10. CLIMATE

10.1 Introduction

Atmospheric emissions from the thermal treatment of waste include emissions of sulphur dioxide (SO_2), oxides of nitrogen (NO_X) and carbon dioxide (CO_2), all of which can in sufficient amounts have a negative impact on climate. Emissions of SO_2 and NO_X can lead to acid rain resulting in the acidification and degradation of ecosystems. Both CO_2 and nitrous oxide (N_2O) are greenhouse gases and can contribute to global warming. This Section assesses the potential impacts on climate as a result of atmospheric emissions from the development and identifies measures to mitigate against any significant impacts.

10.2 Existing Environment

10.2.1 Acidification

Concern during the 1970's about the acidification effects of gases such as SO_2 and NO_X led to the United Nations Economic Commission for Europe (UNECE) Convention on Long Range Transboundary Air Pollution (CLRTAP) in Geneva in 1979. A Protocol to this Convention was signed in Helsinki in 1985, committing signatories to a 30% reduction in SO_2 emissions between 1980 and 1993, although Ireland was not a signatory. This was followed by the 1988 Sophia Protocol on NO_X emissions, which committed signatories to stabilise emissions at 1987 levels (105,000 tonnes for Ireland) by 1994. The 1994 Oslo Protocol committed signatories to a 30% reduction in SO_2 emissions on 1980 levels by 2000, which meant an Irish target level for SO_2 emissions of 157,000 tonnes.

The most recent limits set for SO_2 and NO_X emissions arise from the 1999 Gothenburg Protocol and the new EU Directive on national emission ceilings. The Gothenburg Protocol sets emission ceilings for 2010 of 42,000 tonnes of SO_2 and 65,000 tonnes of NO_x for Ireland. The Proposal for a Directive of the European Parliament and of the Council (99/067 (COD)) on national emission ceilings for certain atmospheric emissions requires Ireland to reduce emissions to 28,000 tonnes of SO_2 and 59,000 tonnes of NO_X by 2010.

Although not a signatory, Ireland achieved the target set in the Helsinki Protocol for SO_2 reductions between 1980-1993 mainly through switching to natural gas, through a decrease in the sulphur content of gas oil used and through a decrease in the sulphur content of the coal burned at the Moneypoint power station. In 1996, SO_2 emissions were 147,000 tonnes however they rose to 176,000 tonnes in 1998. The rise in SO_2 emissions can be attributed to a marked increase in the consumption of primary fuels since 1995 as a result of the growing economy and increased electricity demand. Power stations account for 60% of the total SO_2 emissions and these stations are now being used to almost full capacity. Any reductions that resulted from low sulphur coal and a switch to greater dependence on natural gas fired plant have been offset in latter years by the need to fully utilise the oil fired plants.

According to the recent EPA report 'Ireland's Environment – A Millennium Report', Ireland is now one of the highest per capita SO_2 emitters in the EU and is unlikely to meet its commitment to reduce SO_2 emissions to 157,000 tonnes.

Transport and power generation together account for about 80% of NO_x emissions with transport being the single most important source contributing 50% of the total. The benefits of catalytic converters, which began to appear after 1993, have already been offset by the huge increase in the use of fuels for transport in recent years. According to the EPA, Ireland has not met the target of stabilising NO_X emissions at 1987 levels (105,000 tonnes) by 1994. Irish per capita emissions of NO_X remain close to the EU average.

Very substantial reductions will be required over the next ten years to meet the stringent limits set in the Gothenburg Protocol and the proposed EU Directive on national emission ceilings.

10.2.2 Greenhouse Gases

Based on EPA figures, the total emissions of greenhouse gases in 1998 expressed as CO_2 equivalent, was 63,724,000 tonnes which represented an 18% increase on 1990 levels. The waste sector (landfill) generated 75,900 tonnes of methane which is equivalent to 1,594,000 tonnes of CO_2. Therefore the waste sector contributed approximately 2.8% to the total emissions of greenhouse gases. The principal sources of greenhouse gas emissions in Ireland are the agricultural, energy and transport sectors.

