GF Environmental Limited

Enviroparks Ltd

Health Risk Assessment for the Enviroparks Development at Hirwaun

April 2009

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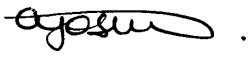
Signature: 

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Executive Summary

A Health Risk Assessment has been undertaken to assess the potential risk to health of residents living in the vicinity of the proposed Enviroparks development at Hirwaun. The assessment considered the potential risk associated with exposure to pollutants in emissions from the reciprocating engines associated with the proposed development.

Consideration was given to pollutants for which there are statutory objectives and limit values for the protection of health, such as nitrogen dioxide, sulphur dioxide and particles, as well as to other pollutants for which there are regulatory limits specified for the operation of the process.

The results from the assessment indicate that the risk to health of the local population due to exposure to pollutants in emissions from the proposed Enviroparks development is likely to be very low.

1. Introduction

1.1.1 Air Quality Standards (AQS) have been established primarily to protect the health of the general population and, as was shown in the Air Quality section of the Environmental Statement, detailed atmospheric dispersion modelling predicted that there were unlikely to be any exceedences of any AQS or Environmental Assessment Level. Accordingly, it is expected that the operation of the proposed Enviroparks facility is unlikely to pose a significant risk to the health of the local population living in Hirwaun and the surrounding area. In order to quantify the potential impact of airborne pollutants on the health of surrounding communities, a health impact assessment (HIA) has been carried out.

1.1.2 The primary source of potential pollutant emissions from the proposed Enviroparks facility is the main chimneys associated with the development. The proposed development is a highly efficient integrated waste management facility that initially sorts the incoming feedstock materials to extract recyclables, before preparing the feedstock for further processing. This employs five interlinked technologies to process the remaining material and recover energy from the residual waste. The five main processing and energy production technologies are:

a) A 'Biomax' separator that extracts oil similar to a bio-diesel from organic materials such as waste food, and other food industry products;

b) Anaerobic digestion, which provides a useful energy source in the form of methane gas that is used subsequently for power generation;

c) Pyrolysis, in which solid organic materials are converted to a useful fuel gas under high temperatures and in the absence of oxygen;

d) A plasma gasifier process in which materials are converted to simple gases and an inert, glass-like solid material that can be used as an aggregate in construction; and,

e) The liquid and gaseous fuels produced by the above processes are then fed to a range of reciprocating engines to recover energy in the form of electricity.

1.1.3 There are three chimneys on-site that will discharge pollutant emissions from reciprocating engines associated with the above processes. Detailed atmospheric dispersion modelling was undertaken using ADMS Version 4.1 in order to quantify the potential impact on local air quality of emissions from the combustion sources within the Enviroparks facility. The receptor grid used in the modelling for the health impact assessment was larger than that used in the associated air quality assessment that is reported elsewhere. The larger grid results in a slight difference in the coordinates of the reported maximum values, but the magnitude of Process Contributions and associated Predicted Environmental Concentrations are not significantly different, and provide a robust basis for the health risk assessment.

1.1.4 Health effects associated with exposure to pollutants are generally associated with either acute effects (noticeable effects soon after exposure), or chronic effects (noticeable effects after prolonged exposure). The pollutants considered in the air quality assessment fall into the following categories:

Acute Effects

- Oxides of Nitrogen (NO_X);
- Sulphur Dioxide (SO_2);
- Particulates (PM_{10});
- Carbon Monoxide (CO);
- Hydrogen Chloride (HCl);
- Hydrogen Fluoride (HF);

Chronic Effects

- Volatile Organic Compounds (VOCs);
- Cadmium and Thallium and their compounds (Cd & Tl);
- Mercury and its compounds (Hg);
- Other Metals; and,
- Dioxins and Furans.

1.1.5 The above pollutants may have significant health effects in isolation, but may also have synergistic effects in combination with other pollutants. For example, the absorption of acid gases such as SO_2 onto fine particles can result in more severe respiratory effects than exposure to either pollutant in isolation.

1.1.6 The assessment has included the consideration of the direct risks associated with the inhalation of substances released from the main chimneys of the Enviroparks facility, as well as the potential indirect effects through ingestion of potentially contaminated, locally grown food.

1.1.7 For most of the pollutants considered, the assessment is based upon the incremental increase in background concentration, the Process Contribution (PC), associated with emissions to atmosphere from the proposed Enviroparks facility. Where data are available on current background concentrations then reference is made to the Predicted Environmental Concentration (PEC), which is the sum of the PC and the current background.

