14. ENVIRONMENTAL CONSIDERATIONS

14.1 General

This chapter described the environmental considerations in the design of the facilities under the headings best available techniques (BAT), best available technology not entailing excessive cost (BATNEEC), cleaner technology and energy efficiency.

14.2 Best Available Techniques

The European IPPC Bureau has not yet defined Best Available Techniques (BAT) for waste incineration. In the absence of other guidance, BAT is taken as conforming with or exceeding the requirements of the Directive 2000/76/EC on the incineration of waste. The waste management facility has been designed with due regard to the requirement to utilise BAT in the plant processes and the emission abatement systems. Examples of the use of BAT in the facility include:

- Energy recovery
- Multi-stage flue gas cleaning systems
- Two stage dioxin removal
- On-line continuous sampling of dioxins in the stack emissions.

Energy Recovery

The heat produced by the combustion of waste will be used to produce electricity.

Multi-stage Flue Gas Cleaning Systems

State of the art, multi-stage flue gas cleaning systems will be provided, as described in sections 9.5.4, 9.5.5 and 9.5.7 above. The experience of the use of these systems, in Indaver's plants in Flanders, has been that the emission limits, set by EU Directive 2000/76/EC on the Incineration of Waste, will be achieved consistently.

Two Stage Dioxin Removal

As described in sections 9.5.4, 9.5.5 and 9.5.7 above, there will be two stages of dioxin removal. Activated carbon and lime mix will be injected into the flue gas streams prior to the bag house filters. There will be a second dioxin removal step prior to discharge. The second stage will use either activated carbon and lime mix and bag house filters or a lignite coke filter. The experience in Indaver's plants in Flanders has been that the dioxin emissions will be significantly below the limit in the EU Directive 2000/76/EC on the Incineration of Waste, even with single stage dioxin removal.

Continuous On-line Dioxin Sampling

The air emission monitoring equipment will include an on-line sampler, which will take continuous samples of the stack gases. The sampler's adsorption tubes will be removed at 14 day intervals for laboratory analysis of dioxin concentration. Refer to chapter 13. The EU Directive 2000/76/EC does not require continuous dioxin sampling.

14.3 BATNEEC

Section 40 (4) (c) of the waste Management Act 1996 requires BATNEEC to be used. The EPA has not published a best available technology not entailing excessive cost (BATNEEC) guidance note specifically for the incineration of waste. Reference has been made to the

BATNEEC Guidance Note for the Chemical Sector in determining BATNEEC for the facility. BATNEEC will be utilised in various aspects of the facility, as follows:

- Breathing losses from the tank farm in the waste to energy plant will be routed to the post combustion chamber
- There will be a closed loop vapour return to the tank farm during tanker offloading operations
- Breathing losses from tank farm in the waste transfer station will be treated in an abatement system
- Fugitive emissions from repackaging room operations, in the waste transfer station will be treated in an abatement system
- Run-off from areas, which will have a greater chance of a spill or leak, will be collected separately and tested prior to release into main drainage systems.

14.4 Cleaner Technology

Where feasible, cleaner technologies will be utilised in the waste to energy plant in order to minimise wastes and reduce resource consumption. Examples include:

- Reuse of all process water, eliminating process effluent
- Collection of rainwater for use in the process
- Air cooled condensers
- Optimising the use of liquid wastes to optimise calorific value
- Use of natural gas as the auxiliary fuel
- Maintaining the waste reception hall and waste bunker at negative pressure

Reuse of Process Water

The evaporating spray towers will be used to cool the flue gases from the boilers. Process effluent such as scrubber water, effluent from the boiler water treatment plant and wash waters will be collected for used in the evaporating spray towers. There will be no process effluent emissions from the waste to energy plant under normal operations.

Collection of Rainwater for use in the Process

Rainwater from the roofs of the buildings in the waste to energy plant will be collected for use in the evaporating spray towers, thus reducing the quantities of treated potable water, from the Cork County Council water main, to be used in the process.

Air Cooled Condenser

A large air-cooled condenser will be used to cool and condense the steam from the turbines. The alternative would be to use water-cooled condensers which would result in a very significant water requirement.

Optimising the Use of Liquid Wastes to Optimise Calorific Value

The liquid wastes, which will arrive at the waste to energy plant, will mainly be comprised of waste solvents. These will have different calorific values. Some of the liquid waste will have a relatively low calorific value, the combustion of which would be insufficient to maintain the temperature of the post combustion chamber at the required level. High and low calorific waste will be stored separately and fed by separate lances to the post combustion chamber. Some liquid wastes may be pre-blended in the day tank. The supply of relatively high and

relatively low calorific value waste to the post combustion chamber will be varied as required. This will ensure that, as far as possible, the waste will be sufficient to maintain the temperature of the post combustion chamber and the use of natural gas as auxiliary fuel will be minimise.

