Attachment D.1: Infrastructure

D.1.1 General Description

The proposed facility is designed to incinerate and recover energy from the residual fraction of non-hazardous household, commercial and industrial waste and sludges. It will consist of an incineration plant with energy recovery (a "waste-to-energy" plant) and ancillary services.

The main buildings or structures on the site will include:

- The main process building
- A turbine building with air cooled condensors
- A warehouse/workshop/education centre
- A transformer compound and ESB substation
- A security building
- A water storage tank and pumphouse

Ancillary services will include:

- Weighbridges
- Access roads and hardstanding areas
- Services including power, water, telephone
- Sewerage and surface water drainage infrastructure
- Fire fighting systems

The general layout of the facility is shown in Appendix D1 (Drawing 15013\WL\005) and in Figure D.1.a below.

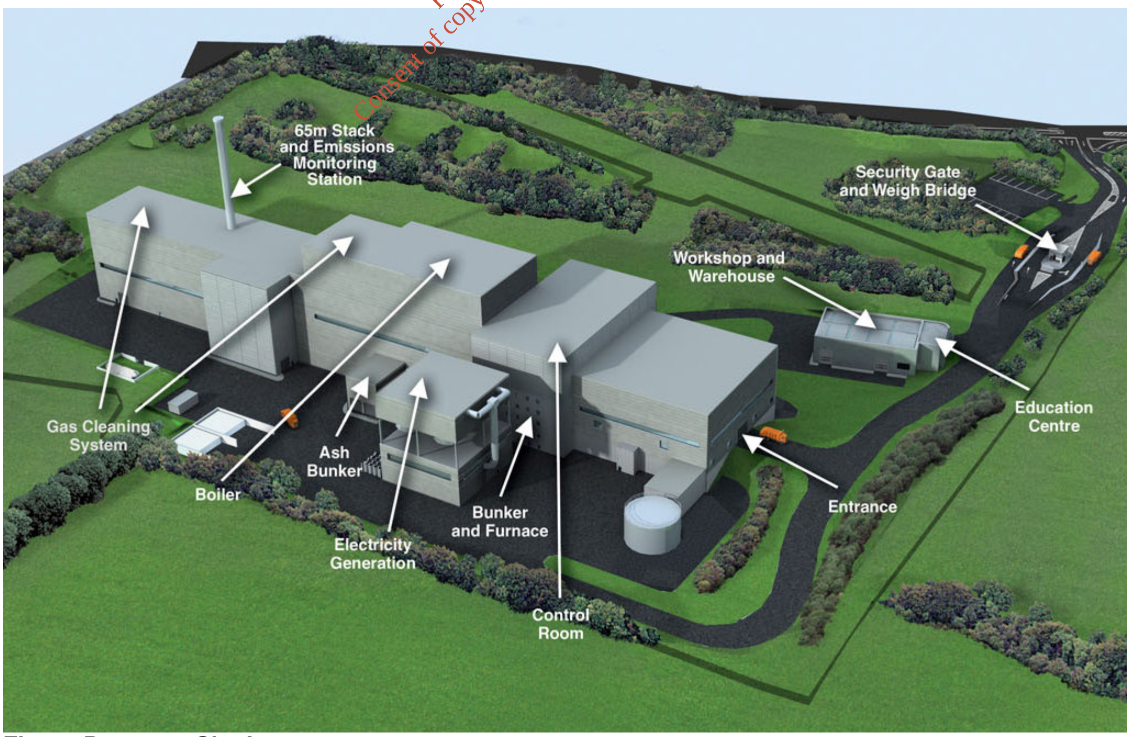

Figure D.1.a: Site Layout

D.1.a Site security arrangements

Security measures will include building security, access control, a closed circuit television (CCTV) system and surveillance measures.

The site will be secured by fencing on all sides, with a 2.4m palisade fence to the road frontage and a 2.4m chain link fencing completely enclosing the remainder of the site. There will be one site entrance from the R152 road to the south-east of the site, which will be used by all traffic entering or leaving the site. Site entrance details are shown in Appendix D2 (Drawing 15013\WL\007).

During the waste acceptance period, there will be manned security stationed in the gatehouse. The site will also be fitted with a CCTV system to monitor areas around the site. The CCTV will be monitored from the gatehouse during daytime hours and from the control room on a 24 hour basis.

The site entrance will be fitted with an electronic security gate, which will remain open during waste acceptance hours. During this period, security staff in the gatehouse will control access to the site by operating barriers at the weighbridges and diversion lanes and by monitoring all other traffic movements either by direct line of sight or with the aid of CCTV equipment. Outside of waste acceptance hours, the only traffic movements will be associated with staff and maintenance contractors. These movements will be monitored and controlled from the control room.

A record of all visitors to the site will be kept. Visitors will be monitored and supervised at all times. No unauthorised personnel will be allowed access beyond the gatehouse unless permitted to do so or accompanied by a facility employee.

D.1.b-c Site roads and hardstanding areas

The layout of the proposed roads and paved areas can be seen in Appendix D1. All site access roads and car parks will have asphalt-wearing surfaces. Roads and car parks will generally have concrete kerbs.

There will be one main access road from the site entrance leading past the weighbridge, workshop and education centre and reception hall to the service yard to the east of the main process building. The service yard will be an asphalt paved area, which will facilitate access to the building and ancillary services. There will also be a small paved area around the workshop and education centre, as well as a staff carpark near the site entrance.

Overall, approximately 6.8Ha of the site will consist of roofs, hardstands, roads and grassed areas which will drain into the stormwater drainage system. Details of this system are provided in Attachment D.1.k and Section 11 of the EIS.

D.1.d Plant (weighbridge)

Two weighbridges will be provided at the facility for vehicles entering and leaving the site, as shown in Appendix D1. These will have a capacity of 50 tonnes each and will be approximately 3.3m x 15.7m in size.

Detail on waste acceptance procedures is provided in Attachment D.2.2.

D.1.e Wheel Wash

As all the roads will be hard-surfaced, there will be no wheel wash at the facility.

D.1.f Laboratory facilities

There will be no laboratory facilities on site. Permanent monitoring equipment will be installed for the continuous measurement of stack emissions. Discontinuous monitoring and other analysis will be carried out by independent and accredited laboratories. Details on air emissions monitoring arrangements are included in Attachment F.2.1.

D.1.g Fuel storage

Small quantities of light fuel oil will be used onsite for start up and auxiliary firing as required. Fuel oil will be transported to the site by truck and stored in a double walled carbon steel tank with a volume of 40m^3 or in a single walled tank contained within a bund. The storage tank and distribution equipment will be mounted on a skid, which will include a spill catch for unloading operations. The skid will be located next to the turbine building to the north east of the waste bunker. Bunding (if required) will be constructed in accordance with BS 8007 (Aqueous Liquid Retaining Concrete Structures) and will be designed for 110% of the total capacity of the storage tank.

Diesel will be required for fuelling the loader used in the bunker reception area. This will be stored in the main fuel oil storage tank. Diesel will also be required for the diesel generator set. Approximately 3m^3 diesel for 12 hours operation at full capacity will be stored in close proximity to the emergency generator within the main process building. This will either be contained within a double walled tank or bunded appropriately to fully contain any spillages.

There will be one transformer located within the transformer compound. This will contain a large volume of oil (not containing any polychlorinated biphenyl (PCB)) and will be bunded appropriately.

D.1.h-i Waste Quarantine and Inspection

A waste inspection area will be provided in a clearly marked and dedicated area of the reception hall as shown in Appendix D3 (Drawing 15013\WL\008). It will be of a sufficient size to facilitate the regular inspection of waste loads from new and existing contractors. The inspection area will drain to the main process building spill tank.

A clearly marked and dedicated quarantine area will be provided in the service yard. This is in line with WL 167-1, which requires that no waste will be quarantined in the waste reception/delivery area. All waste quarantined in this area will be fully contained in transport vehicles ready to be sent offsite for alternative treatment. The drainage of this area will therefore not be an issue.

Waste acceptance and handling procedures are outlined in Attachments D.2.2, H.2 and H.3.

D.1.j Traffic control

A speed limit of 20 kmph will be set to control traffic onsite. This limit will be signposted at the entrance of the facility. The inbound weighbridge and bypass lane will be located at a sufficient distance from the site entrance to ensure any queuing onsite does not disrupt traffic on the Regional Road R152.

At the weighbridges and bypass lane there will be traffic control in the form of barriers. Both inbound and outbound traffic can pass through a bypass lane if they do not require weighing. This will help to maintain the flow of traffic onsite and avoid queuing.

There will be two designated carparks onsite including a staff carpark near the entrance to the facility and a visitors' carpark next to the education centre. The staff carpark will include spaces for 38 vehicles of which 2 will be designated disabled parking spaces. There will be 8 visitor parking spaces of which one will be designated for disabled parking. There will also be a parking area for a bus next to the education centre. Access to the site from public areas will be controlled by the security station.

D.1.k Sewerage and Surface Water Drainage

D.1.k.a Sewerage infrastructure

There will be no process effluent emissions to sewer. Domestic sewage from toilets, changing and kitchen areas will discharge via the foul drainage system into an on site effluent treatment system.

Effluent entering the system will pass into a collection chamber (similar to a septic tank) which retains any solids, before being pumped through a rising main to a series of Puraflo modules. In these modules, the effluent is evenly distributed over the surface of a biofibrous media. As the effluent percolates through the media, it is treated by a combination of physical, chemical and biological interactions between the pollutants and the media. The treated effluent emerges from the base of the unit and is distributed over a percolation area, which will be constructed in accordance with the guidelines in the EPA's Wastewater Treatment Manual.

The Puraflo system is modular and has been designed to treat effluent from 50 people onsite. It is common to developments located in areas with no public sewer facilities, such as golf clubs, and is certified by the Irish Agrément Board.

Typical emissions and other information on the Puraflo system are provided in Appendix D4. The location of the treatment system and percolation area is shown in Appendix D1.

D.1.k.b Surface water drainage infrastructure

The waste-to-energy plant has been designed to ensure there will be no process effluent. Therefore, the drainage infrastructure will only be required to handle surface water runoff and any spills or firewater that may occur.

The surface water drainage system has been designed to mimic as closely as possible the natural drainage of a site in order to minimise flooding or water pollution. This involves discharging surface water runoff at a rate similar to that of natural drainage from agricultural land and preventing any potential contamination of surrounding surface waters.

To facilitate this, the system will be essentially divided into three parts:

1. Only surface waters draining from roofs, roads and hardstanding areas outside the main process building will enter the main surface water drainage system.
2. Any spills or washwater inside the main process building will be collected and stored in a separate spill tank for recircultation within the process.
3. The remaining undeveloped part of the site will continue to drain naturally to existing drainage ditches.

A schematic of the drainage system balance is provided in Figure D.1.b.

