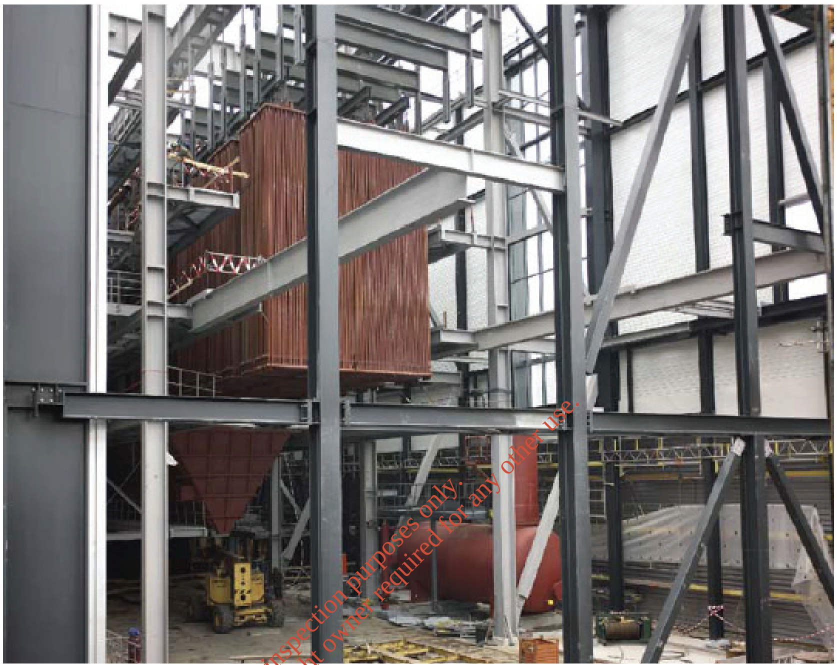
Boilers

5.6.32. The hot flue gases from the furnace will travel into the boiler. The boiler is indicated as item 9 in Figure 5.2. The boiler will have three 'empty' vertical passes and one horizontal convection pass as illustrated in Figure 5.2. The first pass of the boiler will be constructed integrally with the final part of the grate furnace and will be large enough to provide the 2 second residence time, at a minimum temperature of 850°C, after the final addition of fuel and air, as required by the The EU Waste Incineration Directive 2000/76/EC.

Figure 5.5 Boiler for the similar size 34 t/h WtE line at Vestforbrænding, Denmark



5.6.33. In the three 'empty' passes the boiler will have double-skinned walls, which will be smooth on the inner face, and filled with water which will heat up by contact with the hot gases. There will be no hanging heat exchange tubes inside the 'empty' passes. In the convection pass there will be bundles of heat exchange tubes inside in the boiler. The boiler is designed in this way because the hot flue gases contain dust particles, which are sticky at higher temperature. The smooth surface of the empty passes will limit the amount of particles, which can collect on the walls. In travelling through the three empty passes, and heating up the water in their double walls, the flue gas temperature will fall to a suitable level before entering the convection pass.

5.6.34. The dust particles which will adhere to the internal surfaces of the boiler will be cleaned using a combination of online and offline boiler cleaning techniques. The systems to be applied will comprise:

- Mechanical rapping (online)
- High or low-pressure water spraying (online)
- Periodic manual cleaning (offline)

Figure 5.6 Rapping devices for cleaning of the horisontal pass at Elsam Odense WtE

5.6.35. The residues from the second and third passes of the boiler, known as boiler ash, and the residue from the fourth pass of the boiler, known as fly ash, will be collected separately. This is described in Chapter 10 "Residues and Consumables" of this EIS.

5.6.36. Ammonia will be injected into the first pass of the boiler. The ammonia will react with the nitrogen oxides (NO_x) in the flue gases to produce nitrogen and water. This process, known as selective non-catalytic reduction (SNCR) will limit the nitrogen oxide emissions from the plant. This is described in more detail below.

5.6.37. To reduce corrosion, the first part of the boiler will be protected against corrosion by means of e.g. nickel/chromium alloy cladding.

5.6.38. In the boiler drum, indicated as item 11 in Figure 5.2 water and steam will be separated. The steam to the superheaters will be taken from the boiler drum for super heating.

Boiler feed water

5.6.39. The boiler will convert water to steam in a closed circuit. The boiler feed water will be treated in a demineralisation plant. The water in the steam/water circuit will also be treated with chemicals to prevent corrosion and limit the build up of scale.

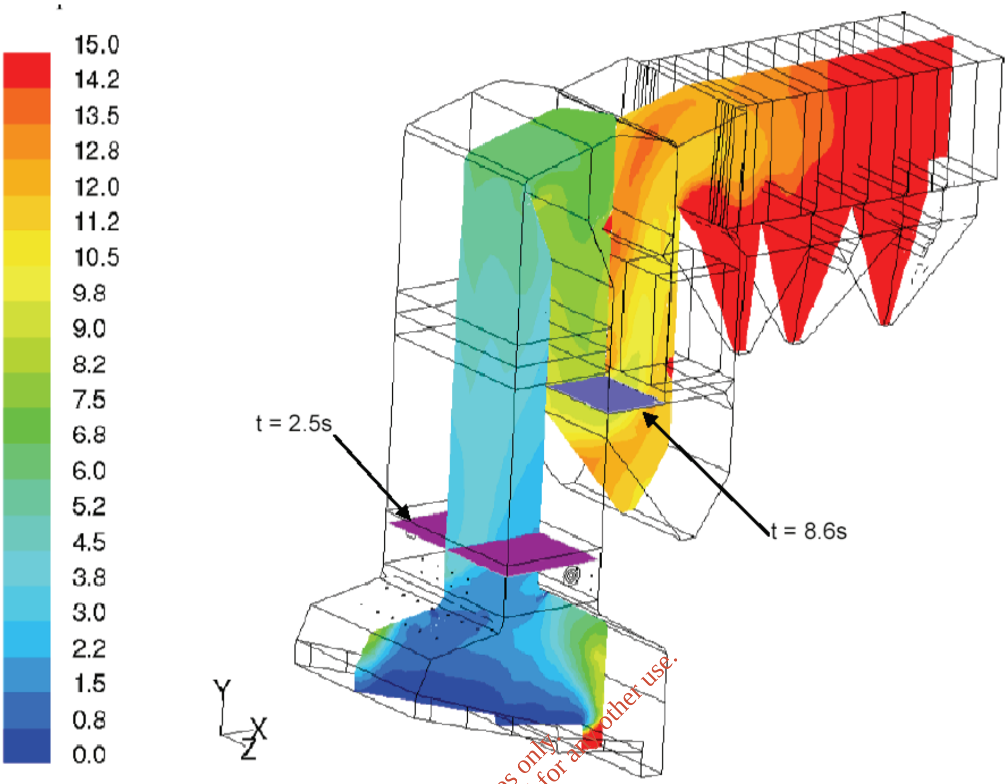
5.6.40. The boiler will have a thermal conversion efficiency of at least 90%. It will operate with steam temperature of approximately 400 °C and a pressure of circa 45 bar. These are the optimum parameters, chosen to balance the additional maintenance costs associated with greater corrosion at higher steam temperatures and pressures, with the value of the additional electricity produced.

5.6.41. In the design of the furnace and boiler, computerised fluid dynamics (CFD) simulations as show in Figure 5.7, will be used to:

- optimise furnace and boiler geometry so as to improve combustion performance
- optimise combustion air injection so as to improve combustion performance

- optimise reagent injection points of the selective non catalytic reduction system so as to improve the efficiency of the abatement of nitrogen oxides whilst minimising surplus ammonia, the generation of nitrous oxide and the consumption of reagent.

Figure 5.7 Example of CFD calculation to improve combustion performance of a WtE Facility



Turbine and Generator

5.6.42. The steam from the boilers on both combustion lines will be expanded across a turbine, which will drive a generator. The turbine and generator are indicated as items 13 and 14, respectively, in Figure 5.2. The steam leaving the turbine will be cooled and condensed to water in a condenser. The condensate will then be returned to the boiler feed water system.

Figure 5.8 Turbine and generator set at Elsam Odense WtE

5.6.43. The condenser pressure will be minimised by using cooling water from River Liffey, which will give a higher electrical efficiency than would be obtained with air-cooled condensers or cooling towers.

