DUBLIN WASTE TO ENERGY PROJECT

BRIEF OF EVIDENCE

MAJOR ACCIDENT HAZARDS

DON MENZIES

ARUP CONSULTING ENGINEERS

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1 Qualifications and Experience

My name is Don Menzies. I am a Director of Arup Consulting Engineers. I have responsibility at Board level for health and safety policy within the company.

I hold a first class honours degree in Chemical Engineering from the National University of Ireland (University College, Dublin), a first class honours degree in Commerce from the National University of Ireland (University College, Dublin), a PhD in Agricultural Engineering from the University of Newcastle upon Tyne, the degree of Barrister-at-Law from King's Inns, Dublin and a Diploma in International Arbitration from the National University of Ireland (University College, Dublin).

I am a Chartered Engineer, a Fellow of the Institution of Engineers of Ireland, a Fellow of the Institution of Chemical Engineers, a Member of the Chartered Institute of Arbitrators, a Member of the Energy Institute and a Member of the Institution of Gas Engineers and Managers. I am a Chartered Scientist and a Chartered Environmentalist.

I am a member of the Safety Register, maintained by the Institution of Chemical Engineers, for Loss Prevention and Safety Professionals. My membership of this Register is renewed at regular intervals, subject to satisfying the Institution of my ongoing relevant work on the area of loss prevention and safety promotion.

I have worked as a consulting engineer for 27 years. My areas of specialization have included loss prevention and safety promotion, and air quality.

I have carried out quantitative risk assessment for a wide range of establishments that store and handle hazardous materials, including a number of LPG storage and distribution installations, an oil refinery, several oil storage and distribution facilities, several bulk pharmaceutical plants and other chemical manufacturing and handling facilities. This work has included computer modelling of major accident scenarios and estimation of risk. I have chaired many Hazard and Operability Studies over a period of 16 years. These studies have included bulk pharmaceutical plants, LPG storage and distribution facilities, oil road tanker filling and despatch, nitric acid plant, adhesive manufacturing plants and other chemical manufacturing facilities.

2 Introduction

Arup Consulting Engineers were the main consultants to Elsam Dublin Waste to Energy Ltd (Elsam) now DONG Energy for the preparation of the EIS and waste licence application for the Dublin Waste to Energy project (DWtE).

My role in the project was as follows:

- Determine whether the proposed facility would come within the scope of the Seveso (COMAH) Directive
- If the proposed facility would come within the scope of the Seveso Directive:
    - Identify potential major accident hazards
    - Estimate the consequences of these hazards
    - Collate information on means to prevent major accidents arising from these hazards
    - Collate information on means to mitigate the effects of these hazards
    - Assess the residual risk

Arup prepared the parts of the EIS that deal with the Seveso Directive. Arup also prepared the Major Accident Hazard Assessment, which was submitted to the Health and Safety

Authority (HSA) and An Bord Pleanála in August 2006. This document was prepared to assist the HSA in the preparation of technical advice on land-use planning for An Bord Pleanála.

This document was revised at the request of the HSA (HSA letter 4 October 2007) to provide additional and more detailed information. Information was prepared and submitted on 8 February 2007 by DCC to the HSA specifically responding to the HSA's request for additional information.

My evidence will cover major accident hazards in the context of the Seveso Directive. I will address concerns relating to these topics which were raised in submissions to the Board.

3 The Seveso Directive

The Control of Major Accident Hazards (COMAH) Directive Council Directive 96/82/EC of 9 December 1996[1] as amended by Directive 2003/105/EC of the European Parliament and of the Council, 16 December 2003[2], is also known as the Seveso II (Seveso 2) Directive or COMAH Directive and has as its objectives:

- the prevention of major accidents which involve dangerous substances, and
- the limitation of their consequences for man and the environment,

with a view to ensuring high levels of protection throughout the Community in a consistent and effective manner.

Insofar as it applies to the operators of affected facilities, the Directive was implemented in Ireland by the *European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006* (SI No 74 of 2006), which I will refer to as the "Seveso Regulations". The Seveso Regulations are enforced by the HSA.

Article 12 of the directive sets out land-use planning requirements for Member States:

[1] Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, O.J. L 10, 14.1.1997, p. 13

[2] Directive 2003/105/EC of the European Parliament and of the Council of 16 December 2003 amending Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances, O.J. L 345, 31.12.2003, p. 97

"Article 12

Land-use planning

1. Member States shall ensure that the objectives of preventing major accidents and limiting the consequences of such accidents are taken into account in their land-use policies and/or other relevant policies. They shall pursue those objectives through controls on:

(a) the siting of new establishments,

(b) modifications to existing establishments covered by Article 10,

(c) new developments such as **transport links**, locations frequented by the public and residential areas in the vicinity of existing establishments, where the siting of developments are such as to increase the risk or consequences of a major accident.

Member States shall ensure that their land-use and/or other relevant policies and the procedures for implementing those policies take account of the need, in the long term, to maintain appropriate distances between establishments covered by this Directive and residential areas, areas of public use and areas of particular natural sensitivity or interest, and, in the case of existing establishments, of the need for additional technical measures in accordance with Article 5 so as not to increase the risks to people.

Member States shall ensure that all competent authorities and planning authorities responsible for decisions in this area set up appropriate consultation procedures to facilitate implementation of the policies established under paragraph 1. The procedures shall be designed to ensure that technical advice on the risks arising from the establishment is available, either on a case-by-case or on a generic basis, when decisions are taken."

These land-use planning requirements for Member States were implemented as follows:

- Powers and duties of the Health and Safety Authority by the Seveso Regulations.
- Powers and duties of planning authorities including An Bord Pleanála by the *Planning and Development Regulations 2001* (SI No 600 of 2001), which I will refer to as the "Planning and Development Regulations".

4 Major Accident

A "major accident" is defined in the Seveso Regulations as an occurrence such as a major emission, fire or explosion resulting from "uncontrolled developments" in the course of the operation of any establishment, leading to a serious danger to human health or to the environment, whether immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances.

In these regulations, "uncontrolled developments" means a situation that goes out of control or occurrence of abnormal conditions, not the lack of a control system. Nor does it mean uncontrolled development in the sense of planning legislation, where these words could mean a development that does not have planning permission.

Seveso facilities are known as "establishments".

The impact of normal operation will be dealt with by the Waste Licence.

5 Applicability of Seveso Directive

The Seveso Directive applies to establishments that store or could generate more than specified "threshold" quantities of hazardous materials.

Threshold quantities are specified for:

(a) Named hazardous substances

(b) Classes of hazardous substances (toxic, very toxic, oxidising, flammable, explosive, dangerous to the aquatic environment, etc)

(c) Groups of hazardous substances:

- Group A: toxic + very toxic
- Group B: explosive + flammable + highly flammable + extremely flammable + oxidising
- Group C: materials classified as N, with risk phrases R50, R50/53 and R51/53

Two threshold quantities are specified in each case: the upper and lower threshold quantities.

5.1 Lower Tier Sites

If any of the **lower** threshold quantities is exceeded the establishment becomes subject to the Directive, and the general obligations must be met by the operator. Such establishments are known as "lower tier" sites. The obligations include the following:

- The operator must be able to prove that:
    - he has **identified** the major accident hazards, and
    - he has taken all necessary measures to **comply** with the Regulations
- The operator must take all necessary measures:
    - to **prevent** major accidents occurring, and
    - to **limit the consequences** of any such major accidents for man and the environment.
- The operator must prepare a Major Accident Prevention Policy (**MAPP**) document
- The operator must notify the HSA and the planning authority in whose area the establishment is situated

These obligations relate to the design, construction, operation and maintenance of the facility. It is therefore not possible to say that the operator has or has not met all the obligations at the early design stages of a project. Compliance can only be determined during operation of the facility.

5.2 Upper Tier Sites

If any of the **upper** threshold quantities is exceeded, in addition to the above general obligations, more onerous obligations are placed on the operator, including the requirements to:

- Prepare and submit for HSA approval a **Safety Report** – this must be done six months before commencement of construction or commencement of operation
- Prepare an **Internal Emergency Plan** – this must be done prior to the commencement of operation
- **Inform** the those likely to be affected by major accident, including the public – this must be done prior to the commencement of operation
- Liaise with the emergency services in preparation of an **External Emergency Plan**

Such establishments are known as upper tier sites or top tier sites.

6 Rationale for Designation of the DWtE Facility as Upper Tier Seveso Establishment

The DWtE site will be an upper tier establishment under the Regulations because the quantities of substances classified as dangerous to the environment exceed the upper quantity threshold specified in the Regulations. Such materials fall into EC class "N". The EC has established a system of risk phrases and safety phrases for dangerous materials. For materials classified as dangerous to the environment (N), the risk phrases (R-phrases) relevant to the Seveso Directive are R50, R50/53 or R51/R53. These have the following meanings:

R50 Very toxic to aquatic organisms

R53 May cause long-term adverse effects in the aquatic environment

R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

The attached Appendix A shows the quantities of hazardous materials stored, which are relevant to the Seveso Directive.

The dangerous substances making the main contribution to the facilities upper tier status are as follows:

- Ammonium hydroxide (used for abatement of emissions to atmosphere of nitrogen oxide)
- Diesel oil (gas oil) (used as a standby fuel)
- Flue Gas Treatment (FGT) residues

6.1 Ammonium Hyrdoxide

Ammonium hydroxide is a solution of ammonia gas in water, which for the proposed facility will be 25% by weight ammonia in water.

Ammonium hydroxide will be stored in a tank in the building. The tank will have a capacity of 180 tonnes of liquid. This material is classified as N, R50. The upper tier threshold quantity for such materials is 200 tonnes. Ammonium hydroxide therefore accounts for 90% of the upper tier threshold quantity for materials that are classified as N., R50 or R50/53.

The only other risk phrase assigned to ammonium hydroxide is "R34 – causes burns".

Other risk phrases related to potential damage to the environment are:

- R54, Toxic to flora
- R55, Toxic to fauna
- R56, Toxic to soil organisms
- R57, Toxic to bees
- R58, May cause long-term adverse effects in the environment
- R59, Dangerous for the ozone layer

None of these risk phrases have been assigned to ammonium hydroxide.