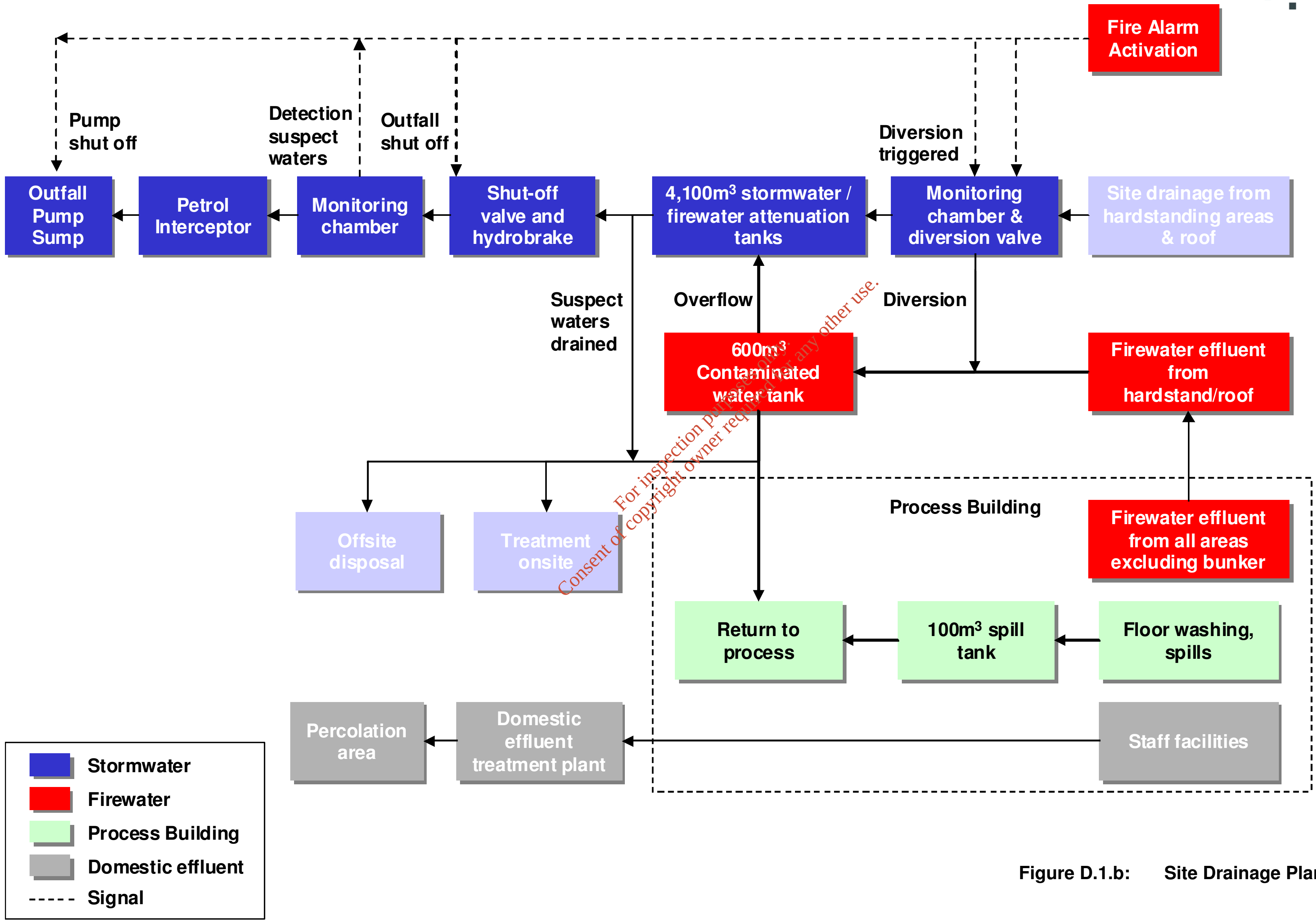

Figure D.1.b: Site Drainage Plan

Main surface water drainage system

The main surface water drainage system will collect rainfall and any spills or firewater[1] from drainage areas outside the main process building. This includes roofs, roads, hardstands and some grassed areas covering approximately 6.8Ha of the site, with an effective hardstand area of 5.46Ha due to semi-permeable surfaces. Consideration was given to surfacing roads and hardstand with pervious paving. However, given the risk of spillage onto these areas from vehicles and loads being transported onsite, the system was designed to collect all surface waters.

Surface water draining from the hardstand areas to the north of the site, where the main activities take place, will be directed to a monitoring station. This will divert any suspect flows to an underground contaminated water diversion tank (600m^3) situated below the pumphouse. The contaminated water tank is designed to cater for contamination of surface water arising from a 1 in 5 year storm lasting 15 minutes. Contaminated flows include runoff from firefighting activities (collected from anywhere onsite with the exception of the waste bunker), as well as spillages or leaks occurring outside the main process building. The contaminated water diversion tank will be of concrete construction and will be fitted with extra containment to prevent any leakage.

Uncontaminated surface water will flow into an underground stormwater/firewater attenuation tank (2,750m^3) via a silt trap and leaf collection basket. This will be located between the process water tank and the drainage ditch to the west of the site as shown in Appendix D5 (Drawing 15013\WL\006). The tank will be made up of interlocking modules in the form of a HDPE lined and sealed “hydrocell” or similar approved modules as shown in Appendix D6 (Drawing 16058\SW\004).

A second underground clean water attenuation tank (1,350m^3) will be provided for surface water draining from the hardstand areas between the road entrance and the warehouse/education centre. This will be similar in configuration to the stormwater/firewater attenuation tank but will be located between the workshop/education centre and the boundary fence, as shown in Appendix D5. Water from this tank will be directed to the first monitoring station as for other surface waters before passing into the stormwater/firewater attenuation tank for discharge.

Water collected in the contaminated water diversion tank will be reused in the process where possible, treated onsite, or transported offsite for treatment or disposal. Water collected in the stormwater/firewater and clean water attenuation tanks will be discharged to a drainage ditch via a second monitoring station. If suspect water is detected at this point, it will trigger the upstream diversion of suspect flows to the contaminated water diversion tank. If the contaminated water diversion tank is full, the discharge pumps will be shut off and the contaminated water will be contained in the stormwater/firewater attenuation tank. This will be either treated onsite or removed from site for disposal.

The discharge rate will be controlled by a hydrobrake system, consisting of a static weir, at a rate similar to that from agricultural land. The drainage ditch, located to the east of the site, eventually leads to the River Nanny.

In the event of fire alarm activation, the discharge outfall pump will be immediately stopped and all stormwater/firewater runoff following the incident will be diverted to the contaminated water diversion tank.

[1] Firewater runoff is also collected from all areas inside the main process building with the exception of the waste bunker.

A Class II full retention separator for petrol like substances will also be installed at the outfall from the stormwater/firewater attenuation tank in accordance with European Standard prEN 858 (installations for the separation of light liquids).

The total combined capacity of all three attenuation tanks (4,700m^3) is designed to simultaneously handle a 1 in 20 year storm lasting 24 hours (see Table 3 of Appendix 11.2 of the EIS) as well as any firewater runoff that may occur with no discharge. This is in line with the EPA Guidance note on the Requirements for Firewater Retention Facilities.

The site itself is designed to cater for anything up to a 1 in 100 year storm[2], whereby flooding of the kerbed yard and kerbed hardstand areas will provide additional attenuation and ensure the recommended discharge rate is not exceeded.

These measures will prevent flooding of the drainage system due to flash flooding onsite. In line with the Dublin City Council Storm Water Management Policy, it was calculated that the discharge rate to the ditch should not exceed 16.98 l/s for the site. It is anticipated that the discharge will only reach the River Nanny during periods of high rainfall, when drainage waters from other areas augment the flow in the ditch. Calculations to determine the expected runoff quantity and required attenuation capacity are provided in Appendix 11.2 of the EIS.

Details on the location and size of pipes, outlets and invert details are provided in Appendix D5.

Main process building drainage

The process has been designed with a combined semi-wet and dry flue gas treatment system and process water recirculation to avoid the production of effluent.

All waters from wash down or other activities within the main process building will be directed to a spill tank located beneath the floor of the building. The spill tank will have a capacity of 100m^3. Water from the spill tank will be used to supplement process water requirements as shown in Figure D.1.c

The spill tank will be of concrete construction and will be equipped with a double containment system similar to that of the waste bunker to ensure that there is no leakage to the ground.

Drainage of the undeveloped part of site

The remaining undeveloped part of the site (approximately 3.2 ha) will continue to drain naturally to existing drainage ditches that ultimately lead to the River Nanny. Any existing intercepting ditches in this area will be fitted with “culvert” or special drainage piping and covered over. Drainage waters will continue to flow into the ditches via infiltration trenches and will be channelled into the culvert pipes. These pipes will direct drainage waters to the original field boundary drainage ditch system as before. The infiltration trenches will intercept stormwater flow from the undeveloped areas of the site before it reaches any of the areas of roads or hardstanding draining to the main surface water drainage system.

Conversely, due to the natural south to north slope of the ground, it will not be possible for any stormwater from the roads or hardstanding areas to enter the existing field boundary drainage ditches. Therefore, surface waters collected from the undeveloped part of the site will not come into contact with any potential contamination from the plant.

[2] Peaking at 24 hours

It is intended to heavily landscape the undeveloped areas of the site with selected trees and shrubs. This will have the beneficial effect of increasing the “time of concentration” of the storm flows thereby reducing downstream effects.

D.1.I All Other Services

D.1.I.a Power

Subject to agreement with ESB Networks, the plant will connect to the 38kV distribution network at Duleek (approximately 4km south of the site) via an underground cable. This connection will be used to export electricity and, as required (e.g. during startup or shutdown), import electricity for onsite demand.

The 38kV cable will enter the site near the site entrance and feed into the electricity substation and transformer compound to the north of the site. There will be one transformer located within a transformer compound for exporting and importing electricity. The site distribution transformer will be located in the main process building and will reduce voltage from 400V for use in site equipment.

The Electricity Supply Board (ESB) substation containing switchgear associated with the import/export of electricity will be located next to the transformer compound. The indicative size of the substation is 3 m in height, and 8 m x 8 m in plan. It is expected that the dimensions will be finalised once the exact requirements of ESB are known.

A 110kV power line traverses the site. However, due to the proposed layout of the facility, there will be no requirement for the diversion of this line. A natural gas pipeline also runs directly under the development site as shown in Appendix B5. As no buildings will be constructed over or near this pipeline, there will be no requirement for its diversion.

D.1.I.b Water Supply & Demineralisation

The plant has been designed for low water consumption by including an effluent free flue gas treatment system and an air-cooled condenser. The main water requirements will be for the spray drier absorber, ash quenching system and domestic use. Process water for the steam cycle and water for cleaning will account for the rest of the demand. A summary of the expected water requirements is provided in Table D.1.a below.

Table D.1.a: Average water requirement

Use	**Quantity (m^3/hr)**
Process (flue gas, ash quenching, steam cycle)	6.5
Domestic supplies	2.0
Firefighting[3]	0.2
Total	**8.7**

The total water requirement for the plant will be c. 65,250 m^3 per annum[4]. This will be met by groundwater abstraction from an onsite production well, which will be installed adjacent to well TW1 as shown in Figure 10.4 of the EIS. Water will be pumped from the well to an aboveground water storage tank with a capacity of approximately 2,000m^3 located to the east of the reception hall adjacent to the fire pump house. Approximately 600m^3 will be reserved for process water and the remainder will be retained for potential fire fighting requirements.

[3] Represents normal flows as used around buildings and site for cleaning. Firefighting flows represent extraordinary flows and will be in the region of 600 – 700 m^3/h
[4] Maximum consumption assuming 7,500 operating hours per annum, 200,000 tpa

The storage tank will be provided with a level switch, which will be linked into the plant's central control system. When the level in the storage tank falls below a set level, the submersible pumps in the groundwater abstraction well will be switched on to refill the tank. The peak refill rate from the well to the tank is estimated at $15m^3/h$.

Well trials on site indicate that the aquifer has more than adequate capacity to supply the facility without any significant impact on groundwater levels.

A demineralisation unit will be installed to treat $3m^3/h$ of abstracted water on average for use in the nitrogen oxides (NO_x) treatment system and boiler feed water system. The unit will be based on ion exchange technology, which will produce a stream of waste water with an elevated concentration of dissolved solids. This stream will be recycled for use in the plant.

A schematic of the onsite water balance is provided in Figure D.1.c.

