379.8	6.6
Total	**5749**	

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There are no Irish, European or World Health Organisation AQS limit values for dioxins or furans. The WHO expresses a limit value in terms of Tolerable Daily Intake which cannot be accurately related to ambient air concentration of dioxins. However the predicted maximum hourly and annual average GLC's of dioxins are 7×10^{-9} µg/m^3 and 2.5×10^{-10} µg/m^3 respectively. At these extremely low ambient air concentrations the dioxins/furans will not lead to a perceptible increase over background levels and will thus not any impact on human health or the environment.

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Table 4.8 Predicted Maximum Ground Level Concentrations Compared to Air Quality Standards

Emission	Type of Prediction	Maximum Concentration ($\mu g/m^3$)	SI No. 244 of 1987 ($\mu g/m^3$)	% of Limit	Directive 99/30/EC ($\mu g/m^3$)	% of Limit	WHO 1987 & 1999 ($\mu g/m^3$)	% of Limit	SI No. 445 of 1994 ($\mu g/m^3$) (1)	% of Limit
NO_2	98th Percentile of a Years Hourly Average	**73.65**	200	37	-----	-----	-----	-----	-----	-----
NO_2	99.8th percentile of a Years Hourly Average	**90.65**	----	-----	200	45	-----	-----	-----	-----
NO_2	Annual Average	**5.13**	-----	-----	30-40 (2)	13 - 17	-----	-----	-----	-----
SO_2	99.7th percentile of a Years Hourly Average	**22.47**	-----	-----	350	6	-----	-----	-----	-----
SO_2	Daily Average	**14.10**	-----	-----	-----	-----	125	11	-----	-----
SO_2	98th Percentile of a Years Daily Average	**8.47**	250-350 (3)	2-3	-----	-----	-----	-----	-----	-----
SO_2	99.2th percentile of a Years Daily Average	**10.77**	----	-----	125	9	-----	-----	-----	-----
SO_2	Annual Average	**1.28**	----	-----	20 (4)	6	50	3	-----	-----
Dust	98th Percentile of a Years Daily Average	**1.69**	250	1	-----	-----	-----	-----	-----	-----
Dust	90th Percentile of a Years Daily Average	**0.98**	-----	-----	50 (5)	2	-----	-----	-----	-----
Dust	Annual Average	**0.26**	-----	-----	20 (5)	1	-----	-----	-----	-----
TOC	Hourly Average	**7.12**	-----	-----	-----	-----	1,000 (6)	1	-----	-----
HCl	Hourly Average	**7.12**	----	----	-----	-----	-----	-----	350	2
HF	Hourly Average	**0.71**	----	-----	----	----	----	----	63	1
PCDD / PCDF (7)	Hourly Average	**7×10^{-9}**	-----	-----	----	----	-----	-----	-----	-----
	Annual Average	**2.5×10^{-10}**	-----	-----	-----	-----	-----	-----	-----	-----
Cd & Tl (8)	Annual Average (Cd)	**1×10^{-3}**	-----	-----	----	-----	5×10^{-3}	20	-----	-----
	Hourly Average (Tl)	**0.03**	-----	-----	-----	-----	-----	-----	2.5	1
Hg	Annual Average	**1×10^{-3}**	-----	-----	----	----	1	0.001	-----	-----

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Table 4.8 Predicted Maximum Ground Level Concentrations Compared to Air Quality Standards

Emission	Type of Prediction	Maximum Concentration ($\mu g/m^3$)	SI No. 244 of 1987 ($\mu g/m^3$)	% of Limit	Directive 99/30/EC ($\mu g/m^3$)	% of Limit	WHO 1987 & 1999 ($\mu g/m^3$)	% of Limit	SI No. 445 of 1994 ($\mu g/m^3$)	% of Limit
Sum of 9 Heavy Metals (9)	Annual Average (Pb)	**0.01**	2	0.5	0.5	2	0.5	2	-----	-----
	Hourly Average (Sb)	**0.37**	-----	-----	-----	-----	-----	-----	12.5	3
	Hourly Average (As)	**0.37**	-----	-----	-----	-----	-----	-----	2.5	15
	Hourly Average (Cr)	**0.37**	-----	-----	-----	-----	-----	-----	1.25	30
	Hourly Average (Co)	**0.37**	-----	-----	-----	-----	-----	-----	2.5	15
	Hourly Average (Cu)	**0.37**	-----	-----	-----	-----	-----	-----	5	7
	Annual Average (Mn)	**0.01**	-----	-----	-----	-----	0.15	7	-----	-----
	Hourly Average (Ni)	**0.37**	-----	-----	-----	-----	-----	-----	2.5	15
	Daily Average (V)	**0.14**	-----	-----	-----	-----	1	14	-----	-----

Notes:

(1) Limit value is derived by dividing the Occupational Exposure Limit (OEL) by a factor of 40

(2) Limit value of 30 $\mu g/m^3$ is for the protection of vegetation and limit value of 40 $\mu g/m^3$ is for the protection of human health.