1.1.8 The HIA considers the potential impact of emissions of pollutants released from the reciprocating engines at Enviroparks Hirwaun, on the health of local people living and working in the vicinity of the proposed development.

1.1.9 The assessment of the significance of these effects has been determined in relation to the following criteria:

- Comparison with the relevant Air Quality Standard or Environmental Assessment Level (EAL);

- The ratio between the Process Contribution and the AQS or EAL; and,
- The incremental impact on health (in accordance with COMEAP procedures[1]).

1.1.10 The COMEAP procedure involves the calculation of the potential number of members of the population that might be admitted to hospital as a result of exposure to pollutants. The following formula is used in the calculation procedure:

$$\text{Incremental Impact} = C_{avg} \times \left(\frac{D_{Pollutant}}{10} \right) \times B_{Health}$$

Where:

C_{avg} is the modelled concentration (annual average - µg m^{-3} derived from modelling);
$D_{Pollutant}$ is the COMEAP dose-response coefficient (% increase per 10 µg m^{-3})
B_{Health} is the baseline rate for the health effect (per annum)

1.1.11 The dose-risk coefficients specified in the COMEAP study are summarised in the following table:

Pollutant	Health Outcome	Dose-Response Coefficient
PM_{10}	Deaths brought forward (all causes) Respiratory hospital admissions	+ 0.75% per 10 µg m^{-3} (24 hour mean) + 0.80% per 10 µg m^{-3} (24 hour mean)
Sulphur dioxide	Deaths brought forward (all causes) Respiratory hospital admissions	+ 0.6% per 10 µg m^{-3} (24 hour mean) + 0.5% per 10 µg m^{-3} (24 hour mean)
NO_2	See note below	See note below
Notes: For NO_2 a coefficient of 0.5% per 10 µg m^{-3} was used to estimate the effect on respiratory hospital admissions in a sensitivity analysis.		
Source: COMEAP (1998)		

1.1.12 It should be noted that the assessment is based upon the maximum value for the Process Contribution which is predicted to occur within ~200 metres to the east of the development site. The corresponding values at nearby specific receptors are likely to be considerably lower, as the magnitude of the Process Contribution decreases markedly with distance from the point of release.

1.1.13 In addition, a detailed dioxin health risk assessment has been carried out in line with the Human Health Risk Assessment Protocol (HHRAP) developed by the US EPA[2].

1.2 Nitrogen Dioxide (NO_2)

1.2.1 The potential impact on human health of NO_2, arising from emissions of oxides of nitrogen (NO_X) from the reciprocating engines associated with the proposed Enviroparks facility, has been considered in relation to both the hourly peak and annual predictions.

[1] COMEAP (Committee on the Medical Effects of Air Pollutants) (1998) The quantification of the effects of air pollution on health in the United Kingdom. Department of Health, London: The Stationary Office
[2] http://www.epa.gov/Region6//6pd/rcra_c/protocol/protocol.htm

Maximum Hourly PC	Existing Background Concentration	AQS	Ratio of AQS/EAL to PC
63 µg m^{-3}	-	200 µg m^{-3}	3.2
Maximum Annual PC	**Existing Background Concentration**	**AQS**	**Ratio of AQS/EAL to PC (PEC)**
6.6 µg m^{-3}	10.1 µg m^{-3}	40 µg m^{-3}	6.1 (2.4)

1.2.2 The atmospheric chemistry module in ADMS was not used to calculate the conversion of NO_X to NO_2 in the emissions from the Enviroparks facility. Instead, the following methodology for calculating annual average and hourly average NO_2 ground-level concentration was used, which is based upon conversion of the ADMS model predictions for NO_X as shown in Equation 1 and Equation 2:

Equation 1 Calculation of Annual Average NO_2 Predicted Environmental Concentration

$$(\text{Annual } NO_{X\ \text{Modelled}} \times 0.7) + \text{Annual } NO_{2\ \text{Monitored}}$$

Equation 2 Calculation of Hourly Average NO_2 Predicted Environmental Concentration

$$(\text{Hourly } NO_{X\ \text{Modelled}} \times 0.35) + (\text{Annual } NO_{2\ \text{Monitored}} \times 2)$$

1.2.3 This methodology, which is approved by the Environment Agency Wales, is likely to overestimate the PEC for NO_2 in close proximity to the site, as the conversion of NO_X to NO_2 is unlikely to be instantaneous as it requires mixing of the plume with the ambient air and its associated oxidant species (O_3, etc). Accordingly, applying the 70% conversion of NO_X to NO_2 at locations close to the point of release may overestimate significantly the potential NO_2 process contributions at these locations. As the plume migrates away from the stack it disperses and mixes with the ambient air resulting in lower concentrations of pollutants, so the PC for NO_X and hence associated NO_2, will be lower farther afield.