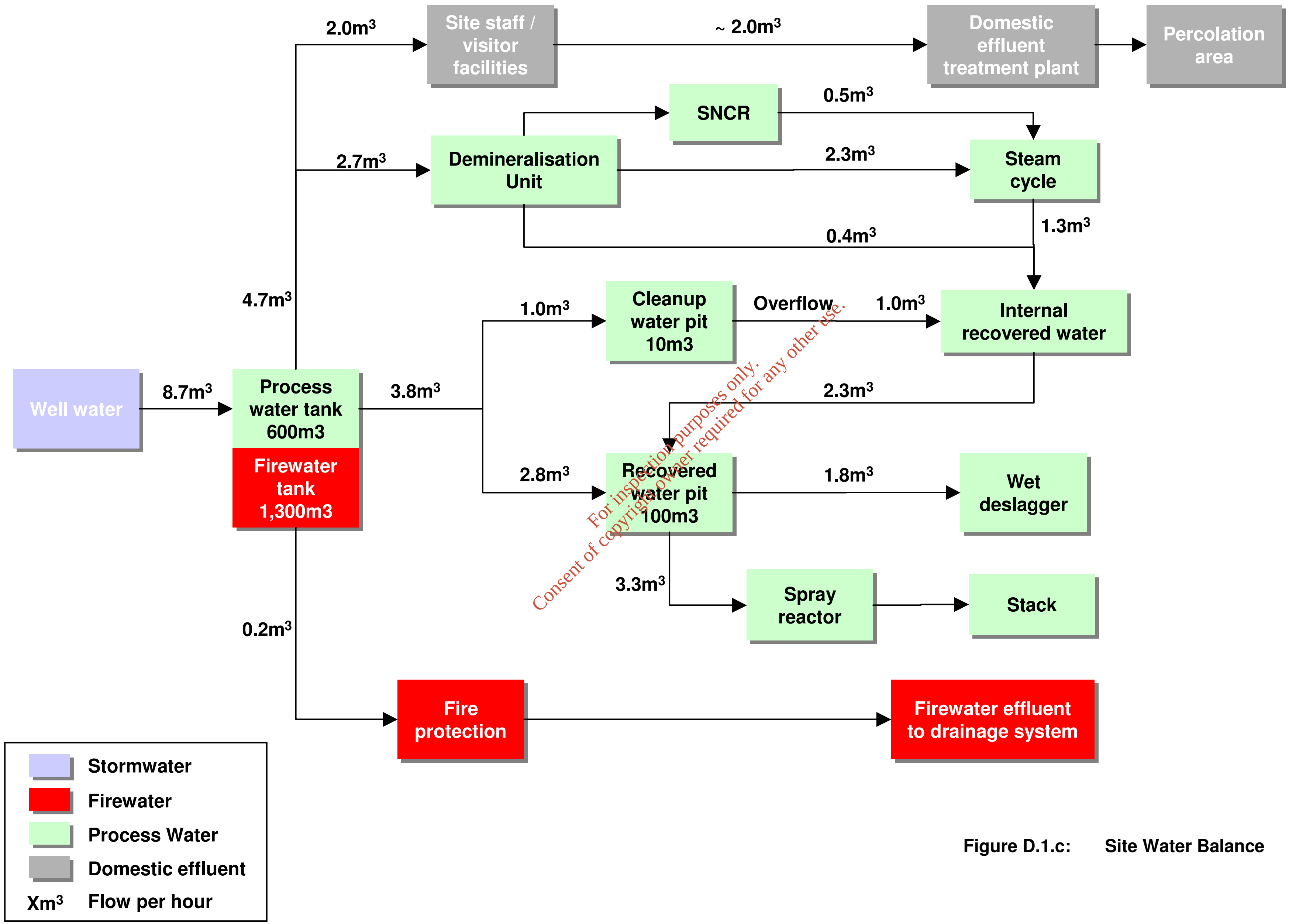

Figure D.1.c: Site Water Balance

D.1.l.c Telephone

A telecommunications network including phone lines will be ducted from the site entrance parallel to the roadway to the main process building where a main switch will be provided. The network will extend from the process building to all areas of the site where telemetry or remote monitoring is required. All cables will be buried underground and ducted. Telephones will be provided in all offices, in the control room and in each electrical/instrument/emissions room and will be connected to a central control box on the ground floor.

D.1.m Plant Sheds, Garages and Compounds

D.1.m.a Workshop and Education centre

A warehouse and education centre will be located to the south of the main process building. This will be approximately 37 m x 18 m in plan and 9 m in height. It will include a large warehouse area, workshop, offices, storage, staff and visitor toilet facilities and an education centre.

The education centre will be made available for site visitors, school tours, and the Community Liaison Committee meetings. It will provide information on waste management, the operation of the facility, compliance and environmental monitoring.

The layout of the workshop and education centre is shown in Appendix D7 (Drawing 15013\WL\011).

D.1.m.b Service Yard

The service yard will be a large paved area on the western side of the main process building. It will provide vehicle access to the eastern and northern sides of the main process building, the turbine building, the pump house and water tank, the quarantine area, the transformer compound and ESB substation, the effluent treatment system and the fuel storage tanks. Access will be provided via a one-way system starting at the reception hall entrance, as shown in Appendix D1. An external loading bay will be provided at the fuel storage tanks and enclosed loading bays will be provided for the bottom ash, boiler ash and flue gas treatment residue storage areas.

D.1.n Site Accommodation

D.1.n.a Gatehouse

The gate house will be located near the site entrance. It will consist of a single storey building approximately 6m x 4.5m in plan and 4m in height. The gate house will accommodate the site security, access to the control system and waste reception staff. It will include a small office and toilet facilities.

The location of this building is shown in Appendix D1.

D.1.n.b Main Process Building

Visitor and staff facilities will be provided in the main process building, adjacent to the waste bunker. This will include showers and lockers, a canteen, meeting rooms, offices and toilet facilities. The layout of these facilities is shown in Appendix D8 (Drawing 15013\WL\012). Facilities will also be provided in the workshop as described in Attachment D.1.m.a above.

D.1.o Fire control system

The main fire safety objectives adopted in the design of the Meath waste-to-energy facility are outlined in Section 5.17.3 of the EIS. The entire plant has been designed and equipped with fire protection and detection systems in line with the Building Regulations, the Code of Practice for Fire Safety in Buildings BS5588 and in consultation with Indaver’s insurers. The fire protection system will be based on systems tried and tested in Indaver's existing waste-to-energy plants.

The facility is considered to be normal fire risk (as outlined in Part B of the building regulations) as the likely fuel source, the waste, has a high moisture content and a slow natural burn rate. Furthermore, there will be no external ignition sources present other than the waste overheating.

The buildings will be divided into fire areas and fire separation compartments. All areas within all buildings will have at least two possible escape routes with a maximum distance of 45m to a fire resistant staircase or door giving to the exterior. Emergency lighting will be provided inside the building so an emergency exit can be found from any point within the plant without other light sources.

The systems for detection and fire fighting will include fixed water cannons, smoke/heat detectors, a fire alarm system, smoke ventilation, hydrants and hose reels, dry/wet rising mains, portable extinguishers, on site storage of water and manual call points.

The alarm system will comply with IS 3218 and will provide both audible and visual signals. All signals from explosion limit detection, fire detection and fire fighting equipment will be relayed to the control room. Hose reels on the ground floor will be installed such that any area of the building will be covered by at least two jets. Reels will be installed at intermediate landing levels outside the protected stairwells. For the main process building, dry rising mains will be installed. Portable extinguishers of appropriate types will be installed throughout the building as required.

Smoke vents will be installed on the roof of the main process building. These will automatically open if a fire is not brought rapidly under control. Smoke vents can also be opened manually and from a remote control panel. The total area of smoke vents will be approximately 1% of the floor area of each smoke ventilated space.

The firewater pumps will be located in the pumphouse adjacent to the reception hall and will supply a fire main and hydrant system. A fire fighting volume of approximately 1,200m^3 will be supplied from the water storage tank, which will guarantee a water supply for 120 minutes assuming fire fighting flows of 600 to 700m^3/h as described in Attachment D.1.l.b. This will be further supplemented by local fire service capabilities.

Staff will be trained in Emergency Response techniques in order to deal with emergencies including firefighting as outlined in Attachment J.1.2. As part of the detailed design and further to discussions with the local fire service, an application for a fire safety certificate will be made to the Local Fire service, which will detail all fire fighting capabilities for the facility.

A more detailed description of potential operating hazards and related fire control measures is provided in Section 5.17.4 of the EIS.

D.1.p Civic Amenity Sites

Civic amenity sites will not be provided at the facility by direction of An Bord Pleanala in planning reference PL17.219721 (see Appendix B6).

D.1.q Any other waste infrastructure

No other waste recovery infrastructure will be provided at the facility.

D.1.r Composting infrastructure

There will be no composting infrastructure.

D.1.s Construction and demolition waste infrastructure

There will be no construction and demolition waste infrastructure.

D.1.t Incineration infrastructure

D.1.t.a Main process building

The main process building will comprise of four main sections, including the waste reception hall, waste bunker, furnace/boiler area and flue gas treatment system. This is shown in Appendix D3.

The main process building height will vary from approximately 24m (54 mOD) in the reception hall to 40m (70 mOD) in the steam boiler section, with the stack reaching 65m (95.5 mOD).

The reception hall will form a single storey space and will be maintained under negative air pressure to prevent any fugitive emissions. Trucks carrying waste will enter through doors on the south west side. There will be five chutes in the north east side of the hall where waste will be tipped into the waste bunker. The reception hall floor level will be 10.50m above the waste bunker floor level to enable gravity feeding.

The bunker will have a gross volume of 16,000m^3. Above the bunker will be the hopper platform level where a single hopper will be located to feed the furnace. This level will also include a service area for the overhead travelling cranes. The bunker will be serviced by two such cranes, each with 3.5 tonne carrying capacity. This part of the building will also include a five-story section comprising visitors facilities, showers and lockers, a canteen, offices and a control room at with windows overlooking the bunker.

The tallest section of the building will contain the grate furnace, boiler, spray drier absorber and bottom ash bunker. Plant equipment will be accessed by up to nine levels of access platforms.

The remaining section of the building will house the reaction duct, baghouse filter, stack and storage tanks. The stack will be accessible via a steel ladder. A room to house the stack emission monitoring equipment will be located near the stack, accessible from an access platform. The consumables and residues storage tanks will be isolated from the rest of the main process building to minimise dust or other emissions from storage.

D.1.t.b Turbine Building

The turbine building will be located to the west of the waste bunker, linked to the boiler in the tallest section of the building by a pipe rack (see Appendix D9 - Drawing 15013\WL\0010). It will comprise a two storey building with a turbine, motors and demineralisation equipment, condensation tanks and a vacuum system. An air cooled condenser unit will be mounted on the roof. The building will be 24.6m x 24.6m in plan and 27.7 m in height.

D.1.t.c Compliance with Waste Incineration Directive

According to Article 4 (2) of the Incineration of Waste Directive 2000/76/EC, the application for a permit for an incineration or co-incineration plant should include a description of the measures which are envisaged to guarantee that:

(a) the plant is designed, equipped and will be operated in such a manner that the requirements of the Directive are taking into account the categories of waste to be incinerated

(b) the heat generated during the incineration and co-incineration process is recovered as far as practicable

(c) the residues will be minimised in their amount and harmfulness and recycled where appropriate

(d) the disposal of residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Community legislation

A copy of the Directive is provided in Appendix D10. According to Article 4 (3) of the Incineration of Waste Directive 2000/76/EC, the permit should only be granted if the application shows that the proposed measurement techniques for emissions into the air comply with Annex III and, as regards water, comply with Annex III paragraphs 1 and 2.

