4 Description of the Proposed Development

4.1 Introduction

4.1.1 Overview

Indaver proposes to develop a Resource Recovery Centre in Ringaskiddy in County Cork.

The proposed development will consist principally of a waste-to-energy facility (waste incinerator) for the treatment of up to 240,000 tonnes per annum of residual household, commercial and industrial non-hazardous and hazardous waste and the recovery of energy. Of the 240,000 tonnes of waste, up to 24,000 tonnes per annum of suitable hazardous waste will be treated at the facility. The proposed development will maximise the extraction and recovery of valuable material (in the form of ferrous and non-ferrous metals) and energy (in the form of 21 megawatts of electricity) resources from residual waste.

In addition to the provision of the waste-to-energy facility, the proposed development will include an upgrade of a section of the L2545 road, a connection to the national electrical grid, an increase in ground levels in part of the site, coastal protection measures above the foreshore on Gobby beach and an amenity walkway towards the Ringaskiddy Martello tower.

This chapter presents a description of the proposed Ringaskiddy Resource Recovery Centre development.

The site location and neighbouring land uses are described in Section 4.2. Principal design objectives and design constraints are presented in Sections 4.3 and 4.4. The main features of the proposed development are described in Section 4.5. Sections 4.6 to 4.16 describe the operations, processes and controls, site services, site management, health and safety and decommissioning of the waste-to-energy facility.

4.2 Site Location and Neighbouring Land Uses

4.2.1 Site Location

The site for the Ringaskiddy Resource Recovery Centre is located approximately 15km to the south-east of Cork City, in the townland of Ringaskiddy on the Ringaskiddy Peninsula in the lower part of Cork harbour. Refer to **Figures 1.1** and **1.2** in **Chapter 1** ***Introduction*** of this EIS which show the site location.

The L2545, the main road from Ringaskiddy village to Haulbowline Island forms the northern boundary of the site. The eastern boundary of the site extends to the foreshore of Cork harbour along Gobby Beach. The lands to the immediate south and west are in agricultural use. The site surrounds the Hammond Lane Metal Recycling Co Ltd facility. The site is located approximately 800m east of the village of Ringaskiddy.

4.2.2 Existing Site Description

The site covers an area of approximately 13.55 hectares and is situated on a north-facing slope. The land rises from north to south, and also generally from east to west. The lowest elevation is approximately 2.05-3.0m Ordnance Datum (OD) along the northern boundary with the local road. The highest point is approximately 41.0m OD along the southern site boundary in the vicinity of the Martello Tower, which is in the adjoining field to the south. The site is currently covered in scrub with some pockets of trees and open grass areas. Refer to **Figure 4.1** which shows the existing site layout

The overall outer boundary of the site is roughly rectangular in shape with narrower sections at the eastern and western ends, and with the Hammond Lane Metal Recycling Company Ltd metal/scrap processing yard located centrally within the site with its own direct access from the local L2545 road to the north. Although this yard is located centrally within the Indaver site, it does not form part of the site. There is also an ESB Networks compound located between the eastern boundary of the Hammond Lane facility and the Indaver site. Refer to **Figures 4.1** and **4.2** which show the existing site layout.

The site can be divided into six areas as described below. Refer to **Figures 4.1** and **4.2** which show the existing site layout. Refer also to **Figures 4.3** to **4.6** which show the site in context in the surrounding environment.

Area 1: An area of flat ground along the northern site perimeter to the west of the Hammond Lane Metal Recycling Company entrance. This flat ground is under arable cultivation. This area is referred to as “*western fields*” in this EIS.

Area 2: An area of scrubby land which extends east from the Hammond Lane Metal Recycling Company entrance to the top of the glacial till face which adjoins Gobby Beach at the harbour edge and to the eastern portion of the southern site boundary. This area is largely covered in gorse and brambles interspersed with small patches of grassland. A farm track runs through this area from the L2545 to the southern boundary of the site. This area to the east of Hammond Lane is referred to as “*waste-to-energy facility*” in this EIS. There is a small rectangle of land not in Indaver’s ownership in Area 2 that is encircled by the site. Refer to **Figures 4.1** and **4.2. (**No development is proposed within this small rectangle of land as part of the Ringasdkiddy Resource Recovery Centre).

Area 3: An area of land in pasture along the high southern perimeter of the site. This widens towards the west, sloping sharply down to the north-western corner of the site.

Area 4: An area of dense undergrowth growing across the centre of the site where the slope is steepest. This overgrown section extends west behind (and to the south of) the Hammond Lane Metal Recycling Company. The upper slopes at the western side are overgrown with trees.

Area 5: This is the area within Indaver ownership encompassing the L2545 local road and Gobby Beach carpark along the northern boundary of the site

Area 6: This is the Gobby beach area within Indaver ownership above the foreshore. The coastline along the eastern boundary of the Indaver site consists of a glacial till face adjoining Gobby Beach. The glacial till face is very shallow near the public carpark to the north and steepens to the south to a maximum of 10-12m high.

4.2.3 Immediate Vicinity

The site encircles the Hammond Lane Metal Recycling Company facility. The facility contains several metal buildings, concrete walls, and some large pieces of machinery. Hammond Lane expanded its facilities in 2015. There is also an ESB Networks compound located adjacent to the eastern boundary of the Hammond Lane facility. Refer to **Figures 4.1** to **4.6**.

The L2545 is an extension of the N28 that leads from Ringaskiddy past the proposed development site and over the bridge to the crematorium on Rocky Island and Haulbowline Naval base.

The Irish Maritime and Energy Research Cluster (IMERC) campus is being developed on the northern side of the L2545 road, which forms the northern boundary of the site. IMERC is supported by University College Cork, Cork Institute of Technology and the Irish Naval Service. The National Maritime College of Ireland (NMCI), the first major component of IMERC, opened in 2004. The Beaufort Research Laboratory (construction completed in 2015), is located on the site to the east of the National Maritime College of Ireland, will be IMERC's second major building. Further developments for IMERC will be located on the remainder of the land to the east of the National Maritime College of Ireland (refer to **Figures 4.3 to 4.6**).

Some warehouses are located on the northern side of the L2545 road, to the west of the National Maritime College of Ireland.

The land to the immediate south of the Indaver site is owned by IDA Ireland and is in agricultural use. Refer to **Figures 4.3 to 4.6**. Just beyond the southern boundary, the site is further visually defined by the high voltage electricity line that runs west overhead to connect with the ESB sub-station near Shanbally and east (then north) to Haulbowline Island. Further to the southwest, the land continues to rise slightly to create the ridgeline on which a Martello Tower is located at the highest point (43m OD).

The land to the west of the site is in agricultural use. Further to the west there is a single, large, white-painted residential property (Ring House) located approximately 50m from the boundary, set within a field and surrounded by trees.

The eastern section of the M28 Cork to Ringaskiddy Motorway Scheme is proposed to cross the far western part of the Indaver site. The scheme, proposed by Transport Infrastructure Ireland (TII) (formerly the National Roads Authority) has not yet been published. Refer to Figure 4.7 which shows an indicative location of the proposed M28 Cork to Ringaskiddy Motorway Scheme in the vicinity of the Indaver site.

4.2.4 The Wider Area

The centre of Ringaskiddy village is located approximately 800m to the west of the site of the proposed development. The Port of Cork's port facilities are located to the north of Ringaskiddy village.

The Ringaskiddy peninsula is industrial in character, with a number of pharmaceutical companies having large manufacturing facilities in the area, in addition to the Port of Cork facilities. The locations of some of these industries are shown in **Figures 4.3 to 4.6**. Recent additions to the Ringaskiddy area include three 100m hub-height wind turbines, located on industrial sites. A fourth similar wind turbine has received planning permission. The DePuy wind turbine is located to the south of the Indaver site

The Cork Harbour area has a mixture of urban developments, such as Cobh, Rushbrooke and Monkstown, and pockets of industry near the shore. Spike Island is located approximately 500m to the east of the site, with the disused Fort Mitchell prison being situated there. There is an Irish Naval Service base situated on Haulbowline Island (refer to **Figure 4.3**) and a crematorium on Rocky Island. Both islands lie to the north of the site.

4.3 Principal Design Objectives

4.3.1 Waste-to-Energy Facility

The principal design objectives for the waste-to-energy facility can be summarised as:

- the facility should treat industrial hazardous and non-hazardous waste and municipal solid waste with energy recovery.
- the facility's capacity should be selected to ensure that the incentive to minimise waste is maintained.
- the technology should be robust and adaptable to the small and changing Irish market.
- safety and environmental protection should be given the highest priority.
- the existing need for waste management facilities should be addressed, in conformance with Irish Government and EU policy, in a sustainable manner.
- the facility should meet all current and foreseeable future regulatory standards.
- the facility must be BAT in accordance with the Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration (BREF) (EC 2006) and the requirements of the Industrial Emissions Directive 2010/75/EU.
- the facility's construction and operation should minimise resource consumption and the generation of waste.
- the facility should optimise existing site features and have the minimum feasible impact on the neighbourhood.

4.3.2 L2545 Road Upgrade

The principal design objective for the upgrade of the L2545 road is to improve the surface water drainage so that the road does not flood after prolonged rainfall and to raise the level of the road above the 1:200 year tidal event with an added allowance for climate change.

4.3.3 Increase in levels of the Indaver site

The principal design objective for raising the ground levels of the Indaver site is to raise the levels above the 1:200 year tidal event with an allowance for climate change. The site is not indicated in the Carrigaline Local Area Plan 2011 zoning map for Ringaskiddy as being in Flood Zone A or B. It is worth noting that the Indaver site is classified as Flood Zone C[1] according to the OPW Planning Guidelines (2009) which means that the probability of flooding from rivers and the sea is low.

4.3.4 Coastal Protection Measures

The principal design objective for the coastal protection measures is to reduce the rate of erosion of the glacial till face, which forms the eastern boundary of the Indaver site, while minimising the impact on recreational users of the beach and on the adjoining coastline to the north and south. The design of the coastal protection measures include an allowance allow for climate change. The proposed waste-to-energy facility is not reliant on these coastal protection works.

4.4 Design Constraints

4.4.1 Site Use

The site is approximately 13.55 hectares. The location of the Hammond Lane Metal Recycling Company and ESB Networks compound premises divides the site into two distinct parts, one to the east and one to the west. The layout of the waste-to-energy facility will be confined to the eastern part.

The topography of the site imposes other constraints, particularly on access to the upper part, to the south and west of the Hammond Lane Metal Recycling Company. However, the topography also presents the opportunity to use the difference in level to facilitate gravity feeding of waste into the bunker.

The works proposed to connect into the National Grid are confined to the land owned by Indaver.

4.4.2 Building Height and Building Location

To help to minimise the visual impact of the waste-to-energy facility, the building height was reduced to the practical minimum in the context of the available technology for facilities such as these. More detail is provided in **Chapter 11 *Landscape and Visual Assessment*** of this EIS. Refer also to **Appendix 4.5** (***Architectural Design Report***)

The design of the main waste-to-energy process building is based on a straight line process. The axis of the process building preserves the views from the Martello tower. In addition, design of the main process building is broken down

[1] Flood Zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types of flood zones defined in the OPW Planning Guidelines (2009): A, B & C. The Indaver site is located in *Flood Zone C* which is defined as "Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding)"

into a series of irregular block shapes to reduce visual impact. Colours have been used to integrate the building shapes into the adjacent landscape

4.4.3 L2545 Road Upgrade

The upgrade works to the L2545 are confined to the land owned by Indaver and a narrow strip owned by Hammond Lane. The upgraded road must tie into the levels of the access roads to the adjoining premises and the existing road levels at either end of the upgrade.

4.4.4 Coastal Erosion Protection Measures

The coastal protection measures are confined to the land owned by Indaver, above the foreshore.

4.5 Main features of the Ringaskiddy Resource Recovery Centre

The proposed development will consist principally of a waste-to-energy facility (waste incinerator).

In addition, the proposed development will include an upgrade of a section of the L2545 road, a connection to the national electrical grid, an increase in ground levels in part of the site, coastal protection measures above the foreshore on Gobby beach and an amenity walkway to the Ringaskiddy Martello tower. These are all described in detail below.

4.5.1 Overview

The waste-to-energy facility will treat up to up to 240,000 tonnes per annum of hazardous and non-hazardous residual household, commercial and industrial waste which is currently landfilled or exported. Up to 24,000 tonnes per annum of suitable hazardous waste will be treated at the facility. The facility will maximise the extraction and recovery of valuable material (in the form of ferrous and non-ferrous metals) and energy (in the form of 21 megawatts (MW) of electricity) resources from residual waste.

Waste-to-energy (or incineration) is the burning of waste at high temperature, in a carefully controlled environment, using the heat to generate electricity. Incineration does not destroy waste, but converts it to ash, a large proportion of which is suitable for recovery or recycling, for example in road construction. Ferrous and non-ferrous metals within the ash can also be recovered for recycling. These processes are described in more detail below in Section 4.6.

The heat produced by the combustion process will be recovered and will generate approximately 21 megawatts of electricity of which up to 18.5MW will be exported to the National Grid. The electricity produced by the waste-to-energy facility will be enough to supply the power needs of approximately 30,000 households.

The main elements of the waste-to-energy facility are described below and include:

- Main process building, with a stack extending to 75mOD
- Turbine hall and aero-condenser structure
- Security building/gate house and weighbridges
- Administration building
- Firewater storage tank and pump house
- Surface water attenuation tank and firewater retention tank
- Light fuel oil storage tank, aqueous ammonia storage tank and unloading area
- Aqueous waste storage tank and tanker unloading area
- Electricity substation, compound and grid connection
- Emergency access
- Site lighting

Refer to **Figures 4.7 to 4.10** for the overall layout plans of the proposed development. Refer to the planning application drawings for the building details. An outline description of the buildings is provided below. Note: the dimensions provided below are rounded to the nearest 0.5m. Refer to the planning application drawings for further details.