5.6.44. The design of the turbine will allow for production of district heating to a future district heating network.

5.6.45. The generator will be cooled using the internal cooling circuit of the Facility.

5.6.46. The turbine will be designed to optimise the power output and thus the electricity supply. The nett power output will be circa 60MWe. The electrical power use in the plant will be reduced as far as is feasible. The following design decisions are particularly important in this respect:

- The flue gas treatment systems are designed and organised in such a way that flue gas reheating will be avoided.
- The SNCR system will be used as an alternative to the more energy-consuming selective catalytic reduction (SCR).
- The use of primary fuels will be limited to the consumption of the auxiliary burners.
- Frequency converters will be implemented throughout the Facility reducing the power consumption for electrical motors.

Flue Gas Treatment

General

5.6.47. The EU Waste Incineration Directive 2000/76/EC specifies limits on the emission of the following substances from incinerators:

- Oxides of Nitrogen (NO_x)
- Carbon Monoxide (CO)
- Particulates (Dust)
- PolyChlorinated Dibenzo Dioxins (PCDD)
- PolyChlorinated Dibenzo Furans (PCDF)
- Hydrocarbons (expressed as Total Organic Carbon (TOC))
- Sulphur Dioxide (SO_2)
- Hydrogen Chloride (HCl)
- Hydrogen Fluoride (HF)
- Heavy Metals - Antimony, Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Mercury, Nickel, Thallium, Tin and Vanadium.

Reduction of Nitrogen Oxides (NOx)

5.6.48. Nitrogen oxides are produced by combustion, being formed partly from the oxidation of the nitrogen contained in the waste and partly from the oxidation of the nitrogen in the combustion air.

Figure 5.9 One SNCR injection level at Elsam Odense WtE Facility

5.6.49. The primary means of reducing NO_x in the flue gases is to optimise the combustion process to reduce the formation of NO_x by oxidation of the nitrogen in the combustion air. Primary measures will include:

- CFD simulation of the grate and furnace section to optimise the injection of combustion air.
- The use of both primary and secondary air injection systems to reduce the excess air in the primary combustion zone, thus reducing the amount of thermal NO_x created.
- Operation with reduced excess air, reducing NO_x formation.
- Water-cooled grate bars, which allows the primary air supply to be controlled by the combustion process rather that the need to cool the grate bars.

5.6.50. The secondary means of reducing NO_x is selective non-catalytic reduction. This is the injection of ammonia into the flue gases in the first pass of the boiler. This is indicated as item 10 in Figure 5.2. The NO_x levels in the flue gases will be closely monitored to optimise the rate of ammonia injection.

Dioxin and Furan removal

5.6.51. Dioxins and furans are formed in all combustion process. The furnace and boiler will be designed to reduce the formation of dioxins and furans. Measures to do this will include:

- Combustion at high temperature as required by the The EU Waste Incineration Directive 2000/76/EC.
- Well-controlled combustion secured by means of CFD simulation at the design stage, and an advanced combustion control system to aid the reduction of PCDD/F and its precursors.
- During normal operation, the temperature in the three empty passes of the boiler will be above 600 °C. When entering the horizontal convection pass, the flue gas will be cooled very rapidly due to the large heat convection surfaces. This will reduce the residence time of the dust-laden flue gases in the zone where the

temperature drops from 450 to 200 °C, in which zone PCDD/F is likely to reform (the reformation of dioxins is called de-novo synthesis).

Semi-Dry Flue Gas Treatment System

5.6.52. Activated carbon and lime will be injected into the flue gases before they enter the fabric filters. This is indicated as item 18 in Figure 5.2. Activated carbon consists of small porous carbon particles, which have a very large surface area. Heavy metals and organic compounds such as dioxins and furans, polychlorinated biphenyl (PCB), polycyclic aromatic hydrocarbons (PAH) and other hydrocarbons, that will be present in the flue gases, will be adsorbed onto the surface of the carbon particles. The lime injected into the flue gases will react with the acid gases, HCl SO_2 and HF, to form flue gas treatment residues (FGT).

5.6.53. The flue gases will react with the activated carbon and lime, and will then enter the fabric filters. These are indicated as item 19 in Figure 5.2. The fabric filters consist of multiple filters in separate compartments. Having separate compartments means that filter elements can be maintained or replaced without having to shut down the entire system. The carbon, lime and other particulates such as dust will collect on the outside of the fabric filters to form a ‘cake’, while the flue gases will pass through. As the dust cake will accumulate, the pressure drop across the filter will increase. When the pressure drop reaches a pre-set level, a reverse pulse of air will cause the dust cake to detach and fall into hoppers, located at the bottom of the filters.

5.6.54. The flue gas treatment residues will contain ash and dust carried over from the boiler, the activated carbon with adsorbed heavy metals and organic compounds, un-reacted lime and salts. Residue collection is indicated as item 20 in Figure 5.2. The handling and disposal of the flue gas treatment residues is described in section 10 of this EIS.

Flue Gas Cooling

5.6.55. The flue gas leaving the boiler will be at circa 200°C. After the fabric filter the flue gases will be cooled to circa 100°C prior to entering the wet scrubber system. The flue gas cooler is indicated as item 21 in Figure 5.2. The flue gas will be cooled by passing it through a large heat exchanger, which will preheat either the combustion air or condensate and thus increase the power output.

Wet Scrubbing System

5.6.56. There will be a two stage wet scrubbing system. The scrubbing system is indicated as item 22 in Figure 5.2. The first stage will remove the remaining components of HCl, HF and mercury in gaseous form from the flue gases, using recirculated water. The second stage will remove the remaining components of SO_2 by adding NaOH to the recirculating scrubber water.

5.6.57. The two-stage wet scubber system thus will act as a polishing filter and results in lower air emissions.

5.6.58. The waste water streams from the scrubbers will be returned to the boiler/semidry system and thus ultimately removed as part of the FGT-residues.

Induced Draft Fan

5.6.59. The induced draft fan is indicated as item 23 in Figure 5.2. The flue gases will be drawn from the furnace through the boiler and flue gas treatment line by the induced draft fan, which will be located towards the end of the line.

Silencer

5.6.60. Prior to being emitted from the stack, the flue gases will pass through a silencer. The silencer is indicated as item 24 in Figure 5.2.

Emissions Monitoring

5.6.61. Emissions monitoring equipment will be located in the flue gas duct within the building screen immediately prior to the stack. The composition of the flue gas emitted will thus be exactly the same as that monitored. The monitoring equipment is indicated by item 25 in Figure 5.2. Continuous monitoring will be undertaken for the following:

- Oxides of Nitrogen (NO_x)
- Sulphur Dioxide (SO_2)
- Particulates (Dust)
- Hydrogen Chloride (HCl)
- Hydrogen Fluoride (HF)
- Total Organic Carbon (TOC)
- Carbon Monoxide (CO)
- Temperature
- Oxygen content
- Flue gas flow

5.6.62. Emissions monitoring will include the measurement of dioxin emissions from the stack on a fortnightly basis. A monitoring filter will be removed and analysed in an independent laboratory with the subsequent results being representative of dioxin emission concentrations for that period. It should be noted that such monitoring is not a requirement of EU or Irish legislation.

5.6.63. Regular monitoring will be undertaken for the heavy metals Antimony, Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Mercury, Nickel, Thallium, Tin and Vanadium as well as PCDD/F. The monitoring system will meet the requirements of the the EU Waste Incineration Directive 2000/76/EC and the EPA Waste Licence.

Ancillary equipment

Emergency Generator

5.6.64. There will be an uninterruptible power supply and diesel fuelled emergency generator in the plant. In the event of a power failure the uninterruptible power supply will maintain key monitoring and control equipment running until the emergency generator starts up. The generator will then take over and maintain key monitoring, control, flue gas treatment and safety equipment running to allow a safe shutdown of the Facility.

Figure 5.10 Emergency Diesel Generator

5.7. Best Available Techniques (BAT)

IPPC Directive Definition of BAT

5.7.1. The Integrated Pollution Prevention and Control (IPPC) Directive 96/61/EC (implemented in ireland by amendments to the Environmental Protection Agency Acts 1992-2003 and the Waste Management Acts 1996-2003) introduced the concept of best available techniques, which are to be used in pollution prevention and control.