<u>Design, Equipment and Operation</u>

The facility has been designed for non-hazardous municipal and similar wastes and non-hazardous sludge. Accordingly, the plant will treat only “mixed municipal waste” (see definition in Article 3 (3) in Appendix D10) and non-hazardous sludge, and will not process “hazardous waste” (see definition in Article 3 (2)). Selected processes and equipment are in line with the Best Available Techniques (BAT) for mixed municipal waste, as outlined in Attachment L.1.3.

To ensure that waste entering the plant is restricted to municipal and similar wastes or sludges, a waste acceptance procedure will be implemented. This will outline a requirement for the inspection of waste deliveries from new waste contractors and ongoing spot check inspections for existing waste contractors (see Attachment H.2).

<u>Heat Recovery</u>

Heat recovery options for the plant are detailed in Section 3.4.1 of the EIS. Heat recovered from the combustion of waste can be used to either generate electricity and/or directly for heating purposes. While it is more energy efficient to use heat for direct heating purposes, this requires a dedicated distribution system and a relatively stable energy demand. Due to the location of the plant, it is not feasible to develop a distribution system and the demand would not be sufficient to enable efficient heat recovery. It is therefore not considered an option for the proposed facility.

Although the site is not in the vicinity of process heat users, it was considered to be the most suitable site for the location of a waste-to-energy facility due to its central position in relation to waste arising in the region, good road access, appropriate zoning and other factors. The site selection process is discussed in Section 2.5 of the EIS.

Without the option to distribute heat, the generation of electricity is the most energy efficient option for the facility. Heat will be used in the form of steam to drive a turbine, which will generate approximately 17.2MW electricity. Of this approximately 14.7MW will be exported to the distribution network. This gives the plant a gross electrical efficiency of 25% and a net electrical efficiency of approximately 21%.

The plant has been designed for maximum energy efficiency in order to optimise electrical output. Some of the techniques used for this are outlined in Attachments G.2.1 and L.1.3. A heat balance for the plant is provided in Attachment G.2.1.

Minimisation of Residue

The plant will generate solid residue in the form of ash and material from the flue gas treatment system. Based on an annual operating capacity of 200,000 tonnes of waste over 7,500 hours, the total residue production will include:

- Approximately 50,000 tpa bottom ash
- Approximately 1,000 tpa boiler ash
- Approximately 10,000 tpa flue gas treatment residues

In order to minimise the generation of bottom ash and boiler ash, the combustion process has been designed to be as complete as possible. For example, the grate furnace has been designed to facilitate the mechanical break-up of waste, to optimise contact with air and to ensure an adequate residence time for the waste. Process control and other measures for optimising combustion conditions are outlined in Attachments D.2.3 and L.1.3.

In order to minimise the amount of flue gas treatment residue produced, a combined semi-wet and dry process with recirculation was selected. This system generates less residue than dry flue gas treatment systems and by recirculating unreacted reagents from the baghouse, both conserves reagent and reduces solid residue production. This is discussed further in Attachment L.1.3.

Disposal of Residue

The recovery and disposal options for residues are comprehensively outlined in Attachment H.4.

Proposed Measurement Techniques

The monitoring and sampling systems proposed have been selected to comply with Annex III of the Waste Incineration Directive 2000/76/EC. A full description of the proposed systems is provided in Attachment F.2.

D.1.u Any Other Infrastructure

There will be no other infrastructure on the site.

D.1.v Infrastructure Modifications

The principle modifications to the infrastructure approved in Waste Licence 167-1 are outlined in Table D.1.b below.

Table D.1.b: Infrastructure Modifications

Aspect	Difference
D.1.b-c: Site roads and hardstanding areas	The layout of the proposed roads and hardstanding areas has been adjusted to facilitate the new site layout. In particular, the service yard is now located to the north west of the site rather than the east of the site
D.1.g: Fuel storage	Light fuel oil will be used rather than natural gas for auxiliary firing. This will require fuel to be stored onsite, whereas gas was previously to be sourced from the nearby low-pressure gas pipeline. References to accepting waste oil in the Community Recycling Park have been omitted, as the park will no longer be included in the development.
D.1.j: Traffic control	The speed limit is expressed as 20 kmph rather than 10 mph. Traffic control measures for the Community Recycling Park have been omitted, as the park will no longer be included in the development. Additional traffic measures have been outlined.
D.1.k: Key services	Power and telephone services were not previously outlined in this section. The plant will be connected to Duleek substation via the 38kV distribution network, rather than the 20kV network as previously noted. In this application, all water requirements will be met by groundwater abstraction and no water will be sourced from the public water mains in line with PL17.219721. Due to increased efficiencies in the design of the plant, the overall water requirement has decreased from 15m^3 per hour to 8.7m^3 per hour.
D.1.l: Sewerage and Surface water drainage	All surface water runoff collected in the drainage system will be discharged to the drainage ditch at a controlled rate, rather than being recirculated within the plant as previously proposed. This was modified to better mimic the natural drainage patterns of the area. While the storage volume for process water and firewater has remained constant, attenuation capacity for surface water runoff has been increased from 1,500m^3 to 4,700m^3 given that water is no longer recirculated onsite. The design includes three attenuation tanks rather than two, to minimise the effects of contamination in the event of a spill or fire. All surface water runoff will also now pass through a Class II full interceptor for petrol like substances.
D.1.m: Plant sheds, equipment and garage	The workshop will now include an education centre, offices and related facilities. The service yard is now located towards the north west rather than to the east of the main process building.
D.1.n: Site Accommodation	Offices and other facilities will now be accommodated within the main processing building and the warehouse/education centre rather than in a separate administration building.

D.1.p: Civic Amenity Sites	A civic amenity site will not be provided at the facility, by direction of An Bord Pleanala in planning decision PL17.126307 because "*It is considered that this aspect of the proposed development, which is to serve a local need only and would attract unnecessary car-borne traffic, would more appropriately be located in the local population centre of Duleek"*
D.1.q: Any other waste infrastructure	A materials recycling facility will no longer be included in the development because, since this was proposed in 2001, separate collection has been rolled out and a number of MRF facilities have been developed within the region.
D.1.t: Incineration infrastructure	The layout of the main process building within the site has changed. The length of the building now roughly aligns with the boundary fence at the back of the site. The process building no longer includes a sorting plant or flue gas treatment residue / boiler ash solidification unit. The maximum height of the buildings has increased from 30m to 40m above ground (60.75mOD to 70mOD) and the bunker size has increased from 12,000m^3 to 16,000m^3. The section outlining compliance with the Waste Incineration Directive includes changes such as: • an updated heat balance and improved net energy efficiency from 18% to 21%. • an increase in residue production from 38,000 tpa to 61,000 tpa. This is explained further in Attachment D.2.10. • an increase in the recovery of ferrous metals from 2,100 tpa to approx. 5,000 tpa depending on the composition of incoming waste.

Attachment D.2: Description of Processes

D.2.1 Overview

The Meath waste management facility will consist of a single waste-to-energy line with a nominal capacity of 26.7 tph assuming the average calorific value of waste will be 9.4 MJ/kg. It will be based on conventional grate furnace technology, with a 70MW steam boiler and an advanced flue gas treatment system. The main process steps will include:

- Waste acceptance and handling
- Moving Grate Furnace with SNCR-deNO$_x$
- Boiler
- Energy recovery and Water/Steam Circuit
- Flue gas treatment
    - i. First stage dioxin removal
    - ii. Spray drier absorber
    - iii. Reaction duct and baghouse filter
    - iv. Induced draught fan and stack
- Ash handling

Each of these steps is described in more detail below, with a focus on the process description, process control and abnormal operations. Appendices D3, D9 and D11 (Drawings 15013\WL\008, 15013\WL\0010 and 15013\WL\009) show the layout of the plant in detail. A plant schematic is provided in Figure D.2.a.

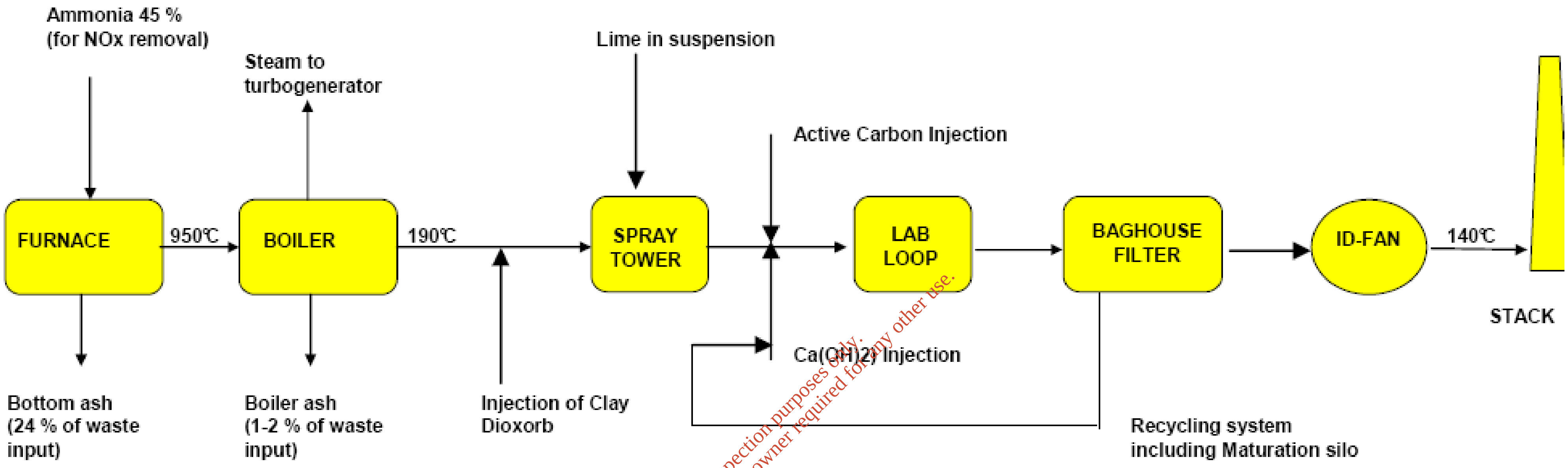

Figure D.2.a: Schematic of Plant

The selected technology is proven and reliable and has been used in many countries worldwide. In the design of the facility, Best Available Techniques (BAT) were taken into account wherever possible (see Attachment L.1.3). The reason for selecting the final design and consideration of alternatives is given in Section 3 of the EIS.

The amount of waste that can be treated in the facility varies with its calorific value, since the energy generated by the waste must not exceed the boiler's 70MW thermal capacity. This is explained further in Section 5.4 of the EIS. In any case, in line with planning permission PL17.219721, the maximum capacity of the plant will be 200,000 tpa.

D.2.2 Waste acceptance and handling

The waste acceptance and handling operations include a waste reception hall, a 16,000 m^3 waste bunker, a control room, a manually/automatically operated grab crane and furnace feed hoppers. Please refer to Figure D.2.b for a flow diagram of the waste acceptance and handling step.