Use of Natural Gas as the Auxiliary Fuel

It will be necessary to burn fuel to heat up the furnaces after a shut down, and to maintain the temperature in the furnace if low calorific waste is being burnt. Natural gas, which will have low emissions, will be used as the auxiliary fuel.

Maintaining the Waste Reception Hall and Waste Bunker at Negative Pressure

To reduce the potential for litter and odour emissions, the waste reception hall and waste bunker will be maintained under negative pressure. This will be achieved by drawing primary combustion air from these areas.

14.5 Energy efficiency

The waste management system will incorporate systems and procedures to conserve energy. These include:

- Steam generation at relatively high temperature
- The expansion of the steam to a relatively low pressure in the turbine
- Using the flue gases to preheat the boiler feed water
- Secondary combustion air taken in from under the roof of the waste to energy building
- Using the steam from the turbine in a reheater for plume suppression
- Variable speed drive on fans and pumps

Steam Generation at Relatively High Temperature.

Steam will be generated at 400°C. This is the highest temperature that is technically feasible for waste incineration.

Expansion of the Steam to a Relatively Low Pressure in the turbine

The steam will enter the turbine at 400°C, 41bara, and will be expanded to 0.15bara at 56°C. This will be the widest bandwidth feasible, for steam produce with waste as fuel, and will give the optimum energy yield.

Using the Flue Gases to Preheat the Boiler Feed Water

The economiser section of the boiler will act as a flue gas /water heat exchanger. The boiler feed water will be pre-heated and the flue gases will be cooled down, prior to entering the evaporating spray tower. This maximises the heat removal from the flue gases

Secondary Combustion Air taken from under the Roof of the Waste to Energy Building

Secondary combustion air will be drawn from under the roof of the waste to energy building. This will have the effect of cooling this space down and utilising the warm air for combustion.

Using the Steam from the Turbine in a Re-heater for Plume Suppression

Steam will be bled from the turbine to be utilised to reheat the flue gases, following treatment, prior to discharge. Thus, the frequency of occurrence of a visible plume will be reduced. The use of this steam will have minimal impact on electricity production.

Variable Speed Drive on Fans and Pumps

Variable speed drives will be used on the larger electrical motors such as the ID fan and the aerocondensers. The actual equipment to have variable speed drives will be optimised at the detailed design stage.

14.6 International and National Comments on the Incineration of Waste

14.6.1 World Health Organisation (WHO)

Waste Incineration, Local Authorities Environmental Health Planning Pamphlet Series No. 6 (E), WHO, 1996.

The following are quotations from the WHO pamphlet:

> *'The incineration of waste is an hygienic method of reducing its volume and weight which also reduces its potential to pollute'*
>
> *'Incineration is one of a number of waste disposal strategies which can be used to ensure that wastes are handled in an environmentally sustainable manner'*
>
> *'Modern incineration equipment fitted with air pollution control technology can make waste incineration an environmentally acceptable form of waste treatment which minimises the potential for harm'.*

14.6.2 European Union

6th Environment Action Programme – An Action Programme for the Environment in Europe at the beginning of the 21st Century

The European Union has prepared a series of action programmes on the environment. In the '6th Environment Action Programme – An Action Programme for the Environment in Europe at the beginning of the 21st Century' the EU had the following goal:

> *'In short we need to encourage the development of a society where the cars we drive are clean, the wastes we produce are recycled or disposed of safely, the energy sources and technologies we use do not lead to global warming, the products we make, from computers to baby toys, do not disperse hazardous chemicals into the environment, our food and our bodies, and where our business, tourist, housing and agricultural activities are planned so as to protect our biodiversity, habitats and landscapes'*

Comments on the incineration of waste in the programme include:

> *'New waste treatment facilities meet extremely high operating standards that reduce emissions and risks significantly'*
>
> *'The Community's approach to waste management policy is based on the guiding principle of the waste hierarchy which gives preference first to waste prevention, then to waste recovery (which includes reuse, recycling and energy recovery, with preference being given to material recovery), and lastly to waste disposal (which includes incineration without energy recovery and landfilling)'*

For waste that are still generated to achieve a situation, where:

> *'the quantity of waste that still need to go to final disposal are reduced to an absolute minimum and are safely destroyed or disposed of '*
>
> *'waste is treated as closely as possible to where it is generated'*