The other elements of the proposed development include:

- Public amenity footpath
- L2545 road upgrade
- Increase in levels on site
- Coastal protection measures
- Diversion of services

These are all described in detail below.

4.5.2 Main Process Building

The main process building will be circa 176m x 81m approximately, in plan. The building height will be up to 50.7m metres above Ordnance Datum (mOD (Malin) The ground floor level will vary from circa 0 to circa 10 metres OD. The bunker will be of reinforced concrete. The bunker floor will be constructed as a concrete watertight basement. In the event of a fire in the building, this area will act as a firewater retention tank.

The main part of the building will be largely a single space, with sub-divisions as required by the process.

The furnace, boiler and flue gas cleaning equipment will be located in the building. The bottom ash handling area will be located in the building at the south side. The boiler feed water treatment equipment, boiler feed water tank, will be located between the boiler and the steam condensate area within the building. The transformers and high voltage switch room will be located in the building along the northern side. The lime silo, boiler ash silos, flue gas cleaning residue silos and activated carbon or activated clay storage area will be located inside the building along the south side.

The waste bunker and the tipping hall will also form single storey spaces. The floor of the waste bunker will be at circa 0mOD and the floor of the waste reception hall will be at circa 10mOD. Waste, discharged into a chute in the wall/floor of the tipping hall, will be gravity fed into the waste bunker. The multi-storey portion will house offices, locker rooms, the control room/crane operator room, a laboratory canteen and offices.

A room to house the stack emission monitoring equipment will be located the sixth floor under the roof. It will be adjacent to the stack, in the main building. This room will be accessible by stairs. The circular shaped stack is attached to the main process building and there will be access from the emissions monitoring equipment room to the sampling points on the stack. The top of the stack will be at 75mOD. The top of the stack will be indicated by white strobe (flashing) obstacle warning lights. The lights will be incandescent or of a type visible to Night Vision Equipment. The lights will emit light at the near infra-red (IR) range of the electromagnetic spectrum specifically at or near 850 nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light.

The tipping hall will be enclosed and trucks carrying waste will enter the reception hall through doors at its southern side. There will be six chutes in the western wall/floor of the tipping hall into which waste will be tipped therefore a number of trucks will be able to empty the waste into the reception hall over a short period of time. The tipping hall and waste bunker will be under negative pressure with the air extracted from these spaces used for primary combustion air. This will also minimise the risk of odours leaving the building.

The workshop will be located on the northern side of the main process building. The floor level will be at circa 5mOD and the workshop will be approximately

16.5m long by 10m wide by 8m in height. The workshop will be used by the maintenance team on site for repairs and will contain tools and equipment such as a welding facility, grinders etc.

The warehouse will be located underneath the tipping hall.. The floor level will be at circa 5mOD and the building will be approximately 40m long by 13.5m wide by 4m in height. The warehouse will be used for the storage of spare parts and consumables such as personal protective equipment.

A perimeter access road surrounds the main production building providing vehicular access to the main building as well as other buildings on site.

On the north east side of the main process building there will be a multi-storey admin area that will house the production team for the operation of the facility. This will include offices, changing facilities, meeting rooms, the main control room and a laboratory for testing of incoming and outgoing waste streams.

There will be a nitrogen generator and nitrogen buffer storage vessel located just to the south of the process building.

4.5.3 Turbine Hall and Aero-Condenser structure

The turbine hall will be located to the rear and south of the main process building. It will be approximately 25m by 15m and circa 16m in height. An aero-condenser structure will be located adjacent to the turbine hall. This structure will be approximately 35m by 15m and circa 16m high. It will support the air cooled condenser fans and will be open to allow free air flow.

4.5.4 Security building / gate house and weighbridges

The security building will form part of the administration building. It will accommodate the site security. The drivers of waste trucks and tankers will report to the security staff on arrival at the waste-to-energy facility. The only exception will be some truck drivers on long term contracts, carrying non-hazardous waste, who will access the facility using swipe cards. The security building will also have toilet facilities for truck drivers. Further details on traffic management of the waste trucks entering and departing the site are provided in in **Chapter 7 *Roads and Traffic*** of this EIS.

Two weighbridges will be located close to the waste-to-energy facility entrance, situated at the north-western part of the site. All trucks will be weighed on entering and before leaving the facility.

4.5.5 Administration Building

The administration building will be a two-storey building located to the west of the main entrance. The building will primarily contain office space and meeting rooms for staff but will also have a visitors' centre and a training centre. Parking for 57 cars will be provided adjacent to the admin building.

The training centre will include a high-tech, multi-media training facility. Using the Indaver German Training Centre model, this facility will provide courses for industrial customers in areas such as; Dangerous Goods, Transport Safety & Legislation, Waste Legislation and Packaging of Waste. The Centre will also provide opportunities for waste education for second and third level institutes. With a high-tech laboratory on site, Indaver could also provide training in the analysis of waste composition.

The visitor centre will act as a gateway to the site, showcasing best practice in resource recovery management and sustainability. Indaver will strive to deliver a high quality, exciting experience for visitors. A viewing area will give visitors a 'birds-eye' view of the site. As the owners of Ireland's first waste-to-energy facility, Indaver understands and values the importance of education. Since Indaver has opened their gates of the Meath facility in 2011, they have welcomed more than 2,000 visitors onsite.

4.5.6 Fire water storage tank and pump house

A tank will be provided for the storage of water to be used for firefighting. The tank and associated pump house will be located to the south of the main process building. The floor level of the pump house will be at circa 11mOD and the building will be approximately 17m long by 9.25m wide by 6m in height. The pump house will accommodate the fire-fighting water pumps and process water pumps.

4.5.7 Surface water attenuation tank and firewater retention tank

A surface water tank and a firewater retention tank will be provided. Both tanks will be located underground beneath the administration building car park to the west of the main entrance.

4.5.8 Light fuel oil storage tank, ammonia storage tank and unloading area

A double skinned tank for the storage of light fuel oil will be located south of the process building. Light fuel oil will be used to heat up the waste-to-energy facility to conditions ready for waste and the keep the incineration temperature above 850°C during operation on waste. An aqueous ammonia tank will be located to the east of the fuel oil storage tank. Aqueous ammonia is used as a reagent for the reduction of nitrogen oxides in the flue gases as described in Section 4.7.4 below.

Directly to the north of the light fuel oil storage tank, a common unloading area will be provided for deliveries of both light fuel oil and aqueous ammonia. This area will be contained in the event of any leaks or spills during unloading operations.

4.5.9 Aqueous waste storage tank and unloading area

Aqueous wastes referred to in this document includes liquid wastes such as water waste streams with mixed solvents and/or inks, contaminated water from fire fighting and clean up operations, storm water and leachate from landfill sites etc. Solvents referred to in this document are solvent streams with a high water content.

A double skinned tank for the storage of aqueous waste will be located to the east of the light fuel oil storage tank. Aqueous waste deliveries will either be unloaded directly into the tank or fed to the furnace directly (direct injection). Unloading time will be approximately 1 hour into the tank and up to 24 hours when fed by direct injection. The feeding rate from the storage tank and by direct injection will be the same and fully controllable up to a maximum of 1.5 tonnes per hour.

The unloading area will be located to the west of the storage tank and will be designed to contain any potential spills or leaks from unloading operations. An overhead gantry will be provided to facilitate sampling and inspection of the tankers delivering aqueous waste.

4.5.10 Electricity substation building, compound and grid connection

4.5.10.1 Electricity substation building and compound

The electricity import/export substation and compound within the Indaver site will be located east of the main entrance to the waste-to-energy facility.

The electricity import/export substation will be approximately 15m by 5m in size and will contain the electrical switchgear, protection relays, current transformers and voltage transformers and a transformer; all associated with the import/export of electricity from the facility from/to the national grid. The compound will be divided into two adjacent parts. One part of the compound will be dedicated to the infrastructure required by ESB Networks and will also contain a substation building for the ESB metering and associated equipment.

The other part of the compound (dedicated for Indaver's equipment) will be directly adjacent and will contain the transformer required to step down the voltage from 38kV to 10kV and other associated equipment such as switchgear, protection relays, current transformers and voltage transformers. Indaver will also have a substation building which will be built adjacent to the one required by ESB. The entire compound will be fenced and the two parts will be separated by a fence.

4.5.10.2 Grid Connection

The waste-to-energy facility will be connected to the national electrical grid via the 38kV electrical substation (known as Lough Beg substation) adjacent to the eastern boundary of the Hammond Lane facility. This connection method has been determined by a feasibility study carried out by ESB Networks (Refer to Appendix 3.2). Based on discussions with ESB Networks, the connection will simply be an extension of the 38kV line into the ESB side of the proposed Indaver electricity compound as this line currently terminates at the existing Lough Beg substation. ESB Networks have confirmed that the extension of the 38kV line into the Indaver site can be over ground or underground. Indaver have selected the underground option and the proposed routing for the underground lines has been identified on the drawings. The routing has been designed in compliance with ESB guidelines and standards. The grid connection will be made by running underground cables from the ESB side of the Indaver electricity compound to the Lough Beg substation.

The lands over which the entire grid connection will be constructed lie within Indaver's ownership (save for a small section comprising associated works on the adjacent Lough Beg substation owned by ESB Networks). These works will be carried out by ESB Networks and do not form part of the planning application.

Based on the discussions with ESB Networks in relation to the connection of the 38kV cable within the ESB Networks lands, there is the possibility to connect in two ways and the decision as to which way will be decided in the detailed engineering phase by ESB Networks

- *Option 1: Cable Connection within the ESB Lough Beg substation building.*

This involves a trench of approximately 5m to be excavated on the ESB side of the substation fence that will meet up with the trench that will be excavated on the Indaver lands from the new Indaver substation building to the ESB fence. The underground cable will then emerge in the Lough Beg substation building and be connected to the existing busbar within the distribution board. There shall be some electrical switchgear for protections as per the ESB standards/specifications along with metering equipment that shall allow ESB to monitor usage on both import and export of power.

- *Option 2: Cable connection directly to cable on existing end mast*

  Much like option one this involves a trench of approximately 5m to be excavated on the ESB side of the substation fence that will meet up with the trench that will be excavated on the Indaver lands from the new Indaver substation building to the ESB fence. The underground cable will then emerge in the Lough Beg substation building. This cable shall then be connected to some electrical switchgear for protections as per the ESB standards/specifications along with metering equipment that shall allow ESB to monitor usage on both import and export of power. The cable shall then exit the Lough Beg substation via a second trench that will be excavated between the Lough Beg substation building and the mast that carries the existing 38Kv power line from the Barnahely substation. This trench shall be approximately 5m in length and will be within the ESB Networks Lough Beg substation lands. The underground cable will then emerge next to the existing mast and shall be connected directly to the existing 38kV line via a standard T connection, this form of connection is possible on an end mast like the one situated in the Loughbeg substation.

Due to the layout of the facility, there will be no requirement to divert the existing 38 kV lines which traverse the site.

4.5.11 Emergency access

Emergency access is provided through the main entrance on the left and right hand sides of the weighbridges. In addition, an emergency access will be provided to the facility in the event that the main access point is blocked. This will be located to the east of the main access road and will be reserved for use by the emergency services.

4.5.12 Site Lighting

Site Lighting will include a mixture of 8m high pole mounted and building mounted lights to light up entrances and roads with full cut off LED light head fixtures to reduce any light pollution into the surrounding area. There will be 3 number low intensity obstacle lights at the top of the stack, as described in Section 4.5.2 above.

4.5.13 Public amenity footpath

A public amenity footpath and viewing gallery, located outside the facility's security fence, will be provided along part of the southern and eastern site boundaries to allow public access between the Martello tower and Gobby Beach car park. Refer to **Chapter 11 *Landscape and Visual*** of this EIS for a more detailed description.

4.5.14 L2545 Road Upgrade

The proposed upgrade works to a section of the L2545 local road, which adjoins the northern boundary of the site, will consist of raising a section of the road and improving the surface water drainage to alleviate local flooding issues along the road.

4.5.14.1 Background to flooding issues on the L2545

The existing levels of the road along the northern boundary of the Indaver site are set at circa 2.4m to 2.95m OD. Based on a review of all available information, the predicted 1 in 200 year design tidal level has been estimated as 2.73m OD. Sections of the road close to the Gobby beach car park are below this level and are therefore at risk of tidal flooding during a 1 in 200 year tidal event.

Based on a review of the historic flooding of the road, discussions with Cork County Council, and the preliminary flood risk assessment mapping produced by the OPW, there is a significant risk of pluvial flooding of the road during periods of heavy rainfall combined with high tide.

The existing storm water drainage system along the road consists of a 450mm diameter pipe which outfalls to the sea at Gobby Beach. There are a minimal number of gullies along the road to accept water and transfer it to the storm water sewer. Therefore, it can be concluded that the existing formal drainage system along the road is inadequate. The dominant drainage mechanism for the road is “over the edge” drainage to the Indaver site on the south side of the road. A number of channels have been cut in the berm on the southern side of the road which allow surface water runoff from the road to discharge directly into the Western Fields area of the Indaver site.

The invert level of the outfall is -0.28mOD. As the level of the tide rises above this elevation the drainage system can become tide locked if there is insufficient differential head at the outfall. When this occurs the surface water which has reached the pipe is unable to discharge through the outfall and collects in the drainage pipe. The discharge pipe becomes surcharged and any subsequent rain water falling on that area of the road normally drained by the existing gullies cannot drain away and causes the road to flood. This area of the road is located adjacent to the entrance to the public car park at Gobby beach.

The L2545 upgrade has been designed to address the above issues.