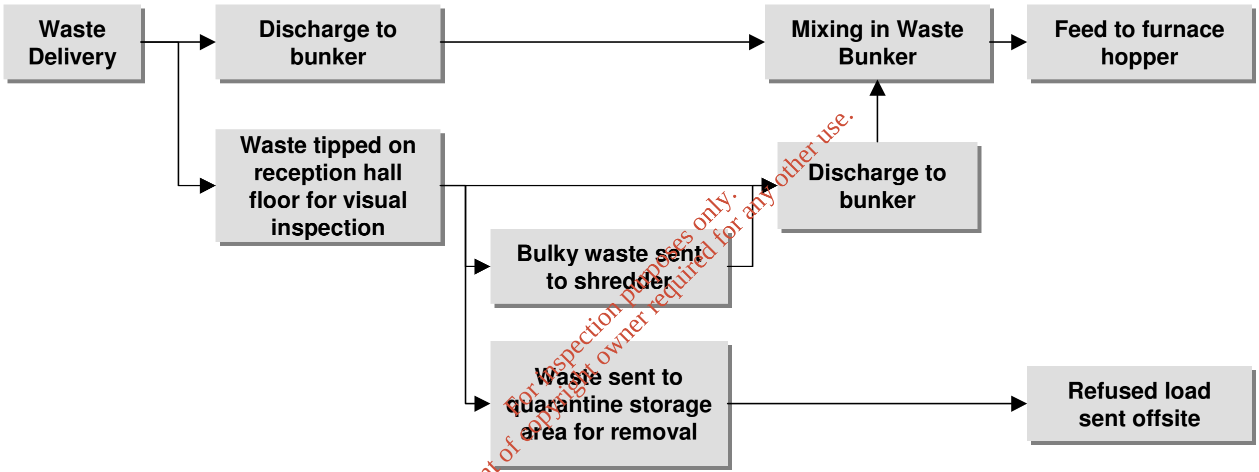

Figure D.2.b: Waste Acceptance and Handling Process Flow

D.2.2.a Process Description

Deliveries will only be accepted at the facility from authorised carriers holding relevant waste collection permits. A copy of all authorised carrier permits will be retained at the facility.

On entering the facility, trucks will report to the weighbridge first before proceeding to the reception hall. Drivers will present documentation relating to the waste load to staff in the gatehouse, where intake schedules will be checked, loads will be compared with the delivery docket and drivers will be issued with a batch card. The trucks will then be weighed. Some trucks with standard contracts will access the facility using a swipe card, which will record their details.

All waste material entering the facility will be recorded in a tracking system that logs:

- the date
- the name of the waste collection contractor
- the vehicle registration number
- the waste EWC code and description of the waste
- the weight of each consignment

- a unique SAP shipment number
- the name of the person checking the load
- details of the rejected load if applicable.

These records will be submitted to the planning authority on a monthly basis in line with Condition 4 of planning permission PL 17.219721 and will be summarised in the annual environmental report.

After passing the weighbridge and gatehouse, waste trucks will drive into the enclosed reception hall. Frequent inspections of waste will be required to ensure that all contractors are in compliance with Indaver Ireland's waste acceptance criteria. All new contractors bringing waste to the facility will be required to have a percentage of their loads inspected for an initial trial period. This is to ensure that the contractor understands the types of waste that can be disposed of at the facility and that materials not permitted under the site waste licence do not enter the plant. In addition, existing waste contractors will occasionally be required to have their loads inspected, which will ensure that the contractors maintain vigilance in relation to the types of material that they collect.

The waste inspection area will be located in the reception hall as indicated in Appendix D3. As well as a visual inspection, a handheld radioactivity detector will be used to inspect loads for radioactivity. Radioactive wastes will not be accepted at the facility.

Any non-conforming waste will be loaded into suitable covered containers or trucks, which will be consigned to a designated waste quarantine area. This may include, for example, bulky waste, loads with a high level of PVC plastic content or hazardous wastes. The quarantine area will be located in the service yard (see Appendix D3) away from the main activity areas. The trucks or containers will be held in this area for a short period to allow the waste contractor time to make alternative disposal arrangements, if necessary. All refused loads of waste will be recorded.

Any bulky waste will be sent to a shredder located in the reception hall before being discharged to the bunker. This will reduce the size and modify the shape of the waste to suit the grate furnace requirements and ensure complete combustion. The shredder will be mobile and will be filled using a bulldozer or other loader. Its total capacity will be 20 tph.

Sludges will be received in a dedicated pit area as shown in Appendix D3 and pumped directly into the furnace. The grate furnace can handle up to 10% sludge in the waste flow.

Loads not being inspected or having passed the waste inspection process will be discharged into the bunker through one of the five discharge chutes. The gross bunker capacity is 16,000 m^3. Mixed waste (non-hazardous municipal / commercial / industrial) of the type expected at the plant typically has a density of 0.3 – 0.4 tonnes/m^3, giving an approximate bunker capacity of 5,600 tonnes. This will be sufficient to allow the plant to accept waste during periods of shutdown and to continue operating over prolonged periods without deliveries (e.g. during long weekends). The waste bunker will be of water-tight construction and will also have a double containment mechanism with inspection ports to ensure that there is no leakage (see Attachment F.1.2).

Operators located in the control room overlooking the bunker will screen the waste and remove any material unsuitable for incineration. Travelling grab cranes will be used to blend waste in the bunker. This will ensure that, despite the variety within the waste loads delivered, the feed to the furnace is relatively uniform. The grab cranes will also be used for feeding the blended waste material via the feeding hoppers to the highest point of the furnace. The cranes can be operated either manually, semi automatically or fully automatically. The average retention time of the waste in the bunker is three days.

Draft waste acceptance and handling procedures are included in Attachments H.2 and H.3 respectively.

D.2.2.b Process Control

The waste reception hall will be maintained under negative pressure to prevent the egress of odour or windblown waste. This will be achieved by drawing some of the air for combustion from the waste bunker.

The waste in the feeding hoppers will provide an airtight seal or plug between the furnace and the bunker area. This will help to prevent flame back flow from the furnace through the hopper and into the bunker as discussed in Section 5.17.4 of the EIS. The bunker will be continuously monitored from the control room to ensure adequate feeding of waste to the furnace to maintain this plug, and to monitor for potential incidents.

The feeding chute to the furnace will be fitted with a low level alarm, which sounds in the control room when the amount of waste in the hopper drops below a certain level. When the cranes are in automatic mode, this signal will call for waste from the cranes directly without any operator intervention.

D.2.2.c Abnormal Conditions

The greatest potential for fire is in the bunker, where localised heating can occur due to the decomposition of organic material or as a result of hot ash in the waste. As described in Section 5.17.4 of the EIS, crane operators located in the control room will detect smouldering waste in the bunker at an early stage. In this event, the section of waste that is smouldering or on fire will be lifted into the feed hoppers and covered with another layer of waste. This will isolate it from the rest of the waste in the bunker and will ensure it is quickly dealt with in the furnace. If the crane operator fails to detect a fire, automatic fire detection systems will activate an alarm in the control room. More information on fire fighting systems is included in Attachment D.1.o.

Volatile Organic Compunds (VOCs) like methane (CH_4) may arise in the bunker due to the decomposition of waste or presence of volatile materials e.g. wood preservatives, traces of oil. To monitor for any potential accumulation of VOC levels in the waste bunker that could cause a fire risk, a lower explosive limit (LEL) detector will be installed. This will alert plant operators in the event of levels deviating from set limits. The induced draught (ID) fan at the end of the flue gas treatment system will then ramp up to increase air flow through the bunker, removing any possibility of explosive atmosphere conditions.

When the incinerator is shut down, the primary air fan will be used to evacuate any odours from the bunker and discharge them via the stack. If the primary air fan is shut down for maintenance, waste in the bunker will be sprayed with odour suppressing chemicals to minimise odour emissions. If the shutdown is for a prolonged period (e.g. a planned annual shutdown lasting for 2 weeks), the plant may accept waste until the bunker has reached its capacity. The bunker capacity is approximately equivalent to 10 days plant throughput. If the bunker reaches capacity during a shutdown, the plant will cease to accept waste and all waste will be directed to suitable alternative outlets. There will be no storage of waste outside of the waste bunker and the quarantine area.

D.2.3 Moving Grate Furnace

In the moving grate furnace, conditions are optimised for the complete combustion of waste to release the maximum amount of energy and minimise pollutant loading in the flue gases. Figure D.2.c below shows the process flow of this step. A full description of the combustion process is provided in Section 5.6.2 of the EIS.

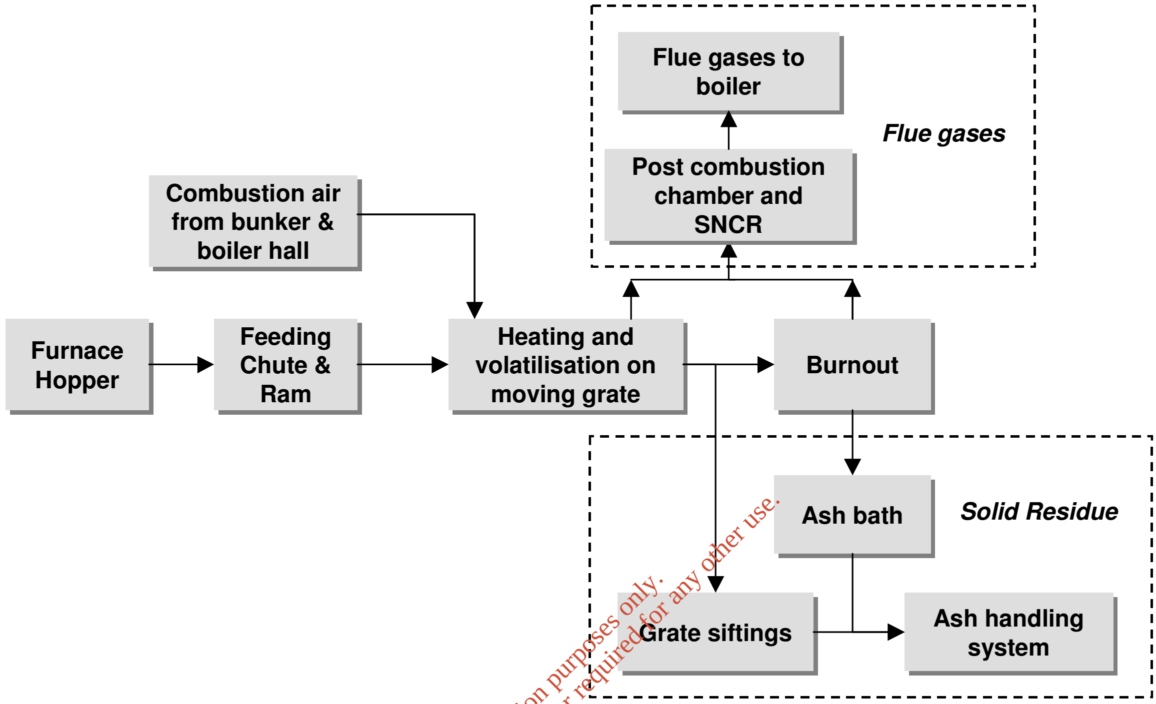

Figure D.2.c: Moving Grate Furnace Process Flow

D.2.3.a Process Description

Waste from the furnace hoppers in the bunker area will be fed into the furnace at a controlled rate by feeding rams. The furnace will consist of a "grate" type mechanism angled at a slope of 25°. The grate mechanism is designed to facilitate the slow, continuous movement of waste through the furnace, ensuring an even distribution of waste, good mechanical break-up and efficient air distribution. This provides for a controlled and complete combustion. The average residence time in the furnace will be approximately one hour.

The furnace chamber will have water-cooled ceilings and walls, to ensure optimal conditions for burnout of flue gases. Air will be used as the primary cooling source for the grate, with additional water-cooling in the wear zone just above the grate and the mid-section of the grate.

Primary air for combustion will be drawn from the bunker, pre-heated by steam from turbine extraction and fed to the furnace from below the grate. Secondary air drawn from the top of the boiler hall will be fed over the grate to assist with combustion and facilitate mixing of the flue gases. The induced air movement through the furnace will prevent the possibility of flame back flow in the hopper.

The grate furnace will have a nominal design capacity of 26.7 tph (assuming waste with a calorific value of 9.4MJ/kg), but will be able to operate effectively over a range from 13.6 to 26.7 tonnes per hour depending on the calorific value of the waste, as explained in Section 5.4 of the EIS.