5.7.2. The term “best available techniques” is defined in Article 2(11) of IPPC Directive as:

> “the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole.”

5.7.3. Article 2(11) of the same Directive goes on to clarify further this definition as follows:

(a) "techniques" includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;

(b) "available" techniques are those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator;

(c) "best" means most effective in achieving a high general level of protection of the environment as a whole.

5.7.4. This definition of BAT is implemented in Ireland by section 5 of the Waste Management Acts 1996-2003.

5.7.5. The EU has prepared a series of reference documents, for different industrial activities, which define BAT for that activity. The final edition of the Best Available Techniques Reference Document (BREF) on Waste Incineration, entitled 'Waste Incineration (WI)', was issued by the European Commission under the framework of the IPPC Directive in July 2005.

5.7.6. Chapter 5 of the BREF document lists the techniques which are considered BAT with respect to WtE facilities. The recommendations of the BREF document on waste incineration have been implemented throughout the design of the facility and will be implemented in it operation. Appendix 5.1 demonstrates compliance of the Dublin WtE Facility with the relevant provisions of the BREF document.

BAT and the Stockholm Convention on Persistent Organic Pollutants

5.7.7. The concept of BAT is also used in the Stockholm Convention on Persistent Organic Pollutants. PCBs, dioxins and furans are listed in Annex C of the Convention, which addresses persistent organic pollutants, which are formed and released unintentionally. The Convention requires best available techniques to be used to prevent or reduce the release of these chemicals.

5.7.8. In the Convention, the concept of best available techniques is not aimed at the prescription of any specific technique or technology, but at taking into account the technical characteristics of the installation concerned, its geographical location and the local environmental conditions. In determining best available techniques, consideration should be given to:

"…(b) General release reduction measures: When considering proposals to construct new facilities or significantly modify existing facilities using processes that release chemicals listed in this Annex, priority consideration should be given to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of such chemicals. In cases where such facilities will be constructed or significantly modified, in addition to the prevention measures outlined in section A of Part V the following reduction measures could also be considered in determining best available techniques:

(i) Use of improved methods for flue-gas cleaning such as thermal or catalytic oxidation, dust precipitation, or adsorption;

(ii) Treatment of residuals, wastewater, wastes and sewage sludge by, for example, thermal treatment or rendering them inert or chemical processes that detoxify them;

(iii) Process changes that lead to the reduction or elimination of releases, such as moving to closed systems;

(iv) Modification of process designs to improve combustion and prevent formation of the chemicals listed in this Annex, through the control of parameters such as incineration temperature or residence time."

5.7.9. The Convention allows for the participating parties to develop guidance with regard to best environmental practices. Draft guidelines have been prepared and these are also addressed in Appendix 5.1.

5.8. Plant Management

5.8.1. There will be 64 staff members employed at the Facility. The senior technical staff will be personnel with experience running large scale WtE facilities. Other staff will be recruited locally. All relevant staff will be given the necessary training in Elsam's plants in Denmark and with the equipment suppliers prior to start up.

5.8.2. There will be full time maintenance staff employed in the Facility to undertake routine maintenance and inspection of equipment. The maintenance staff will implement a planned preventative maintenance programme to ensure all equipment is operating effectively.

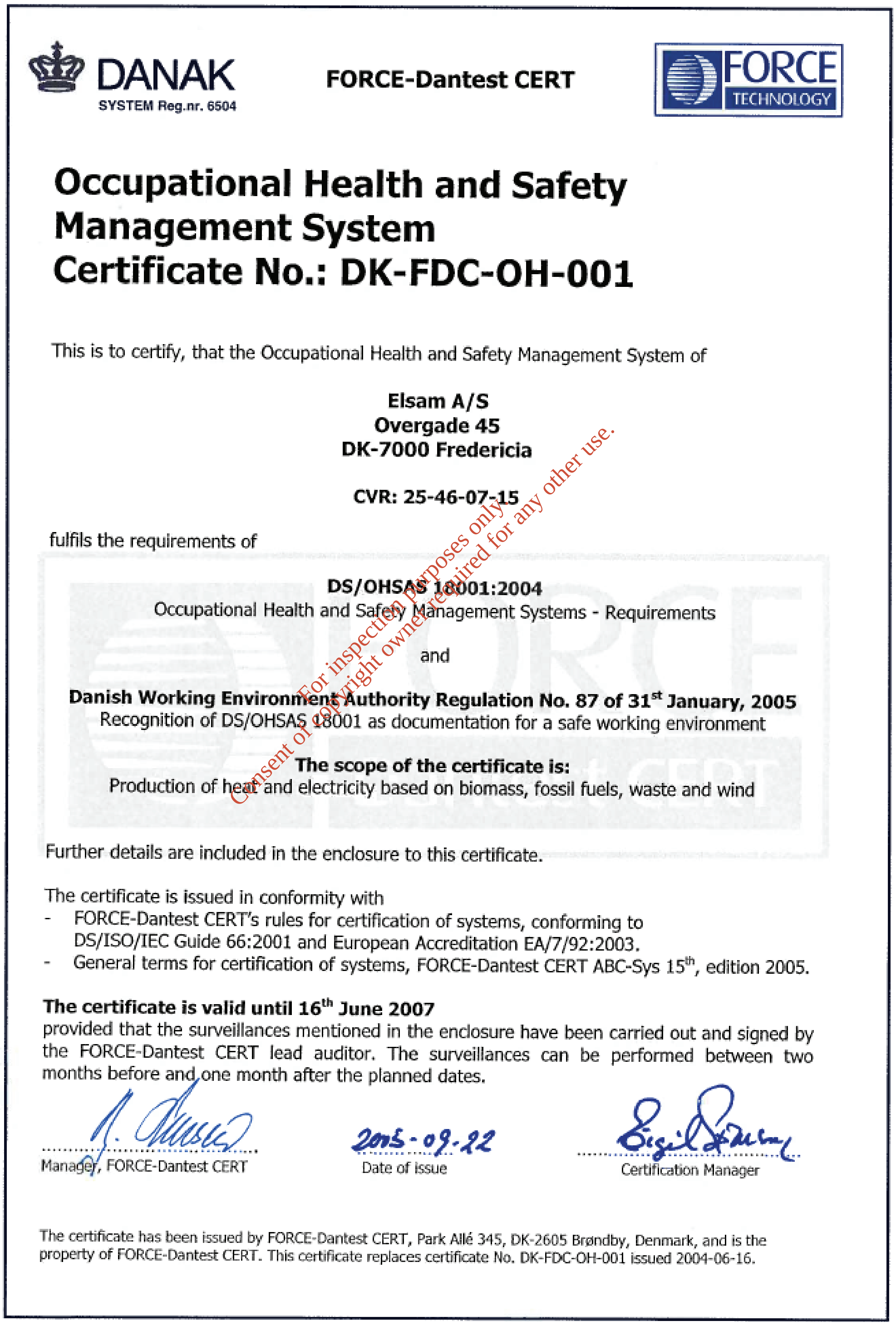
5.8.3. The Facility will be kept to a high standard of cleanliness, and waste management procedures will be put in place to seek to minimise, reduce and recycle waste arising from the maintenance of the Facility. The following specific procedures will be implemented:

- Regular inspection and cleaning of roads and Site areas of the Facility will be undertaken to ensure that they are maintained free of litter, refuse, dust or dirt.
- Unauthorised notices, which may be attached to the Facility fence will be removed within 24 hours.
- Staff will monitor to ensure that vehicles delivering waste or transporting residues have adequately secured loads and that waste will not be spilled or dropped from the vehicles.
- Staff will regularly inspect and clean the building internally and externally to prevent the accumulation of litter or dust.
- Staff will ensure that waste reception areas and waste charge hopper areas are cleaned regularly.
- Dust from unloading of waste will be controlled in accordance with good industry practice.
- Areas for handling of residues will be kept clean in accordance with good industry practice. These areas will be inside the main building.
- Staff will monitor to ensure that no waste will be stored outside the dedicated storage facilities.

5.9. Health and Safety

5.9.1. The operator will be required to give health and safety high priority. The intended operator has obtained independent accreditation to the DS/OHSAS 18001:2004, the international standard for safety management systems.