4.5.14.2 Description of L2545 upgrade

The proposed L2545 upgrade works will include raising a 185m section of the road to a maximum height of 3.45m OD between the car park and the eastern end of the Hammond Lane Metal Company. This is approximately 1.0m above the existing road level. This will elevate the road to above the 200 year design tidal water level plus an allowance for climate change. This will offer a high level of protection to the road from tidal flooding. The road will be raised over a length of approximately 185m in order to ensure a smooth transition down to existing road levels, in accordance with road design standards. The recently constructed footpath on the northern side of the road will also be raised to the new road level.

The proposed road drainage network upgrade will extend along the entire northern boundary of the Indaver site. It has been designed to cater for the 7 hours when the storm water outfall is tide locked by a 200 year design high tide, 2.73m top water level (TWL), combined with a 1 in 30 year rainfall event plus an allowance for climate change.

A 260 metre length of new linear concrete surface water channel will extend from the western boundary (of the western field area) of the Indaver site, running along the southern edge of the L2545 until it meets the entrance to the Hammond Lane Metal Company. This section of the L2545 is currently super-elevated – i.e. the camber on the road falls from north to south, therefore surface water drains to the south. This section of the L2545 will not be raised as the existing levels are already above the predicted 1 in 200 year design tidal level (2.73m OD). The new surface water channel will be drained at regular intervals by gullies which will outfall to the existing 450mm diameter surface water sewer beneath the road. Therefore surface water will no longer flow from the road into the Indaver site (western fields) to the south.

The raised section of the L2545 between the car park and the eastern end of the Hammond Lane Metal Company will be drained by a kerb and gully sealed drainage system which will be connected to two new surface water pipes underneath the road. The two 1500mm diameter pipes will be approximately 190m in length and will provide 660m^3 of surface water storage. There will be three large concrete chambers constructed on the line of the twin surface water pipes at the start middle and end of the run. The first two chambers will be situated in the road and the terminal chamber will be constructed at the entrance to the car park by Gobby Beach. The recently constructed surface water drainage system on the Haulbowline road will be diverted into the terminal chamber. This chamber will be connected to the existing 450mm diameter surface water sewer via a short length of new 450mm diameter pipe, a new Class 1 bypass hydrocarbon interceptor and a new manhole constructed on the line of the existing pipe. This will allow the upgraded surface water drainage system to discharge to sea via the existing 450mm surface water outfall at Gobby Beach.

All of the above works will be within Indaver ownership, apart from a small area in Hammond Lane ownership. Consent has been given by Hammond Lane to undertake these works.

4.5.15 Increase in levels of the Indaver site

The ground levels of the Indaver site vary considerably in both the north-south direction and the east-west direction. Along the southern boundary of the site the levels vary from circa 10m OD to circa 41m OD. Along the northern boundary of the site the ground levels vary from circa 2.05m OD to circa 4.0m OD. As discussed above, the 1 in 200 year design tidal level has been estimated as 2.73m OD.

The levels of the low-lying parts of the site will be raised to 4.55m OD. The ground levels in the western fields area of the site consisting of a 10,000m^3 area will be raised by a maximum height of 2.5m above ground level. A small area of land within the waste-to-energy side of the site adjacent to the L2545 road will also be raised to 4.55m OD. This level will offer a very high standard of flood protection to the site. The calculation of this level has been determined as follows:

The minimum site flood defence level was calculated at 4.28m OD Malin. This levels allows for 2.73m (200 year tidal level) plus 1.05m (climate change) plus 0.5m (freeboard).

For climate change, the OPW Draft Guidance on the “Assessment of potential future scenarios for Flood Risk Management” suggests the use of two scenarios, a mid-range future scenario (MRFS) and a high end future scenario (HEFS). The MRFS represents a likely future scenario which is within the bounds of the widely accepted projections. The HEFS is a more extreme, but plausible future event, and is within the upper bounds of the widely accepted projections.

The proposed 1.05m allowance for climate change allows for the high end future scenario.

It was decided to use an even more conservative site flood defence level of 4.55m OD given that that a number of recent developments close to the site in Ringaskiddy (Beaufort Research Laboratory and IMERC) have already utilised this level. The 4.55m OD level will offer a very high standard of flood protection to the site.

Further details on flood risk are provided in **Appendix 13.4 *Flood Risk Assessment.***

4.5.16 Coastal Protection Measures

Coastal protection measures in the form of shingle above the foreshore on Gobby Beach are proposed along the eastern boundary of the Indaver site.

The coastline along the eastern boundary of the Indaver site consists of a glacial till face adjoining Gobby Beach. The glacial till face is very shallow near the public car park to the north and steepens to the south to a maximum of 10-12m high. Issues in relation to coastal erosion were raised by An Bord Pleanála during the course of the 2008 planning application process. In response to the issues raised by the Board, a coastal study was carried out by Arup in order to better understand the coastal processes in the vicinity of the site, the rate of erosion of the glacial till face and the specific coastal protection measures required. The coastal erosion study undertaken included an evaluation of the retreat rate of glacial till face based on historical information and surveys. Numerical wave modelling, a wave run-up assessment and beach sediment transport assessment were carried out.

The study found that the proposed development would not increase the current rate of erosion of the glacial till face.

As part of the study, a very conservative rate of erosion was applied to the site in order to assess whether the proposed development could be impacted over the duration of the planning permission (40 years in total). The study found that there would be no impact on the proposed development after 30 years. The study found that there could be a risk of an impact on a small section of the proposed development after 40 years however this would be confined only to the amenity walkway and a small section of a diverted gas pipeline outside of the fence line. The waste-to-energy facility would not be impacted by coastal erosion during the duration of the planning permission.

Indaver engaged with Gas Networks Ireland (GNI) in relation to the proposed diversion route within the Indaver site. GNI confirmed that they were satisfied that the proposed gas diversion route was feasible.

Coastal protection mitigation measures are not required for the waste-to-energy facility element of the development. However, given the concerns raised by An Bord Pleanála and given the low risk that the amenity walkway and a section of the diverted gas pipeline could be impacted in 40 years' time, coastal protection measures have been included in this planning application as a precautionary measure so as to reduce the rate of erosion of the glacial till face.

The protection measures will consist of the placement of approximately 1100m^3 of shingle (of appropriate size and shape (rounded) above the foreshore on Gobby beach along the eastern boundary of the Indaver site. This will be a 'soft' solution which will reduce erosion rates by increasing beach levels i.e. reducing near shore water depth and wave heights and will protect the glacial till face from breaking waves.

The addition of sacrificial material such as shingle, is well-recognised worldwide as a coastal engineering solution. The net coastal sediment transport will go from south to north according to wind conditions and swell, therefore the material is likely to move towards the north in the medium and long term. The Cork Harbour Special Protection Area (SPA) is located to the south west of the site therefore the sacrificial material will not impact on the SPA.

Further details on these mitigation measures are provided in Chapter 13 ***Soils, Geology, Hydrogeology, Hydrology and Coastal Recession*** of this EIS.

4.5.17 Diversion of services

4.5.17.1 Diversion of services along the L2545 local road

The known underground services are a 450mm diameter watermain, 220kV electricity cables, 4 bar 125mm gas transmission main, public lighting cables, Eircom underground cables and Enet fibre optic cables. There is also an overhead electricity line crossing the road. There is only a marginal increase in road level (circa 100mm) at this location. The public lighting columns at the northern edge of the footpath, on the northern edge of the road, will have to be raised to match the new road level and the associated duct chambers will also be raised to match the new footpath level.

New Eircom ducting is proposed for the northern road verge to allow Eircom cables to be locally diverted within the road. The gas main will also be locally diverted within the road. The existing surface water drainage from the Haulbowline road will be diverted into the new surface water system as described above. The 450mm diameter watermain will also be diverted along the section of road to be raised between the car park and east of Hammond Lane. All of the utilities providers have been consulted in relation to the proposed diversions.

The 220kV power lines and corresponding ESB telecoms fibre optics cables beneath the L2545 may need to be raised as a result of the raising of the L2545. Both ESB Networks and EirGrid have been consulted in relation to the proposed works. ESB networks will carry out a thermocouple temperature study of the existing cables to determine if the power capacity of the cables will be derated because of the works. A number of potential solutions have been identified by ESB Networks if it is determined that the cables will be derated to an unacceptable level. The worst case option in terms of potential impacts would involve diverting the cables into new ducts laid at a higher level underneath the raised section of road. The existing cable would be cut and recovered over the section of the road that is being raised and reused in the new higher ducts. A short length of new cable would also be required. Three new joint bays would be required to allow the raised cable to be jointed back to the existing cables at either end and to join the short length of new cable to the recovered length of cable respectively.

Diversion works to the remaining services are not envisaged, however some protection measures like cover slabs may need to be employed during the construction phase. Refer to **Chapter 5 *Construction*** for further details.

4.5.17.2 Diversion of services within the Indaver site

Gas main

There is an existing underground 300m diameter 19Bar gas transmission main located within the site. The gas main is not currently supplying gas to any site. The gas main runs along the southern boundary of the site and then moves northwards through the site. The gasmain terminates at the existing Above Ground Installation (AGI) along the Haulbowline Road before the bridge to Rocky Island. Due to the nature of the proposed works, the gasmain will require to be diverted within the site. Gas Networks Ireland have been consulted in relation to the proposed diversion and have agreed on an indicative diversion route along the eastern boundary of the site. The indicative diversion route within the site is shown on planning drawings.

Overhead power lines

There is a 10kV power line located on an approximate north-south alignment in the eastern part of the site, adjacent to the Hammond Lane premises. This will require a diversion within the site. ESB Networks have been consulted in relation to the proposed diversion and have confirmed that an underground or over ground diversion is possible within the site. The indicative diversion route within the site is shown on the planning drawings.

There is another 10kV power line on an approximate north-south alignment adjacent to the western boundary of the western part of the site. This will not be impacted by the proposed development.

There is 38kV power line which enters the ESB Networks substation, adjacent to the Hammond Lane premises, from the southwest. This will not be impacted by the proposed development.

4.6 General Operations of the Waste-to-energy Facility

4.6.1 Operating hours

Subject to the necessary permissions, it is anticipated that construction of the Ringaskiddy facility will commence in 2017/2018. It is assumed that the peak construction period will occur in 2019. It is assumed that the facility will be operational in 2020.

It is anticipated that the facility will operate 24 hours per day, seven days per week, for an average of 8000 hours per year. There will be planned shutdowns for maintenance purposes. Waste acceptance will be limited to the hours 06.00 to 20.00 on week days and 09.00 to 14.00 on Saturdays. As detailed in **Chapter 7** (***Roads and Traffic***) operational waste deliveries will be restricted during the AM and PM peak periods (from 07.00-09.00 and 16.00-18.00 respectively).

The waste bunker will have sufficient capacity which will allow the acceptance of waste during shut downs and periods when there are no deliveries such as holiday periods and Bank Holidays.

A scheduled shut down for maintenance will take place once a year. Such a shutdown will be typically longer than 1 week, but less than 3 weeks. As these shutdowns will be planned it will be possible to organise an alternative outlet for the waste. Alternatives would be another waste incinerator or a landfill facility, depending on the type of waste and the availability of such facilities at the time. However, the facility will still take waste during a shutdown but at a reduced rate.

4.6.2 Scope

The waste-to-energy facility will have one furnace and flue gas cleaning line. The line will have a moving grate furnace with a state-of-the-art flue gas cleaning system.

The moving grate line will burn non-hazardous and suitable hazardous household, commercial, industrial and other suitable waste. The line will also be able to burn the residues from mechanical-biological treatment of waste, if these residues become available. The facility will have the capability to treat low risk hazardous wastes. Many of these can be found in municipal solid waste, (e.g. paint tins, rags and wipes contaminated with paints or oils), which are treated without difficulty on a grate furnace. Other streams would include “low hazard” materials from industry such as contaminated personal protective equipment/clothing, filters, absorbents, redundant over-the-counter preparations, medicines, and raw materials such as sugars, starches and gelatine tablet coatings. These streams are classified as hazardous in compliance with the European Waste Catalogue due to their chemical or physical properties. However, this does not imply that they are dangerous to handle (i.e. they may be handled by householders and businesses regularly). Refer to **Appendix 4.1** for a complete list of EWC codes proposed for the facility.

Heat will be recovered and converted to electricity. The incineration process will produce bottom ash, much of which will be suitable for recovery as daily cover for landfill sites or for recycling in civil engineering applications such as road construction. A small quantity of waste, which will require disposal in a landfill for hazardous waste, will be produced, primarily as a result of the flue gas cleaning process (see **Section 4.9**). This will be disposed of to a landfill for hazardous waste after treatment if necessary or to a salt mine, either in Ireland, if one is available, or abroad.

4.6.3 Moving grate furnace

The capacity of the moving grate furnace, in terms of the tonnage of waste per annum to be treated, will depend on the calorific value of the waste being burned and on the number of operating hours per annum of the facility.

The calorific value of municipal solid waste is variable. The experience from operating a similar facility in Meath, Ireland and Flanders, Belgium, is that the average calorific value of non-hazardous municipal solid waste in the bunker at any given time ranges from 6 – 16 MJ/Kg, with an average of circa 9.5 MJ/Kg.

The facility will be able to operate at 60 - 110% of its nominal capacity and the number of operating hours per annum of the facility is expected to be 8,000 hours. Regardless of the various permutations possible, it is proposed that the facility will not exceed an annual throughput of 240,000tpa.

4.7 Processes

The design of the proposed facility has been optimised to include the most up to date emissions control and flue gas cleaning technology. The waste-to-energy process will consist of a number of main process elements as follows:

- waste acceptance
- waste intake and storage
- combustion process
- energy recovery process
- flue gas cleaning.