Community Strategy for dioxins, furans and polychlorinated biphenyls (COM(2001) 593 final)

The strategy focuses on controlling known sources of dioxins:

- hospital waste incineration,
- Iron ore sintering,
- Electric arc furnaces,
- non ferrous metal industry,
- miscellaneous industrial sources and non-industrial sources

> *'The dominant source of dioxins in the EU has traditionally been uncontrolled waste incineration. The Directives on waste incineration ensure that this will no longer be the case'*

14.6.3 Environmental Protection Agency (EPA)

EPA Hazardous Waste Plan, 2001

EPA prepared a plan for the management of hazardous waste in Ireland. The Plan states:

> *'In order to apply the proximity principle and ensure security of hazardous waste recovery and disposal outlets, Ireland should seek to become self sufficient in hazardous waste recovery and disposal capacity'*
>
> *A thermal treatment disposal facility for the management of hazardous waste currently exported for disposal is required if Ireland is to become self sufficient in hazardous waste management. In the event of a facility being established, consideration should be given to the imposition of import and export restrictions in relation to the disposal of hazardous waste'*

Priorities for the period 2001 to 2006 are set in the plan. These include:

> *7. The development of hazardous waste landfill capacity and thermal treatment for hazardous waste requiring disposal to achieve self sufficiency and reduce our reliance on export'*

EPA Inventory of Dioxin and Furan Emissions to Air, Land and Water in Ireland for 2000 and 2010

The scope of the Inventory of Dioxin and Furan Emissions to Air, Land and Water in Ireland for 2000 and 2010 was to:

> *'Compare the current (2000) and the future (2010) dioxin emissions to permit the potential impact of new dioxin sources, in particular thermal waste treatment plants, to be estimated.'*
>
> *Summary Emissions Inventory- 'For both 2000 and 2010 inventories, the majority of emissions are identified as coming from one individual sector, namely uncontrolled combustion processes'*
>
> *Waste incineration will contribute less than 2% to total dioxin emissions to air in 2010*
>
> *'Incinerator bottom ash and flyash to be landfilled under controlled conditions at licensed facilities thereby limiting any potential release of dioxins to the environment'*

14.6.4 Food Safety Authority of Ireland

Levels of Dioxins, Furans and PCBs in Irish milk, 1991- 2000

Food Safety Authority of Ireland report into the Levels of Dioxins, Furans and PCBs in Irish milk, 1991-2000, which was published in 2002, had the following conclusions:

> *'The decline in dioxin and dioxin-like PCB levels found in the study over the period 1991 –2001 shows that it is possible to operate industrial incineration facilities to exacting standards that ensure the food supply is not contaminated via environmental pollution'*

14.6.5 Health Research Board (HRB)

Health and Environmental Effects of Landfilling and Incineration of Waste – A Literature Review.

The HBR report into the health and environmental effects of landfilling and incineration of waste was published February 2003. The authors of the report conducted a very extensive literature review on the health effects of incineration and landfill.

Amongst the conclusions were:

> ***'Incineration of waste***
>
> *Monitoring of the emissions from industrial hazardous waste incinerators is currently carried out as an Integrated Pollution Control (IPC) licence condition. None of the facilities licensed for hazardous waste incineration have been found to be in breach of their IPC licence conditions. Dioxin emissions to the atmosphere from incinerators were estimated to be less than 1% of the total estimated national atmospheric dioxin emissions from all sources. Accidental fires were found to be the primary source of atmospheric dioxin emissions.*
>
> *Municipal waste is not incinerated in Ireland; however this is under consideration as part of integrated waste management plans. In the past, municipal waste incinerators world-wide were major sources of dioxins and other environmental pollutants. However, since the early 1990s, the application of stringent emission limit values to a broad range of environmental pollutants has significantly reduced the environmental impacts of municipal waste incineration. A combination of improved combustion practices and staged air pollution control techniques allows modern municipal incinerators, if operated according to the design standards, to meet the environmental requirements embodies in the recent EC directive on the Incineration of Waste.*
>
> ***'Epidemiological studies of the health effects of landfilling and incineration***
>
> *As there is a paucity of literature relating to modern landfill and incineration sites, nearly all of the studies identified in this report relate to older technologies. It can be assumed that as emission controls improve, risks of adverse health effects diminish.'*
>
> ***'Health effects of incineration***
>
> *There is some evidence that incinerator emissions may be associated with respiratory morbidity. Acute and chronic respiratory symptoms are associated with incinerator emissions.*

The HBR report, a very comprehensive study, which took 15 months to complete, has found no reason to delay the implementation in Ireland of modern integrated waste management infrastructure including incineration of waste.