6.2 Diesel Oil

Diesel oil and gas oil are very similar in their hazard properties. These materials are used in diesel engines in road vehicles, standby generators and in heating appliances. In the proposed DWtE facility diesel oil will be used as a standby fuel.

Diesel oil will be stored in a tank within the building, with a capacity of 100 tonnes. The upper tier threshold quantity for diesel oil type materials is 25,000 tonnes. This is the threshold quantity for a named substance, even though dies oil is classified as N, R51/53.

Diesel oil therefore accounts for 0.4% of the upper tier threshold quantity for this named substance.

Other risk phrases assigned to diesel oil are:

- R40 - Possible risk of irreversible effects
- R65 - Harmful: may cause lung damage if swallowed
- R66 - Repeated exposure may cause skin dryness or cracking

No other risk phrases relating to potential damage to the environment have been assigned to diesel oil.

6.3 FGT Residues

FGT residues are collected in the air emission abatement equipment. These residues are classified as N, R51/53.

The rationale for classification of FGT residues as risk phrase R51/53, toxic to aquatic organisms/may cause long-term adverse effects in the aquatic environment, is described below.

Heavy metals and their oxides that are classified as N, R50/53 include cadmium, cadmium oxide, cobalt oxide, cuprous oxide, lead monoxide, zinc oxide, arsenic, arsenic pentoxide, arsenic trioxide, mercury metal, mercury oxide, chromium trioxide.

A report by the European Environment Agency (EEA)[3] [3], gives information on typical concentrations of heavy metals in solid wastes from Municipal Waste Incineration plants. Based on this report, FGT residues contain over 4% of heavy metals that are classified as N, R50/53.

The EC Dangerous Preparations Directive 1999/45/EC states that if a mixture or “preparation” contains between 2.5% and 25% of materials classified as N, R50/53, then the entire mixture is classified as N, R51/53.

Therefore the entire FGT residue is classified as N with risk phrases R51/53. Up to 700 tonnes of FGT residue will be stored on site. The upper tier threshold quantity for this type of material is 500 tonnes. FGT Residues therefore account for 140% of the upper tier threshold for materials that are classified as N, R51/53.

FGT Residues would not be classified as toxic because the total quantity of heavy metals present that are themselves or as inorganic salts classified as toxic is 1.1%. The EC Dangerous Preparations Directive 1999/45/EC[4] states that if a mixture or “preparation” contains more than 25% of materials classified as toxic, then the entire mixture is classified as toxic. This is not the case with FGT Residues.

[3] EEA, Technical report No 38 *Dangerous substances in waste*, February 2000

[4] Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations, O.J. L200 30.7.1999 L page 1

No other risk phrases relating to potential damage to the environment have been assigned to heavy metals.

6.4 Other Materials

Other hazardous materials will be stored on site, but the quantities are very small in relation to the quantities of ammonium hydroxide and diesel oil.

6.5 Total Inventory

The quantities of hazardous materials stored on site are compared with the threshold quantities for groups of hazardous substances as specified by the Seveso Directive as follows:

Group A: No materials stored on site are classified as very toxic or toxic.

Group B: The total quantity of materials stored on site that are classified as explosive, flammable, highly flammable, extremely flammable or oxidising amount to 1.67% of the upper tier quantity threshold for this group of materials.

Group C: The total quantity of materials classified as N, with risk phrases R50, R50/53 or R51/53 amount to 231% of the upper tier quantity threshold for this group of materials.

However, if the FGT Residue were not classified as N with risk phrases R5/-53, the site would not be a Seveso establishment.

7 Project Timeline

A scoping meeting was held with the HSA on 9 May 2006. Arup proposed at the meeting to model the following scenarios:

- Diesel bund fire
- LPG BLEVE
- Loss of containment of Flue Gas Treatment residues ammonium hydroxide

The HSA advised that where a major accident scenario was omitted from the assessment, the rationale for omitting it should be included in the report.

The results of a preliminary assessment of major accident hazards were included in Chapter 13 of the EIS, which was submitted to An Bord Pleanála on 30 June 2006.

On 25 July 2006 the HSA requested that a detailed assessment of the consequence and likelihood of major accidents to man and the environment be carried out.

Major Accident Hazard Assessment 2006 was submitted to An Bord Pleanála and to the HSA on 31 August 2006, in order to assist the HSA in providing to An Bord Pleanála technical advice on land-use planning. The EIS and the Major Accident Hazard Assessment report made up the planning documentation, which is in the public domain.

On 4 October 2006 a request was received from the HSA for additional information as follows:

1. Include site layout showing the positions of the tanks containing the Dangerous Substances (Diesel, NH_4OH).
2. Give details on bund and tank dimensions.
3. Section 3.6.3 – Aircraft Impact – data based on Canvey. Rework using methodology in HSE Publication (CRR series) “The Calculation of Aircraft Crash Risk in the UK” 1997

4. Section 3.6.5 – Tide Level – 1 in 200 year flood will be 0.7m less than site level. What are the major accident implications of a flood.
5. A review of accident history in municipal waste incinerators should be given.
6. Section 4.3.2 refers to "automatic shut-off valve" preventing tank overfilling. Please supply more details on the reliability of this valve.
7. Section 5. In terms of Major Accidents identified, is an explosion in the boiler/grate a credible event?
8. Section 5.2.3 – indicate the suitability of the "Aermod" software for purpose to which it is being applied. Provide the Authority with the source terms used and the results obtained.
9. Section 5.2.4 – "totally contained at ground level" – provide more detail on the actual retention capacity within the main process building.
10. Section 5.2.5 – provide more detail on liquid retention.
11. Section 5.2.7 – fire in waste bunker. Estimate the likelihood of a fire. Modelling should be carried out on the early stages of a fire to determine the potential ground level concentrations of any dangerous substances produced by a fire, in a variety of atmospheric conditions, including D_{10}.
12. Section 5.3.5 – in relation to thermal effects from diesel fire, model also to $4kw/m^2$ and $7kw/m^2$ heat fluxes. If the fire scenario is actually outside the building, examine also the effects in D_{10} conditions.
13. Table 14 – what is the distance to "dangerous dose"? (See also point 8)
14. Section 6.1.1 – provide more details on bund and tank dimensions, and on the building drainage system.
15. Section 6.1.3 – how likely is a failure of the flu gas treatment system? What would be the consequences associated with such failure?
16. Section 6.1.5 – more details on tank and bund dimensions are required.
17. Section 6.2.6 – provide more detail on how the spilled material will be rendered safe.
18. Section 6.2.8 – demonstrate there is sufficient capacity on site to retain the projected amount of firewater required.
19. Section 7.1 – describe the emergency access and egress arrangements. Demonstrate the safety of any occupied building on the site. Consider toxic effects, as well as thermal radiations and overpressure events in the demonstration.

On 8 February 2007 a response to the HSA Request for Additional Information was submitted (*Major Accident Hazard Assessment Report February 2007* incl. cover notes).

On 15 February 2007, notification was received from An Bord Pleanála of first public display period for significant additional information, including *Major Accident Hazard Assessment Report February 2007*, with cover notes.

8 Identification of Potential Major Accident Hazards

8.1 Procedure

Potential major accident hazards were identified by examining:

- Hazardous materials stored on site

- Hazardous materials that could be generated on site
- *Criteria for the Notification of an Accident to the Commission as provided for in Article 15(1)* set out in Annex VI to Council Directive 96/82/EC, and reproduced in **Schedule 7 to the Seveso Regulations.**

The latter have been recommended to us by the HSA in the case of other Seveso sites as an appropriate source of information for the purposes of identifying potential major accident hazards.

8.2 Major Accident Hazards

The following major accident hazards were identified:

- Diesel bund fire
- LPG BLEVE (Boiling Liquid Expanding Vapour Explosion)
- Failure of flue gas treatment equipment (see Chapter 8 of EIS)
- Loss of containment of FGT residues
- Loss of containment of ammonium hydroxide
- Loss of containment of biocides
- Fire in waste bunker
- Loss of Containment of Firewater

9 Methodology for Consequence Estimation

Where practicable, quantitative estimation of the consequences of potential major accidents was carried out. In other cases a qualitative assessment was made. Qualitative assessment of hazards is a recognised and acceptable methodology.

9.1 Guidelines on Modelling

In modelling the catastrophic loss of containment (LOC) of diesel Arup followed the LOC scenarios described in the *Purple Book*.[5] Scenarios other than catastrophic LOC are described in the Purple Book, however this was chosen as the worst possible scenario.

Based on discussions with the HSA on other projects, a bund overtopping fraction was predicted for the diesel and ammonium hydroxide scenarios based on published methodologies.

A fire in the waste bunker was modelled at the request of the HSA in accordance with the methodology used in the major accident report for the Indaver waste management facility at Ringaskiddy.

The aircraft impact assessment was carried out at the request of the HSA in accordance with the UK HSE methodology[6].

9.2 Model

For quantitative estimation of the consequences of potential major accidents, the model used was the DNV Technica computer model package PHAST v 6.51. This is an integrated suite of models and is supplied with a properties database including physical and hazard

[5] Committee for Prevention of Disasters (1999) *Guidelines for Quantitative Risk Assessment CPR 18E* First Edition (The TNO Purple Book) [4]
[6] HSE (1997) *The Calculation of Aircraft Crash Risk in the UK*. Contract Research Report 150/1997.

properties for about 2,000 pure substances. This model is used throughout the world by many operating companies, consultants and regulatory authorities, including the HSA.

Diesel oil was modelled using the properties advised by DNV Technica.

LPG (propane) is included in the properties database.

In order to model the consequences of loss of containment of ammonium hydroxide, PHAST's mixture subroutine was used, as recommended by DNV Technica. Properties were calculated by the model from the properties of ammonia and water, both of which are in the properties database, and these were updated to actual properties for ammonium hydroxide given in published references.