Figure 5.11 The Elsam DS/OHSAS 18001:2004 certificate



DANAK
SYSTEM Reg.nr. 6504

FORCE-Dantest CERT

FORCE TECHNOLOGY

Occupational Health and Safety Management System
Certificate No.: DK-FDC-OH-001

This is to certify, that the Occupational Health and Safety Management System of

Elsam A/S
Overgade 45
DK-7000 Fredericia

CVR: 25-46-07-15

fulfils the requirements of

DS/OHSAS 18001:2004
Occupational Health and Safety Management Systems - Requirements

and

Danish Working Environment Authority Regulation No. 87 of 31st January, 2005
Recognition of DS/OHSAS 18001 as documentation for a safe working environment

The scope of the certificate is:
Production of heat and electricity based on biomass, fossil fuels, waste and wind

Further details are included in the enclosure to this certificate.

The certificate is issued in conformity with
- FORCE-Dantest CERT's rules for certification of systems, conforming to DS/ISO/IEC Guide 66:2001 and European Accreditation EA/7/92:2003.
- General terms for certification of systems, FORCE-Dantest CERT ABC-Sys 15th, edition 2005.

The certificate is valid until 16th June 2007
provided that the surveillances mentioned in the enclosure have been carried out and signed by the FORCE-Dantest CERT lead auditor. The surveillances can be performed between two months before and one month after the planned dates.

Manager, FORCE-Dantest CERT

2005-09-22
Date of issue

Certification Manager

The certificate has been issued by FORCE-Dantest CERT, Park Allé 345, DK-2605 Brøndby, Denmark, and is the property of FORCE-Dantest CERT. This certificate replaces certificate No. DK-FDC-OH-001 issued 2004-06-16.

5.9.2. 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.

Safety training and procedures

5.9.3. The operations staff will undergo training in safety procedures in accordance with Elsam's OHAS 18001 certification. The safety training comprises inter alia the following WtE specific training:

a) Training and education course in Denmark to obtain competence in working safety specific for WtE facilities

b) Fire fighting including fire fighting with breathing apparatus

c) First aid treatment

d) Emergency evacuation procedures

e) Training in plant start up and shutdown procedures.

f) Training in safety plans for maintenance periods

g) Training/education from specific equipment and material suppliers to the Facility.

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

a) Marking and closing of work areas

b) Securing of plant before work is initiated

c) Earthing of motors and transformers

d) Work in containers, tanks and on platforms

e) Inspection of movable hoisting tackles and hangers

f) Inspection of electrical manual tools and extension cords

g) Inspection of grinding machines and grinding wheels

h) Inspection of battery system

i) Inspection of measuring instruments for personal safety.

Fire and safety systems

General

5.9.5. Fire safety will be of key importance in the design, construction and operation of the Facility. This will be ensured by the following key measures:

- The Facility will be designed by experienced and skilled staff to internationally recognised design codes and standards. This will utilise the competences of Elsam Engineering which has long term design experience of WtE facilities combined with a local fire consultant who will be able to provide services in connection with relevant guidance and fire safety standards.

- Hazard and operability studies will be undertaken of operating equipment and procedures.

5.9.6. 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 the bunker area.

b) A pressurised fire hydrant system will be established to comply with the relevant standards and applicable technical guidelines.

5.9.7. 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 area and flue gas treatment area

c) Turbine area

d) Rooms for electrical equipment

e) Area for handling and storage of equipment

f) Administration and Service area.

5.9.8. 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.

5.9.9. 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. Also hand-operated fire extinguishers will be located at strategic locations in the Facility.

Firewater retention

5.9.10. 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 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.

5.9.11. The bunker will have a gross volume of circa 65,000 m^3. The area may be partially filled with waste, but as the waste will absorb a significant amount of water it is estimated that significant volumes of firewater will be retained in the bunker.

Emergency response systems and procedures

Emergency Services

5.9.12. 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 contruction.

5.9.13. 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.

Emergency Procedure Strategy

5.9.14. An "Emergency Procedure Strategy" or "EPS", incorporating requirements and procedures identified in the HAZOP Assessment, 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 emergencies. A schedule of the telephone numbers for Duty Operators shall be provided to the relevant authorities so that contact can be made with the Duty Operator at any time.

a) The EPS will be compatible with the Dublin Metropolitan Region Major Emergency Plan.

b) The EPS will contain detailed arrangements for dealing with any anticipated emergency and shall include inter alia:

(i) management arrangements - including named personnel;

(ii) roles and responsibilities;

(iii) labour, transport, plant, materials and equipment availability;

(iv) mobilisation procedures;

(v) communication methods;

(vi) liaison; and

(vii) other relevant topics.

c) The EPS will also specify that emergency services and other relevant authorities, relevant persons and interested parties are advised of the procedure for initiating the EPS prior to the commencement of the operations;

d) The EPS will be continuously reviewed and will be modified as necessary to ensure that the operation and maintenance requirements are met at all times. The amended EPS will form part of the Annual Operations Plan.

e) In the event of an emergency, an inspection of all actual or potentially affected areas will be carried out by the duty operator without undue delay and any works necessary to return the Facility to a safe condition shall be completed.

f) A register of all emergency incidents will be maintained at the facility including, inter alia: time of receipt of notification; the recipient; and the notifier, and with full details of all actions taken. If the Facility is closed or partly closed, the details will include the nature and period of closure and the time at which the Facility was fully available again.

g) From time to time the Site emergency services in conjunction with the relevant authorities shall hold emergency planning meetings and conduct emergency exercises. The selected operator shall participate in all such meetings and exercises as required by the emergency services and Relevant Authorities.

5.10. Environmental management

5.10.1. The operator will be required to implement an environmental management system. The intended operator has obtained independent accreditation to ISO 14001, the international standard for environmental management systems.

Figure 5.12 Elsam's ISO 14001 certificate

DANAK
Reg. nr. 6005

FORCE-Dantest CERT

FORCE TECHNOLOGY

Environmental Management System
Certificate No.: DK-FDC-14001-016

This is to certify, that the Environmental Management System of

Elsam A/S
Overgade 45
DK-7000 Fredericia

fulfils the requirements of

DS/EN ISO 14001:2004
Environmental Management Systems - Requirements

The scope of the certificate is:
Production of heat and electricity based on biomass, fossil fuels, waste and wind

Further details are included in the enclosure to this certificate.

The certificate is issued in conformity with:
- FORCE-Dantest CERT's rules for certification of systems, conforming to DS/ISO/IEC Guide 66:2001 and European Accreditation EA 7/02:2003.
- General terms for certification of systems, FORCE-Dantest CERT ABC-Sys 15th edition, 2005.

The certificate is valid until 16th June 2007
provided that the surveillances mentioned in the enclosure have been carried out and signed by the FORCE-Dantest CERT lead auditor. The surveillances can be performed between two months before and one month after the planned dates.

Manager, FORCE-Dantest CERT — 2005-09-13 Date of issue — Certification Manager

The certificate has been issued by FORCE-Dantest CERT, Park Allé 345, DK-2605 Brøndby, Denmark, and is the property of FORCE-Dantest CERT. This certificate replaces Certificate No. DK-FDC-14001-016 issued 2004-06-16.

5.10.2. An environmental management system will be implemented in the Dublin WtE facility and accreditation to ISO 14001 will be sought in due course. The environmental management system will also be in accordance with the condtions of the Waste Licence. The environmental management system will contain the following elements:

- Management and reporting structure
- Schedule of environmental objectives and targets
- Programme and designation of responsibility for targets
- Documentation
- Corrective action
- Awareness and training
- Communications programme
- Maintain key environmental information on the internet
- Community liasion committee

Environmental Management System

5.10.3. The Environmental Management System will include the following documents:

a) the environmental management programme;

b) the waste management plan;

c) the working place plan; and

d) the safety and emergency plan.

Environmental management programme

5.10.4. The environment management programme will include procedures which address:

a) environmental policy;

b) organisation;

c) control of environmental management programme;

d) current regulatory requirements;

e) non-compliance;

f) internal environmental audit;

g) Emergency plans;

h) environmental control plans;

i) matrix of Environmental Management System;

j) storage of documentation regarding the external environment;

k) training;

l) review; and

m) communication.