(3) Limit value of 250 $\mu g/m^3$ applies when corresponding percentile of suspended particulates >150 $\mu g/m^3$ and limit value of 350 $\mu g/m^3$ applies when corresponding percentile of suspended particulates ≤ 150 $\mu g/m^3$.

(4) Limit value is for the protection of ecosystems.

(5) Directive 99/30/EC sets limit values for PM_{10} (particulate matter ≤ 10 μm in diameter) rather than all particulate matter. After the limit values have been implemented in Member States they will be reviewed and more stringent limit values may be applied as part of Stage 2 of the Directive.

(6) Limit value is for Toluene which can be used as a standard for measuring Total Organic Carbon (TOC). The limit value is a 1987 WHO guideline and is based on an averaging time of 30 minutes.

(7) There are no air quality standard limit values for dioxins and furans. The 1999 WHO guidelines expressed a limit for dioxin like compounds in terms of Tolerable Daily Intake in TEQ/ kg bwd (Toxic Equivalent uptakes per kilogram of body weight per day). The Tolerable Daily Intake for dioxin like compounds is 1-4 TEQ/ kg bwd.

(8) The maximum predicted annual and hourly average GLCs are for the sum of Cd & Tl. The WHO annual average limit value is for Cd. The hourly average limit value is for Tl and was derived by dividing the Occupational Exposure Limit (OEL) by a factor of 40.

(9) The maximum predicted annual, daily and hourly average GLCs are for the sum of the nine heavy metals. The limit values for all of the heavy metals with the exception of Pb, Mn and V are derived by dividing the Occupational Exposure Limits (OELs) by a factor of 40.

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4.4.6 Assessment of Cumulative Impacts

There is currently one and there may potentially be another significant point sources of atmospheric emissions in the vicinity of the proposed Waste Management Facility, the existing Platin Cement factory and the proposed Marathon Combined Cycle Gas Turbine power plant. Atmospheric emissions from all three developments could potentially give rise to a cumulative impact on ground level concentrations of NO_2, SO_2 and particulates.

In order to assess the potential for a cumulative impact, air dispersion modelling was carried out based on the emission data contained in the Platin Cement IPC Application and the Platin Power Project EIS.

As the emissions of particulates from the proposed Marathon power plant are insignificant and the predicted particulate GLCs from the waste to energy plant are at most 2% of the AQSs, cumulative particulate emissions were not modelled. Therefore air dispersion modelling was carried out to assess the cumulative impact of the three developments on ground level concentrations of NO_2 and SO_2.

The results of the cumulative impact modelling together with the relevant air quality standards are presented in Table 4.9. Contours plots of the GLCs are included in the Air Dispersion Modelling report.

The maximum predicted GLCs of NO_2 and SO_2 from the Platin cement factory occur approximately 5-6 km north-east of the factory and therefore do not coincide with GLCs of emissions from the proposed waste to energy plant or the Marathon power plant. The maximum predicted GLCs from the waste to energy plant usually occur approximately 230m north-east of the stack while maximum predicted GLCs from the Marathon power plant occur approximately 270m north-east of the Marathon stack and do not coincide with the maximum GLC's from the waste to energy plant.

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The results demonstrate that the predicted maximum GLCs of NO_2 and SO_2 of emissions from the proposed waste to energy plant, Platin cement factory and the proposed Marathon power plant are below all Air Quality Standard limit values or guidelines.

The cumulative impact modelling results are based on the Marathon power plant running on distillate oil (rather than natural gas) which results in much higher emissions of NO_2 and SO_2. According to the Marathon EIS, distillate oil will be only be used as a short term backup fuel in case of an interruption in the natural gas supply. During normal operation on natural gas much lower levels of NO_2 and SO_2 will be emitted and consequently any cumulative impact will be greatly reduced.

The cumulative modelling is based on the worst case discharge conditions occurring at the three plants at the same time and also at the same time as the worst case meteorological conditions. The maximum predicted GLCs are therefore based on a worst case scenario which is unlikely to arise and the modelling is therefore very conservative.

In summary, the cumulative atmospheric emissions from the waste to energy plant, Platin cement factory and Marathon power plant will not cause ground level concentrations of NO_2 and SO_2 to exceed Air Quality Standard limit values or guidelines.

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Table 4.9 Predicted Maximum Ground Level Concentrations of NO_2 and SO_2 resulting from Cumulative Emissions from Platin Cement, Marathon Power and the Indaver Waste Management Facility.