9.3 Meteorological Data

Meteorological conditions are a major factor in determining the consequences of loss of containment of hazardous substances. The meteorological conditions most relevant to predicting the consequences of potential major accidents are wind speed and atmospheric stability.

All scenarios were modelled under the following weather conditions:

Table 1 Meteorological Conditions

Wind Speed (m/s)	Pasquill (Atmospheric) Stability Category	Weighting
1.5	F	6.25%
1.5	D	12.50%
5	D	31.25%
10	D	50.00%

Stability Category D occurs for about 75% of the year. Stability Category F occurs for about 7% of the year.

The last condition (D10) was specified by the HSA.

9.4 Assumptions

As the western side of the building will be open to allow truck access (open surface area to atmosphere will be approximately 480 m^2) the major accident hazard scenarios have been modelled as outdoor events. This is a conservative assumption, and represents a "worst case" situation.

10 Diesel bund fire

Loss of containment of diesel oil from the storage tank into its bund could occur through pipe or tank leakage, rupture of a hose connection from a road tanker or through catastrophic rupture of a tank and subsequent ignition of the material in the bund.

Total catastrophic failure of the storage tank (en extremely unlikely event) would probably result on some of the oil overtopping the bund wall and forming a pool. This extent of this pool could be limited by ramps at the various points of entry to the building.

10.1 Bund Overtopping Modelling

The percentage of oil overtopping the bund in such an event was calculated as follows.

A number of correlations based on experimental results have been developed for the potential overtopping of the bund wall following the catastrophic rupture of a storage tank.[7] [8] [9] These include two correlations presented in reports published by the UK Health and Safety Executive (HSE). Based on these correlations 63% of the contents of a full tank of diesel oil would overtop the bund wall.

10.2 Consequences

Diesel oil is not a flammable material, and is difficult to ignite. However, once ignited it can continue to burn.

It is a also material that can be harmful to the aquatic environment.

Fire

HSA land-use planning is based on the concept of dangerous dose.

A dangerous dose is defined as one where

- There is severe distress to almost everyone.
- A substantial fraction requires medical attention.
- Highly susceptible people might be killed.

Recent HSA generic advice on land-use planning for the Leeside Oil Terminal Company Limited, Galway[10], recommends that in relation to the consequences of a fire, the appropriate measure of heat flux and its duration is a thermal dose unit (TDU).

A thermal dose unit is calculated as follows:

$TDU = (kW/m^2)^{4/3}.t$

t = exposure time = 20 sec

1000 TDU is taken as the “dangerous dose”.

Where the heat effects amount to 1800 TDU or higher, the HSA recommends that development be restricted to industrial development (subject to consultation with the HSA), with occasional occupation by small numbers of people. This is termed the “Inner Zone”.

Where the heat effects amount to 1000 TDU or more, but less than1800 TDU, the HSA recommends that development be restricted to that recommended for the Inner Zone, commercial and industrial development that will accommodate less than 100 persons, and retail and catering development less than 250m² in floor area. This is termed the “Middle Zone”.

Where the heat effects amount to 500 TDU or more, but less than 1000 TDU, the HSA recommends that development be restricted to that recommended for the Inner and Middle Zones, commercial, retail and catering development, industrial development and small housing developments.

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[7] HSE (2001) *Effects of secondary containment on source term modelling*, prepared by WS Atkins Consultants Ltd for the Health and Safety Executive, Contract Research Report No 324/2001

[8] HSE (2005) *An experimental investigation of bund wall overtopping and dynamic pressures on the bund wall following catastrophic failure of a storage vessel*, Prepared by Liverpool John Moores University for the Health and Safety Executive 2005, Research Report No 333

[9] Thyer, A.M., Hirst, I.L. & Jagger, S.F. (2002) *Bund overtopping - the consequence of catastrophic tank failure*, Journal of Loss Prevention in the Process Industries, vol. 15, no. 5, pp. 357-363 (7)

[10] HSA (2005) *Land-use Planning Advice for Galway City Council In relation to Leeside Oil Terminal Company Limited at Lough Atalia Road, Galway City*, 21 September 2005

Where the heat effects amount to less than 500 TDU, the HSA does not recommend restrictions on development.

In the case of a fire following total loss of containment from the diesel oil tank to its bund, the PHAST model predicts the distances to specified thermal radiation levels to be 8, 13 and 19 m respectively for the Inner, Middle and Outer HSA Zones.

In the case of a fire following total loss of containment from the diesel oil tank to its bund, and overtopping of the bund to form a pool that is not limited to the building, the PHAST model predicts the distances to specified thermal radiation levels to be 74, 75 and 145 m respectively for the Inner, Middle and Outer HSA Zones.

A bund or pool fire involving diesel oil could escalate to other parts of the Facility.

A fire in the diesel tank would not lead to an explosion.

Environment

Information on the environmental impact of gas oils (diesel fuels and heating oils) is given in CONCAWE Product Dossier no. 95/107[11] as follows:

> On release to the environment the lighter components of gas oil will generally evaporate and be photooxidised by reaction with OH radicals. Depending on the circumstances, the remainder may become dispersed in the water column or adsorbed to soil or sediment. Higher molecular weight components may also be subject to photooxidation. On release into water, gas oils will tend to float on the surface and spread out; the components are generally poorly soluble in water, but the most soluble will dissolve and be dispersed.
>
> No data are available on the behaviour of gas oils in standard tests for biodegradability. Although a gas oil would not be expected to be "readily biodegradable" as defined by OECD guideline tests, most of the hydrocarbon species present are known to be degraded by micro-organisms; in a modified Sturm test (OECD method 301B) approximately 40% biodegradation was recorded over 28 days.
>
> The aquatic toxicity data on gas oils indicates that acute $LL_{50}/EL_{50}/IL_{50}$ values for aquatic organisms are in the range 1 to 100 mg/l. However there is little available data generated using accepted protocols for oil products and the current database should be interpreted with caution.

10.3 Prevention

Diesel oil has a relatively high flash point (>52°C) i.e. a flammable air/vapour mixture would not be formed above the liquid surface at ambient temperatures.

All tanks at the Facility will be designed to international standards.

Transfer of diesel to the storage tanks will take place within the bund in accordance with Standard Operating Procedure (SOP). Tank valves will be located within the bund. Regular visual inspection of the bund will take place for leaks.

The building drainage system is a closed or contained system. Therefore the risk of contamination of surface water from loss of containment of diesel will be minimised. As the bund will be contained within the building, bund overtopping from instantaneous rupture of a bulk tank will not be possible.

In the event of loss of containment, and failure of the bund, a spill of diesel oil would be contained within the building as the Facility comprises tertiary containment.

[11] CONCAWE (1996) *Gas oils (diesel fuels/heating oils)* Product Dossier no. 95/107

10.4 Mitigation

The heat effects of a diesel bund fire on the surrounding environment would be mitigated by the fact that the bund will be enclosed in the building.

Mitigation of effects on the environment would be provided by the total containment provided on site.

11 LPG BLEVE

An LPG bottle battery will be provided for the ignition of the oil-fired burners. The LPG system will be used for start-up of the oil burners. The LPG system will therefore be in use for 10 seconds approximately 20 times per year. The location and design of the bottle battery will be in accordance with all relevant Irish codes and standards.

LPG is a term that applies mainly to propane and butane. Both gases are flammable, and if ignited will burn or explode.

In the event of an engulfing or adjacent intense fire, the LPG bottles could become overheated and rupture.

11.1 Consequences

The consequences of overheating LPG bottles could be a Boiling Liquid Expanding Vapour cloud Explosion (BLEVE). The effects of a BLEVE are a fireball and projectiles. The fireball results in emission of heat and a pressure wave, known as overpressure, i.e. pressure in the air above or over atmospheric pressure.

The heat effects are assessed on the same basis as diesel oil fires.

The effects of an explosion are measured by the overpressure, which is the pressure above atmospheric pressure. Three levels are specified by the HSA: 600 mbar, 140 mbar, 70 mbar, as being the determinants of the Inner, Middle and Outer Zones.

In the case of a simultaneous BLEVE of all LPG bottles, the PHAST model predicts the distances to specified thermal radiation levels to be 78, 99 and 129 m respectively for the Inner, Middle and Outer HSA Zones. The distances based on explosion overpressure are 26, 34 and 133 m respectively.

11.2 Prevention

The LPG storage cylinders will be located in a separate fire compartment. The area will be classified in accordance with the relevant codes for specification for electrical equipment. Access to the storage area will be controlled and an exclusion zone maintained outside the storage location.

11.3 Mitigation

The effects of explosion overpressure on the surrounding environment would be mitigated by the location of the tanks within the building. Explosions of the scale possible from an LPG cylinder would be attenuated by the building and the smoke venting system. The automatic fire suppression system will extinguish small fires, and engulfment of the LPG cylinders in a fire is highly unlikely.

12 Failure of Flue Gas Treatment Equipment

This scenario envisages the failure of the flue gas treatment equipment and emission of untreated gases for a short period.

12.1 Consequences

The results of modelling of emissions due to failure of flue gas treatment equipment are presented in Chapter 8 of the EIS.

12.2 Prevention

Failure of the FGT treatment equipment will be prevented through the monitoring and maintenance programme, as well as a system of instrumentation and automatic response including provision of duplicate key instruments.

12.3 Mitigation

In the event of failure of the FGT equipment that cannot be repaired within a short period of time, the Facility will be shut down as rapidly as is consistent with safety procedures.

13 Loss of Containment of FGT residues

Up to 700 tonnes of FGT residues will be stored in enclosed silos equipped with HEPA filters which will be located inside the main process building. In the unlikely event of loss of containment, the FGT residues would spill to ground within the building.

13.1 Consequences

In the event of loss of containment, FGT residues would remain in a deposit at ground level and would be contained within the building. A very small amount of particles could be entrained in the air and might escape from the building.

FGT Residue is not classified as toxic to humans because of the very low concentration of heavy metals that are themselves or as inorganic salts classifies as toxic. Hence no risk to human safety or health is posed by loss of containment of FGT Residues.

Modelling of the loss of containment of FGT residues was not considered necessary as the vast majority of the residues would be contained within the building and could not escape from the site.