1.2.4 As can be seen in the above table, there is a significant factor of ~3 for the ratio between the maximum hourly PC for NO_2 of ~63 µg m^{-3} and the hourly average AQS of 200 µg m^{-3}. The corresponding factor for the annual average NO_2 concentration is ~6, which falls to ~2.4 when the PEC value is taken into account. Nevertheless, the predicted PEC is significantly below the health-based annual AQS for NO_2.

1.2.5 When the COMEAP methodology is applied to the data for NO_2, the estimated increase in respiratory admissions to hospital per million population per year could be about twenty eight, which is considered to be low. However, this is based upon the maximum Process Contribution, which occurs ~300 metres from the site, where very few people are likely to be exposed to pollutant emissions for extended periods. At the house at Penderyn Reservoir, the nearest location where the general population may be exposed for significant periods of time, the corresponding figure for the estimated increase in respiratory admissions to hospital per million population could be about 4, which is considered to be very low.

1.3 Sulphur Dioxide (SO_2)

1.3.1 The potential impact on human health of SO_2, arising from emissions from the proposed Enviroparks facility, has been considered in relation to both the hourly peak and annual predictions.

Maximum Hourly PC	Existing Background Concentration	AQS	Ratio of AQS/EAL to PC
29 µg m^{-3}	-	350 µg m^{-3}	12.1
Maximum Annual PC	**Existing Background Concentration**	**AQS**	**Ratio of AQS/EAL to PC (PEC)**
1.5 µg m^{-3}	2.79 µg m^{-3}	50 µg m^{-3}	33.3 (15.2)

1.3.2 As can be seen, there is a significant factor of ~12 for the ratio between the maximum hourly PC of ~29 µg m^{-3} and the hourly average AQS of 350 µg m^{-3}, and the corresponding factor for the annual average is ~33 (~15 for the PEC value), which indicates that there is little risk of exceeding the health-based AQS for SO_2. For assessment of the predicted annual average SO_2 concentrations, reference was made to the Environmental Assessment Level of 50 µg m^{-3} recommended by the Environment Agency Wales for long term assessment of SO_2 [3], instead of the Air Quality Standard of 20 µg m^{-3} that is specified for the protection of ecosystems.

1.3.3 When the COMEAP methodology is applied to the data for SO_2, the estimated increase in respiratory admissions to hospital per million population per year could increase by about 6, which is considered insignificant. This value falls to about one per million head of population at the house at Penderyn Reservoir, the nearest location where members of the general public may be exposed for significant periods to emissions from the proposed Enviroparks facility.

1.4 Particulates (PM_{10})

1.4.1 The potential impact on human health of particulates, arising from emissions from the proposed Enviroparks facility, has been considered in relation to both the hourly peak and annual predictions.

Maximum Daily PC	Existing Background Concentration	AQS	Ratio of AQS/EAL to PC
4.6 µg m^{-3}	-	50 µg m^{-3}	10.9
Maximum Annual PC	**Existing Background Concentration**	**AQS**	**Ratio of AQS/EAL to PC (PEC)**
0.5 µg m^{-3}	22.5 µg m^{-3}	40 µg m^{-3}	80 (1.7)

1.4.2 As can be seen, there is a significant factor for the ratio of ~11 between the maximum daily PC of ~3 µg m^{-3} and the daily average AQS of 50 µg m^{-3}, and the corresponding factor for the annual average is ~80 (~1.7 for the PEC value), indicating that there is a low risk of exceeding the health-based AQS for PM_{10}.

[3] Environment Agency Wales, Environmental Assessment and Appraisal of BAT, IPPC H1, 2004

1.4.3 When the COMEAP methodology is applied to the data for particulates and based upon the maximum PC value, the estimated increase in respiratory admissions to hospital per million population per year could increase by about 2, which is considered insignificant. The corresponding value at the house at Penderyn Reservoir is less than one per million head of population.

1.5 Hydrogen Chloride (HCl)

1.5.1 The health effects associated with exposure to hydrogen chloride are primarily acute impacts on the respiratory system, accordingly, the assessment is based upon the short term modelling predictions. The maximum hourly PC for hydrogen chloride is ~4.1 µg m^{-3}, which gives a factor of ~195 for the ratio of the PC to the short term EAL of 800 µg m^{-3}. Consequently no significant effects on the health of the community are expected as a result of the emission of HCl from the proposed Enviroparks facility.