4.7.1 Waste acceptance – general

Solid hazardous and non-hazardous waste will arrive at the site in a number of different waste vehicles including compactor trucks, skip trucks ejector trailers and walking floors, with all contents covered. All waste trucks entering the waste-to-energy facility will pass through a scanner to detect the presence of any radioactive elements. Radioactive waste will not be accepted in the facility. A truck found to be carrying radioactive waste will not be accepted for treatment.

Waste trucks will drive onto the weighbridge, located at the entrance. All trucks carrying waste, which enter and leave the facility, will be weighed. Drivers will present their documentation, relating to the waste load, to the staff in the security gatehouse. Some trucks, on long-term contracts, carrying non-hazardous waste, will access the facility using a swipe card, which will record their details. The drivers of these trucks will not have to report to the security offices.

Following completion of the waste acceptance procedures, the trucks carrying waste will proceed via the site road to the enclosed tipping hall.

Tankers of aqueous waste will be sampled and analysed prior to offloading into the aqueous waste storage tank or direct injection. This sampling may be done before or after arrival on site. If sampled and analysed on site, the sampling will be done in the aqueous waste unloading area adjacent to the aqueous waste storage tank. Key parameters will be analysed to ensure conformity with the specified waste acceptance criteria and with the parameters agreed with the customers. As a minimum, water content, pH, chlorine and calorific value will be checked for each aqueous waste load. In the event that the specification for the aqueous waste load is not met, then arrangements will be made for the dispatch of the tanker to the most suitable facility either in Ireland or abroad.

Access for sampling the tankers on site will be provided by an overhead gantry. This gantry will also facilitate operations associated with offloading the tanker.

4.7.2 Waste Handling

The waste handling and storage facilities for solid waste will consist of:

- the waste tipping hall
- the waste bunker with semi-automatic grab cranes
- waste hopper.

Waste handling and storage facilities for aqueous waste will consist of tanker offloading bays and the aqueous waste tank.

4.7.2.1 Waste tipping hall

Covered trucks containing solid waste will enter the supervised tipping hall and will be directed towards discharge chutes. The trucks will discharge the waste into the bunker through chutes in the wall of the waste tipping hall.

Effluent treatment facility sludge will be treated in the waste-to-energy facility. This material will have a moisture content of approximately 75% and will be handled in a similar manner to solid waste.

To prevent the egress of odours, the tipping hall will be maintained under negative pressure, i.e. air will be drawn in through any openings rather than escaping out. Air for combustion will be drawn from the tipping through the waste bunker. As the waste tipping hall will be an enclosed area, windborne litter will not be generated.

If for any reason the waste-to-energy facility is shut down, typically for 1or 2 weeks per year, the main fans for combustion air and flue gases will be kept in operation for as long as possible to maintain the tipping hall under negative pressure.

4.7.2.2 Waste Bunker

The bunker capacity has been chosen to allow the facility to accept waste during periods when the furnace is shut down for maintenance and also to allow the facility to continue operating over prolonged periods, such as long weekends, without deliveries. The floor of the bunker will be at 0.00mOD approximately, that is 10m below the floor level of the tipping hall. Mixed solid waste such as non-hazardous household, commercial and industrial waste, of the type the facility will treat, typically has a density of 0.3 to 0.5 tonnes/m^3, giving an approximate bunker capacity of circa 4,100 tonnes, or equivalent to circa 5 days operation of the facility.

Crane operators, positioned in the control room/crane operator room overlooking the bunker, will use travelling grab cranes to mix the waste in the bunker, so that despite the variety within the solid waste loads delivered, the feed to the furnace will be relatively uniform.

4.7.2.3 Waste Hopper

The lower section of the waste feeding chute will be double walled, with cooling water circulating in the cavity. There will be two grab cranes. The grab cranes will feed the mixed waste into the hopper~~s~~. The approach of the grab crane to the hopper opening will be controlled automatically by the facility's computerised control system. Once the operator has selected the option of placing the material held by the grab crane in the hopper, the crane will proceed to the hopper and discharge the material.

The grab crane will be designed to fit into the hopper so as to ensure that any bridging or blockage can be broken up or removed. The waste will then be discharged to the furnace from the hopper.

The waste will be moved forward from the hopper into the furnace using a ram mechanism. The waste plug in the chute will provide a seal between the high temperature furnace and the bunker. The volume of waste will be controlled by adjusting the stroke and the frequency of the ram.

4.7.2.4 Process Control within the Waste Bunker

The process of waste acceptance/delivery into the bunker and feeding into the hopper is closely controlled via the control room using visual control sensors in the bunker. The bunker will be continuously monitored by the operator, who will ensure that there will be adequate mixing of waste and will also monitor the bunker should any portion of the waste begin to smoulder. A lower explosive limit (LEL) detector will be installed in the waste bunker to monitor methane levels. The lower alarm level will alert the facility operators to the raised methane levels and the need to take corrective action.

The operator of the grab crane will ensure that the correct mix and volume of waste will be fed into the hopper~~s~~. The actual feeding of waste into the hopper will be controlled automatically, but under operator supervision. There will be monitors in the control room relaying pictures from CCTV cameras, which will allow the operator to observe the discharge of waste from the grab crane, the quantity of waste remaining in the hopper and also to observe any blockages in the hopper. Should the level of waste in the hopper drop to a pre-defined level, an alarm will sound in the control room to alert the grab crane operator to this fact. The temperature in the hoppers will be monitored continuously by the process control system.

The rate of feeding the waste to the furnace~~s~~ will be controlled by adjusting the ram on the hopper.

4.7.2.5 Process Control for aqueous waste storage and unloading

The aqueous waste storage tank will have a capacity of 250 m^3. The tank will be double walled and fabricated from mild steel.

When aqueous waste tankers will be unloaded into the aqueous waste tank, there will be close monitoring and supervision by an operator in the field and by the panel operator at the central control system. Level indication, oxygen monitoring and overflow protection will be provided in the tank. The empty space above the liquid level inside the tank will be kept under a constant nitrogen blanket. This is to ensure that an inert atmosphere will always be maintained inside the tank as there will be mixed solvents present in the incoming aqueous wastes.

The nitrogen blanket will be supplied by a nitrogen generator and nitrogen buffer storage vessel. The generator is essentially a molecular sieve that is fed with dry, oil-free air from the compressed air system on site. The generator and the buffer storage vessel will be located to the west of the aqueous waste tank. The buffer storage vessel will have a capacity of 5m^3.

During unloading operations from waste tankers into the tank, the headspace of both will be connected using a flexible hose. This will allow the displaced nitrogen from the storage tank to be exchanged with the tanker as it offloads. This will ensure that an inert atmosphere is maintained at all times and will keep air (and hence oxygen) out of the tank and incoming waste tankers.

Based on the demands of the plant and available storage capacity in the aqueous waste storage tank, once the specifications have been met, the aqueous waste will be offloaded into the storage tank or sent for direct injection to the furnace. The average feed rate to the furnace for direct injection will range from 0.5T per hour to 1.5 T per hour. The feed rate will be dependent on the calorific value of the waste and the prevailing conditions in the furnace at that time. If the tanker is offloaded directly to the storage tank, then this operation will take approximately 1 hour.

The stormwater drainage from the aqueous waste unloading area will be contained as described in Chapter 4.14.3.

In addition to the nitrogen blanket and oxygen monitoring in the tank, standard fire protection measures which will be employed for the protection of the aqueous waste tank. This will include a fixed, automatic deluge system fed by the fire ring main on site. In the unlikely event of a fire in the area, sprinkler heads fixed to the tank will activate to protect the tank. In the event that suitable tanker cleaning facilities are not available in the Cork area, tanker cleaning equipment will be installed. The equipment will consist of a series of pumps, and a small boiler unit used in conjunction with cleaning agents to wash out tankers and clean them for re-use. The equipment will be located on the south side on the main process building (directly north of the aqueous waste storage tank.

Once aqueous waste tankers have been emptied on site, then a cleaning head will be inserted into the top opening of the tanker from the gantry access platform. The tank will then be cleaned and the washings will either be re-circulated for another cleaning operation or unloaded to the aqueous waste storage tank.

4.7.3 Furnace

4.7.3.1 Moving Grate Furnace

A moving grate furnace is proposed for the facility. Refer to **Figure 4.12** for a schematic of its operation. The moving grate furnace will operate in a similar fashion to an escalator, pushing waste from the top of the furnace to the bottom to ensure complete combustion. An excess quantity of air will be drawn in through the furnace to ensure sufficient cooling of grate bars. The chosen technology is considered BAT.

The moving grate mechanism will transport the waste slowly from the feed point at the top of the furnace to the ash discharge at the bottom of the furnace. The rate at which the waste will travel through the furnace will be controlled to optimise the combustion. The residence time for waste in the furnace will be approximately one hour.

As the waste enters the hot furnace the material will be heated due to contact with the hot flue gases and radiated heat from the walls of the incinerator. The initial heat (temperature range of 50˚C to 100˚C), will drive off the moisture from the waste.

The next stage in the combustion process will be volatilisation, where the combustible gases and vapours will be driven off. The volatilisation stage will take place within the temperature range of 200˚C to 750˚C.

The volatile components of the organic material of municipal solid waste typically account for 70 to 90% of the flue gases, and are produced in the form of hydrogen, carbon monoxide, methane and ethane. The combustion of these volatiles will take place immediately above the surface of the waste and in the combustion chamber above the grate.

The volatile gases and vapours released will immediately ignite in the furnace due to the temperature of the furnace gas, which will be within the range 850˚C and 1,000˚C. Typical mean residence times of the gases and vapours in the combustion chamber will be 2 to 4 seconds. The final section of the grate will be the burnout section where the ash will be held for long enough to ensure sufficient burnout.

The grate will discharge the resultant bottom ash into a water bath/ wet de-slaggers, and then via a conveyor to an ash hall. Refer to **Section 4.14** for further information on ash handling and recovery of ferrous and non-ferrous metals.

Refer to **Appendix 4.2** for details on furnace start up and shut down procedures.

4.7.3.2 Combustion Air

Primary combustion air will be drawn from the reception hall and bunker by the primary air fan. Secondary combustion air will be drawn from the roof spaces above the furnaces and boilers, by the secondary air fan. The air in the roof space will be heated by convection and radiation.

4.7.3.3 Process Control of the Moving Grate Furnace

The control parameters to be monitored to optimise the conditions in the moving grate furnace will be as follows:

- Waste feed
- Burnout of waste in the furnace
- Temperature
- % O_2 in the flue gases
- concentration of CO in the flue gases
- concentration of NO_x in the flue gases
- Steam flow and pressure.

The addition of combustion air to the furnace will be controlled to ensure optimum operating conditions. The secondary air will be provided to assist in the combustion process, to provide mixing of the flue gases. The operating conditions will ensure complete combustion of the volatile gases. The induced air movement through the furnace will prevent the possibility of "flames" from the furnace entering the hopper. Air will also be used as a cooling source for the grate itself.

The burnout of waste in the furnace will be controlled by visual inspection of the flame front via cameras and monitors, and by automatic monitoring of the temperature in the last section of the furnace. The temperature will be controlled by the air supply rate and the waste feed rate. Light fuel oil will be used to bring the furnace up to the specified temperature of 850˚C prior to start-up of the waste feed.

The furnace temperature will be continuously monitored and controlled to ensure that this minimum temperature is maintained and supplementary firing with light fuel oil will be used if necessary.

The levels of O_2 and CO and the temperature in the flue gases will be monitored and the combustion air input optimised to ensure efficient and effective combustion.

The rate of waste feed will be controlled to maintain constant steam production at the desired temperature and pressure.

4.7.3.4 Inputs and Outputs to the Moving Grate Furnace

The inputs to the moving grate furnace will be mixed solid wastes, aqueous wastes, fuel and combustion air. The outputs will be combustion gases and bottom ash.

4.7.3.5 Emissions from the Furnace

There will be no emissions to the environment from the furnace during normal operations.

The furnace will normally be maintained under negative pressure. There will be a number of reasons why there might be excessive air pressure in the furnace, for example, a blockage downstream of the furnace in the flue gas treatment systems or the sudden increase in the calorific value of the waste. Pressure sensors in the furnace will detect the high pressure in the furnace. The computerised control system will increase the speed of the induced draught fan, which will control the velocity of the flue gases, to reduce the pressure in the furnace. If the fan reaches its full capacity without a corresponding drop in pressure in the furnace, the facility will automatically generate an alarm to reduce the waste feed. If there is a further increase in the pressure, the facility will automatically initiate a quick-stop sequence. The quick-stop sequence is described in **Appendix 4.3**.

In the moving grate furnace, there will be the possibility that a pressurised object, such as a large gas cylinder, would enter the furnace undetected in the waste feed. This could cause an explosion which could result in damage to the refractory brick lining of the furnace. The furnace will be designed to withstand such incidents and monitoring of the condition of the refractory bricks will be undertaken.

4.7.4 Control of Nitrogen Oxides (NOx) - Urea/Ammonia Solution Injection

4.7.4.1 Process Description

All combustion processes lead to the formation of nitrogen oxides (NOx). These substances are formed partly from combustion of the nitrogen fraction in the waste feed and partly from the oxidation of nitrogen in the combustion air. NOx formation will be controlled in two ways. Optimal combustion conditions in the furnace will minimise the oxidation of nitrogen in the combustion air. Mixing of the waste will also prevent localised high temperatures (and therefore higher NOx levels) in the furnace and cladding materials with suitable heat transfer properties will be used to give an optimal flue gas temperature. Secondly, in order to meet the strict NOx emission values set by the EU Industrial Emissions Directive 2010/75/EC, ‘De-NOx’ technology will be used.