13.2 Prevention

FGT residues will be transported in sealed, road tanker wagons suitable for transport of such products. Refer to Chapter 10 of the EIS for further details on Residues and Consumables.

FGT residue silos will be equipped with HEPA filters to prevent fugitive emissions.

13.3 Mitigation

In the event of loss of containment of FGT residues, Workplace Safety Instructions will be followed. These Instructions provide the following information with regard to FGT residues:

- Composition/facts on constituents
- Risk identification
- First aid instructions
- Fire extinguishing
- Precautions to prevent accidental discharge
- Handling and storage
- Exposure control/personal safety equipment
- General and chemical characteristics

- Stability and reactivity
- Toxicological information
- Environmental information
- Disposal
- Transport information
- Information concerning regulations
- General information/applications

14 Loss of Containment of Ammonium Hydroxide

Loss of containment of ammonium hydroxide could occur due to the failure of a storage tank or leakage from a pipe flange or valve. Ammonia vapour would be released from the surface of the released material, and would be extracted from the building by the extract fans.

14.1 Ammonia Vapour Dispersion End Points

Ammonia is a pungent gas. A wide range of values for the odour threshold has been reported, from 0.6 ppm to 53 ppm, with a geometric mean of 17 ppm for the detection threshold.

The releases of ammonium hydroxide were modelled to determine the distance to reach the concentrations shown in the table below:

The UK Health & Safety Executive defines a Specified Level of Toxicity (SLOT) for land use planning[12] as follows:

- Severe distress to almost every one in the area
- Substantial fraction of exposed population requiring medical attention
- Some people seriously injured, requiring prolonged treatment
- Highly susceptible people possibly being killed

The Toxic Load for a given substance is a function of its concentration in air (c) and the duration of exposure (t). The SLOT Dangerous Toxic Load (SLOT DTL) is expressed as follows:

SLOT DTL = Concentration $(\text{ppm})^n$ x Time of Exposure (minutes) = 3.78×10^8

For ammonia, the HSE gives $n = 2$, therefore, for a 30 min averaging time (time of exposure),

UK SLOT DTL = 3,550 ppm

The HSA defines a dangerous dose for setting the specified area (i.e. that area likely to be affected in the event of a major accident) around upper tier Seveso establishments as half the UK Dangerous Dose.[13] Therefore,

Dangerous Dose = ½ x 3,550 ppm = 1,775 ppm

[12] Health & Safety Executive, UK. *Assessment of the Dangerous Toxic Load (DTL) for Specified Level of Toxicity (SLOT) and Significant Likelihood of Death (SLOD)*

[13] Health and Safety Authority (2004). *Setting the Specified Area – Paper on the Approach of the HSA*

The HSA does not specify concentrations of hazardous gases or vapours for the purposes of land-use planning, but rather adopts a risk-based approach. The criterion is the risk of fatality.

In the case of a total loss of containment from the ammonium hydroxide storage tank to its bund, the PHAST model predicts the distance to the dangerous dose to range from 79 m to 601 m, depending on the meteorological conditions.

In the case of total loss of containment from the ammonium hydroxide storage tank to its bund, and overtopping of the bund to form a pool that is contained by the building, the PHAST model predicts the distance to the dangerous dose to range from 298 m to 461 m, depending on the meteorological conditions.

In the case of total loss of containment from the ammonium hydroxide storage tank to its bund, and overtopping of the bund to form a pool that is not limited to the building, the PHAST model predicts the distance to the dangerous dose to range from 449 m to 1,595 m m, depending on the meteorological conditions.

14.2 Prevention

Loss of containment of ammonium hydroxide could occur from the storage tank, in the unlikely event of the failure of a storage tank or leakage from a pipe flange or valve.

Ammonia vapour would be released from the surface of the released material, and would be extracted from the building by the extract fans. Ammonia odour might be detectable outside the site boundary.

Ammonium hydroxide storage tank will be designed to international standards, and the tank will be located in a bunded area. The bund will limit the surface area from which ammonia could evaporate.

14.3 Mitigation

Ammonium hydroxide will be isolated from surface waters by primary containment (storage tank), secondary containment (bund) and tertiary containment (the Facility's closed drainage system).

15 Loss of Containment of Biocides

Biocide (sodium hypochlorite, i.e. household bleach) will be used for treating cooling water pipes. This material will be stored in a bulk container with a capacity of approximately 10 tonnes, in a bunded area within the facility. Any leaks from the bulk tank will be retained in the bunded area, and are not likely to give rise to any risk to human health or the environment.

The biocide will be dosed to the cooling water. Dosing will be by means of a metering pump and small diameter pipe. Failure of the dosing control system could result in continued pumping of biocide to the cooling water. The impact on the environment of continuous dosing of biocide would be local to the proposed cooling water outfall, and could include some diminution in population of aquatic organisms.

16 Fire in Waste Bunker

The largest quantity of combustible material on the site is in the waste bunker (capacity 65,000 m^3).

The worst case fire scenario is considered to be a fire in the waste bunker. This could be caused by, for example, hot ashes igniting combustible materials in the bunker.

16.1 Consequences

The effects of such a fire could be:

- Generation of smoke, which would be vented from the building through the smoke vents. Hot smoke rises, and therefore it is not likely that such smoke would descend to ground level within the immediate vicinity of the Facility. Dispersion and dilution of the smoke would occur before it descends to ground level
- Such a fire would be extinguished by application of firewater and/or foam. Firewater run-off could contain heavy metals and contaminate receiving waters, but all firewater used to fight a fire in the waste bunker will be retained in the bunker and will not pose a threat to the environment.
- A fire could escalate to other parts of the Facility

The USEPA software model Screen3 was used to determine the ground level concentrations (GLCs) of dioxins that would result from different size fires in the waste bunker. The capacity of the waste bunker is approximately 48,750 tonnes of waste.

The three fire scenarios analysed were:

- 1 tonne of waste burned over 30 minutes
- 50 tonne waste burned over 1 hour
- 1,000 tonne waste burned over 10 hours

A fire involving the entire contents of the waste bunker is not considered credible, because of the fire suppression facilities that will be provided.

These scenarios were selected through reference to the hazard evaluation report for the Indaver waste management facility at Ringaskiddy, Cork.[14] The model was used to predict the concentration of dioxins at ground level for various distances from the source. The model was used for the default range of weather conditions in SCREEN3:

It was assumed that 72.8 ng I-TEQ per kg dioxins are released per tonne of municipal waste burned.[15] This is the emission rate estimated by the US EPA for backyard fires involving domestic waste. The generally accepted method of reporting dioxin results is in terms of an international toxic equivalent quantity (I-TEQ). (Backyard burning produces significantly more dioxins due to the lower combustion temperatures)

16.2 Estimate of Likelihood of Fire

A Dutch guidance document[16] suggests values for the area, duration and relative probability for warehouse fire scenarios, as a function of the fire-fighting provisions for the warehouse.

For a fire in the waste bunker over the entire waste surface area (approximately 1,900 m^2), the predicted frequency would be 8.8×10^{-7} per year. The predicted frequencies for 1-tonne, 50 tonne and 1000 tonne fires are 7.8×10^{-4} per year, 4.0×10^{-6} per year and 8.8×10^{-4} per year respectively.

However, to be conservative, the frequencies per year of the 1, 50 and 1,000 tonne fire events were taken to be 1 per year, 1 in 20 years and 1 in 70 years respectively.

[14] Byrne O'Cléirigh (2002) *Report on Hazard Identification & Evaluation for Major Accident Prevention Waste Management Facility, Ringaskiddy Indaver Ireland*

[15] http://www.epa.gov/ncea/pdfs/dioxin/nas-review/pdfs/part1_vol1/dioxin_pt1_vol1_ch06_dec2003.pdf

[16] *Risico-Analyse Methodiek CPR-15 Bedrijven* (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, Den Haag, October 1997

16.2.1 1 tonne Waste Fire

In order to predict the worst case amount of dioxins inhaled by a person from the 1 tonne fire event, a number of assumptions are made [10]:

- A 1 tonne fire is an annual event (this assumption is highly conservative, as shown below)
- Fire would be brought under control in 1 hour
- Wind is unidirectional for the duration of the fire. This is a conservative approach as in reality the wind direction would change over the course of the event, giving a lower average concentration at any particular point
- Plume temperature is 20ºC. This is a conservative approach to take as it reduces the dispersion that would take place in a hot buoyant plume, giving higher GLCs
- Release of smoke occurs through the smoke vents on the roof of the building. Smoke vents comprise 1% of roof area over the waste bunker
- Total dioxins produced by the fire remain suspended in the plume as it disperses downwind
- Person takes no evasive action i.e. remains at the point of maximum concentration of the duration of the fire
- Person inhales the maximum predicted GLC for 50% longer than the actual duration of the fire i.e. for 45 min
- The average person inhales 20 m^3 air/day
- 75% dioxins inhaled are retained
- Average bodyweight = 70kg

The highest predicted GLC of dioxin downwind of the fire is 1.891×10^{-6} µg I-TEQ/m³ at a distance of 206 m from the waste bunker. This is at the worst case weather condition. The scenario is modelled for a range of wind speeds and stability categories. The results reported are for the worst case combination of wind speed and stability factor.

16.2.1.1 Estimation of Dioxin Intake by Inhalation

The quantity of air inhaled over 45 min = 0.626 m^3

Therefore, total dioxins inhaled over 45 min in the worst case

$= 0.626\ m^3 \times 1.891 \times 10^{-6}\ \mu g m^{-3}$

$= 1.18 \times 10^{-6} \mu g$

Dioxins retained

$= 75\% (1.18 \times 10^{-6} \mu g) = 8.86 \times 10^{-7} \mu g$

Dioxins retained per kg bodyweight

$= 3.47 \times 10^{-11}\ \mu g/kg$

$= 3.47 \times 10^{-5}\ pg/kg$

The Word Health Organisation (WHO) ceiling for dioxin Tolerable Daily Intake (TDI) is 1.0 pg. I–TEQ per kg bodyweight [10]. Therefore, the maximum intake by inhalation of dioxins at ground level is 2.88×10^4 times lower than the value that the WHO has set as the maximum ceiling TDI for humans. This is the minimum safety margin for all weather conditions modelled.