1.6 Hydrogen Fluoride (HF)

1.6.1 The health effects associated with exposure to hydrogen fluoride are primarily acute impacts on the respiratory system, accordingly, the assessment is based upon the short term modelling predictions. The maximum hourly PC for hydrogen fluoride is ~0.41 µg m^{-3}, which gives a factor of ~610, for the ratio of the PC to the short term EAL of 250 µg m^{-3}. Consequently no significant effects on the health of the community as a result of the emission of HF from the proposed Enviroparks facility are expected.

1.7 Volatile Organic Compounds (VOCs)

1.7.1 There are no environmental assessment levels for VOCs, therefore to provide a worst case assessment, the PC values for VOCs were compared against the AQS for benzene, which is 3.25 µg m^{-3} expressed as an annual average. The health effects associated with exposure to benzene in the ambient air are primarily chronic impacts, accordingly, the assessment is based upon the long term modelling predictions.

1.7.2 The maximum annual average PC for VOCs was 0.59 µg m^{-3}, which gives a factor of ~5.5, for the ratio of the annual PC to the annual AQS of 3.25 µg m^{-3}, which indicates that there are unlikely to be any significant effects on the health of the community as a result of exposure to emissions of VOCs from the proposed Enviroparks facility, particularly as benzene is likely to represent a small proportion of the total VOC emissions.

1.8 Heavy Metals

1.8.1 Modelling predicted that the maximum annual PC for cadmium would be 0.001 µg m^{-3}, which gives a factor of ~5 for the ratio of the annual PC to the annual AQS of 0.005 µg m^{-3}. This was based upon an overly pessimistic assumption that cadmium would constitute all of the allowable release of cadmium and thallium, and that the release would be at the WID limit. Accordingly, the impact of cadmium emissions from the operation of the proposed Enviroparks facility is expected to be significantly lower, and unlikely to have a significant impact on the health of the local community.

1.8.2 The factor for the ratio between the annual PC and the annual AQS for airborne exposure to mercury was ~250. It is therefore concluded, that emissions of mercury from the chimneys associated with the proposed Enviroparks facility are unlikely to have a significant effect on human health in the surrounding communities.

1.9 Dioxins and Furans

1.9.1 The US EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities was used to assess the potential risk to health of residents living in the locality of the proposed Enviroparks facility near Hirwaun. The assessment considered the potential risk associated with the uptake of dioxins due to emissions from reciprocating engines associated with the proposed development.

1.9.2 The assessment considered the potential risk to health due to inhalation of dioxins. The basis for assessment was Normal Operating Conditions based upon emissions of dioxins at the WID limit of 0.1 ng m^{-3}. The maximum daily dioxin inhalation rate for a 70 kg adult was estimated to be 0.008 pg kg^{-1} day^{-1}, and the corresponding figure for a 14.5 kg infant was estimated to be 0.0109 pg kg^{-1} day^{-1}. The Tolerable Daily Intake (TDI) for dioxins is 2 pg kg^{-1} day^{-1}, accordingly the estimated exposure via inhalation for adults represents ~0.4% of the TDI, while the estimated value for infants is ~0.6% of the TDI. Corresponding values for people living and working in the vicinity of the site were considerably lower in relation to their distance from the chimneys of the Enviroparks facility.

1.9.3 Deposition modelling of emissions of dioxins from the proposed Enviroparks facility showed that the maximum rate of deposition for dioxins when considered in the gaseous phase was ~6.78 x 10^{-12} µg m^{-2} s^{-1}, which corresponds to an annual deposition rate of ~0.21 ng m^{-2} $annum^{-1}$. The corresponding deposition rates for dioxin release in the particulate phase were ~9.90 x 10^{-12} µg m^{-2} s^{-1}, ~2.27 x 10^{-11} µg m^{-2} s^{-1} and ~5.49 x 10^{-10} µg m^{-2} s^{-1} for particles sizes of 0.1 µm, 1 µm and 10 µm. The corresponding annual deposition rates were ~0.31 ng m^{-2} $annum^{-1}$, ~0.72 ng m^{-2} $annum^{-1}$ and ~17.3 ng m^{-2} $annum^{-1}$.