The UN Framework Convention on Climate Change (FCCC) was signed in 1992 and under the terms of the Kyoto Protocol Ireland has given a commitment to limit greenhouse gas emissions in the period 2008-2012 to 13 percent above 1990 levels. However, there has already been an 18% increase in net emissions of greenhouse gases between 1990 and 1998 and based on the most recent EPA forecasts, by 2010 the net emissions will have increased by approximately 30% over 1990 levels. Emissions of greenhouse gases have shown sustained growth in Ireland during the 1990's and the transport and energy sectors have accounted for most of the increase in CO_2 emissions, with increases of 77% and 36% respectively. Substantial reductions in greenhouse gas emissions will be required to meet Ireland's commitments under the Kyoto Protocol and this will have far reaching implications for the energy, transport and agricultural sectors.

At present there are no large scale thermal treatment or waste to energy plants operating in Ireland and therefore this activity is not a current source of either acid or greenhouse gas emissions in Ireland.

10.2.3 Micro-climate

The physical nature of the landscape of the development site and immediate vicinity, i.e. low lying, relatively flat terrain, agricultural land means that the site does not have any distinctive micro-climate in comparison to the larger surrounding area. There are no natural or semi-natural habitats, such as woodlands or marshes on the development site which could have an influence on micro-climate.

The site comprises four agricultural fields with hedgerows and/or treelines forming the field boundaries. The only habitats present are grassland, both meadow and pasture, and hedgerows and ditches which do not significantly influence micro-climate.

10.1 Construction Impacts and Mitigation

The construction phase of the development will not result in any atmospheric emissions that could have an impact on climate other than minor emissions from the operation of construction vehicles and machinery on site. Therefore no mitigation measures are required.

10.2 Operational Impacts and Mitigation

10.2.1 Acidification

Operation of the waste to energy plant will result in emissions of SO_2 and NO_X both of which can be considered acid gases and which can cause acidification and degradation of ecosystems.

The European Council has adopted a new Directive (2000/76/EC) on the incineration of waste. The aim of the Directive is to prevent, or where that is not practicable, to reduce as far as possible negative effects on the environment and the resulting risks to human health, from the incineration and co-incineration of waste. The reduction of acid gas emissions will assist with the Community Strategy to combat acidification. The Directive sets emission limit values of 50 mg/m^3 of SO_2 and 200 mg/m^3 of NO_X.

A number of measures will be incorporated into the plant design to ensure atmospheric emissions from the plant do not exceed the emission limit values specified in the Directive. The optimised combustion conditions in the furnace will minimise the oxidation of nitrogen in the combustion air. $DeNO_x$ technology will be used to further reduce the levels of NO_X. A urea solution will be injected into the furnace, which breaks down to form water and ammonia and the ammonia will react with NO_x at high temperature to reduce the NO_x to nitrogen and water vapour. Levels of NO_x will be continuously monitored to optimise the quantity of urea injected. Two wet scrubbers using a calcium based neutralisation agent will be operated in sequence to reduce the levels of acidic (including SO_2) and other compounds in the flue gas.

The emissions of SO_2 and NO_X from the waste to energy plant will not exceed the limits specified in the new Directive, with expected average flue gas emission concentrations of 20 mg/m^3 of SO_2 and 150 mg/m^3 of NO_X.

Operation of the waste to energy plant will result in approximately 0.66 g SO_2/kWhr (based on maximum emission rates) and 2 g NO_X/kWhr (also based on maximum emission rates) electricity generated which are lower than the corresponding average values for power plants of 4.55 g SO_2/kWhr and 2.34 g NO_X/kWhr electricity generated (based on figures from the ESB Environmental Report, 1997). Therefore the operation of the waste to energy plant will result in less emissions of NO_X and SO_2 per unit of electricity generated than conventional power plants. Based on continuous operation at the maximum emission rates, annual emissions from the waste to energy plant would be 50 tonnes per year of SO_2 and 235 tonnes per year of NO_X. As Indaver Ireland expect to operate significantly below the maximum emission levels, this is a conservative assessment of the total emissions. ESB emission data for 1996 indicates annual emission rates for the combined ESB power plants of 81,650 tonnes of SO_2 and 41,840 tonnes of NO_X.