16.3 50 and 1,000 tonne Waste Fires

Assumptions made for the 50 and 1,000 tonne scenarios are as follows:

- 50 tonne fire is a 1 in 20 year event. 1,000 tonne fire is a 1 in 70 year event. These assumptions are highly conservative, as shown below.
- Wind is unidirectional for the duration of the fire. This is a particularly conservative approach to take for the longer fire duration scenarios
- Plume temperature is 500ºC
- The roof above the waste bunker area caves in. Thus the area of release of smoke from the fire is the same as the surface area of the waste bunker
- Total dioxins produced by the fire remain suspended in the plume as it disperses downwind
- Person takes no evasive action remains at the point of maximum concentration of the duration of the fire
- Person inhales the maximum predicted GLC for 50% longer than the actual duration of the fire i.e. for 90 min for the 50 tonne scenario and 11 hours for the 1,000 tonne scenario
- The average person inhales 20 m^3 air/day
- 75% dioxins inhaled are retained
- Average bodyweight = 70kg

For the 50 tonne fire scenario, the maximum intake by inhalation of dioxins at ground level is 1.19×10^4 times lower than the value that the WHO has set as the maximum ceiling TDI for humans. This is the minimum safety margin for all weather conditions modelled.

For the 1,000 tonne fire scenario, the maximum intake by inhalation of dioxins at ground level is 2.10×10^3 times lower than the value that the WHO has set as the maximum ceiling TDI for humans. This is the minimum safety margin for all weather conditions modelled.

Based on the scenarios modelled, the risk posed to human health by dioxin inhalation from a fire in the waste bunker is deemed to be insignificant.

16.4 Prevention

The Facility will be designed by experienced and skilled staff to internationally recognised design codes and standards. HAZOP studies will be undertaken of the Facility's equipment and procedures. Fire prevention measures include segregation of the waste bunkers in a separate fire-resisting compartment.

16.5 Mitigation

A fire detection and suppression system will be provided to extinguish any fire in the waste bunkers as rapidly as practicable. An "Emergency Procedure Strategy" (EPS), incorporating the requirements identified in a Hazard and Operability (HAZOP) assessment for the Facility, will be prepared. The EPS shall ensure that resources are available to respond to emergencies at all times during the operational period and that suitably qualified personnel will be available at all times to manage the response of the emergency services. An outline of the EPS is given in Chapter 5 of the EIS.

17 Loss of Containment of Firewater

In the event of a fire, firewater could be contaminated with waste and other materials stored onsite.

17.1 Consequences

Firewater, if it escaped from the site, could contaminate receiving waters.

17.2 Prevention and Mitigation

The waste storage bunker will provide capacity to store over 10,000 m³ of water and collapsed foam. Adequate firewater retention capacity will be provided for at the Facility by the stormwater storage tank and waste bunker.

The storm water drainage system of the Facility will be connected to an internal storm water tank where the water will be collected for reuse in the process. In the event of a fire an automatic shutoff valve will prevent any discharge of fire water to the internal drainage tank. Fire water will be collected in the bunker, which will act as a firewater retention tank.

17.2.1 Risk Assessment of Firewater

17.2.1.1 Firewater Generation

The retention capacity required for firewater is calculated in accordance with EPA (Draft) Guidance on firewater retention.[17]

The EPA in its draft Guidance Note recommends that firewater run-off volume during a fire be based on the maximum 24-hour event for 20-year return period, or 50 mm, whichever is greater. Rainfall data from the Meteorological Office weather station at Dublin Airport show a 24-hour precipitation event with a 20-year return period of 63 mm.

As the quantity of rainwater during the maximum 24-hour event, 20-year return period is greater than 50 mm, it is used to calculate the firewater retention volume required.

The areas of the room and of the internal site roads and grass at the site are 18,165 m², 15,369 m² and 17,253 m² respectively. The rainwater run-off volume is calculated as 2,210 m³:

The EPA Draft Guidance Note assumes that a fire is suppressed 'within a reasonable period of time'. The maximum duration of a fire event at the site is taken to be 2 hours.

Assuming an unlimited supply of fire suppression water on-site, the volume of firewater that will be used over a 2 hour period will be limited only by pumping capacity provided.

Assuming a discharge rate of 2 m^3/min from each fire hydrant, if water is applied to a fire through 4 hoses for 2 hours, this would create a total of approximately 960 m³ of potentially contaminated firewater to be retained on site, in addition to 2,210 m³ of rainfall, a total of 3,170 m³.

The EPA Draft Guidance Note recommendation on fire duration may not be representative of fires in a Municipal Waste Incineration Plant bunker. If a fire were to continue for 10 hours, the total quantity of firewater would be 4,800 m³, in addition to the 2,210 m³ of rainfall, a total of 7,010 m³.

17.2.1.2 Firewater Retention

There will be no direct discharge to surface water of rainwater, sewage or process wastewater from the facility. The stormwater drainage system of the facility will be connected to an internal stormwater tank where the water will be collected for reuse in the

[17] EPA (Draft) *Guidance Note to Industry on Requirements for the Establishment of Fire Water Retention facilities* (2 August 1995).

process. The stormwater tank will be equipped with an overflow option, which will overflow to the waste bunker. In the event of a fire/emergency, an automatic shutoff valve will prevent discharge to the tank and divert firewater to the waste bunker. The tank will be equipped with a monitoring station to continuously monitor pH-values. (The technical water tank will recirculate all technical water within the system – i.e. closed system). Storm water will be collected in a rainwater collection tank which will be directed to the technical or process as required – the overflow from this will be to the connection to the combined sewer and storm drain under normal conditions. In the event of a fire an automatic shutoff valve will prevent discharge to the tank and divert firewater to the waste bunker).

Ammonium hydroxide and diesel will be isolated from surface waters by primary containment (storage tanks), secondary containment (bunds) and tertiary containment (the facility's closed drainage system).

A fire on-site could be caused by, for example, hot ashes igniting combustible materials in the waste bunker. Contamination of surface water offsite would be prevented by the containment of firewater run-off. Waste will be contained in a bunker with dimensions 75 m x 25 m x 35 m i.e. a gross volume of approximately 65,000 m³. Fires would be automatically extinguished using water or foam. At the time of a fire, the bunker may be partially filled with waste. However, as the waste will absorb a significant amount of water, it is estimated that significant volumes of firewater would be retained in the bunker (65,000 m^3 x 750kg/m^3 = 48,750,000 kg (48,750 tonnes) waste, leaving spare capacity for 16,250,000 kg (16,250 tonnes) of firewater). This is over five times the quantity of firewater for a 2-hour fire and coincident 20-year return 24 hour rainwater that would to arise, and over three times that for a 10-hour fire.

Hence, adequate firewater retention capacity will be provided for at the facility by the stormwater storage tank and waste bunker for potentially contaminated firewater.

18 External Factors Contributing to a Major Accident

18.1 Neighbouring Facilities

The proposed facility is to be located on the reclaimed lands of the Poolbeg Peninsula in the administrative area of Dublin City Council, as shown in Figure 3 in the EIS. Other Seveso establishments are located in the south port and north port areas.

The area surrounding the proposed DWtE facility is mainly industrial in character, primarily consisting of port-related activities such as freight storage, power generation and wastewater treatment. Across the Liffey, the North Dockland area includes a number of ferry terminals.

Residential areas in closest proximity to the site are Irishtown, Ringsend and Sandymount.

Irishtown Nature Park is located to the southeast of the site. The established residential areas of Irishtown and Ringsend lie approximately 1 km to the west of the site. The established residential area of Sandymount lies approximately 1 km to the south of the site.

The main facilities of Dublin port are located across Dublin harbour, to the north of the site.

The site of the former Irish Glass Bottle Company (IGB) factory lies approximately 0.5 km to the west. The plant manufactured glass bottles, and was classified as a Seveso site because of the quantities of arsenic compounds stored in that site. Operations on this site ceased some years ago, and it is now vacant. Fabrizia Developments has applied for planning permission for residential development on a site beside the former IGB site. A decision to grant permission is at present under appeal to An Bord Pleanála.

18.1.1 South Port Seveso Establishments

The Seveso sites in the south port area are:

- Poolbeg ESB Generating Station
- Synergen Dublin Bay Power Plant

Both the Poolbeg and Synergen Dublin Bay Power stations are establishments covered by the Seveso Directive i.e. they are potential major accident hazard sites subject to the requirements of SI No 74 of 2006.

The Poolbeg ESB Generating Station is situated at the eastern end of the Poolbeg peninsula on ninety acres of land, a large part of which was reclaimed from the sea. The basic generating system (500 MW) is a steam turbine system. A 470 MW CCGT was added in 1999. The principal fuel is natural gas, but distillate oil (gas oil) is stored on site as a back-up or reserve fuel.

The Synergen Dublin Bay Power Plant is immediately to the west of the site across Shellybanks Road. It is a 400 MW Combined Cycle Gas Turbine (CCGT), and is located on Pigeon House Road within the south port area. The principal fuel is natural gas, but distillate oil is stored on site as a back-up or reserve fuel.

The site of the proposed waste to energy facility lies outside the Consultation Distance (as specified in SI No 600 of 2001) for all the facilities in the North Port. It lies within the Consultation Distance of the Synergen Dublin Bay Power Plant.

Although the proposed development is within the Consultation Distance of the Synergen Power Station, which is a Seveso establishment, that of itself does not make the proposed development a Seveso establishment.

18.1.2 North Port Seveso Establishments

The Seveso sites in the north port area are:

- CalorGas – LPG storage and filling depot
- Minchem (Indaver) – waste handling and blending facility
- Albion Chemical Distribution (Irl) Ltd – chlorine gas cylinder and drum storage
- Irish Shell, Statoil, Esso and Tedcastle – bulk oil storage

It is not expected that the proposed DWtE facility and the existing Seveso facilities will have any significant cumulative impacts.