1.9.4 There is a clear indication that if particulate sizes were >10 µm then the associated dioxin deposition rates would increase dramatically. There is little information available on the particle size distribution of emissions from reciprocating engines, however, a reference in the US EPA Emissions Inventory to particulate emissions from natural gas combustion indicates that the majority of particles are likely to be less than 1 um in diameter. The likelihood is that the majority of any dioxins released from the proposed Enviroparks facility would be associated with the particulates in the emission to atmosphere. Accordingly, the model predictions for dioxin deposition associated with the particulates with a diameter of 1 µm represents an appropriate worst case value for assessment of dioxin deposition to soils in the vicinity of the proposed Enviroparks facility.

1.9.5 Using equations from the US EPA HHRAP (Human Health Risk Assessment Protocol), a value was calculated for the incremental annual average increase in dioxin concentrations in soils within the vicinity of the proposed Enviroparks facility. Based upon the dioxin emissions limit in the EC Waste incineration Directive, a value of 0.006 ng kg^{-1} for the increase in concentration due to deposition in the vicinity of the site. The corresponding value at the nearest downwind residential receptors was about one third of the maximum value.

1.9.6 The uptake of dioxins by free-range chickens foraging at the location of maximum deposition predicted by modelling was estimated using the US EPA HHRAP methodology. Estimates of the intake of dioxins by members of the local population deriving all of their dietary requirements for eggs and chicken meat from this location indicate that daily values for adults and children would be well within the Tolerable Daily Intake of 2 pg kg^{-1} day^{-1}.

1.9.7 The estimated daily intake of dioxins arising from the consumption of eggs and chicken meat, based upon the maximum incremental annual average increase in dioxin concentration in the soil due to the operation of the proposed Enviroparks facility, represent values that are between ~0.9% and ~0.6% of the Tolerable Daily Intake for adults and infants respectively.

1.9.8 The estimated daily intake of dioxins arising from the ingestion of soil, based upon the maximum incremental annual average increase in dioxin concentration in the soil due to the operation of the proposed Enviroparks facility, represent values that are <0.001% of the Tolerable Daily Intake.

1.9.9 The estimated daily intake of dioxins arising from the consumption of fruit and vegetables, based upon the maximum incremental annual average increase in dioxin concentration in the soil due to the operation of the proposed Enviroparks facility, represent values that are between ~0.3 and ~0.7% of the Tolerable Daily Intake for adults and infants respectively.

1.9.10 The results from the assessment indicate that the operation of the proposed Enviroparks facility is likely to have a low impact on the exposure of the surrounding population to dioxins via inhalation and dietary consumption. The worst case intake from this combination of pathways would represent ~1.4% of the TDI of 2 pg kg^{-1} day^{-1} for adults and ~1.2% of the TDI for infants. This value corresponds to the location of maximum Process Contribution which is located ~200 metres to the east of the site. Corresponding values predicted for residential receptors and allotment areas in the vicinity of the site were three to four times lower than the maximum value, and decreased rapidly with distance from the site.

1.9.11 The assessment indicates that the risk to health of the local population due to exposure to dioxins in emissions from the reciprocating engines associated with the proposed Enviroparks facility is likely to be low.

1.9.12 A copy of the detailed dioxin health risk assessment is also available.

1.10 Drinking Water Supplies

1.10.1 The Penderyn Reservoir is located to the rear of the proposed Enviroparks facility, and consideration has been given to potential health risks associated with pollutant deposition and subsequent dissolution into the drinking water supply.

1.10.2 Of the pollutants that may be released from the chimneys of the Enviroparks facility, NO_X and SO_2 are probably the most significant in terms of the magnitude of their release. Other pollutants that may be of concern in terms of their potential health effects are the heavy metals such as mercury and cadmium, as well as dioxins.

1.10.3 Based upon the results from dispersion modelling, estimates of deposition of the above pollutants have been made for Penderyn Reservoir. The results are presented in the following table.

Pollutant	Annual Deposition Rate ($\mu g.m^2/s$)	Monthly Deposition Rate (kg/ha/month)	Deposition to the Reservoir (kg/month)	Concentration (µg/litre)	Drinking Water Standard (mg/litre)	% of Drinking Water Standard
Nitrogen/Nitrate	1.21×10^{-3}	0.01	0.08	0.6	50	0.001
Sulphur/Sulphate	2.42×10^{-3}	0.03	0.25	1.3	250	0.0005
Mercury	1.80×10^{-7}	4.7×10^{-6}	3.7×10^{-5}	6.21×10^{-5}	1.0 [a]	0.006
Cadmium	1.80×10^{-7}	4.7×10^{-6}	3.7×10^{-5}	6.21×10^{-5}	5.0 [a]	0.001
Dioxin	1.30×10^{-12}	3.4×10^{-11}	2.7×10^{-10}	4.49×10^{-7} [b]	3×10^{-5} [b,c]	1.5