This technology uses the reaction of ammonia and nitrogen oxides at high temperature to convert the nitrogen oxides to nitrogen and water vapour. This reaction will be achieved by the injection of either an ammonia solution or urea into the first section of the boiler. The urea, if used, will break down to form ammonia due to the temperature (approximately 900°C). The ammonia will then react with NOx to produce nitrogen and water. Throughout this process the NOx levels will be monitored to optimise the quantity of ammonia solution/urea injected and ensure that emission values will be well within the EU NOx emission limits.

This technology of ammonia solution/urea injection is known as Selective Non Catalytic Reduction (SNCR). SNCR is a proven technology and experience has shown that it will attain the daily NOx emission limit of 200 mg/Nm^3. Typical NOx emissions from the proposed facility will be well below this Industrial Emissions Directive emission limit. The impact of the NOx emissions is addressed in **Chapter 8 *Air Quality*** of this EIS.

4.7.4.2 Process Control for the Urea/Ammonia Injection

The ammonia solution or urea will be injected into the first section of the boiler at a controlled rate, which will be based on the NOx concentration and flue gas flow measured continuously in the stack.

4.7.4.3 Emissions from the Urea/Ammonia Injection

There will be no emissions to the environment from the urea/ammonia injection system.

4.7.4.4 Inputs and Outputs

The inputs to the system will be flue gases and ammonia solution or urea. The output will be cleaned flue gases and nitrogen.

4.8 Energy Recovery

4.8.1 Waste Heat Boiler

4.8.1.1 Process Description

Technology has improved in recent years and energy recovery has become very efficient for waste to energy facilities. The aim of this facility is to generate 21MWh of electricity for use in approximately 30,000 homes. To achieve this the following is proposed.

The thermal energy generated by burning the waste in the furnaces will be transformed into electricity using a conventional steam cycle. This will consist of a boiler to generate steam, a steam turbine across which the steam will be expanded to produce motive power and a condenser to condense the steam and dissipate the low-grade waste heat.

The steam boiler will operate to 40 bar and 400°C, the standard steam parameters for electricity generation from waste incineration.

The boiler outlet temperature for the proposed development will be 180°C and is considered BAT. Such a temperature is required for the evaporation of excess water in the process and the minimisation or avoidance of liquid effluent.

The boiler will consist of a number of empty passes and a final pass with tube bundles. The empty flue gas passes will be constructed from membrane walls without obstructions such as tube banks. The empty passes will allow heat transfer from the flue gas to the evaporating water in the membrane walls mainly by radiation. There will be no tube bundles in this section of the boiler as the fly ash will be sticky at temperatures above 650ºC, and would quickly deposit on, and foul the surfaces.

For the grate furnace the large empty first pass will allow sufficient time at high temperature to complete combustion. The lower part of the first pass will be refractory lined to avoid corrosion and to provide thermal insulation close to the furnace. The refractory lined part of the first pass of the boiler will be designed to ensure that the specified minimum residence time, temperature and oxygen content, after the last air/fuel injection, will be maintained, to ensure compliance with the Industrial Emissions Directive.

The flue gases, (combustion gases leaving the 1st boiler pass) will then pass through three further stages containing heat exchangers (refer to **Figure 4.13**):

- Evaporator – The evaporator will evaporate the boiler water to form wet steam at 45 bar gauge, 260°C.
- Superheater – This will heat the wet steam to form superheated steam at about 41 bar gauge, 400°C.
- Economiser – This will preheat the boiler feed water to about 220°C, in order to recover more heat from the flue gas.

The primary purpose of the steam boiler/economiser will be to exchange heat between the flue gas and the water/steam circuit, which will produce steam for power generation.

Some 85% of the energy produced by the combustion of waste will be recovered as steam in the boiler. This is somewhat lower than with a power facility for the following reasons:

- The flue gases from the incineration process will contain corrosive elements, which would attack the boiler components if steam were to be recovered over a wider temperature range, either at higher temperatures or at lower temperatures.
- Variation in waste parameters requires a higher amount of unused air passing through the stack and hence greater heat losses compared to that of a power facility for instance, where excess oxygen is typically 1 to 3% vol.

De Novo-synthesis, that is the reformation of dioxins, has the potential to occur over the temperature range 450˚C to 250˚C during cooling in the latter stages of the boiler. In order to minimise the formation of dioxins the following design measures will be implemented:

- Automatic controlled cleaning, by mean of fixed installed cleaning devices, of heat transfer surfaces to reduce the amount of metals, particularly copper, present which can act as a catalyst in the formation of dioxins.
- Rapid cooling over the range 450˚C to 250˚C by increasing the velocity of the flue gases through the section of the boiler where cooling over this temperature range will occur. This increase in velocity will accelerate heat transfer and cool the gases more rapidly. The total residence time of the gases in the boiler will be approximately 30 seconds.

As with all boiler facilities it is necessary to treat the feed water to the boiler to a high level of purity. A demineralisation facility will be provided for this purpose to meet a demineralised water demand of the order of 25 m^3/day. An equivalent volume of water will then be purged from the boiler to prevent the build-up of salts in the steam circuit. This purge is often referred to as ‘boiler blow down’. This blow down will be re-used back in the process. Small quantities of boiler treatment chemicals will be added to the boiler feed water to prevent corrosion and scale build up in the steam circuit.

4.8.1.2 Process Control for the Boiler

The steam flow will be controlled by valves, which will control the flow of the steam to the turbine according to a specified load or other operating conditions. The system will be equipped with stop valves, which will interrupt the steam flow if the operating conditions fall outside pre-set levels.

4.8.1.3 Emissions from the Boiler and Condenser

A small quantity of water will be purged constantly from the system and replaced with fresh make up water. This blow down will be recycled for re-use in the process. There will be no other emissions from the boiler and condenser.

4.8.1.4 Inputs and Outputs

The inputs into the boiler will be hot flue gases and boiler feed water and the outputs will be cooler flue gases, boiler ash and superheated steam. Refer to **Section 4.13.3** for details of the boiler ash. In addition, some small amounts of boiler treatment chemicals will be added to the boiler feed water to prevent corrosion and scale build up in the steam circuit.

4.8.2 Steam Turbine

4.8.2.1 Process Description

In the proposed facility, the steam from the boiler will be expanded in a single steam turbine down to a pressure of 0.1 bar absolute (see **Figure 4.14**). This low pressure will maximise the energy recovery from the turbine, which will be used to drive the generator set and give a total electrical output of approximately 21MW. As approximately 2.5 MW is required for electrical demand within the facility, the net electrical output will be approximately 18.5 MW.

The wet steam (about 11% will be condensed in the turbine) from the turbine will exit at a temperature of approximately 50˚C and will be further condensed in an air-cooled condenser. This will maintain the low pressure at the turbine exhaust and dissipate the waste heat into the air via banks of heat exchangers similar to a car radiator. The air-cooled condensers will reduce the water requirement of the facility, as no cooling water will be required.

The condensate will be collected in a tank, from where it will be pumped to the boiler feed water tank for recirculation to the boiler.

The electrical generator will be cooled using a smaller air cooler, with oil as the heat transfer fluid and water in a closed circuit as cooling source.

4.8.2.2 Process Control for the Steam Turbine

There will be a steam bypass to the condenser, which will be used during start up and in the event of a failure of the steam turbine. The steam pipes will be provided with pressure relief valves, which will automatically activate in the unlikely event of the steam pressure exceeding a set level.

The turbine will control the steam coming from the boiler by changing its rotation speed. The turbine hence ‘follows’ the steam production from the boiler.

Alarms, controls and measurements from the steam turbine control and protection system will be relayed to the main facility control system, so that the operation of the turbine can be best monitored and controlled from the central control room.

4.8.2.3 Process Emissions from the Turbine

There will be no emissions from the turbine or generator set.

4.8.2.4 Inputs and Outputs

The inputs into the turbine will be superheated steam, and the outputs will be lower grade steam taps mentioned above for application in the process and low pressure steam which will go to the condenser. The turbine will drive the generator set, which will produce electricity for facility consumption and export to the national electricity grid, approximately 21MW.

4.9 Flue Gas Treatment

4.9.1 General

The flue gas treatment system has been designed to ensure compliance with the emission limits specified in the EU Industrial Emissions Directive 2010/75/EC. The flue gas treatment equipment proposed is a ‘semi dry’ system. The ‘semi dry’ system would comprise a cooling section, a dry reactor and a bag house filter.

4.9.2 Cooling section

4.9.2.1 Process Description

The flue gas leaving the boiler will still be relatively hot at approximately 180˚C and will be further cooled in the cooling section to a temperature of about 145˚C. The lower temperature is required for the optimal operation of the lime and activated carbon or clay injection downstream. The cooling section will be essentially an enlarged flue gas duct with either a flue gas / hot water heat exchanger or a water quench.

An activated carbon or carbon/clay mixture will also be injected as a first stage dioxin removal step. The process description and control is described in Sections 4.9.3.1 and 4.9.3.2 below.

In the subsequent dry reactor, lime, reactivated flue gas cleaning residue and activated carbon or clay will be injected.

4.9.2.2 Process Control for the Cooling section

The temperature of the flue gases leaving the cooling section will be monitored and maintained at the required temperature of about 145˚C by controlling the rate at which the water is sprayed directly in the flue gas process control for the dry reactor or the heat exchanged in the flue gas/ hot water heat exchanger

The rate of lime injection in the dry reactor will be dependent on the acid concentration in the flue gases measured in the stack and upstream after the boiler. The flue gases will enter the top (or bottom) of the reactor by forced draft and will travel downwards (or upwards), through the cloud of lime, reactivated flue gas cleaning residue and activated carbon or carbon/clay mixture. The added re-agents and dust entrained in the flue gases will be collected in the baghouse filter. Part of the residue from the bag filter will be reactivated and returned to the reactor to obtain a better use of the lime. The remainder of the residue will be sent as solid wastes for offsite disposal (refer to **Section 4.13.1**).

4.9.2.3 Emissions from the Cooling section

There will be no emissions from the cooling section.

4.9.2.4 Inputs and Outputs

The inputs to the cooling section and dry reactor will be flue gases, water, lime, recirculated flue gas cleaning residue and activated carbon or clay. The outputs will be cooled clean flue gas, water vapour and reaction salts. The quantity of solid residues collected at the bottom of the reactor will be negligible.

4.9.3 Activated Carbon/Clay Injection and Baghouse Filter

4.9.3.1 Process Description

Dioxins and furans are complex chlorinated hydrocarbon molecules, which are formed as a consequence of any combustion process. As described previously the facility is designed to minimise the reformation of dioxins and furans (the term ‘dioxin’ is taken to include dioxins and furans), by maintaining the flue gases at a high temperature of over 850˚C for over 2 seconds in the furnace and by rapidly cooling the gases from 450˚C to 250˚C. These measures will reduce the dioxin concentration in the flue gases to a low level. The flue gas cleaning equipment will reduce dioxin concentrations in the flue gas to levels well below the limit set in the Industrial Emissions Directive. Typical emissions from a facility with this equipment are 0.01ng TEQ/m^3 (0.000,000,000,01g TEQ/m^3).

A fixed amount of activated carbon or a carbon/clay mixture will be injected in two places. The first will be into the flue gases in the cooling stage and the second into the flue gas either in the dry reactor or just after it. Activated carbon consists of small, porous carbon particles, which due to their porosity have a very large surface area. The large surface area will adsorb heavy metals and trace levels of organics present in the flue gas, such as dioxins, furans, Polycyclic Aromatic Hydrocarbons (PAHs) and hydrocarbons. These carbon granules and other particulates, such as dust, will then be removed by filtration as the flue gases pass through the baghouse filter. The activated carbon/clay mixture will work in a similar manner to activated carbon and the activated carbon/clay mixture will contain a minimum of 10 % activated carbon. This is to ensure the adsorption of heavy metals and mercury.

The dosing of the activated carbon or carbon/clay mixture will have redundancy built in, starting from the bottom extraction point of the storage silo and ending at the injection point in the flue gas flow. This means that each of the two injection points will have two lines running towards it so that one is always available. It will be possible to run both lines simultaneously and the control of the dosing flow will be doubled.

The baghouse filter will contain multiple filter bags in separate compartments. The separate compartments will allow for maintenance and changing of filter bags whilst the filter is on-line. The dust laden flue gases will be sucked from the outside (foul side) to the inside (clean side) of the filter bags leaving a dust cake on the outside of the bags. The pressure drop over the bags will increase as more dust accumulates. A reverse pulse of clean compressed air will be blown inside the bag as soon as a preset pressure drop set-point is reached. The airwave will inflate the bag and make the carbon and particulates on the outside crack and fall into collection hoppers below.

The dust cake will consist primarily of fly ash carried over from the boiler, reaction salt from the flue gas pollutants with lime, excess lime and activated carbon or clay.

4.9.3.2 Process Control

The activated carbon or carbon/clay mixture will be injected at a fixed rate controlled by a volumetric dosing screw. This fixed rate will be based on operating experience of the Indaver's incineration facilities in Meath and Belgium. The rate of dosing will allow for the maximum reduction in emissions.

The weight of the activated carbon or carbon/clay feed bin will be monitored continuously to ensure that dosing is continual. Should the weight of the feed bin remain steady, which would indicate that the feed to the process had stopped, an alarm will be activated in the process control room.

The pressure drop over the bags will be monitored continuously. The removal of carbon and particulates from the bags will be controlled on defined pressure set-points. The baghouse filter will have one redundant compartment.

4.9.3.3 Emissions

Activated carbon or clay will be stored in a silo fitted with a high efficiency particulate air (HEPA) filter. Residues will be transferred from the baghouse filter to an enclosed silo fitted with a HEPA filter by an enclosed conveyor with the process building. Both handling systems will prevent dust or carbon emissions to the atmosphere from the activated carbon or clay injection or baghouse filter stages. Therefore the only emission will be filtered air from the storage silos and such emissions will only occur when the silos are being filled.