18.2 Earthquake

The risk of earthquakes in the area is very low. "The whole of Ireland is practically free of earthquakes".[18] Should an earthquake occur, this could cause a major accident through loss of containment of diesel or ammonium hydroxide at the facility.

18.3 Aircraft Impact

In the Major Accident Hazard Assessment submitted to An Bord Pleanála and the HSA in August 2006, the frequency of aircraft impact at the proposed site was estimated to be 1.83 x 10^{-8} yr^{-1}, based on the HSE Canvey Report (1978).

The HSA requested in its letter of 4 October 2006 that the frequency of aircraft impact be estimated based on the methodology described in the UK HSE report CRR-150-1997.[6] The frequency was estimated to be 1.14 x 10^{-6} yr^{-1}.

There have been no incidences of small transport, large transport or military aircraft accidents in Ireland in the past 10 years. For this reason, background crash rates for these categories of aircraft were based on UK data as provided in CRR-150 1997.

[18] *Seismicity and Earthquake Hazard in the UK*, Roger Musson (British Geological Survey)

18.4 Subsidence

The facility will be built on reclaimed land, i.e. made ground (refer to Chapter 12). However, this has been well compacted, and the facility is to be piled. It is not expected that subsidence will occur, and if it does, it would be of such a limited nature that it would not be expected to result in a major accident at the facility. Further information is given in the EIS, Chapter 11.

18.5 Tide Level

Currently the site level varies from about 5mOD Malin in the northern part to about 3.5mOD Malin in the southern part. Various options in relation to site level and ground floor level for the process lines were considered. In order to minimize the amount of excavation required to construct the bunker and balance the amount of soils to be excavated and filled, an optimum site level of about 5mOD Malin was chosen. This also ensures that the site is safe from risk of flooding as it is at least 1 m above the 1/200 year predicted flood level for Dublin (3.4 m Malin AOD).[19]

Following the IPCC 2001 Climate Change Report a value of 480 mm was taken as the design standard for sea level rise in the Dublin area by 2100. However this figure is now under review and a value of 900 mm for sea level rise by 2100 is being used for some recent developments.

Assuming a value of 0.9 m for sea level rise then the 1 in 200 year event in 2100 would have a value of 4.3m OD Malin. The proposed site level is about 5mOD Malin, and therefore the risk from flooding on this site is extremely remote, even in the event of a 1 in 200 year flood event.

18.6 Assess the residual risk

With the implementation of the preventative and mitigation measures described above, it is not considered that there will be any residual impacts with regard to major accident hazards resulting from the proposed development. The residual risk to humans and the environment is extremely low.

The residual impact on risk to humans from the DWtE will be negligible.

19 SAFETY MANAGEMENT SYSTEM

As part of this facility, the operator will implement an environmental management system and safety management system accredited to ISO 14001 and OHSAS 18001.

The operator will obtain independent accreditation to the OHSAS 18001:2004, the international standard for safety management systems.

The main features of the safety management system are to set goals and targets and to have standard operating procedures, staff training, audits, annual report etc.

19.1 Outline of System

The following issues will be covered in the DWtE facility's Safety Management System:

- Organisation and personnel: the roles and responsibilities of personnel involved in the management of major hazards at all levels in the organisation. The identification of training needs of such personnel and the provision of the training so identified.

[19] Greater Dublin Strategic Drainage Study, *Regional Drainage Policies* Vol 5 Climate Change. Dublin City Council, March 2005

- The involvement of employees and, where appropriate, subcontractors.
- Identification and evaluation of major hazards: adoption and implementation of procedures for systematically identifying major hazards arising from normal and abnormal operation and the assessment of their likelihood and severity.
- Operational control: adoption and implementation of procedures and instructions for safe operation, including maintenance of plant, processes, equipment and temporary stoppages.
- Management of change: adoption and implementation of procedures for planning modifications to, or the design of new installations, processes or storage facilities.
- Planning for emergencies: adoption and implementation of procedures to identify foreseeable emergencies by systematic analysis and to prepare, test and review emergency plans to respond to such emergencies.
- Monitoring performance: adoption and implementation of procedures for the ongoing assessment of compliance with the objectives set by the operator's Major-Accident Prevention Policy and Safety Management System, and the mechanisms for investigation and taking corrective action in case of non-compliance. The procedures will cover the operator's system for reporting major accidents or near misses, particularly those involving failure of protective measures, and their investigation and follow-up on the basis of lessons learnt.
- Audit and review: adoption and implementation of procedures for periodic systematic assessment of the major-accident prevention policy and the effectiveness and suitability of the safety management system; the documented review of performance of the policy and safety management system and its updating by senior management.
- Means for prevention, detection, isolation and mitigation of the effects of potential major accidents will be covered by emergency plans (adoption and implementation of procedures to identify foreseeable emergencies).

19.2 Safety Training and Procedures

The operations staff will undergo training in safety procedures. The safety training includes the following DWtE specific training:

- Training and education course to obtain competence in working safely, specific for DWtE facilities
- Fire fighting including fire fighting with breathing apparatus
- First aid treatment
- Emergency evacuation procedures
- Training in plant start up and shutdown procedures
- Training in safety plans for maintenance periods
- Training/education from specific equipment and material suppliers to the facility.

In addition the staff will be trained and educated in the following standard items relating to power plants in general.

- Marking and closing off work areas
- Securing of plant before work is initiated
- Earthing of motors and transformers

- Work in containers, tanks and on platforms
- Inspection of movable hoisting tackles and hangers
- Inspection of electrical manual tools and extension cords
- Inspection of grinding machines and grinding wheels
- Inspection of battery system
- Inspection of measuring instruments for personal safety

19.3 Fire Safety Systems

19.3.1 General

Fire safety will be of key importance in the design, construction and operation of the plant.

This will be ensured by the following key measures:

- The plant will be designed by experienced and skilled staff to internationally recognised design codes and standards. A local fire consultant will provide services in connection with relevant guidance and fire safety standards
- Hazard and operability studies will be undertaken of operating equipment and procedures
- The following fire prevention measures will be implemented in the facility:
  a) In the waste bunker a foam suppression system will be established. There is an established track record with using a foam system for bunker areas.
  b) A pressurised fire hydrant system will be established to comply with the relevant standards and applicable technical guidelines
- The main building will be divided into fire compartments. At present the following individual fire compartments are anticipated:
  a) Ramp, reception hall and waste bunker
  b) Boiler house and flue gas treatment area
  c) Turbine area
  d) Rooms for electrical equipment
  e) Area for handling and storage of equipment (including residues and bottom ash storage areas)
  f) Administration and Service area

  At penetrations of fire compartment walls special precautions will be taken, such as fire stopping of pipes and cables, water curtains or sprinkler systems at the primary air intake in the waste bunker and in the duct for the bottom ash conveyor.
- On the site and inside all the process buildings fire hydrants will be located. On the hopper deck in the waste bunker the fire hydrant and foam systems will be located to be able to control a fire in the waste bunker. Furthermore, hand-operated fire extinguishers will be located at strategic locations in the facility.

19.3.2 Firewater Retention

The stormwater drainage system of the facility is connected to an internal Stormwater Storage Tank where the water is collected for reuse in the process. The Stormwater Storage Tank is, however, equipped with an overflow option, which overflows to the combined sewer pipeline. In the event of a fire, the automatic shut-off value would prevent discharge to the combined sewer and water would be diverted to the waste bunker through a higher level overflow.

Should a fire occur, firewater would be collected in the drainage system and drained to the Stormwater Storage Tank. The valve on the overflow to the combined sewer would be closed, and if the Stormwater Storage Tank reaches capacity, firewater will overflow through the higher level overflow to the waste bunker, which will act as a firewater retention tank.

The waste bunker has a capacity of approximately 65,000 m^3. In the event of an emergency, the area may be partially filled with waste, but as the waste can absorb a significant amount of water it is estimated that significant volumes of firewater can be retained in the bunker. The density of the waste is approximately 750 kg/m^3. The firewater retention capacity of the waste bunker is thus a minimum of 25% of the total bunker capacity.

20 EMERGENCY RESPONSE

20.1 Emergency Plans

1. It will be ensured that:
   - the operator draws up an internal emergency plan for the measures to be taken inside the establishment
   - the operator supplies the competent authorities with the necessary information to enable it to draw up external emergency plans
2. The emergency plans will be established with the objectives of:
   - containing and controlling incidents so as to minimise the effects, and to limit damage to man, the environment and property,
   - implementing the measures necessary to protect man and the environment from the effects of major accidents,
   - communicating the necessary information to the public and to the services or authorities concerned in the area,
   - providing for the restoration and clean-up of the environment following a major accident.
3. The emergency plans will contain the information set out in Annex IV of the Seveso II Directive.
4. Without prejudice to the obligations of the competent authorities, it will be ensured that the internal emergency plans provided for in this Directive are drawn up in consultation with personnel employed in the establishment.
5. It will be ensured that internal and external emergency plans are reviewed, tested, and where necessary revised and updated by the operator at suitable intervals of no longer than three years. The review will take into account changes occurring in the establishments concerned or within the emergency services concerned, new technical knowledge and knowledge concerning the response to major accidents.
6. It will be ensured that the operator puts the emergency plans into effect without delay for this purpose:
   - when a major accident occurs, or
   - when an uncontrolled event occurs which by its nature could reasonably be expected to lead to a major accident.

20.2 Systems and Procedures

20.2.1 Emergency Services

Throughout the construction and operations period there will be a 24 hour per day, 7 day per week emergency service. This service will include immediate action in the case of e.g.:

a) Fire alarm

b) Accidents on site

c) Spillages

d) Malfunction of dewatering pumps during construction.

The services will be equipped with vehicles, radio communications, equipment and trained personnel so as to be able to deal effectively and promptly with any risk, threat or hazard to persons, livestock or property arising from the construction and operation phases.