Emission	Type of Prediction	Maximum Concentration ($\mu g/m^3$)	SI No. 244 of 1987 ($\mu g/m^3$)	% of Limit	Directive 99/30/EC ($\mu g/m^3$)	% of Limit	WHO 1987 & 1999 ($\mu g/m^3$)	% of Limit
NO_2	98th Percentile of a Years Hourly Average	**74.2**	200	37	-----	-----	-----	-----
NO_2	99.8th percentile of a Years Hourly Average	**143.65**	----	-----	200	72	-----	-----
NO_2	Annual Average	**5.89**	-----	-----	30-40 (1)	15 - 20	-----	-----
SO_2	99.7th percentile of a Years Hourly Average	**247.9**	-----	-----	350	71	-----	-----
SO_2	Daily Average	**101.7**	-----	-----	-----	-----	125	81
SO_2	98th Percentile of a Years Daily Average	**48.76**	250-350 (2)	14-20	-----	-----	-----	-----
SO_2	99.2th percentile of a Years Daily Average	**76.29**	-----	-----	125	61	-----	-----
SO_2	Annual Average	**4.55**	-----	-----	20 (3)	23	50	9

(1) Limit value of 30 $\mu g/m^3$ is for the protection of vegetation and limit value of 40 $\mu g/m^3$ is for the protection of human health.

(2) Limit value of 250 $\mu g/m^3$ applies when corresponding percentile of suspended particulates >150 $\mu g/m^3$ and limit value of 350 $\mu g/m^3$ applies when corresponding percentile of suspended particulates ≤ 150 $\mu g/m^3$.

(3) Limit value is for the protection of ecosystems

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4.4.7 Operational Mitigation Measures

A number of measures have been incorporated into the design of the waste to energy plant to ensure that emissions from the plant do not exceed regulatory emission limit values and the impact on human health or the environment would be insignificant. These measures have already been discussed in detail in Section 2.4, and can be summarised as follows.

Emissions of nitrogen oxides (NO_X) will be minimised by optimising combustion conditions in the furnace to minimise the formation of NO_X and using a $DeNO_x$ urea injection system to reduce NO_X to nitrogen and water vapour. Two wet scrubbers using a lime (or limestone) based neutralisation agent will be used in sequence to remove acidic compounds (SO_2) and traces of heavy metals. A small amount of activated carbon will be injected into the flue gases leaving the evaporating spray tower, which will react with and adsorb trace levels of organic compounds and heavy metals. These carbon granules as well as other dust and particulates in the flue gases will be removed the baghouse filters. The plant will remove dioxins and furans from the flue gases using a two stage process. The first stage involves the injection of activated carbon into the flue gases as previously mentioned which will adsorb dioxins and furans. The second stage will involve passing the flue gases from the wet scrubbers through an activated lignite coke filter which will remove dioxins and furans as well as other hydrocarbons, acids and heavy metals. The furnace and flue gas cleaning plant will be operated under negative pressure which will ensure that the only emissions from the plant will be those fully treated and discharged through the stack. These design measures will ensure that emissions do not exceed regulatory emission limit values.

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Flue gas monitoring equipment consisting of continuous monitors and regular grab sampling will be used to monitor emissions from the plant. This will include a state of the art dioxin sampler and analyser which will allow dioxin emissions to be continuously sampled. The flue gas monitoring will allow any changes in emission levels to be immediately detected and appropriate action to be taken if required.

4.5 Conclusions

The only emissions from the proposed facility that has the potential to affect air quality are the flue gases discharged via the 40m stack.

As the waste sorting plant and the waste bunker are contained in the waste acceptance hall, which is maintained under negative pressure there is no potential for odours.

As no kitchen waste will be accepted at the community recycling park and the area will be constantly manned and maintained clean, there will be no odours from this area.

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The existing air quality in the area is good as would be expected of the rural area in which the site is located. Emissions from the waste to energy plant, at sufficiently high concentrations, could have a number of adverse impacts on human health and the environment. The concentrations of these emissions from the proposed waste to energy plant will be below regulatory limit values. Air dispersion modelling has shown that the ground level concentrations of these emissions will not exceed Air Quality Standard limit values which are designed for the protection of human health and the environment as a result of atmospheric emissions from the waste to energy plant.

Dispersion modelling has also shown that there will be no significant cumulative impact on air quality as a result of atmospheric emissions from the waste to energy plant or other developments in the vicinity. A number of design and mitigation measures will be put in place to minimise the impacts that the construction and operational phases of the development have on air quality and therefore the waste to energy plant is not predicted to have any significant adverse impacts on air quality.

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