4.9.3.4 Inputs and Outputs

The inputs from this stage of the process will be the activated carbon/clay/lime. The outputs will be flue gases and flue gas cleaning residues.

4.10 Waste-to-Energy Facility Control System

4.10.1 Control Room

The control room will be located above the bunker. From here crane operators will visually inspect the waste and, using a grab and automated transfer system, will control waste entering the furnaces from the bunker.

The facility's automated computer system will be controlled and monitored from here. Emissions data from the emissions monitoring station located on the stack will also be monitored here.

4.10.2 Automated Control System

The facility will be controlled by an interface computer system (screens, keyboard, and printers). The system will monitor all the parameters and measurements required in order to have a good overview of facility performance. It will execute facility control loops, report low-level and high-level alarms and will control different levels of safety interlocking.

The control system will include the following measurement equipment:

- air flows (primary, secondary, wall cooling if any, recirculation if any) in each section of the different injection systems;
- temperatures and pressures of all flows;
- furnace temperatures;
- temperature in the burn-out section
- flue gas temperature at the roof of the first boiler pass (for verification of burning at a minimum temperature of 850°C for 2 seconds);
- oxygen content of the flue gas at boiler outlet;
- temperature of the flue gases at the roof of the first boiler pass (triple measurement); and
- temperature at outlet of the boiler.

Flue gas emission monitoring is described in **Section 4.11** below.

Minimum control parameters will include the steam rate, temperature in the post combustion chamber, waste throughput, NOx-content and O_2-content. The control system will use these parameters to control the various inputs into the furnace.

The system will include the following operating modes:

- Full automatic control under normal operating conditions where minimum control parameters can be set for the system, such as steam or waste flow and temperature. In this mode no intervention on the response characteristic of the control should be required or be made available to the operator.
- Safe manual control where different input flows can be set for the system, with system protections and interlocks operating normally. This mode will be required for starting and shutdown, and when reacting to variations in operating conditions, such as extreme fuel variations. When switching from

the full automatic mode to safe manual control mode due to an operational situation beyond the limits of the control loop, the operator will be guided by the control system.

- Maintenance mode where either the automatic or manual control mode will be in operation but with control system parameters, alarm settings and interlocks available to the operator for optimisation. This mode will be protected by means of keys and/or passwords.

The control system will be assisted by:

- A visual check of the combustion process by means of one or more colour cameras on the furnace;
- An on-screen indication of the position of the current waste treatment and energy production of the furnace;
- Operational procedures which will be in place for reaction to low-level alarms or when the facility is not running to full capacity.

Operational procedures will be in place for normal operations, start up, controlled shut down and automatic shutdown.

The facility is protected by an interlock system, which is described in **Appendix 4.2**.

4.11 Emissions Monitoring

The Industrial Emissions Directive 2010/75/EC requires continuous monitoring of specific parameters and regular sampling of dioxins present in the flue gases prior to discharge from the stack to ensure compliance with emission limit values.

The facility will be licensed by the EPA, which will specify the environmental monitoring that must be performed. Sample points will be accessible to EPA personnel for their independent inspection and monitoring programme.

4.11.1 Continuous Monitoring of Flue Gases

The furnace and gas cleaning facility will be operated under negative pressure generated by the induced draft fan located adjacent to the stack. This will ensure that the only emissions from the facility will be those fully treated by the flue gas cleaning system and discharged through the stack.

Flue gas monitoring equipment will be installed to monitor emissions. The equipment will consist of continuous monitors and regular grab sampling according to the specifications laid down in EU and Irish legislation for incineration facilities.

The following parameters will be continuously measured in the stack: total dust, TOC, HCl, HF, SO_2, NO_x, CO, temperature and O_2. These continuous measurements will be accessible in ‘real time’ in the control room.

There will also be regular monitoring for heavy metals Cadmium, Thallium, Mercury, Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel, Vanadium and Tin.

The emission values will be relayed to both the control room, where the operators will have 24 hour access to this information and will be able react if necessary, and to the QESH (Quality, Environmental, Health & Safety) Department where they will be monitored for compliance with the relevant half-hourly, daily and monthly averages.

All monitoring equipment will be certified by an independent certification company and will adhere to the relevant standards. The company used will ensure the reliability, safety and quality of the equipment.

Preventive maintenance contracts will be put in place with the equipment suppliers who will also be able to provide a 24-hour call out service. Calibration of equipment will be carried out as per supplier recommendations. Calibration by means of parallel measurement is conducted at least annually in Indaver facilities in Meath and Belgium and this practice will also be applied at the proposed facility. The monitoring equipment will also have auto calibration capabilities where possible.

There will also be back-up monitoring equipment available for use during maintenance and calibration.

4.11.2 Continuous Sampling of Dioxin Emissions

Although it is not a requirement of EU or Irish legislation, the monitoring equipment will include a state of the art continuous dioxin sampler.

Due to the very low levels of dioxins in the flue gases leaving the stack, no proven technology is currently available, which is capable of providing continuous monitoring. The continuous dioxin sampler will allow the dioxin emissions to be sampled continuously. A dioxin filter will be placed in the stack to collect dioxin emissions on a fortnightly basis. This will then be removed and analysed in an independent laboratory. Laboratory testing of the samples will give dioxin emission concentrations and mass emission rates over a two-week period. This equipment is in use in existing Indaver facilities such as the Waste-to-Energy facility in Meath.

The monitoring and sampling systems proposed are considered BAT for compliance with emission limit values set down in EU Directive 2010/75/EC.

4.12 Process Inputs

The major input to the process is waste for incineration. Other inputs include water, light fuel oil and reagents such as lime and activated carbon.

4.12.1 Waste

Waste inputs are described and quantified in **Section 4.7** above.

4.12.2 Water Supply and Use

As the facility uses an air cooled condenser rather than cooling towers it will have a significantly lower water requirement than would otherwise be the case. The major water requirement will be for flue gas cleaning due to cooling by direct water injection and the wet de-slagger. Process water (for the steam cycle), domestic potable water and water for cleaning account for the rest of the demand. The expected water requirements are listed in the following **Table 4.4**.

Table 4.4 Water Requirement

Use	**(m^3/hr)**
Flue gas cleaning	2.88
Process (steam cycle)	1.0
Domestic supplies	0.27
Cleaning	1.0
Fire fighting	0.2
Total	**5.4**

The water requirement will be supplied from the Irish Water water main in the road. Refer to **Section 4.15.1**.

4.12.3 Support Fuel

The facility will use light fuel oil at start up to bring the furnace to the required operating temperature of 850˚C’. Light fuel oil may also be occasionally required as a supplementary fuel to maintain the temperature if waste of an exceptionally low calorific value is received. An automatic control system will bring light fuel oil on line should the temperature drop below 850˚C. It will also be required for operation of the emergency power generator. It is estimated that 400 tonnes of light fuel oil will be used per annum to raise the temperature at start up and maintain it as required.

This light fuel oil will be supplied from an on-site storage tank.

4.12.4 Other Inputs

Other inputs included sodium hydroxide (NaOH) 50% solution, and hydrogen chloride (HCl) 30% solution in the demineralisation facility, ammonium hydroxide (NH_4OH) and sodium phosphate Na_3PO_4 for the boiler feed water, lime, activated carbon and clay in the flue gas cleaning and urea/ammonia in the de-NOx stage.

The quantities of inputs will vary, depending on the calorific value of the waste and the flue gas cleaning equipment chosen. Estimated hourly consumption is indicated in **Table 4.5** below.

Table 4.5 Estimate Hourly Consumption of Inputs

	(kg/hr)
Lime	304
NaOH (50%)	4.0
HCl (30%)	5.0
Ammonia (25%)	104
Or Urea	65

(as alternative to ammonia)	
Activated Carbon	16
Clay/Carbon mixture (as alternative to Activated carbon)	20

4.13 Process Outputs

4.13.1 Solid Waste Residues

There will be three solid residues from the waste-to-energy facility:

- Bottom Ash
- Boiler Ash
- Flue Gas Cleaning Residues.

Ferrous and non-ferrous metals will be recovered from the bottom ash. The types and approximate quantities of ash and residues expected to be produced from the waste-to-energy process are detailed below.

The classification of the residues as hazardous or not will be made by reference to the classification set out in the European Waste Catalogue (EWC). If the residue does not contain the properties listed in H1 to H15 of the 'Waste Catalogue and Hazardous Waste List', and Annex III of the Waste Framework Directive 2008/98/EC, it will be non-hazardous. A suite of analyses will be carried out on the residue and the results will be compared with the requirements of the Directive.

A separate suite of analyses, including leachate testing, of the residue is required to determine the type of landfill, to which it should be disposed. This will ultimately determine if the residue is suitable for disposal to a non-hazardous landfill in accordance with the Landfill Directive (99/31/EC), the Waste Framework Directive 2008/98/EC and the Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

Leachate is the aqueous effluent produced by rainwater on landfill sites and generally contains a high concentration of dissolved solids. A leachate test involves filtering water through ash and then analysing the water properties.

4.13.2 Bottom Ash

The bottom ash will be at a high temperature when it exits the furnace. The bottom ash from the grate will be discharged into a water bath, and then via a conveyor to the ash hall. This process will take place within the building. Refer to **Figure 4.15** for a schematic of the ash handling operations.

The bottom ash will consist of silicates, minerals, metal pieces and glass compounds. Ferrous metals, e.g. scrap steel, and non-ferrous metals, will be recovered from the moving grate bottom ash during transfer to the ash hall. A metal separator (over-band rotating magnet) and a non-ferrous metal inductive separator, located on and after the last conveyor before the bottom ash bunker, will remove ferrous metal and non-ferrous metals and transfer them to separate compartments of the ash hall. The ash hall bunker will have the capacity to store the equivalent of 10 days of ash. Ash will be transferred from the bunker to collection trucks using a front end loader. All trucks leaving the facility will be securely covered to prevent any ash escaping from the trucks.

From experience of operating similar facilities in Meath Ireland and Flanders, Belgium, it is anticipated that the bottom ash will be non-hazardous. The bottom ash from the Meath waste-to-energy facility has been classified as non-hazardous and non-toxic to the aquatic environment according to EPA methodology and Commission Regulation (EU) No 1357/2014 and Commission Decision 2014/955/EU. The bottom ash has been tested since 2011 and to date there has been no change in the classification.

Bottom ash from waste incineration in EU countries, including Belgium, is widely used in civil engineering applications such as road construction. Although there are no Irish or European legislation or standards governing the quality of ash for use in roads, if the ash is to be used for road construction it must generally be of better quality than if it were to be disposed of in landfill. This improvement in quality can be achieved by treating the ash in an ash recovery facility. This option for the recovery of bottom ash is discussed in **Chapter 15 *Material Assets*** of this EIS**.**

If an ash recovery facility is constructed in Ireland it would be the intention of Indaver to proactively identify potential uses for the bottom ash. If no market can be found for the bottom ash, it will be sent off-site of to a suitably licensed landfill for non-hazardous waste.

4.13.3 Boiler Ash

About 1-2% by weight of the waste input will be collected as boiler ash. The boiler ash will consist of compounds that will be carried over in vapour or particulate form from the combustion chamber. Boiler ash will be separately collected and stored in accordance with BAT. Residues will be removed from the boiler by an enclosed conveyor system and transferred to a silo located within the building. The silos will be fitted with HEPA filters to prevent dust emissions. The boiler ash will be transferred to a specialised collection truck which will have an enclosed container. One boiler ash silo of approximately 100m^3 will have the capacity to store the equivalent of 10 days of residue. Refer to **Figure 4.15** for a schematic of the ash handling operations. Boiler Ash will be treated in the same way as flue gas residues and sent to a landfill for hazardous waste or to salt mines.

4.13.4 Flue Gas Cleaning Residues

The flue gas cleaning residues will be approximately 4-5% by weight of the waste input. This material will contain particulates which were not collected in the boiler ash. It will also contain spent activated carbon or clay.

Flue gas cleaning residues will be removed from the baghouse filter by an enclosed conveyor system and transferred to silos located within the enclosed building. There will be two silos with a combined capacity of between 360m^3 and 540m^3. This will provide approximately 10 days storage capacity of residue. The silos will be fitted with HEPA filters to prevent dust emissions. These residues will be transferred to a specialised collection truck which will have an enclosed container. The truck will be parked alongside the building and the silo will be connected to the container opening prior to discharge of the residues. There is no prerequisite to solidify these residues prior to transport off-site. Refer to **Figure 4.15** for a schematic of the ash handling operations.

Due to their leachate characteristics it is expected that these residues will be classified as requiring disposal in a landfill for hazardous waste.

If such a facility is available in Ireland, then the residues may be pre-treated on site prior to dispatch. The pre-treatment process will consist of a simple batch mixer which will mix water with the residues and then discharge into 1m^3 FIBC bags to solidify prior to dispatch off-site. The equipment will be located close to the flue gas residue silos within the main process building on the south side. The solidification process will take between 4 and 6 hours.

The bags will then be loaded directly onto trailers and sent off site for treatment. If this option is available, then there will be approximately 77 additional traffic movements per year (due to the addition of water to the residues) which has been accounted for in the traffic assessment in **Chapter 7, *Roads and Traffic*** of this EIS.

Indaver is working with private partners to develop potential outlet options on the island of Ireland and although it is an objective of the EPA National Hazardous Waste Management Plan (2014 - 2020) to develop landfill capacity for hazardous waste in Ireland, there is currently no such capacity. Until such landfill capacity is developed in Ireland, the flue gas cleaning residues will be exported for final disposal. In this case, the residues will be treated at the disposal site to immobilise any components which have the potential to leach.

Indaver has over 20 years' experience of sourcing suitable outlets, both in Ireland and abroad, for the disposal of hazardous waste. Indaver also operates its own landfill for hazardous waste in Antwerp, Belgium. Similar residues from Indaver's Meath facility are currently being shipped to salt mines in Germany where the residues are solidified and used to back-fill the mine instead of using other raw materials.