20.3 Emergency Access and Egress Arrangements

In the event of a large spill of ammonium hydroxide or diesel on site, or any other uncontrolled event that could reasonably be expected to lead to a major accident, all people on-site will move to the emergency exit upwind of the spill. Evacuated personnel will move to the nearest nominated personnel emergency assembly point. A windsock will be provided on site to indicate wind direction. On calm days, the nearest emergency exit will be used.

Internal design of the building is not sufficiently advanced to assess internal escape routes, therefore only escape routes from the site are considered here.

21 Separation Distances

Article 12 of the Directive states:

> "Member States shall ensure that their land-use and/or other relevant policies and the procedures for implementing those policies take account of the need, in the long term, to maintain appropriate distances between establishments covered by this Directive and residential areas, areas of public use and areas of particular natural sensitivity or interest…."

However, actual distances are not specified in the Directive or the Regulations.

The Planning and Development Regulations, 2001, specify Consultation Distances for different types of Seveso establishment. If a planning authority receives an application for planning permission for a development within the Consultation Distance of an existing Seveso establishment, the application must be referred by the planning authority to the HSA for technical advice on land-use planning, unless the HSA has already given generic land-use planning advice with respect to the existing Seveso establishment.

Table 2 Consultation Distances from Establishments
(Schedule 8, Table 2, to the *Planning and Development Regulations 2001*)

Column 1 **Type of establishment**	**Column 2** **Distance from establishment perimeter (metres)**
Establishment where pressurised flammable substances (including liquefied petroleum gas) are stored in bulk	
- above ground	600
- mounded/underground	
≤ 100 tonnes	100
> 100 tonnes.	200
Establishment where pressurised or refrigerated toxic substances (including ammonia) are present	
- in bulk storage	2,000
- in cylinder or drum storage.	700
Establishment consisting of or comprising a warehouse where chemicals are present.	700
Establishment where non-pressurised flammable substances are stored in bulk.	300
Establishment where chemical processing involving flammable or toxic substances takes place.	1,000
Establishment where chemical processing, which involves the risk of dust explosion, takes place.	300
Establishment where explosives are manufactured.	1,000

22 Conclusion

22.1 Residential Communities

The following information has been extracted from the EIS:

- There are in the order of 26,500 households (70,000 persons) within an approximate two-mile (approx. 3km) radius of the DWtE facility in Poolbeg (CBRE Report, 2005). The nearest local settlements are Ringsend and Irishtown, which lie to the west of the Site and Sandymount, which is to the southwest. (EIS paragraph 17.3.8)
- Irishtown and Ringsend are traditional dockland areas located on the eastern side of Dublin City. The area is currently undergoing unprecedented development as part of the Dublin Docklands Development Masterplan for the Grand Canal Docks Area, which provides a strategy for the social, economic and physical rejuvenation of the area. (EIS paragraph 17.3.10)
- There is a broad mix of residential property types in these areas, varying from older terraced dwellings and local authority estates to modern apartment and townhouse developments. There are cottages and terraced townhouses mainly located in areas around Pigeon House Road, Stella Gardens and west of the South Lotts Road. New developments of apartments and townhouses are generally centralised in the Ringsend Road, South Lotts Road, Grand Canal Docks and Fitzwilliam Quay areas. There are

also further large-scale apartment developments planned and being built at Grand Canal Harbour, Charlotte Quay and Barrow Street. A number of local authority flat complexes and estates are located at Thorncastle Street, Oliver Plunkett Street and around Ringsend Park. (EIS paragraph 17.3.11)

22.2 Industrial and Commercial Developments

The following information is taken from the EIS:

- The land around the Poolbeg Peninsula is in general industrial and storage use with some ancillary second generation office accommodation. This area is associated with Dublin Port and is primarily owned by the Dublin Port Company. Users include ESB, Ringsend Wastewater Treatment Works, Irish Cement Ltd. (EIS paragraph 17.3.12)
- There are a number of modern office developments located at the Grand Canal Docks and Charlotte Quay. There is a mix of local retail and offices generally around the Ringsend Road, Bridge Street and Irishtown Road Areas. (EIS paragraph 17.3.13)
- Sandymount is a prime inner suburban district, located on the coastline between Irishtown and Merrion Road. (EIS paragraph 17.3.14)
- Sandymount Village is located central to the area and comprises a mix of shops, cafés and local businesses. There is little evidence of extensive stand alone office or industrial developments either located or proposed in the Sandymount area. (EIS paragraph 17.3.16)
- Planning Applications and subsequent permissions have been granted for a number of mixed use developments in the vicinity of the proposed DWtE facility. (EIS paragraph 17.3.17)

22.3 Proposed Development

- Planning Application 4996/04 by Fabrizia Developments is currently under appeal to An Bord Pleanala. The site is bounded by Sean Moore Park on the south west, the former Irish Glass Bottle Company lands to the northwest and Sandymount Strand to the southeast. The development will consist of 16 No. blocks comprising 93,114 m² of total floor area and 24,700 m² of basement car parking in 5 No. mixed use blocks, 5 No. residential blocks, 5 No. office blocks and 1 retail pavilion. The development will consist of 783 no. apartments, about 21,804 m² of office space, about 2,602 m² of retail space and about 1,353 m² of other uses (crèche, bar, restaurant).

22.4 Other Features

A pitch and putt course lies immediately to the south of the Synergen Power station, and immediately to the west of the site of the proposed DWtE. It is not expected that this pitch and putt course would have a high occupancy.

22.5 Dublin Docklands Development Authority Masterplan 2003

The Dublin Docklands Development Authority (DDDA) published a Masterplan in 2003.

Zoning objectives include:

Zone 1	To protect, provide and improve residential amenities
Zone 2	To protect and/or improve the amenities of residential conservation areas
Zone 6	To provide for the creation and protection of enterprise and facilitate opportunities for employment creation
Zone 14	To seek the social, economic and physical rejuvenation of an area with mixed use, of which residential and Zone 6 would be the predominant uses

Zones 1, 2 and 14 include residential development. Zone 6 does not include residential development.

The site of the old Irish Glass Bottle Company is zoned partly Zone 6 and partly Zone 14. The nearest point of that part in Zone 14 is almost 1 km from the centre of the site for the proposed DWtE facility.

23 Summary of Quantified Effects of Potential Major Accidents

23.1 Diesel Oil and LPG

The effects of a fire involving diesel oil or a BLEVE of the total inventory of LPG would not have any serious effects outside the vicinity of the site, and these effects would be limited to an area 200 m from the site. The chances of such events happening are in any case exceedingly low and would require an unusual combination of events. For example, the chances of failure of a pressurised or non-pressurised storage vessel are about 1 in a million (10^{-6}).

23.2 Ammonium Hydroxide

It is proposed to use a mixture or solution of ammonia in water, known as ammonium hydroxide, for abatement of emissions of nitrogen oxides. The solution will be 25% by weight, ammonia in water. The vapours from this solution at ambient temperatures are 97% ammonia, so in the event of a spill ammonia vapours could be generated and could disperse into the atmosphere.

The rate of evaporation of ammonia would depend on the temperature of the ground, the temperature of the air and the wind speed. The ammonia would be carried with the wind and would disperse eventually to an indiscernible concentration.

Only areas downwind of the release would be at risk of experiencing an uncomfortable concentration of ammonia vapours, and the concentration would drop off with distance.

The chances of such an event are very low. The chances of total or catastrophic failure of the storage vessel are extremely low, about one in a million, i.e. 10^{-6}. Failure of the tank would result on the ammonia solution being captured in the retaining bund. The chances of failure of the bund are also extremely low, so that the chances of an uncontained release of ammonia solution are exceedingly low. Conservatively, the chances of failure of the retaining bund are one in a thousand, i.e. 10^{-3}, so the likelihood of catastrophic failure of the tank <u>and</u> failure of the bund is 10^{-9}.

At the proposed site, the wind blows predominantly from the west, as shown by the wind roses in Figure 8.4 of the EIS. Further, it is only under certain conditions of atmospheric stability that very poor dispersion occurs. For example, Atmospheric Stability Condition F occurs about 7% of the time.

Hence, the conditions of wind direction and atmospheric stability that could lead to more elevated concentrations of ammonia downwind of a spill adverse in any of the residential areas in the general area of the site are exceedingly low indeed. Such chances are in all probability less than that of lightning strike.

Therefore overall the risk to which any person is exposed as a result of loss of containment of the ammonia solution storage vessel is infinitesimal.

24 Conclusion

The risk to residential areas from a fire involving diesel oil or a BLEVE involving LPG is virtually non-existent.

Because of the directional and meteorological factors, the risk to residential areas from a spill of ammonium hydroxide is exceedingly low.

Overall, in my opinion the proposed waste to energy facility will not give rise to an unacceptable risk to persons living in the vicinity of the facility.