Waste management plan

5.10.5. The waste management plan will outline measures to ensure that generation of solid waste, including construction and demolition waste will be minimised and if reused or disposed of in an appropriate manner.

5.10.6. Appropriate measures will be taken to ensure that waste delivered to the Facility will be handled to prevent the spread of litter and the generation of leachate. The measures include items such as contractual conditions with waste suppliers and routine check of vehicles.

5.11. Main Alternatives Considered

General

5.11.1. Chapter 4 "Site Selection" describes the methodology used to select the Poolbeg Site for the proposed facility. Alternative sites considered are also described in Chapter 4.

5.11.2. This section outlines the main design and technology options considered in the concept engineering phase of the project.

Site layouts

5.11.3. A number of different site layouts were considered in the scheme design phase. The main options related to the access point to the Site, which could be from Shellybanks Road or Pigeon House Road.

a) Site access from Pigeon House Road in the northeast corner of the Site (selected option)

b) Site access from Pigeon House Road in the northwest corner of the Site (eliminated due to lack of right turn lane)

c) Site access from Shelly Banks Road in the southwest corner of the Site (eliminated due to extensive unnecessary vehicle movement on Site)

5.11.4. The chosen option has the entrance to the Site from Pigeon House Road, with the waste reception entrance on the eastern side of the main building and the materials and residues storage areas on the western side.

Site Levels

5.11.5. Currently the Site level varies from circa 5m OD in the northern part to circa 3.5m OD in the southern part. Various options in relation to Site level and ground floor level for the process lines were considered. In order to mininise 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 circa 4.7m OD was chosen.

Buildings

5.11.6. The main process equipment of a WtE plant, such as furnaces, boilers and flue gas treatment equipment, can be located outdoors and this gives a very cost effective facility. However, this solution makes the Facility appear more visually intrusive, as all process equipment is visible. Operation and maintenance of the facility has to be undertaken outdoors which in bad weather conditions is undesirable, and it is more difficult to provide dust, noise or odour control.

Figure 5.13 Alternative option not selected - Picture of WtE Facility without a building shell

5.11.7. Once the decision to enclose the process equipment had been taken, the building options were considered. Various parts of the process equipment could be enclosed in separate buildings, with the services areas such as control room, offices and administration area, workshop and stores also housed separately. This was considered to be more visually intrusive that enclosing all in a single building shell.

5.11.8. Another possible option was to keep the waste reception area outside the building shell. See Figure 5.13. However, this would result in increased noise nuisance, from waste trucks manoeuvring and unloading in the waste reception area, and dust and odour emissions. Therefore it was decided to enclose the waste reception area within the building shell.

Figure 5.14 Alternative option not selected – semi-open waste reception area

5.11.9. In determining the shape of the building shell, the typical industrial “box concept” was considered. When using the “box concept”, the process equipment is covered by a building shell shaped as a series of boxes, where the size of each box matches the size of the process equipment. An example of the “box concept” is Elsam’s Skærbæk Power Plant, Unit 3, (see Figure 5.15).

Figure 5.15 Elsam Kraft A/S Skærbæk Power Plant, Unit 3

5.11.10. As the Dublin WtE project is a high-profile project, located on a prominent site on the Poolbeg Peninsula, it was decided that the Facility should be an architectural landmark. Consequently, the building shell has been moulded to provide an aesthetically pleasing shape, rather than provide the minimal functional building.

Level of waste reception hall floor and waste bunker floor

5.11.11. The final level of the Site will be approximately 4.7mOD, with the bunker floor at an approximate level of 0.00 m OD and the waste hopper deck at an approximate level of 30.00 mOD. The optimum floor level of the waste reception hall is 12.00 mOD approximately. A ramp will provide truck access from Site level to the waste reception hall.

5.11.12. Various combinations of waste reception hall floor level and bunker floor level were considered. The waste reception hall could be located with a floor equal to the Site level, an approx level of 4.7 mOD. This would mean that the ramp from the Site level to reception hall could be omitted. However, to create sufficient waste storage capacity, the waste bunker would have to occupy a greater area and/or be deeper. A larger waste bunker would entail a larger, more visible and more expensive building shell. A deeper waste bunker would require more complex and expensive construction. It would also alter the ratio of excavation to fill required on Site and may mean that excavated material would have to be removed from the Site.

5.11.13. A more elevated waste reception hall would also be possible. However, in order to maintain the required height of the waste hoppers above the reception hall floor level, this solution would require the level of the process lines to be raised resulting in a higher structure and would require the import of more fill material onto the Site.

Process Options

5.11.14. Chapter 3 of this EIS addresses the policies of the Dublin Waste Management Plan and the consideration of waste management options, which led to the decision by the four Dublin Local Authorities to provide a WtE plant for the Dublin region for the management of residual municipal and similar non hazardous solid waste. The alternative processes available for the treatment of such waste to recover energy, which were considered for the Dublin WtE Facility were:

- Incineration using a moving grate furnace
- Incineration using fluidised bed furnace
- Pyrolysis
- Gasification

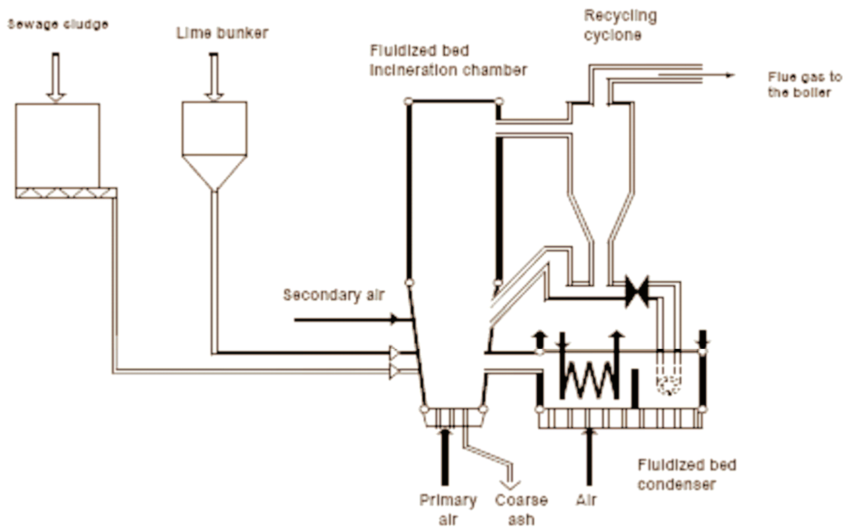
Moving Grate Furnace

5.11.15. The waste treatment process chosen for the Dublin WtE plant is incineration using a moving grate furnace. The process is further described in section 5.6 above.

Fluidised Bed Furnace

5.11.16. The main alternative to a moving grate furnace for the incineration of municipal and similar non-hazardous solid waste is a fluidised bed furnace. In a fluidised bed furnace solid or sludge-like waste is introduced onto a bed of sand or similar inert material. The sand bed is fluidised by an updraft of air from under the bed. The bed is maintained at a temperature of 600 to 900°C. In this heat the waste dries and then combusts. A schematic of the fluidised bed process is provided in Figure 5.16.

Figure 5.16 ***Main components of a circulating fluidised bed (source BREF document)***



5.11.17. The end products from either a fluidised bed or moving grate furnace and associated energy recovery and flue gas treatment are as follows:

- fly ash and flue gas treatment residues.
- boiler ash
- bottom ash
- ferrous and non-ferrous metals

5.11.18. The weight of the residues is approximately 20-30% of the weight of the waste input. The volume of the residues is approximately 5-10% of the volume of waste input. The principal end of life options of these residues are recycling, involving the magnetic separation of any metals, and incorporation of bottom ash into road construction, or disposal to landfill. The surplus energy produced can be recovered through production of electricity and heat. The heat can be used for example for industry, for the drying of materials and for district heating schemes for households.

5.11.19. Flue gas treatment involves removal of particulate matter (dust), heavy metals, acid gases and dioxins. In terms of emissions to the environment, modern incineration plants must comply with the EU Directive on Incineration of Waste 2000/76/EC.