The quantities of ash and residues will vary, depending on the calorific value of the waste, the pollutants in the waste and the flue gas cleaning equipment chosen. Estimate quantities are indicated in **Table 4.6** below.

Table 4.6 Estimated Quantities of Residue and Recovered Metals

Material	(kg/h)
Bottom Ash (incl. 15 % moist) (Non-Hazardous for disposal)	6583
Boiler Ash (Hazardous for disposal)	250
Flue Gas Cleaning Residues (Hazardous for disposal)	1138
Ferrous metals	300
Non-ferrous metals	30

4.13.5 Electricity

The waste-to-energy facility will generate 21MW of electrical energy produced by the combustion of the waste, of which 2.5MW will be used by the facility itself with the remainder, approximately 18.5 MW being exported to the national grid. This will supply 150 GWh of electricity per annum, which will contribute to reducing Ireland's greenhouse gas emissions. Refer to **Chapter 9 *Climate*** of this EIS. Enough electricity will be exported to power 30,000 homes annually.

4.13.6 Heat Balance

Depending on the calorific value of the waste, the heat balance will vary slightly. The expected heat balance is outlined below. Refer also to **Figure 4.16**.

Heat loss by radiation from hot equipment (furnace, boiler, steam cycle) will be approximately 2 MW (2%). This heat, while not recovered, will heat the building. It will be emitted to atmosphere through the natural draught of the building ventilation system.

The expected internal heat recovery (waste to steam) for the facility will be 66.7MW.

66.7 MW steam will enter the turbine at a pressure of 40bar and a temperature of 400˚C. This steam will be converted to 21 MW of electricity and 45.7 MW of hot air which will be dissipated by the air cooled condenser. 7.8 MW steam at lower pressure will be extracted from the steam turbine for internal use.

Steam will leave the turbine at a pressure of 0.10 bar, a temperature of 46 ˚C and only 11% condensed. The remaining 89% of the steam will be condensed in the air condensers using an indirect cooling system. Therefore the steam will be condensed in a closed loop and ambient air will be heated.

The remaining 11.3 MW of heat will be released from the boiler to the flue gas cleaning system and will be emitted via the stack and through insulation heat loss. This heat is not expected to have any impact on the site or surrounding area.

4.13.7 Energy Efficiency

The electrical generation efficiency of this design will be about 25%, which is low compared with efficiencies of about 37% that can be achieved with coal burning technology or about 57% with modern natural gas combined cycle gas turbine facilities. However, the principal function of the technology is to reduce the volume of waste going to landfill rather than to generate electricity efficiently. The electrical generation efficiency of the proposed facility is high for a waste-to-energy facility.

A number of options are being investigated by suppliers to improve the energy recovery of waste incineration. One of these options is the use of external superheaters that boost the temperature and pressure of the steam from the boiler. However these technologies are not proven in waste-to-energy context and do not have an economical payback as they require additional fossil fuel, and thus have not been considered for this facility.

A number of novel technologies for the use of the low-grade heat available from waste incineration are at the research stage. These include the Kalina cycle, an ammonia and water based system, and the upgrade of gas turbine fuel (synthesis gas) by chemical change. These technologies are however still in the development stage and thus have not been considered for this facility.

Ireland is required, under EU Directive 2009/28/EC, to ensure that by 2020 at least 20% of all energy consumed in the State is from renewable sources. Incineration with energy recovery of the biodegradable fraction of non-hazardous waste results in production of renewable energy. This is addressed in more detail in **Chapter 2 *Planning and Policy Framework and Need for the Scheme*** of this EIS.

4.14 Description of Secondary Process/Activities

4.14.1 Emergency Generator

The proposed facility will have a sophisticated control system and back-up system for protection against events which could have the potential to damage the facility, human health or the environment. In the event of a power cut the facility will automatically go into island mode and run independently from the grid, where the turbine is ramped down to provide only house load to the facility and no export. If the turbine is then to shut down while in island mode the complete facility will go into shutdown. During automatic shutdown waste will be prevented from entering the furnace and most electrical /electronic equipment, motors and fans will cease operating except those required to cool the facility and provide emergency lighting. In the event of a power cut, however, these critical motors and fans will require an emergency power supply. This will be provided with a backup or emergency electrical generator powered by a diesel motor.

The backup generator will be tested weekly for approximately 1hour but only used during automatic shutdowns or power cuts.

4.14.2 Un-interruptible Power Supply

The emergency generator will start-up within seconds after the detection of a power cut but not quickly enough to completely avoid an interruption of power supply. Hence, in the unlikely event of a failure of the supply from the electrical distribution system, the facility's un-interruptible power supply (UPS) will supply electricity to the critical systems, such as the facility control and computer systems. The UPS will be designed to maintain a power supply to the control systems until the emergency generator comes on line for a maximum of 30mins.

4.14.3 Waste-to-Energy Facility Water Management

4.14.3.1 Waste-to-Energy Facility Storm Water Management

The eastern part of the resource recovery facility, when constructed, will form a rainwater catchment area of 3ha consisting of roofed areas, roads and hard standings. The storm water runoff will be discharged to the Local Authority sewer located in the L2545 road to the north of the site.

In order to prevent flooding of the local sewers the rate of discharge from the site will be controlled to the greenfield rate, based on the SUDS Design Guidelines. The site will be provided with attenuation to store and control the storm water discharge. The attenuation storage capacity will be sufficient for a 1 in 30 year storm over a 24 hour period allowing for 10% for climate change, having a greenfield discharge rate of 18l/s.

The storm water from all of the roads and hard standings will be conveyed via a class 1 hydrocarbon interceptor to the fire water retention tank, which is indicated as tank no. 1 on the drainage drawings. The fire water retention tank will have a capacity of 1690m^3. **Refer to Figure 4.18**.

The storm water from the roofs of all of the buildings will be conveyed to the surface water attenuation tank, which is indicated as tank no. 2 on the drainage drawings. The surface water attenuation tank will have a capacity of 1250m^3.

The tanker unloading area, which is located adjacent to the fuel tank, will be provided with cut off drains to collect any spillage that may occur during loading or unloading. A local holding tank with a 2m^3 capacity will be provided. The outlet valve of the local holding tank will be closed during any tanker unloading operation. If a spillage occurs during a loading or unloading operation, the spilled liquid will be collected in the local holding tank. The contents of the tank will then be pumped out and dealt with appropriately. When the unloading operation has finished, if no spillage has occurred, the valve will be opened and the contents of the tank will drain via a forecourt interceptor to the fire water retention tank.

The surface water attenuation tank and the fire water retention tank will be constructed from reinforced concrete and will be located beside each other beneath the staff car park, which is adjacent to the administration building.

4.14.3.2 Drainage of Other Areas

Fill will be placed in the western field to raise the ground level. The surface finish to the fill will be crushed stone which is very porous. Rainwater will pass down through the stone before infiltrating into the ground matching the existing drainage regime in the Western Field.

A new infiltration trench will be located at the toe of the embankment for the raised surface to aid with the infiltration.

The storm water drainage in the L2545 road will be improved as part of the road upgrade works as described in Section 4.5.14 above.

4.14.3.3 Storm Water Monitoring

The outlet from the fire water retention tank, into which the storm water run-off from the hardstanding areas and roads will drain, will be continuously monitored. If the monitoring detects that the contents of the tank are within the limits set by the operating licence, the contents will drain to the surface water attenuation tank. Monitoring of all surface water runoff will then take place in the final manhole, SW MH 50, prior to discharge to the public sewer.. If the monitoring station at this final manhole detects contamination, the outlet pumps will be shutoff and the contaminated water will not be discharged from tank 2. The contaminated water may be conveyed by tanker to the aqueous waste tank for injection into the process, or removed off site for appropriate disposal.

In the event of the activation of the fire alarm the pumps from tank 2 will be shut off stopping any surface water discharge from the site. In this scenario both tanks combine to provide the fire water retention volume required for the site, 2930m³

It is expected that monitoring will normally show the storm water to be uncontaminated

Table 4.7 shows the operation scenarios for the monitoring and sampling scenarios of Tanks 1 & 2.

Table 4.7 Surface Water Tank Operation Scenarios

Tank Number	All runoff In Specification	Monitoring Station 1 Out of Specification Only	Monitoring Station 2 Out of Specification Only	Fire Alarm
Tank 01	Open	Closed	Open	Open
Tank 02	Open	Open	Closed	Closed

4.14.3.4 Fire Water Management

Fire water retention, for the retention and control of contaminated water generated when fighting a fire, will be provided for the waste-to-energy facility area. Refer to **Figure 4.19**.

In the event of a fire in the bunker, the water used to fight the fire will be captured in the bunker where it will be stored for disposal. The bunker will have more than adequate capacity for the volume of water used to fight the fire as well as for the waste which will be in it. If there is a fire in any other part of the waste-to-energy facility, the water used to fight the fire will be captured in the recovered water tanks or clean water tank which are located below the building floor. The bunker and the recovered water tanks will be designed as water retaining structures. The fire-fighting water from any fire in an outdoor area will be captured in the storm water drainage system for the yards and roads and will be collected in a combination of the fire water retention and surface water tanks, in which case it can be stored for disposal. The outlet valve from the fire water retention tank will close if there is a trigger level reached by the in-line monitoring equipment. If the fire water retention tank has insufficient capacity, the water will overflow to the surface water attenuation tank using the combined volume for fire water retention.

4.14.3.5 Recovered Water

During the normal operation of the facility the boiler will be required to purge a small quantity of water out of the system in order that the water quality with in the steam cycle can be maintained to a high quality to protect the steam/water side of the boiler tubes and also the turbine. This water will be captured in holding tanks placed below the ground floor slab and will be reused in the process at the wet de-slagger. Water that is used in the building to wash down any areas will also be captured in this tank by a series of drainage channels inside the building.

4.15 General Site Services

4.15.1 Water

The mains water supply, piped along the L2545 road, which forms the northern boundary of the site, will be used to supply the facility.

The water main will be diverted to facilitate the road upgrade. Refer to **Chapter 15 Material Assets**.

4.15.2 Sanitary Service

Domestic sewage from toilets, changing and kitchen areas will discharge via the foul drainage system into an on-site wastewater treatment facility. The treated domestic effluent will then be pumped to Irish Water's foul sewer located east of Ringaskiddy Village. Once the Irish Water Lower Harbour sewage treatment facility (Shanbally plant) has been constructed and becomes operational the temporary on-site treatment facility will be decommissioned and untreated sanitary wastewater will be pumped directly to the Irish Water sewer located east of Ringaskiddy Village, which will then be pumped to the Lower Harbour wastewater treatment facility.

4.15.3 Telecom

Telecom cables including phone lines will be ducted from the site entrance to the main process building where a main switch will be provided. The telecommunications network will extend from the process building to all areas of the site where telemetry or remote monitoring is required. All cables will be underground and ducted.

4.15.4 Gas and Electricity

The gas main which crosses the southern part of the site will be diverted. Discussions have been held with Gas Networks Ireland and they have confirmed that a diversion of the line is to be completed subject to agreement of details at the appropriate time. An indicative layout of the diversion is shown on the planning drawings.

A number of overhead lines traverse or run close to the site. Discussions have been held with ESB networks regarding these and as described in section 4.5.19 above and in **Chapter 15 *Material Assets*,** of this EIS, only one 10kV line requires a diversion. An indicative layout of the diversion is shown on the planning drawings.

4.16 Site Management

When completed and fully operational, the facility will employ approximately 62 permanent personnel, some of whom will work in shifts as the facility will be operational 24 hours per day. Employed personnel will be split between the following functions:

- management and administration,
- operations,
- maintenance,
- quality control and assessment,
- shift operators for the waste-to-energy facility.

Initially, senior managerial staff will be sourced from experienced personnel either in Ireland or Belgium. All other staff will be recruited locally prior to start-up.

Key staff will be recruited prior to commissioning and will be trained by experienced personnel at a similar waste-to-energy facility in Ireland or Belgium. Training will also be carried out in co-operation with the waste-to-energy facility contractor and equipment designers and suppliers. As part of the contractual agreement, the incinerator contractor will be required to remain on-site until the facility has been fully commissioned. By doing this, the operators will become familiar with the equipment and learn first hand from the equipment's design engineers.

The facility's staff will be responsible for routine maintenance and inspections of the facility, maintenance budget planning, procurement of services and materials, managing and supervising repairs and overhauls, the upkeep of the management information system (MIS) and updating and renewing environmental and operating permits.

Major machinery repairs and facility overhauls which cannot be done by the facility's staff will be subcontracted out to either local contractors or to the facility's equipment suppliers. On such occasions the hiring of special expertise or specialised equipment will be required.

Through careful preparation and training, Indaver's staff will be prepared for every stage of construction, commissioning and operation of the proposed facility.

4.16.1 Security

Site security will be provided by a combination of suitable infrastructure and security personnel.

It is proposed that the site entrance will have a security entrance gate. There will be a security fence consisting of palisade fencing (2.4m high) placed along the frontage to main road that forms the northern boundary. The remaining perimeter boundaries of the facility will consist of 2.4m chain link fence. There will be CCTV cameras located at suitable points around the site. Some of these will be mounted on camera towers. The exact number and location of the cameras will be reviewed on an ongoing basis.

A record will be kept of all visitors to the site. Visitors will be monitored and supervised at all times.

4.16.2 Site Tidiness

Litter patrols will be operated by Indaver staff within the facility, around the site and on the public road adjacent to the facility to ensure that litter will not cause a problem. Waste will not be stored outdoors. Trucks carrying waste will be inspected on arrival to ensure that there will be no waste adhering to the wheels. Trucks carrying waste will discharge their loads in the enclosed tipping hall, which will be under negative air pressure, preventing the emission of odour and litter. A pest control programme will be implemented at the site. These measures will ensure that vermin, scavengers and predators will not be attracted to the facility.