25 References

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17. EPA (Draft) *Guidance Note to Industry on Requirements for the Establishment of Fire Water Retention facilities* (2 August 1995).
18. *Seismicity and Earthquake Hazard in the UK*, Roger Musson (British Geological Survey)
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Appendix A

Dangerous Substances Inventory

A1 DANGEROUS SUBSTANCES INVENTORY

Substance	CAS No	Risk Phrases	Classification	Physical Form	Maximum Quantity in Storage (tonnes)	Lower Tier Threshold (tonnes)	Upper Tier Threshold (tonnes)	Fraction of LT Threshold	Fraction of UT Threshold
Named Substances									
LPG (propane)	74-98-6	R12	F+	Liquid/Gas	2	50	200	0.0400	0.0100
Diesel oil	68334-30-5	R40, R65, R66, R51/53	Xn, N	Liquid	100	2500	25000	0.0400	0.0040
Dangerous to the Aquatic Environment - N - R 50/53									
Ammonia (25% w/w NH_4OH)	1336-21-6	R34, R50	N, C	Liquid	100				
Ammonia (25% w/w NH_4OH	1336-21-6	R34, R50	C, N	Liquid	80				
Biocide (sodium hypochlorite solution)	7681-52-9	R31, R34, R50	C, N	Liquid	10				
Total					190	100	200	1.9000	0.9500
Dangerous to the Aquatic Environment - N - R 51/53									
Taski Bruco Accel Z94 (12706.17)	64425-86-1; 107-98-2; 67-63-0; 1310-58-3	R38, R41, R51	Xi, N	Liquid	0.005				
APC residues	301-04-2	R33, R61, R62, R48/22, R51/53	N, Xn	Powder	700				
Total					700	200	500	3.5000	1.4000
Flammable (R10)									
Total						5000	50000		
Highly Flammable (R11)									
Acetone (8804.00)	67-64-1	R11, R36, R66, R67	F	Liquid	0.005				
Mistral Spray, dark/grey 650 °C	64742-95-6; 67-64-1; 123-86-4; 74-98-6; 106-97-8	R11, R36, R52/53	F, Xi, N	Liquid	0.005				
Tangit Reiniger	109-99-9; 67-64-1	R11, R19, R36, R66, R67	F, Xi	Liquid	0.005				
Plastmo PVC-glue 2966	108-94-1; 109-99-9	R11, R19, R36/37	F, Xi	Liquid	0.005				

Substance	CAS No	Risk Phrases	Classification	Physical Form	Maximum Quantity in Storage (tonnes)	Lower Tier Threshold (tonnes)	Upper Tier Threshold (tonnes)	Fraction of LT Threshold	Fraction of UT Threshold
Total					0.02	5000	50000	0.000004	0.0000004
Extremely Flammable (R12)									
Polymer	106-97-8; 74-98-6	R12	F+	Liquid	0.1				
Acetylene	74-86-2; 67-64-1	R5, R6, R12	F+	Gas	0.025				
Kema GM-12 Lubrication	74-98-6; 106-97-8; 110-54-3	R12, R52/53	F+, N	Liquid	0.005				
Total					0.13	10	50	0.013	0.0026
Oxidising (R7, R8, R9)									
Oxygen, gaseous	7782-44-7	R8	O	Compressed Gas	0.025				
Total					0.025	50	200	0.0005	0.000125
q/Q Categories									
q/Q Categories 1, 2			Very Toxic, toxic					n/a	n/a
q/Q Categories 3, 4, 5, 6, 7a, 7b, 8			Explosive, flammable, highly flammable, extremely flammable, oxidising					0.0935	0.0167
q/Q Category 9 + Petroleum Products			Dangerous for the Environment + Petroleum Products					4.4	1.9500

Appendix B

Comments on Public Submissions

B1 Comments on Public Submissions

The main concerns raised in the submissions to An Bord Pleanála in relation to major accident hazards in the context of the Seveso Directive are addressed in the evidence above.

The following are the principal issues raised in the public submissions:

- Failure to consider potential consequences for residential developments within 1 km of site
- Proximity to other Seveso sites
- The accumulation of chemical storage on the peninsula should be addressed
- The facility should not be located within a large city because of potential public health impacts
- The location of the facility within a densely populated area is contrary to Seveso principles
- Failure to consider likely consequences of the Flue Gas Treatment (FGT) equipment breaking down
- No special training proposed for staff in respect of FGT residues
- Failure to provide detail regarding removal of excess firewater from waste bunker
- No detail of handling procedures during transportation of FGT residues to ships
- Insufficient detail regarding how long FGT residues are stored in sealed containers prior to shipping? If they are not directly transported to the ship, how will they be securely stored?
- Outline HAZOP studies should have been completed
- The proximity of high temperature facility to a sphere of compressed methane from Sewerage plant gives rise to concern
- Unclear as to what procedures are in place to prevent breaches of storage containers / areas and to mitigate these breaches
- The EIS is lacking detail in respect of the potential consequences of onsite accidents / mitigation measures
- The Emergency Procedure Strategy should have formed part of EIS
- The estimation of the risk of aircraft impact is based on in appropriate data

B1.1 Failure to consider potential consequences for residential developments within 1 km of site

The consequences of major accidents were assessed and the effects at various distances were given in the Major Accidents Assessment Report.

B1.2 Proximity to other Seveso sites

The distance separating the proposed DWtE facility from other Seveso establishments is such as to minimise the risk of any cumulative impacts.

B1.3 The accumulation of chemical storage on the peninsula should be addressed

The only information available on storage of chemicals in other facilities on the Poolbeg peninsula relates to the two power stations, Poolbeg and Synergen. These materials are diesel oil and natural gas. The proposed DWtE facility will not give rise to an accumulation of natural gas. It is not expected that the materials stored at the proposed DWtE facility, when accumulated with the diesel oil stored at the power stations, will give rise to any significant risk.

B1.4 The facility should not be located within a large city because of potential public health impacts

The health impacts are dealt with by other witnesses.

B1.5 The location of the facility within a densely populated area is contrary to Seveso principles

Schedule 8, Table 2, to the *Planning and Development Regulations 2001* does not specify a Consultation Distance for waste to energy facilities that are Seveso establishments. Of the classes of Seveso establishment that are listed in Schedule 8, Table 2, the class which is closest to the proposed DWtE facility is *Establishment where non-pressurised flammable substances are stored in bulk*, for which the Consultation Distance is 300 m. Diesel oil, although not flammable is combustible. Further, as the reason why the proposed DWtE facility is a Seveso establishment is the quantity of materials classified as dangerous to the environment, the principal risk is to the environment, not people.

B1.6 Failure to consider likely consequences of the Flue Gas Treatment (FGT) equipment breaking down

This will be addressed by another witness.

B1.7 No special training proposed for staff in respect of FGT residues

The outline of the training for staff operators in respect of FGT residues has been given in the Major Accident Hazard Assessment Report. It would be normal for the operator to arrange the details of training when the plant is being commissioned.

B1.8 Failure to provide detail regarding removal of excess firewater from waste bunker

In my opinion sufficient information has been given in the EIS and Major Accident Hazard Assessment. The detailed arrangements will be determined at the detailed design stage. An event that results in such quantities of fire water being applied in the waste bunkers would be extremely rare, and would in all probability result on closure of the facility for a time. The arrangements for removal of the water would depend on the quantity of water and the available means for treatment.

B1.9 No detail of handling procedures during transportation of FGT residues to ships

The flue gas treatment residues retained in the fabric filters will be dislodged into hoppers beneath the fabric filters and will be transported pneumatically to the enclosed flue gas treatment residues silos. The fly ash from the fourth pass of the boiler will be directed to these silos also. There will be two silos located west of the flue gas treatment equipment, each having a gross volume of 350 m³. The silos will be equipped with High Efficiency Particulate Abatement (HEPA) filters to prevent fugitive emissions of flue gas cleaning residues. The residues will be transported off site in sealed containers by licensed/permitted waste contractors in accordance with all applicable regulations.

However, this is an activity outside the proposed facility and does not come with the scope of the Seveso Directive or Seveso Regulations.

B1.10 Insufficient detail regarding how long FGT residues are stored in sealed containers prior to shipping? If they are not directly transported to the ship, how will they be securely stored?

The flue gas treatment residues retained in the fabric filters will be dislodged into hoppers beneath the fabric filters and will be transported pneumatically to the enclosed flue gas treatment residues silos. The fly ash from the fourth pass of the boiler will be directed to these silos also. There will be two silos located west of the flue gas treatment equipment, each having a gross volume of 350 m³. The silos will be equipped with High Efficiency Particulate Abatement (HEPA) filters to prevent fugitive emissions of flue gas cleaning residues. The residues will be transported off site in sealed containers by licensed/permitted waste contractors in accordance with all applicable regulations.

B1.11 Outline HAZOP studies should have been completed

While some organizations operate a multi-stage approach to the identification and assessment of hazards, HAZOP studies are generally reserved until the design of the facility has been advanced to the stage where piping and instrumentation diagrams (P&IDs) have been prepared. It would be almost unheard of for HAZOPs to have been prepared for a facility at the planning permission or development consent stage. I would expect the HSA to require HAZOP studies to be prepared to a satisfactory standard within the context of a Safety Report, which for a new Seveso establishment must be submitted to the HSA for approval 6 months before construction starts.

B1.12 The proximity of high temperature facility to a sphere of compressed methane from Sewerage plant gives rise to concern

The methane sphere is a gas holder approximately 23 m diameter. It is constructed as a dual membrane of 5,000m³ capacity which is used to buffer store the generation of approximately 27,000m³ per day of biogas. The biogas consists of 55-65% methane and 35-38% carbon dioxide, the remainder being sulphur-containing compounds. The design pressure of the sphere is 200 - 220 mBar. Lightning protection is provided and a methane gas leak detector has been provided to monitor the atmosphere in the space between the internal and external membranes. Pressure relief valves are provided to protect against overpressure.

It is difficult to envisage how normal operating temperatures within the facility and the surrounding area could give rise to a hazard for the methane storage facility in the treatment works.

While plastic is a combustible material, it is unlikely that it would melt other than in the event of a fire in the DWtE facility that cannot be fought with conventional fire suppression facilities. Such a fire would require multiple fire seats, and could only be started by a knowledgeable fire setter, i.e. saboteur.

The sphere could be protected against fire by construction of a fire resisting wall between the sphere and the site of the proposed DWtE.

B1.13 Unclear as to what procedures are in place to prevent breaches of storage containers / areas and to mitigate these breaches

24-hour security will be provided within the facility. This will control access to the site. Storage containers will be of robust construction and not vulnerable to casual damage.

B1.14 The EIS is lacking detail in respect of the potential consequences of onsite accidents / mitigation measures

The EIS contained a summary of the consequences. Detailed and adequate information is provided in the Major Accident Hazard Assessment Report.

B1.15 The Emergency Procedure Strategy should have formed part of EIS

The EIS includes outline information on the Safety Management System The Major Accident Hazard Assessment report gives outline information on the emergency procedures is given. The operator will obtain independent accreditation to the ISO 14001 and to OHSAS 18001:2004, the international standard for safety management systems.

The operator will be required to submit a detailed on-site emergency plan to the HSA, who are the competent authority for enforcing the Seveso Regulations.

B1.16 The estimation of the risk of aircraft impact is based on inappropriate data

The calculations to estimate the risk of aircraft impact were carried out in accordance with the methodology required by the HSA.