5.11.20. The main reasons for not selecting fluidised bed furnaces for the Dublin WtE project are:

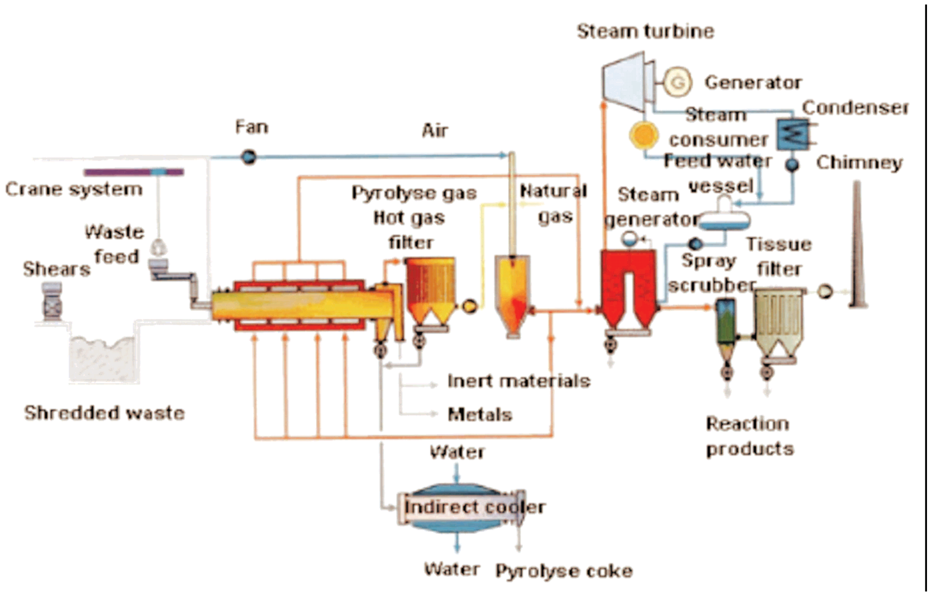
- While the fluidised bed process is well proven technology, and fully developed for biomass facilities, the technology is not suited, nor generally available, for large scale WtE facilities such as the 600,000 tonnes/year which is the design capacity of the Dublin WtE project.
- The fluidised bed process is most suited to the combustion of homogeneous fuels such as coal, peat, straw and wood chips. As fluidised bed technology cannot be utilised for solid household, commercial or industrial wastes without pre-treatment of the wastes, it is not technically or economically the best solution for handling such waste and consequently would not be considered to be the Best Available Technique (BAT).
- More power is consumed by the fluidised bed furnace than by a moving grate furnace.

5.11.21. More information on Best Available Techniques (BAT) reference is made to Appendix 5.1.

Pyrolysis

5.11.22. Incineration is the combustion of waste in the presence of excess oxygen. Pyrolysis is the degassing of wastes in the absence of oxygen. The degassing reaction takes place at a temperature of 400-800 °C by a thermo-chemical process, during which pyrolysis gas and solid coke are formed. A schematic of the pyrolysis process is provided in Figure 5.17.

Figure 5.17 **Main components of a pyrolysis system *(source BREF document)***



5.11.23. Pyrolysis plants for waste treatment usually include the following basic process stages:

- Preparation and grinding: the process requires waste to be shredded or ground, before it enters the kiln. The grinder improves and standardises the quality of the waste presented for processing, and so promotes heat transfer
- Drying (depends on process): a separated drying step improves the lower calorific value of the raw process gases and increases efficiency of gas-solid reactions within the rotary kiln
- Pyrolysis of wastes: where in addition to the pyrolysis gas a solid carbon-containing residue accumulates which also contains mineral and metallic portions
- Secondary treatment of pyrolysis gas and pyrolysis coke through condensation of the gases for the extraction of reusable energy
- oil mixtures and/or the incineration of the gas and coke for the destruction of the organic component and simultaneous utilisation of energy.

5.11.24. The pyrolysis process will typically result in the following end products:

- char (carbon and ash)
- gases and liquids
- residues.

5.11.25. The residues include inorganic non-biodegradable materials. The gas can be used as fuel for boilers, which can generate steam for electricity production. The char can be used as fuel (similar to coal), but burning the char would require a flue gas scrubbing system. The char can also be used as a filter material (activated carbon).

5.11.26. The main reasons for not selecting the pyrolysis process for the Dublin WtE Facility are:

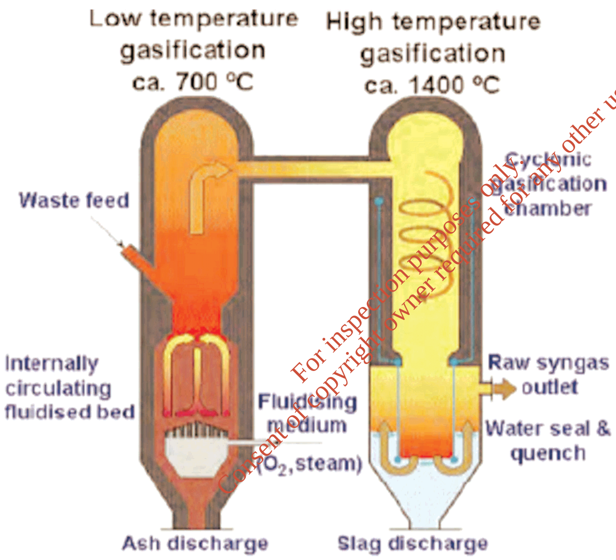
- The pyrolysis process is not sufficiently developed to be able to handle the 600,000 tonnes of waste a year, which is the design capacity of the Facility. The typical though-put range for pyrolysis is approximately 100 tonnes/day, which equates to approximate 35,000 tonnes/year, whereas the design for the Facility requires a throughput in the range of 1,600 tonnes/day.
- Based on overall throughput and operational hours, the use of pyrolysis on the main European waste streams is low compared with incineration. This is mainly due to operational difficulties reported at some installations.

- The pyrolysis technology is mostly suited for homogeneous fuels such as straw, wood chips and/or specific types of waste fractions such as rubber, plastic and wood. The pre-treatment required to handle household, commercial and industrial waste, is significant. As pyrolysis technology cannot be utilised for these wastes without pre-treatment, it is not technically or economically the best solution for handling such wastes and therefore would not be considered BAT.

Gasification

5.11.27. This process is similar to pyrolysis in some ways. With gasification, the pretreated waste is fed into a reactor where carbonaceous material reacts with a gasifying agent (eg air, oxygen, or carbon dioxide) at temperatures of 800-1100 °C or higher. A series of chemical reactions form a combustible gas with traces of tar. The ash residue becomes vitrified (glass-like) at these high temperatures and is separated as a solid residue. The gas can be burned to generate heat or steam. A schematic of the gasification process is provided in Figure 5.18.

Figure 5.18 Schematic diagram of a gasification system (source BREF document)



5.11.28. The advantages of the gasification process include the generation of a manageable solid fraction with low leaching characteristics, and efficient energy recovery. The disadvantages include the high processing costs and the traces of tar in the gas, which may contaminate the quench water. This means that the quench water must be treated. The gasification process is less developed than waste combustion with energy recovery for treating municipal solid waste.

5.11.29. The main reasons for not selecting the gasification process for the Dublin WtE Facility are:

- The gasification process is not sufficiently developed to be able to handle the 600,000 tonnes of waste a year, which is the design capacity of the Facility. The typical though-put range for gasification is approximately 500 tonnes/day, whereas the design of the Dublin WtE Facility requires a throughput in the range of 1,600 tonnes/day.

- The frequency of use (based on overall throughput and operational hours) of gasification on the main European waste streams is low compared with incineration. This is mainly due to operational difficulties reported at some installations.

Cooling methods

5.11.30. Three possible cooling methods were considered for the Facility. These are:

- Once through water cooling using seawater from the River Liffey or Dublin Bay,
- Water cooling by evaporation, using large concrete towers of up to 100 metres high, and
- Air-cooled condensers.

5.11.31. The main considerations in the choice of cooling system were:

- The close proximity of the Site to the River Liffey and the shoreline of Dublin Bay makes the use of convection water cooling possible as an option. Once through cooling using water from River Liffey or Dublin Bay would provide the lowest condenser pressure and thus the highest power output of the three options.

- Water cooling would provide the lowest noise impact. Both evaporation water cooling and air-cooled condensers would have high noise levels.

- Either cooling towers or air-cooled condensers would be large, tall structures. Since convection water cooling would be conveyed in pipes, which would be at low level or underground, the visual impact is far less than the visual impact of the two other options.