4.17 Health & Safety

4.17.1 Design and Construction Health and Safety

The proposed facility has been designed in accordance with the Safety Health and Welfare at Work Act, 2005 and the Safety, Health and Welfare at Work (Construction) Regulations, 2013. The following principles are incorporated into the design of the proposed facility.

- The facility will be designed by skilled personnel according to internationally recognised standards, design codes, legislation, good practice and experience.
- The design will be reviewed to check for safety hazards in steady and non-steady state conditions and for ease of operability. Backup systems for pumps, control systems, power supply and instruments etc. are provided for critical situations.
- Fire detection and firefighting systems are provided;
- The design will comply with Irish Building Regulations Technical Guidance Document Part B Fire Safety and with Indaver's insurance company's requirements.

The installation will be validated as part of commissioning procedures and the installation will be well maintained and cleaned.

Indaver will apply strict rules on safety such as a working permit system, training of operators and staff, and provision and use of personal protection equipment where appropriate; and, wherever possible, Indaver will strive to minimise human interaction in safety critical operations in order to eliminate the potential for 'human factors' to initiate or exacerbate major accidents at the site.

It is the policy of Indaver to attach the greatest importance to the health and safety of all persons employed on the project and indirectly affected by the works. All construction projects are carried out, so far as is reasonably practicable, in such a way that the risks to the health and safety of all persons engaged in, or affected by, its construction and maintenance are eliminated or reduced to an acceptable level under current health and safety legislation, namely the Safety, Health and Welfare at Work Act 2005 and good practice.

Indaver employs specialist consultants to act as health and safety co-ordinators on larger projects. Indaver also employs a full time, fully qualified Health and Safety Manager who is responsible for ensuring that relevant legislation is adhered to and that best practice in health and safety is employed and enforced during construction.

4.17.2 General Operational Safety

The operation of the waste-to-energy facility will involve hazards associated with the handling of combustible materials, chemicals and high-pressure steam. During the detailed design phase of the facility, hazard and operability studies will be carried out. These studies are a systematic method of identifying hazards and assessing mitigation measures.

Indaver operates a combined Quality, Environmental, Safety and Health (QESH) Management System. The proposed facility will operate to ISO 9001:2000, ISO 14001 and OHSAS 18001, the internationally recognised quality, environmental and health and safety standards.

The QESH policies are the top-level documents of each element of the system. They define Indaver’s overall aims and objectives with respect to the provision of a quality service to customers, the provision of a quality workplace to employees and the control over the environmental and health and safety impacts of its activities respectively.

Indaver maintains a Register of Environmental Aspects, which identifies the aspects of Indaver’s activities that can interact with the environment and determines where controls are required. Indaver also carries out Health and Safety Risk Assessments in order to identify the health and safety hazards associated with Indaver’s activities and to determine where controls are required. Both the Register of Environmental Aspects and the Health and Safety Risk Assessments will be updated to incorporate the activities at the proposed facility.

Prior to start-up of the Ringaskiddy facility, a comprehensive set of operating procedures covering all aspects of the different activities will be drawn up. The purpose of these procedures is to ensure that Indaver:

- maintains control over the environmental, quality and safety aspects of its activities,
- meets the aims laid down in the Environmental, Quality and Health & Safety Policies, and
- remains compliant with all relevant operating licences, permits and legislative requirements.

In compliance with the Safety, Health and Welfare at Work Act, 2005, Indaver will draw up a safety statement covering the operation of the facility and appoint safety representatives from the facility workforce. Employees represent Indaver's greatest asset. By providing opportunities, facilities and financial resources, Indaver aims to ensure that all members of staff are in possession of the knowledge, skills and experience necessary to perform their jobs to a satisfactory standard.

The incineration process will be controlled manually and automatically by employees and a computerised control system in the control room. Through recruitment, training, performance management, employee development and succession planning, Indaver provides employees with sufficient training, experience and knowledge for their roles and ensures that they are competent to perform them.

4.17.3 Fire Safety

4.17.3.1 Design for Fire Safety

The fire safety objectives adopted in the design of the Ringaskiddy Waste-to-Energy facility are to achieve compliance with the Irish Building Regulations with particular reference to Technical Guidance Document Part B Fire Safety, so that a Fire Safety Certificate will be obtained for each building prior to the commencement of construction; and to follow as far as practicable the recommendations in the British Standard BS5588 Code of Practice for Fire Safety in Buildings.

4.17.3.2 Fire Systems

The entire facility will be designed and provided with adequate fire protection and detection systems consistent with the requirements of the Building Regulations and in consultation with Indaver's insurers. The fire protection system will be based on tried and tested systems which are provided in Indaver's existing waste-to-energy facility. The systems for detection and firefighting will include smoke/heat detectors, fire alarm system, on site storage of water for firefighting purposes and manual call points.

4.17.4 Potential Operating Hazards and Proposed Preventative Safety Measures

Two infrared smoke detectors will be installed in the bunker. The bunker will also be continuously monitored by the crane operator. Any fire would be detected at an early stage by the operator. The automatic detection systems will also monitor the bunker and will activate an alarm in the control room, should the crane operator fail to detect a fire. On activation of an alarm the shift operators will initiate firefighting.

The best practice from the facilities in Meath and Belgium is to lift the part of the waste on fire into the hoppers from whence it will go into the furnace. This waste will then be covered by placing another layer of waste in the hopper.

Two water cannons will be available in the waste bunker. The capacity of each water cannon will be approximately 300 m^3/hr. Local or remote operation of the water cannons will be possible. All firewater, discharged from the water cannons, will be contained within the bunker.

Smoke vents, in the roof over the bunker, will be opened automatically or manually on activation of the sprinkler alarm.

Dry risers will be installed from the outside wall of the building to the hopper platform and to the reception hall level.

The hopper and furnace will be monitored with infrared smoke detectors. Sprinklers over the hopper will be started automatically if fire is detected.

Fire detection and fire extinguishing systems will be installed along the path of the waste to the furnace as follows:

- The waste feeding hopper will be equipped with sprinklers. In case of fire detection the sprinklers will be activated manually.
- The ram for feeding waste to the furnace will be equipped with a fire damper this will be activated when the temperature exceeds a preset level.
- . Fire detection and firefighting equipment will become active when the fire would break through the waste plug. The damper between the hopper and the feeding ram will be closed as soon as possible as it cannot be closed when the chute is full of waste.

Dedicated ventilation will be provided to avoid the build-up of biogas. The vent air will be drawn into the furnaces for use as combustion air.

There will be 1 lower explosive limit (LEL) detector in the bunker that will generate an alarm. This will give the shift operator the chance to restore safe conditions.

The bunker will be fully constructed in concrete up to the level of the crane bridge supports. Above this level it will be concrete skeleton with steel beams and steel cladding. The wall, separating the bunker area from the incineration section of the facility, will be designed to act as a fire separation wall and the fire protection will extend at least 1m above the adjacent roof of the bunker area.

4.17.4.1 Furnace

The furnace will be provided with detailed control and safety systems. Interlocks will shut down the installation automatically as soon as a fire risk is detected. In an emergency shutdown (see **Appendix 4.2** for details), all air and waste supply will be stopped to extinguish the fire. In this event all gases will continue to be discharged through the stack via the flue gas cleaning facility. In the event of failure of the main control computer or of the supply of utilities such as air or electricity the facility will be automatically shut down in a safe manner.

4.17.4.2 Steam Production

The design of the steam circuit will be carried out to the best industry standards to minimise hazards. In the event of a power failure the emergency generator will keep one boiler feed water pump in operation to keep the water level in the boiler above a minimum. This will prevent overheating of the boiler.

4.17.4.3 Flue Gas Cleaning System

There is no hazard in the flue gas cleaning. The flue gas cleaning will be designed to withstand the highest flue gas temperature that can come out of the boiler.

The risk of fire from the use of activated carbon or clay will be minimised by the following.

A dedicated hazard assessment will be undertaken on the storage and dosing system. The flue gas temperature will be monitored and the temperature of the activated carbon/clay will be maintained below 180°C.

In the event of a temperature threshold being exceeded, the facility will automatically shut down.

4.17.5 Emergency Response Planning

A Site Emergency Plan will be prepared prior to operational start-up, which will set out the response measures to be taken by personnel in the event of an emergency. These measures will be designed to ensure maximum protection for the site employees, site visitors and people in other premises near the site, to limit property damage and to minimise the impact on site operations and on the environment. The Site Emergency Plan will have four basic components, as listed below.

4.17.5.1 Prevention

Prevention involves identifying potential hazards and then taking measures to remove the hazard, or reduce the potential for the hazard and its adverse effects.

4.17.5.2 Preparedness

Emergency planning, training programmes, emergency drill and exercise programmes are integral components of an effective preparedness programme. The site will have a dedicated 'emergency response team', which will be given specific training. Evacuation routes will be defined and all personnel will be aware of them.

4.17.5.3 Response

The site will be manned on a continuous basis. Response activities address the immediate and short-term effects of an emergency.

4.17.5.4 Recovery

Recovery activities and programmes involve restoration of site services and systems to normal status.

4.18 Description of Decommissioning

The facility is expected to have a design life of 25 to 30 years but this could be extended by maintenance, equipment replacement and upgrades.

It is expected that it will be a condition of the industrial emissions licence for the facility that a closure and residuals management plan, including a detailed decommissioning plan, be submitted to the EPA for their approval.

In the event of decommissioning, measures will be undertaken by Indaver to ensure that there will be no environmental impacts from the closed facility. The measures will include:

- Cancellation of all waste supply contracts,
- All wastes at the facility at time of closure will be incinerated,
- All raw materials, oils, fuels, ash and residues etc. on site at the time of closure will be returned to the supplier, or collected and recycled or disposed of by an authorised waste contractor, as appropriate,
- All process equipment will be decontaminated and decommissioned,
- All equipment from the spare parts warehouse, offices and other facilities will be removed and reused or recycled,
- It is not intended to remove all structures or systems from the site. In general, specialist equipment, pipelines and storage tanks will be sold for reuse, where possible, or disposed of off-site. The process building and external equipment will remain on site and will be in a suitable condition for future site use.
- All buildings will be decontaminated ,
- Retention of roads, hard-standings and site fencing, A monitoring programme of all potential emissions including surface water and dust will be conducted after the decommissioning process in order to ensure that emissions from the facility have ceased. The monitoring programme will consist of two monitoring rounds carried out within two months of decommissioning of the facility.
- When operations have ceased, and assuming confirmation from the monitoring programme that all emissions have ceased, it is expected that there will be no requirement for long-term aftercare management at the site.

The decommissioning measures will have to be implemented to the satisfaction of the EPA.

4.19 Regulatory Control

4.19.1 Industrial Emissions Licence

Waste disposal in Ireland is controlled primarily through the Waste Management Act of 1996, as amended. Under the act, the EPA has the responsibility for the licensing of all significant waste recovery and disposal activities. In order to operate the waste management facility, Indaver requires a licence from the EPA under the Act. The EPA granted a waste licence to Indaver in November 2005. The licence was amended by the EPA in January 2014 to bring it into conformity with the Industrial Emissions Directive 2010/75/EC. The licence and amendment can be viewed on the EPA website www.epa.ie.

The table of contents for the industrial emissions licence is given below. The licensee must adhere to a wide range of conditions to ensure the satisfactory management of the facility during its operation. The industrial emissions licence also addresses any restoration and aftercare provisions that may be required, once the facility ceases operations.

Decision & Reasons for the Decision

Part I: Activities Licensed

Part II: Activities Refused

Part III: Glossary of Terms

Condition 1 - Scope

Condition 2 - Management of the Facility

Condition 3 - Infrastructure and Operation

Condition 4 - Interpretation

Condition 5 - Emissions

Condition 6 - Control and Monitoring

Condition 7 - Resource Use and Energy Efficiency

Condition 8 - Materials Handling

Condition 9 - Accident Prevention and Emergency Response

Condition 10 - Decommissioning

Condition 11 - Notifications, Records and Reports

Condition 11 - Financial Charges and Provisions

Schedule A: Limitations

Schedule B: Emission limits

Schedule C: Control & Monitoring

Schedule D: Annual Environmental Report

4.20 Best Available Techniques (BAT)

4.20.1 Industrial Emissions Directive Definition of BAT

In the Industrial Emissions Directive, Directive 2010/75/EC, best available techniques are required to be used in pollution prevention and control.

The term "best available techniques" is defined in Article 2(10) of Directive as:

> *best available techniques" means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole:*
>
> a) *"techniques" includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;*
>
> b) *"available techniques" means 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;"*

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 published by the European Commission in August 2006.

Chapter 5 of the BREF document lists the techniques which are considered BAT with respect to waste to energy 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 4.4** demonstrates compliance of the Ringaskiddy facility with the relevant provisions of the BREF document.

4.20.2 BAT and the Stockholm Convention on Persistent Organic Pollutants

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 (BAT) to be used to prevent or reduce the release of these chemicals.

In the Convention, Annex C deals with the use of BAT. In Annex C Part V B, 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."

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 4.4**.

4.21 References

European Community (2006) *Integrated Pollution and Control Reference Document on the Best Available Techniques for Waste Incineration*

European Community (2010) *Directive 2010/75/EC on industrial emissions (integrated pollution prevention and control)*

Stockholm Convention (2009) *Stockholm Convention on Persistent Organic Pollutants as amended in 2009*

Stockholm Convention (2006) *Guidelines on best available techniques and guidance on best environmental practices relevant to Article 5 and Annex c of the Stockholm Convention on Persistent Organic Pollutants*