Oxides of Nitrogen (NO_x) in the combustion gases will be removed using Selective Non Catalytic Reduction (SNCR). This involves injecting a SNCR reagent (ammonia or urea) at two levels into the post-combustion chamber, which reacts to form nitrogen and water. The SNCR system will ensure the plant operates below the EU Directive 2000/76/EC limit of 200 mg/m^3 for nitrogen dioxide (NO_2).

Fine ash or "grate siftings", will be collected in hoppers located underneath the gate. Bottom ash will be discharged at the end of the grate into a water bath or wet "de-slagger". This de-slagger creates an air-tight seal between the furnace and the main process building. More details on ash handling are provided in Attachment D.2.7.

D.2.3.b Process Control

Process control in the furnace is designed to ensure complete combustion of the waste, to minimise both residues and the pollutant loading in the flue gases. The control system will monitor a range of parameters, which give indications of the combustion conditions, including:

- Temperatures and pressures in different sections of the furnace and boiler
- Steam flow
- Grate resistance
- Burnout of waste in the furnace
- % O_2 in the furnace combustion gases

These parameters will be monitored in a variety of ways. The burnout of waste in the furnace will be controlled by visual inspection of the flame using cameras and monitors and by automatic temperature monitoring in the last section of the furnace. Flue gas monitoring in the furnace (oxygen (O_2)) and at the stack (carbon monoxide (CO) and NO_x) provides information on the condition of the flue gases. Additional feedback may be provided by flue gas monitoring at the boiler exit, if reliable instrumentation suited to the aggressive conditions at the boiler exit can be found.

Based on information gathered, the furnace feed rate and combustion air flow can be adjusted. For example, temperatures in the furnace may be controlled by either increasing or decreasing the waste feed rate, or by firing auxiliary burners in the boiler. The combustion air input can be optimised from information on the flue gas content of O_2 and CO and from the furnace temperature. The rate of feed through the furnace is corrected to ensure the percentage of total organic carbon (TOC) in the combined bottom ash and grate siftings ash is less than 3% in line with EU Directive 2000/76/EC.

No waste will be charged to the furnace unless it can be assured that the temperature and residence time of the combustion gases are in line with the requirements of EU Directive 2000/76/EC. This is described further in Attachment D.2.4.

D.2.3.c Abnormal Conditions

There will be a number of interlocks on the furnace, which will initiate a plant shutdown. These include, for example:

- where excess air pressure occurs in the furnace and is not rectified by the induced draught fan
- where the low level alarm on the hopper is activated and waste is not added to the hopper within a specified length of time

- where excess CO levels occur in the furnace

A full description of the interlock system is provided in Section 5.6.12 of the EIS. In the event of a shutdown, any remaining combustion gases will continue to be drawn through the flue gas treatment system prior to being discharged through the stack.

Furnace startup and shutdown procedures are outlined in Appendix 5.1 of the EIS.

D.2.4 Boiler

The boiler immediately follows the furnace and is designed to extract heat from the flue gases and convey it to the boiler water to produce steam. A full description of the boiler process flow is provided in Section 5.6.4 of the EIS. Figure D.2.d below outlines the process flow.

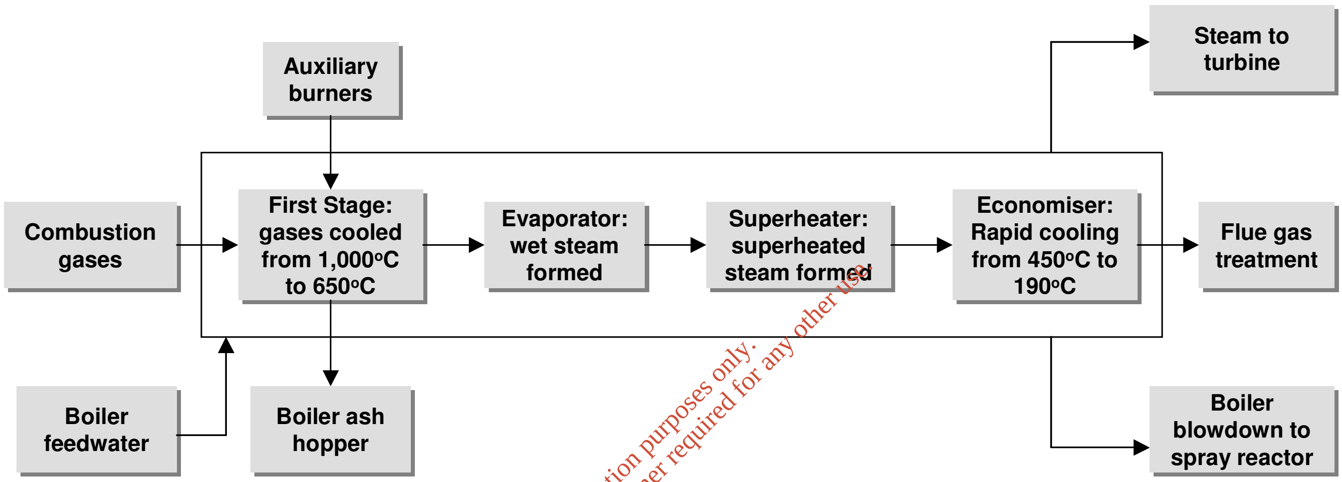

Figure D.2.d: Boiler Process Flow

D.2.4.a Process Description

The boiler will be configured as a natural circulation boiler with three empty vertical passes followed by a horizontal convection pass containing superheaters, evaporators and economisers. Combustion gases will be cooled from about 950°C at the furnace to 190°C at the boiler exit, with the heat being transferred to the boiler water.

Please refer to the EIS section 5.6.4 for a detailed description of the different stages of the boiler.

The total residence time of gases in the boiler will be approximately 30 seconds. In the section of the boiler where combustion gases reach 400°C to 200°C, the velocity of the gases will be increased in order to accelerate heat transfer and cool gases rapidly. This will help to minimise the formation of dioxins/furans.

Boiler ash entrained in the flue gases will drop out between the vertical and horizontal passes of the boiler, where the velocity of the gases is reduced. This will be collected in hoppers beneath the boiler for removal.

D.2.4.b Process Control

In order to control emissions and comply with the EU Directive 2000/76/EC, the first pass of the boiler is designed to ensure that the specified minimum residence time of 2 seconds at 850°C will be maintained after the last air/fuel injection in the normal load range and without auxiliary firing.

Auxiliary light fuel oil burners will be used where necessary to ensure these conditions are met, for example during startup and where the furnace may be operating at partial load. The auxiliary burner will not be in use under normal operation.

The steam flow in the boiler and subsequently in the turbine will be controlled by valves, according to a specified load or other operating conditions. The system will be equipped with stop valves which interrupt the steam flow if operating conditions fall outside preset levels.

A small quantity of water will be purged constantly from the boiler steam circuit and replaced with fresh makeup water from the demineralisation plant. This “boiler blow down” will be recycled for use in the evaporating spray reactor. Small amounts of chemicals (see Attachment G.1) will be added to the boiler feedwater to prevent corrosion and scale buildup in the steam circuit.

The boiler will be constructed for simple operation, monitoring and maintenance. It will be cleaned using a combination of online and offline techniques to reduce dust accumulation and to help minimise the formation of dioxins/furans.

D.2.4.c Abnormal Conditions

In the event of a power failure, the emergency generator will maintain one boiler feedwater pump in operation to keep the water level in the boiler above a minimum and prevent the boiler from overheating.

Another abnormal situation that could occur is a leak of boiler feedwater from the boiler tubes into the flue gas. This would be detected by a significant increase in the water vapour content of flue gases and the level of water in the demineralisation tank dropping faster than expected. In the event of a major leak an emergency shutdown would occur. Use of anti-corrosion chemicals in the boiler feedwater and preventative maintenance of the boiler tubes will reduce the likelihood of such leaks.

D.2.5 Energy Recovery and Water/Steam Circuit

The energy recovery system converts energy in the steam into electricity. Section 5.6.5 of the EIS provides an outline of this recovery process, which has been updated below with new information from the proposed supplier.

Figure D.2.e below gives an overview of the process flow of energy recovery and the water/steam circuit.

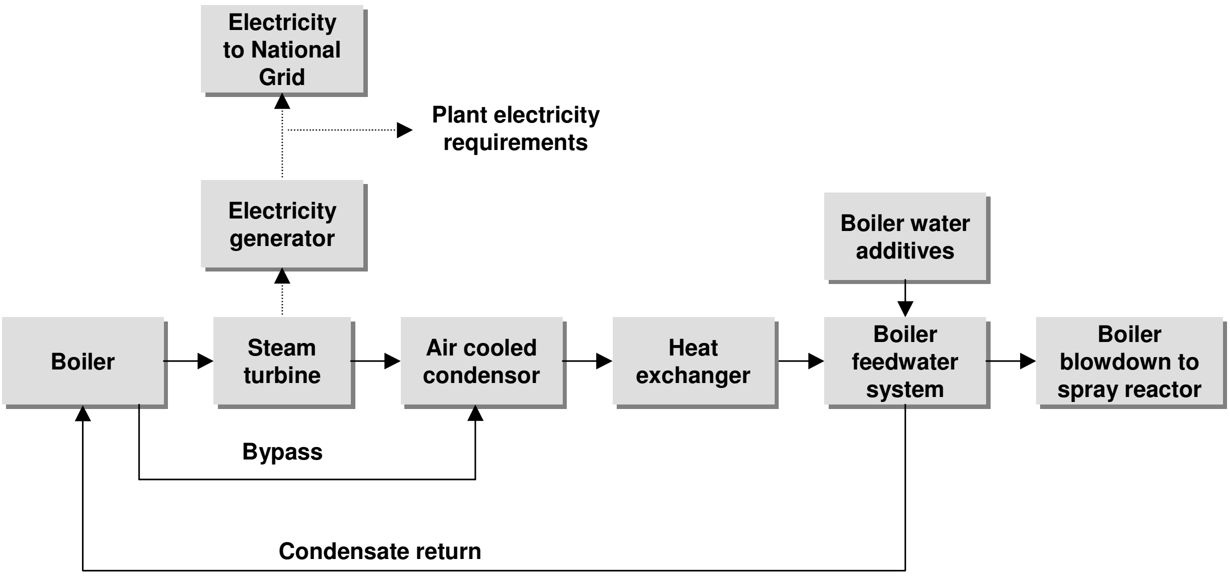

Figure D.2.e: Steam Cycle Process Flow

D.2.5.a Process Description

Steam at 40 bar and 400°C from the boiler will be sent to the steam turbine, which will drive a generator set to give an electrical output of approximately 17.2MW. As approximately 2.5MW will be required for electrical demand within the plant, the net electrical output from the plant for export to the national grid will be about 14.7MW.

The steam pressure at the turbine exit will be extremely low (0.1 bars absolute) in order to maximise energy recovery in the turbine. This will be maintained by the air cooled condensers at the turbine exit, which will dissipate waste heat from the steam leaving the turbine into the atmosphere in banks of heat exchangers. Air cooled condensers substitute cooling water and thereby help to reduce the consumption of water and the amount of effluent produced.

Condensate from the air cooled condensers will be returned to the boiler feedwater tank via a heat exchanger. This will use heat from the turbine to raise the temperature of the condensate from 150°C to 180°C.

The flow of steam through the cycle will be approximately 82 tph at the nominal load of 26.7 tph waste.

D.2.5.b Process Control

The operation of the turbine can be monitored and controlled from the central control room via alarms, controls and measurements on the steam turbine control and protection system. Valves will be used to control the steam flow to the turbine according to operating conditions.