- The main disadvantage of the use of convection water cooling is that a plume of water, which will be warmer than the ambient sea water temperature, will be discharged to the River Liffey or Dublin Bay. The incoming water will be treated with biocides to prevent marine growth fouling and blocking the pipes. The water discharged will also contain these biocides. The full impact of the cooling water discharge is assessed in Chapter 12 "Water" of this EIS.

Figure 5.19 Typical wet cooling tower (source: BREF document on Industrial Cooling Systems)

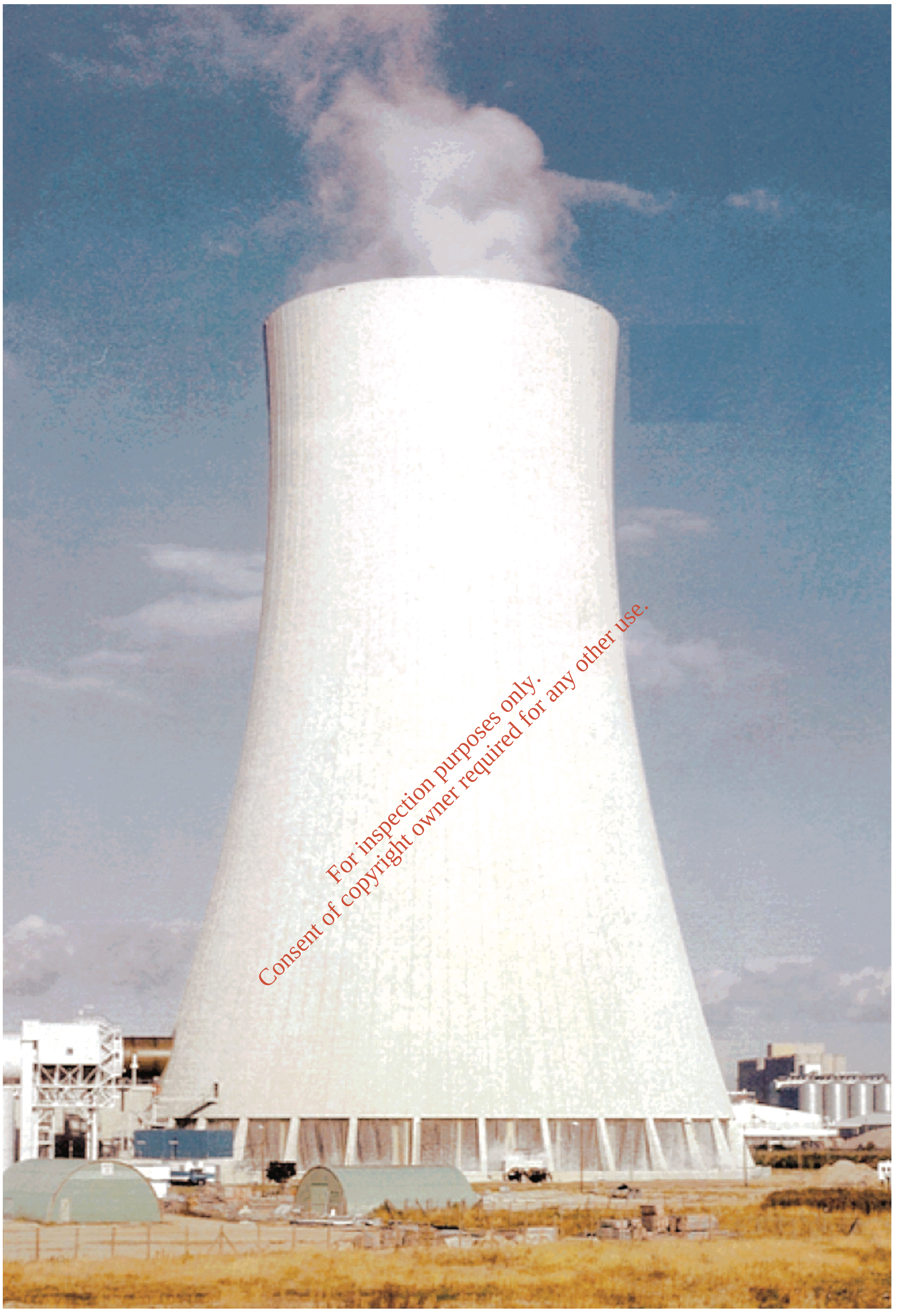


Figure 5.20 Dry cooling tower, (source: BREF document on Industrial Cooling Systems)

Routes for cooling water intake and outfall

5.11.32. The cooling water intake and outfall could be located in Dublin Bay, on the south sid\e of the Site. The Bay is relatively shallow at this location, which results in a lower assimilative capacity for the warm water discharged. Consequently it was decided that the intake and outfall should be on the River Liffey to the north of the Site.

5.11.33. It is proposed that the cooling water intake point will be located at the Dublin Harbour quay, north of the proposed Facility. From the inlet, the cooling water will pass through an open channel to a pumping station. From this point the cooling water will be pumped through an above ground pipeline, which will have a diameter of 1200 mm. The pipeline will cross the existing cooling water outfall channel of the Synergen Power Plant and then will cross Pigeon House Road, on a pipe bridge above the road, before entering the Site. The pipeline will continue underground to the main building.

5.11.34. The cooling water pipelines will cross Pigeon House Road on a pipe bridge, with a vertical clearance of 5.3 m, in compliance with the requirements of the National roads Authority's Design Manual for Roads and Bridges

5.11.35. As an alternative, the two cooling water pipelines could be laid under Pigeon House Road. There are a significant number of existing services which are laid in the road which would result in a significant construction operation, involving the excavation of deep pits on either side of the road, dewatering of the pits and pipe-jacking or tunnelling, to facilitate the laying of the pipes without disrupting the traffic and the existing services. The protected monument the Great South Wall is located on the north side of Pigeon House Road. Based on an assessment of the health, safety and environmental aspects involved, it was considered that the pipe bridge solution for crossing Pigeon House Road above ground is technically and environmentally the preferred solution.

Stacks

5.11.36. The Facility will be equipped with two independent stacks; one for each furnace line. The alternative is to provide a combined single stack.

5.11.37. The advantage of a separate stack for each line is that it is only necessary to take one boiler and flue gas line out of operation for maintenance of the stack, thus enabling the other boiler and flue gas cleaning line to keep incinerating waste and thus producing and exporting electricity during the maintenance period.

5.11.38. With a single stack with a single pipe, when one line is shut down the flue gas velocity would be reduced, which would reduce the efficiency of dispersion of the emissions from the stack. This is avoided with a stack provided for each line.

5.11.39. The two stacks will have a diameter of approximately 3 m. This is typically close to the maximum size for transport on public roads. The stacks will be prefabricated, with a steel core, insulation and a coated outer steel plate surface. This type of stack will be prefabricated off site and will be subsequently transported to Site and erected on a prepared concrete foundation.

5.11.40. With a single stack, the diameter of the stack would have to be larger than 3 m, which would mean that it would no longer be possible to use a prefabricated stack. The stack would have to be constructed on Site in reinforced concrete. Because of the increased diameter, the stack would have a more significant visual impact.

Flue gas treatment

General

5.11.41. The factors, which were considered when selecting the flue gas treatment systems, included the following:

- type of waste, its composition and variation
- type of combustion process, and its size
- flue gas flow and temperature
- flue gas content, size and rate of fluctuations in composition
- target emission limit values
- restrictions on discharge of aqueous effluents
- plume visibility requirements
- land and space availability
- availability and cost of outlets for residues disposal/recovery
- availability and cost of water and other reagents
- energy supply possibilities
- availability of subsidies for exported energy
- tolerable disposal charge for the incoming waste (both market and political factors exist)
- reduction of emissions by primary methods
- emission of noise

5.11.42. The main alternatives considered were:

a) Semidry system without wet scrubber

b) Traditional wet two scrubber system

c) Electrostatic precipitator imidiately after the boiler used in conjuction with a subsequent wet system

d) Tail end fabric filter in combination with either of the above

e) Selective Catalytic Reduction (SCR)

5.11.43. The design of the selected flue gas treatment system utilises a combination of a semi-dry and a two-stage wet system which utilise the benefits of each system

5.11.44. The main benefits of the selected system are:

- The absorption of ammonia in the wet scrubber enables the selective non catalytic reduction system to be operated with a substantial reagent dosage without producing NH_3 emissions to the atmosphere in excess of the emission level associated with best available techniques. This is particularly useful in the event of momentary high raw gas NOx values, which can then be reduced considerably by the selective non catalytic reduction system.
- The combination of semi-dry and wet scrubber systems produces less flue gas treatment residues than a stand-alone semi-dry system.
- The wet scrubber system is particularly efficient in dealing with variations in the emission concentration.
- The system does not entail the discharge of effluent from the wet flue gas treatment system.
- The energy consumption of the system is low compared to the abatement levels provided.