10.4.2 Greenhouse Gases

Operation of the waste to energy plant will also result in the emission to atmosphere of greenhouse gases, namely CO_2 and minor quantities of N_2O. Combustion of waste with energy recovery results in avoided greenhouse gas emissions from two other sources. Firstly, the electricity produced displaces electricity that would otherwise be provided by a power plant. As most power plants burn fossil fuels, and thus emit CO_2, the electricity produced by the combustion of waste reduces utility CO_2 emissions. Secondly, as the waste is thermally treated it is not going to landfill and therefore landfill methane (CH_4) generation and emission is avoided.

The 1998 US EPA report 'Greenhouse Gas Emissions from Management of Selected Materials in Municipal Solid Waste' assessed the relative emissions of greenhouse gases from incineration and other waste management activities. The study estimated the direct emissions of CO_2 and N_2O from the combustion of municipal solid waste (MSW) in a mass burn plant, indirect emissions from the transportation of waste to the mass burn plant, and avoided greenhouse gas emissions from utility power plants. On this basis it was estimated that combustion of MSW with energy recovery results in a net reduction of 0.03 tonnes of carbon equivalent (TCE) per tonne of waste material incinerated. The tonne of carbon equivalent is a means of weighting emissions of different greenhouse gases to account for their different strength.

The waste to energy plant will emit approximately 160,000 tonnes per year of CO_2 to atmosphere. For comparison, the total emissions of CO_2 in Ireland during 1998 was 33,579,000 tonnes with the energy sector contributing 15,047,000 tonnes.

The combustion of waste with energy recovery will result in a net reduction in greenhouse gas emissions if the avoided greenhouse gas emissions from utility power plants and landfill sites are taken into account.

Indeed, it is the policy of the EU and of the Irish Energy Centre to promote the development of renewable energy sources for strategic and environmental reasons.

The Irish Energy Centre has set a target for an increase in renewable energy capacity from 180 MW (1999) to 500 MW by 2005. Biomass (including waste) conversion systems are included within the priority key actions.

10.4.3 Micro-Climate

As a result of the development, a large section of the site that is currently under meadow and pasture will be built upon. Some of the hedgerows will also have to be removed. These features that will be removed do not significantly affect micro-climate. The site does not possess any physical features such as woodlands, lakes, steeply sloping terrain that could influence the micro-climate of the site or immediate vicinity and does not therefore have any distinctive micro-climate in comparison to the larger surrounding area.

The discharge temperature of the flue gas from the 40 m stack will be 100 °C. The maximum exhaust flow rate at the discharge temperature will be 232,237 m^3/hr. Mixing and dispersion of the flue gas in the atmosphere will rapidly dissipate the heat so that there will be no significant incidence of thermal pollution in the vicinity of the development site and therefore no further mitigation measures are required.

The waste heat from the combustion process will be dissipated in the plant air cooled condensers. These are a dry based system which will not lead to plume or mist formation. In addition there will be no heat discharges to local surface water. Based on these factors and experience with similar plants there will be no observable impacts on the microclimate of the area.

10.3 Conclusions

Operation of the waste to energy plant will result in the emission to atmosphere of gases that can cause acidification (SO_2, NO_X) and also greenhouse gases (CO_2, N_2O). A number of design measures will ensure that emissions of SO_2 and NO_X will not exceed the limits specified in the new EU Directive on the incineration of waste which are designed for the protection of human health and the environment. The waste to energy plant will produce less SO_2 and NO_X per unit electricity than is currently produced, on average, by power plants in Ireland.

The waste to energy plant will generate electricity and avoid methane emissions from landfill. Its operation will therefore lead to a net reduction in greenhouse gas emissions. It is therefore being promoted as a renewable energy source by the Irish Energy Centre and the EU.