D.2.5.c Abnormal Conditions

The steam flow can be made to bypass the turbine if, for example, there is a failure in the 38kV power cable used to export electricity or if the plant is instructed not to export any electricity for reasons of network system security. For this reason, the air cooled condenser will have the capacity to dissipate the full heat load (70MW) from the boiler. Should this situation arise, the turbine will operate in “island” mode or at partial-load, generating only just enough electricity to meet the house load of 2.5MW.

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. In the case of a surge of steam due to a sudden increase in the calorific value of waste being combusted, the turbine will be capable of “swallowing”, or absorbing, up to 120% of the nominal load.

D.2.6 Flue Gas Treatment

The flue gas treatment system is designed to ensure emissions from the stack will be significantly below limits set by EU Directive 2000/76/EC. In addition, the system has been designed to eliminate effluent and to minimise the consumption of water, reagents and energy. A combined semi-wet and dry process with recirculation, using lime as the main reagent, was selected as the best process for achieving these goals.

Section 5.6.7-10 of the EIS provided a high level overview of the flue gas treatment system. This has been updated below with information from the proposed supplier, which may vary slightly from the description in the EIS. Attachment L.1.3 describes how the selected system aligns with BAT.

The key components of the flue gas treatment system will include:

- A first dioxin/furan and heavy metals removal stage with expanded clay injection into a duct at the exit of the boiler economiser
- A spray drier absorber, where a lime slurry is injected to cool the flue gases and react with acid gases like hydrochloric acid (HCl) and hydrofluoric acid (HF)
- A second dioxin/furan and heavy metals removal and acid gas treatment stage with the injection of activated carbon, recirculated and reactivated reagent from the baghouse filter and fresh hydrated lime absorbent where necessary in a reaction duct
- A high performance baghouse filter for particulates removal
- A recycling system for baghouse filter residue
- An induced draught fan to maintain the flow through the treatment system
- A 65m stack equipped with continuous emissions monitoring systems

Ancillary equipment such as reagent preparation, storage and injection systems and residue removal will also form part of the flue gas treatment system. A flow chart of the overall system is provided in Figure D.2.f.

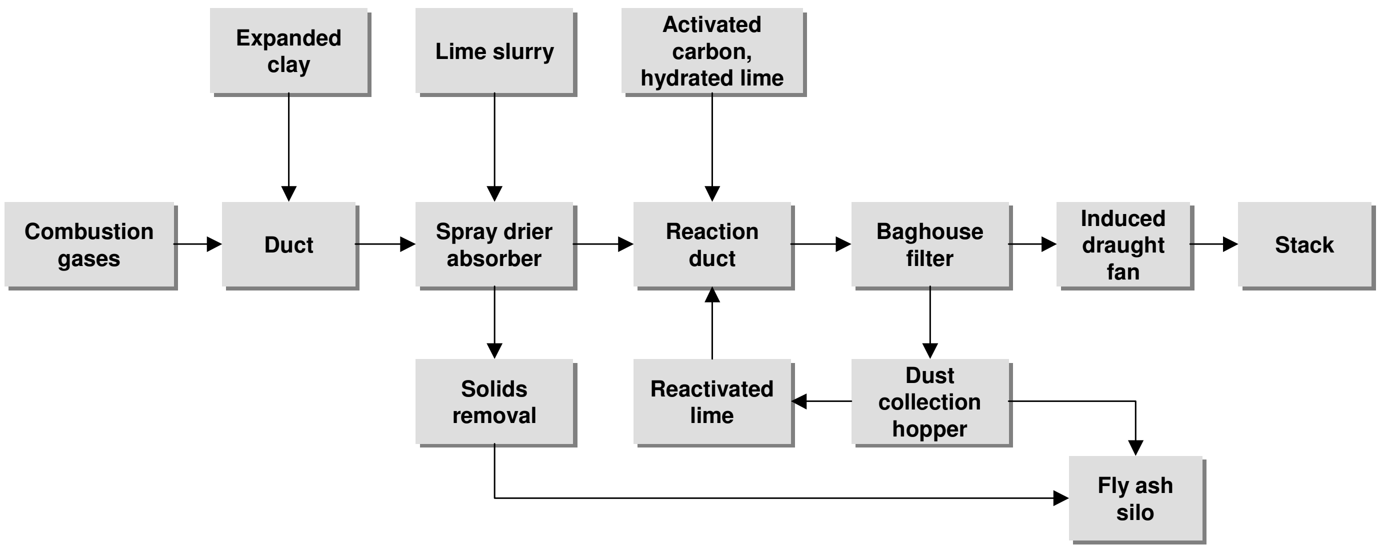

Figure D.2.f: Flue Gas Treatment System Process Flow

D.2.6.a Process Description

First Stage Dioxin Removal

The flue gas will leave the boiler economizer at approximately 190°C. In the duct connecting the economizer to the spray drier absorber, expanded clay will be injected for the first stage of dioxin removal. Dioxins and heavy metals will be adsorbed into the clay for removal in the baghouse filter downstream.

Spray Drier Absorber

The flue gases will then enter the spray drier absorber, which is a large cylindrical vessel with a rotary atomizer. The gases will enter the top of the tower by forced draft and travel downwards in a spiral through the absorber to optimize contact with injected lime slurry and water and ensure a complete reaction. The quicklime ($Ca(OH)_2$) contained in the slurry will react with acid gases like HCl and HF to form reaction salts. Entrained dust and reaction salts will mostly be expelled from the absorber with the flue gas, though small quantities of coarser particles may drop out to be collected at the bottom of the reactor for removal with the flue gas treatment residues.

The spray drier absorber also lowers the temperature of the flue gas to 140°C as required for downstream flue gas treatment stages. This occurs because the injected lime/water slurry mix forms fine droplets and absorbs heat from the flue gases for evaporation.

As the lime is injected as lime milk with water, the spray drier absorber is referred to as a "semi-wet" treatment.

Reaction Duct and Baghouse filter

A reaction duct will be installed downstream of the spray drier absorber to provide a second stage of dioxin, heavy metals and acid gas removal. A number of reagents will be injected into the duct including activated carbon, recirculated and reactivated byproducts from the baghouse filter and, where necessary, fresh hydrated lime. As the fresh lime is injected in the reaction duct in a dry form, this step is referred to as a "dry" treatment.

Conditions in the duct will be highly turbulent to ensure maximum contact between the reagents and any remaining pollutants. The activated carbon will ensure the efficient and effective transfer of any remaining heavy metals, trace organics and dioxins from the flue gas. Fresh hydrated lime will be injected if the pollutant load in the waste is high and the reactivated byproducts alone cannot ensure a sufficient removal of remaining acid gases. The combination of reagents will enable the reaction duct to control emission peaks, increase operational flexibility and reduce residue production from the flue gas treatment system.

Following the reaction duct, flue gases will pass through a baghouse filter. This will consist of 6 independent compartments containing over 12,000 bags with a total surface area of 29,600m^2. Particulates including dust, fly ash, clay, carbon and reaction salts will be deposited on the surface of the bags as the gases pass through each compartment in sequential order. As the particulates accumulate, an automatic cleaning sequence will shake the filter cake off the bag where it falls into dust collection hoppers.

The residues in the filter cake will still contain some un-reacted lime, so approximately four fifths of them will be reactivated and recycled into the reaction duct. The remaining one fifth will be purged from the process as flue gas treatment residue. This recirculation will help to minimise the amount of residues requiring treatment or disposal.

<u>Induced draught fan and stack</u>

An induced draught (ID) fan will be situated after the baghouse filter. This is an axial fan that draws air through the flue gas treatment system from the furnace, ensuring that no combustion gases escape from the plant without first going through the treatment system.

Treated flue gases will then pass into the 65m stack before being emitted to atmosphere. Gases leaving the stack will have a temperature of approximately 140°C so there will be no visible plume. The stack will have ease of access for both emissions monitoring equipment and sampling holes. It will also be fitted with a lightning conductor, aviation warning lights and a condensate drain.

D.2.6.b Process Control

Data collected from the monitoring station at the stack and, if possible, at the boiler exit, will be used to control the flue gas treatment system. Monitoring HCl and SO_2 at the boiler exit would help optimize reagent consumption. However, from operating experience in Belgium, it can be difficult to obtain reliable instrumentation reliable for the aggressive environment at that point in the process.

Temperature is the most important control parameter in the operation of the spray drier absorber. Temperatures of above 250°C in this unit will cause the furnace to shut down, while temperatures below 100°C could cause precipitates. The injection of water with the lime milk will be used to control the temperature according to the boiler exit temperature as well as acid gas measurements at the stack.

The pressure drop across the filter fabric will be continuously monitored and regulated via a set of valves and fans. Regular de-dusting will help to reduce the pressure drop across the filter.

The induced draught fan will be fitted with noise and vibration abatement equipment to minimise emissions.

D.2.6.c Abnormal Conditions

The baghouse filter has been designed with inbuilt contingency so that any one compartment can be shut down for maintenance or repairs without affecting the plant capacity. If one of the baghouse filter components fails, the relevant compartment will be isolated from the flue gas flow and inspected. This will allow for the plant to continue to run at normal load during inspection and repair work.

The risk of excessive temperatures in the baghouse filter will be largely avoided by the high level of dilution of activated carbon with lime and other solids in the flue gas. Temperature sensors will detect any temperature rise and transmit a warning to operating staff. As for a filter failure, the compartment showing a temperature rise can be isolated and rendered inert. Conversely, should the temperature drop below 100^{o}C causing water vapour to condense on the bags and make them wet, an alarm will sound and the relevant compartments will be isolated.

The cleaning of the rotary atomizer will take place online by an injection of hydrochloric acid (HCl). In case of failure or blockage, the atomizer can be replaced during plant operations within 15 minutes. The buffer thickness of lime and residue on the baghouse filters will ensure emissions limits are not exceeded during this time. A lime service tank will act as a backup to ensure lime slurry is always available to the system.

The lime, clay and activated carbon dosing systems have been designed to be robust and have a high availability. In the case of unexpected failure, a second booster fan and spare piping will be installed (but not connected), for redundancy. All reagent feedstock will be monitored to ensure dosing is continual. Should the weight of feeding silos remain steady, indicating the feed has stopped, an alarm will be activated. The feed silos also act as a buffer should there be a failure in reagent preparation systems.

In the case of a power failure, the emergency generator will drive the induced draught fan to draw flue gases from the furnace through the flue gas treatment system before expelling them via the stack.

D.2.7 Residues Handling

D.2.7.a Process Description

The residues handling system has been designed to collect and manage residues arising in the facility for removal from the site. Section 5.7.2 of the EIS provided an outline of the residues handling process. Figure D.2.g below gives an overview of the process flow of residues handling.