Plume suppression

5.11.45. Plume suppression is the reheating of flue gases or the removal of moisture from flue gases to prevent the stack emissions appearing as a visible plume in most weather conditions. Plume suppression would reduce the visual impact of the Facility. However, plume suppression will not be used as it would require significant energy and would reduce the amount of power being exported from the Facility. Plume suppression is only for aesthetic reasons and therefore plume suppression is not considered BAT.

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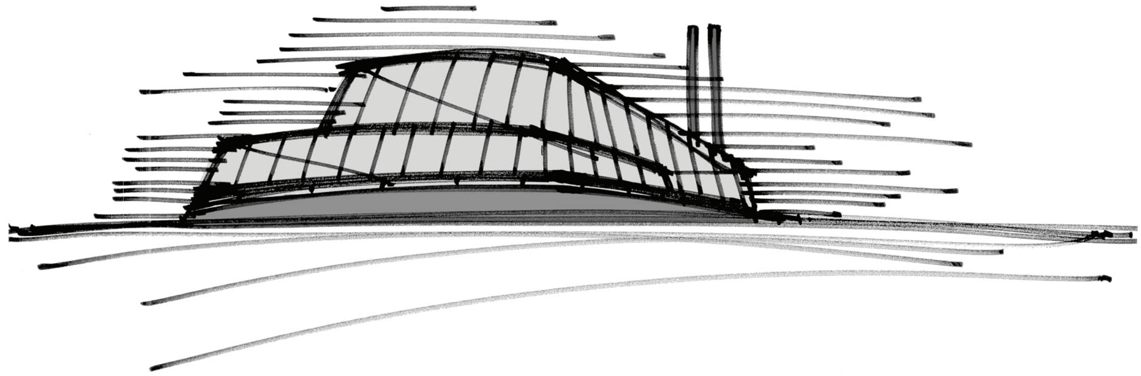

6. Landscape and visual impact

6.1. Introduction

6.1.1. This section of the Environmental Impact Statement (EIS) considers the landscape and visual aspects of the proposed Dublin Waste to Energy (WtE) Facility to be located on the Poolbeg Peninsula, Dublin.

6.1.2. The assessment involved reviewing aerial photography, plans, sections and elevations of the proposed scheme, various publications and reports, together with visits to the Site and environs of the proposed development.

6.1.3. A series of Photomontages, including three night-time versions, have been prepared from a number of viewpoints in the surrounding areas. The views are representative of the range of views towards the proposed WtE and illustrate the physical and visual nature of the proposed development within its setting. The '**as existing**' and '**as proposed**' version is given for each view location.

6.1.4. In addition, two physical models have been built in a 1:500 and a 1:2000 scale. The 1:500 scale model displays the Site layout, Site planning and the architectural concept. The 1:2000 scale model displays the Dublin WtE Facility in relation to the existing road networks, buildings and industrial facilities.

6.2. Methodology

General

6.2.1. Landscape has two separate but closely related aspects. The first is visual aspects, *i.e.* the extent to which new development can be seen. In considering visual impact, various aspects and stages are considered in detail including, construction stage impact, impact on completion of development and longer-term established impact.

6.2.2. The second aspect of landscape is landscape (or townscape) character, *i.e.* responses that are felt towards the landscape. This draws on the appearance of the land, including aspect, land-use, topography, vegetative cover, built environment, *etc*. and their interaction to create specific patterns and landscape or townscape units distinctive to particular localities.

6.2.3. It is important to note that just because a development - or part of a development may be visible does not necessarily determine that the development will have an adverse impact on the landscape or visual character of an area. Rather the manner in which a development 'fits' within an existing setting is the principal consideration of the assessment. As such, a proposed development can result in deterioration, improvement or no appreciable change in existing character. Such effects (or impacts), are assessed as per the significance criteria given in Table 6.1.

The assessment

6.2.4. The assessment has regard to - and the methodology is based on - the Environmental Protection Agency (EPA) 'Guidelines on the information to be contained in Environmental Impact Statements', 2002 and EPA 'Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)', 2003. The assessment also takes cognisance of the 'Guidelines for Landscape and Visual Impact Assessment' prepared by The Landscape Institute (UK) and Institute of Environmental Management and Assessment, 2002.

6.2.5. The assessment takes consideration of the location of sensitive landscapes and visual receptors relative to the proposed WtE Facility and is made with regard to the sensitivity and significance of the Site and to the vulnerability of the landscape to change. In particular the following aspects are considered.

6.2.6. **Landscape character** is the distinct and homogenous pattern that occurs in the landscape reflecting geology, landform, soils, vegetation including mans impact.

6.2.7. **Landscape sensitivity** is the extent to which a landscape can accept change of a particular type and scale proposed without unacceptable adverse effects on its character. This is classified as follows:

- *Not sensitive*: The landscape can absorb development of any scale without any negative change to its existing character.
- *Low sensitivity*: The landscape can tolerate a wide range of appropriate development without significant negative change to its existing character.
- *Medium sensitivity*: The landscape can only tolerate small-scale development of very sensitive design without significant negative change to its existing character.
- *High sensitivity*: The landscape cannot tolerate development without significant negative change to its existing character.

6.2.8. **Visual character** When a viewer experiences the visual environment, it is not observed as one aspect at a time, but rather as an integrated whole. The viewer's visual understanding of an area is based on the visual aspect, the character of elements and the relationships between them.

6.2.9. **Visual quality** Although the interpretation of viewers' experience of landscape can be subjective certain landscapes are obviously of higher visual quality. The visual quality of some such areas may already be recognised through landscape designation *e.g.* as Areas of Outstanding Natural Beauty or Outstanding Landscapes, or Scenic Amenity.

Impact significance criteria

6.2.10. The impact significance criteria used for the landscape and visual assessment is based on those given in the EPA Guidelines on the information to be contained in Environmental Impact Statements, 2002 and as set out in Table 6.1.

Table 6.1 Impact Significance Criteria

Impact Level	Definition
Imperceptible	an impact capable of measurement but without noticeable consequences;
Slight	an impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	an impact that alters the character of the environment in a manner that is consistent with the existing and emerging trends.
Significant	an impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound	an impact, which obliterates sensitive characteristics.

6.2.11. Impacts, which may be rated as positive, neutral or negative, are also considered in terms of duration as set out in the EPA Guidelines with periods ranging from:

- temporary (lasting for one year or less)
- short-term (lasting one to seven years)
- medium-term (lasting seven to fifteen years)
- long-term (lasting fifteen to sixty years)
- permanent (lasting over sixty years)

6.3. References

6.3.1. The following are the main texts referenced in the assessment:

- Countryside Council for Wales; Brady Shipman Martin; University College Dublin, 2001, *Guide to Best Practice in Seascape Assessment*
- Department of Environment & Local Government, 2000, *Draft Guidelines for Planning Authorities Landscape and Landscape Assessment*
- Dublin City Council, 2005, *Dublin City Development Plan 2005-2011*
- Dublin City Council, 2005, *Poolbeg Action Area Framework Plan FDA13*
- Dun Laoghaire Rathdown County Council, 2005, *Dun Laoghaire Rathdown County Development Plan 2005-2011*
- Environmental Protection Agency, 2003, *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*
- Environmental Protection Agency, 2002 *Guidelines on Information to be Contained in Environmental Impact Statements*
- Fingal County Council, 2005, *Fingal County Development Plan 2005-2011*;
- Landscape Institute and Institute of Environmental Management and Assessment, *Guidelines for Landscape and Visual Impact Assessment*, 2002;