Notes: [a] µg/l
[b] ng/litre
[c] US EPA Drinking Water Standard

1.10.4 The above analysis is based upon continuous deposition at the maximum rate on the Penderyn reservoir for one month. It is assumed that the pollutant is completely dissolved and fully dispersed into the contents of the reservoir, which is assumed to be 600,000 m^3, and that there is no withdrawal of water over that period of time. One month is considered to be a reasonable period of time for the contents of a small reservoir such as Penderyn to replenish its stocks. This is assumed to provide a worst case estimate of potential increase in pollutant concentration in the waters of the Penderyn reservoir as a result of emissions from the Enviroparks facility.

1.10.5 The results show that if this worst case scenario was to happen then the Process Contribution for dissolved nitrate would represent a value that is ~0.001% of the UK Drinking Water Standard[4], which is considered to be insignificant. The corresponding values for sulphate, mercury, cadmium and dioxin were 0.0005%, 0.006%, 0.001% and 1.5% of their respective drinking water standards.

1.10.6 The US EPA drinking water standard for dioxin[5] was used as the reference value for this assessment as no comparable figure was available for the UK. It should also be noted that dioxin has a very low solubility in water and therefore the value given in the table above represents a gross overestimation of the likely dioxin concentration that might be present in drinking water in the Penderyn reservoir when the Enviroparks Facility becomes operational.

1.10.7 Accordingly, deposition of pollutants onto the waters of the Penderyn reservoir are unlikely to result in exceedence of UK Drinking Water Standards, and hence the health of those drinking the water is unlikely to be affected adversely.

1.11 Conclusions

1.11.1 Some of the processes within the proposed Enviroparks facility will be subject to regulation by the Environment Agency under the conditions of the EC Waste Incineration Directive (WID). Therefore, to provide a worst case assessment for the potential impact of emissions from all processes within the Enviroparks facility, atmospheric dispersion modelling was undertaken on the basis of Normal Operation with emissions based upon their respective WID limits.

1.11.2 The assessment included the pollutants for which the proposed Enviroparks facility will be regulated by the Environment Agency when operational. The assessment compared the maximum Process Contribution (PC) to ground level pollutant concentrations against the Air Quality Standard (AQS) or Environmental Assessment Level (EAL), based upon a factor calculated from the ratio of the PC value to the AQS.

[4] Statutory Instrument 2000 No. 3184, The Water Supply (Water Quality) Regulations 2000
[5] http://www.epa.gov/safewater/contaminants/dw_contamfs/dioxin.html

1.11.3 The assessment for nitrogen dioxide, sulphur dioxide and particulates also considered the potential increase in hospitalisation as a result of respiratory complaints associated with exposure to these pollutants in the emissions from the proposed Enviroparks facility. Increases of between about twenty eight (NO_2), and less than one (PM_{10}), per million head of population per annum were predicted for the three pollutants at the point of the maximum Process Contribution; values which are considered to be low to insignificant. Values at nearby sensitive receptors were likely to be lower by at least a factor of ten or more.

1.11.4 A detailed health risk assessment for dioxins was undertaken using the US EPA Human Health Risk Assessment Protocol. The results showed that the maximum exposure to dioxins released from the flue stack of the proposed Enviroparks facility was likely to represent ~1.4% of the Tolerable Daily Intake for adults, and ~1.2% for infants, and was considered to be pessimistic based upon the fact that the location of the point of maximum is ~300 metres to the north-east of the chimneys, and in an area where members of the general public are not resident. Results for nearby sensitive receptors where members of the general public may be resident, and where they could be growing significant proportions of their dietary intake, were estimated to be lower by at least a factor of three to four.

1.11.5 Drinking water extracted from the Penderyn reservoir is unlikely to be contaminated significantly by deposition of pollutants from the Enviroparks Facility. A worst case assessment indicated that resulting pollutant concentrations due to deposition and the complete dilution and dispersion within the estimated 600,000 m^3 of water were likely to be a very small percentage of UK Drinking Water Standards, and can probably be discounted as insignificant.

1.11.6 The overall conclusion of the assessment is that the magnitude of potential health effects associated with exposure to pollutants released from the proposed Enviroparks facility is likely to be insignificant at locations where members of the general public are likely to be exposed for extended periods of time.