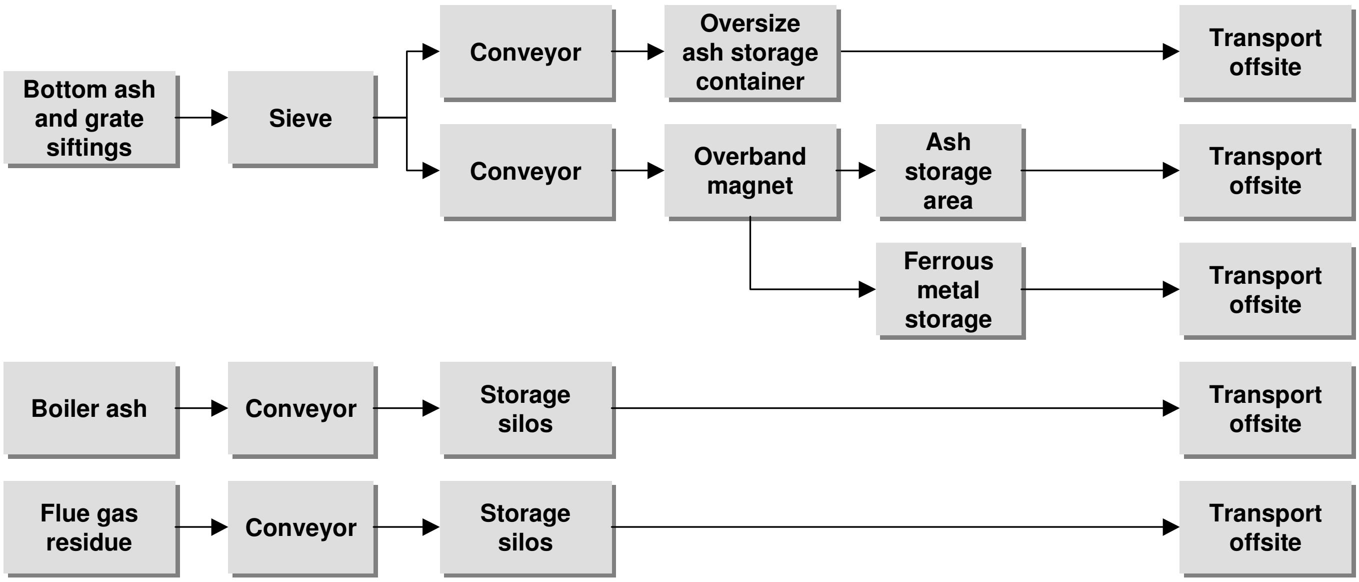

Figure D.2.g: Residues Handling Process Flow

Solid residues are collected from three different process areas including:

- Bottom ash and grate siftings from the grate furnace. This constitutes the bulk of residue from the facility at 25% of waste input by weight or 50,000 tpa. It is mainly composed of inert material such as sand, glass, metal scrap and stones.
- Boiler ash from the boiler ash hopper. This constitutes about 0.5% of the waste input by weight or 1,000 tpa. It consists of light ash particles entrained in the flue gas.
- Flue gas treatment residues from the spray drier absorber and baghouse filter hoppers. This constitutes about 5% of the waste input by weight or 10,000 tpa. They are mainly composed of reaction salts, fly ash, heavy metals and dioxins adsorbed onto activated carbon/expanded clay and some hydrated lime.

The bottom ash and grate siftings will be brought from the water bath to a sieve by conveyor. This separates out oversized ash particles (>200mm), which are stored in a dedicated container within the ash bunker. The remaining ash passes by an overband magnet, which separates out ferrous metals. The metals drop from the magnet into a dedicated storage box in the ash bunker for removal and recycling. Approximately 5,000 tonnes ferrous metals can be recovered annually from the raw bottom ash, depending on the incoming waste composition. The remaining ash is stored in the ash bunker, which has a total capacity of 1,600m^3 or enough for over 10 days ash production. Ash will be transferred from the bunker to collection trucks using a crane and hydraulic grab in an enclosed loading bay.

Boiler ash is removed via enclosed conveyors to two storage silos with a total capacity of 100m^3 in the main process building. Flue gas treatment residues will also be conveyed via enclosed conveyors to residue silos in the main process building. There will be two such silos of 210m^3 each.

D.2.7.b Process Control

The ash collection and conveyance will be controlled locally and can be monitored from the central control room via the plant's main control system. The boiler ash and flue gas treatment residue silos will be fitted with load cells, which signal when the silos are reaching full capacity.

The boiler ash and flue gas treatment residue transport, storage and truck discharge mechanisms have been specially designed to minimise dust emission. This includes, for example, slow moving screw conveyors, chain conveyors, bucket elevators and planetary screw discharges. Equipment for conveying and storing the boiler ash and flue gas treatment residue will be insulated and fitted with electrical trace heating where necessary to avoid deposits and encrustation. The silos will also be equipped with High Efficiency Particulate Abatement (HEPA) filters to prevent fugitive emissions. The boiler ash and flue gas treatment residues will be discharged into trucks in loading bays in the main process building via dust free discharge points.

The water content of the grate siftings and bottom ash is approximately 25%, which will minimise dust emissions during storage.

D.2.7.c Abnormal Conditions

In the event of conveyor failure from the boiler or baghouse filter, there will be sufficient storage within both systems for approximately one day to allow for repairs. If the conveyor cannot be repaired within this timeframe the plant will be shutdown.

D.2.8 Utilities

Water and electricity will be the only utilities consumed onsite. Water will be provided for domestic and process use from a groundwater well on site as there will be no connection to the public watermain.

A 38kV connection to the distribution network will be installed for the import and export of electricity. Electricity will be imported to the site during startup and maintenance shutdowns. During operation, electricity for onsite demand will be provided by the generator onsite.

A natural gas main traverses the site but will not be connected to the site. Reinforcements to the ground covering the main will be made in consultation with Bord Gais Eireann if required.

Compressed air will also be used onsite for a variety of applications and will be supplied from electrically driven variable speed drive compressors.

D.2.8.a Process Description

The electrical systems will comprise the following:

- Electricity generator (max output approx. 19.2MW)
- 38kV electrical substation with 38-10kV transformer and associated switchgear
- 400V supply to motors and equipment provided by distribution transformers.
- 240V supply to lights, main control system etc. provided by distribution transformers.
- Uninterruptible Power Supply (UPS)[5]
- Emergency diesel generator

[5] A battery backup device

The 17.2MW generator will produce electricity at approximately 10kV, which the transformer in the substation will step up to 38 kV for export. The internal distribution transformers will step the voltage down from 10 kV to 400 V and 240 V. This will allow power from the distribution system to be used to start up and shut down the plant if required.

Approximately 1,800 Nm^3/ h compressed air at 7 bar gauge will be used onsite for plant air, service air and instrument air.

D.2.8.b Process Control

The main electrical systems will be monitored and controlled by the central control system. The 400 kV supply to the motors etc will be controlled by switches in the Motor Control Centre (MCC).

Two compressors for compressed air will be run continuously with a third compressor remaining on standby. Compressed air will be stored in a $5m^3$ storage tank, which will provide a buffer against a potential failure of the compressors and will help avoid short-cycling of the compressors due to fluctuating demand. The compressors and air supply will be controlled by the plant's main control system with local controls also available.

D.2.8.c Abnormal Conditions

In the unlikely event of a power failure in the plant and a simultaneous failure of power supply from the electrical distribution system, the plant's UPS will come online to supply electricity to the critical systems such as the flue gas treatment system and computer systems. The UPS will maintain a power supply to the control systems for 15 to 30 minutes. In the meantime, the emergency generator will be started up to supply electricity to motors, pumps and fans until the plant is safely shut down.

The compressed air tank will be equipped with a by-pass in case of maintenance or inspection as well as a safety relief valve, a manometer and manual valves. A high pressure sensor protects the compressor against any abnormal rise in delivery pressure.

D.2.9 Calibration and maintenance system

The maintenance program for the Meath facility will be based on the system in use at Indaver's hazardous waste-to-energy facility in Antwerp, Belgium, but tailored to suit the particular needs and equipment at the Meath plant.

The maintenance programme in Antwerp is part of Indaver's software operating system SAP. The SAP system integrates different management aspects into the one system, e.g., finance, materials management, sales, quality management. The main features of the system are as follows:

- The maintenance programme assigns a unique identity number to each item of equipment when it is installed.
- A maintenance schedule is built up and can be programmed to run automatically. All maintenance orders are recorded.
- The programme has an automatic scheduler, which generates a list of maintenance or replacement tasks to be undertaken each week. For example, calibration and inspection tours are generated automatically by the system. The list contains work instructions designating the equipment, the maintenance task etc.

- The programme has controlled access at different levels. Generally 'read' authorisation is available but 'write' authorisation is limited to designated personnel.
- When a task is completed, maintenance staff notify the relevant process supervisor who verifies the job is complete and signs off on it. This verification is passed back to the appropriate group in the maintenance department, who record that the job is “technically completed”. The SAP programme updates the status of the item and the next maintenance due date is generated.
- The programme automatically updates the inventory of spare parts and signals which items are out of stock. Indaver staff can then order the items as required. Parts are ordered according to the lead times for replacement and their level of importance to plant operation. All maintenance work carried out is linked back to the appropriate cost centre, so the performance trend of individual plant items can be monitored.

Standard maintenance checks are currently carried out at the Antwerp site on a weekly basis. The tasks are assigned to the maintenance operatives through the maintenance programme in the SAP operating system. The types of checks carried out on a weekly basis are as follows:

- visual checks on plant and equipment
- visual checks on the most important pump gasket seals
- greasing of plant and equipment
- pressure and temperature checks on equipment
- discussions with plant operators to identify any problem areas.

Other maintenance tasks are executed less frequently such as:

- monthly checking of the circuitry of the electrical equipment
- 6-monthly overhaul of the most important pumps. The frequency of this will depend on operating experience.
- 6-monthly checks on certain programmable logic controllers (PLC) for plant operation
- annual maintenance of PLC systems for the entire plant
- annual maintenance of safety instrumentation
- annual corrosion detection on process pipe work using a hand held ultrasonic device.

D.2.10 Modifications to the Process Description

The principle modifications to the process description approved in Waste Licence 167-1 are outlined in Table D.2.a below.

Table D.2.a: Modifications to the Process Description

Aspect	Difference
D.2.1: Overview	The plant will now consist of a single incinerator line rather than two lines with a maximum annual capacity of 200,000 tpa.
D.2.2: Waste acceptance and handling	The bunker capacity has increased from 12,000m^3 to 16,000m^3 to handle the increased throughput capacity. The waste quarantine area has been moved from the reception hall to the service yard in line with the requirement in WL167-1 that no waste should be quarantined in the waste reception/delivery area for the incinerator. It will now be possible to operate the grab cranes manually, semi-automatically or fully automatically. Since the plant consists of only one incinerator line, it will have some degree of reduced flexibility. Specifically, the plant will cease to accept waste if the bunker reaches capacity during a shutdown.
D.2.3: Moving grate furnace	The nominal design capacity of the grate is 26.7 tph compared with the previous capacity of two lines operating at 10 tph each. Due to improved design and to optimise process stability, grate siftings will no longer be returned to the bunker but will be mixed with bottom ash.
D.2.4: Boiler	The auxiliary burners will be fired with light fuel oil rather than natural gas.
D.2.5: Energy recovery and water/steam circuit	The flow of steam through the cycle will has increased from 63 tph to 82 tph. The nominal capacity of the generator is 17.2MW rather than 14MW. With a houseload of 2.5MW, the total expected electrical export will be 14.7MW rather than 11MW.
D.2.6: Flue gas treatment	There is now only one flue gas treatment line rather than two separate lines as previously proposed. The units of the flue gas treatment system that have been retained in the new design include the spray drier absorber, reaction duct, baghouse filter, ID fan and stack. A first dioxin removal stage has been added upstream of the spray drier absorber with the injection of expanded clay. With the selected technology, the wet treatment, tail end cleaning and plume abatement steps previously proposed are no longer required. The final system was designed to maximise removal efficiency even in cases of fluctuating pollutant concentration, to maximise energy efficiency, to have a high availability, to minimise reagent consumption and to minimise effluent generation.

D.2.7: Ash handling	The quantities of ash to be generated have increased from 38,000 tpa to 61,000 tpa in total. This includes: • an increase in bottom ash production by 20,000 tpa • an increase in flue gas treatment residue production by 6,000 tpa • a decrease in boiler ash production by up to 1,500 tpa, and • the omission of gypsum, which is no longer produced. The figures given in this application for residue production are supplier guaranteed maximum production figures. It is anticipated that these quantities will decrease through process optimisation once operational. The changes to residue production tonnages reflect an increase in plant throughput as well as changes to the flue gas treatment system. With a semi-dry and wet system, flue gas treatment residue production has increased but important energy efficiency gains have also been made. Bottom ash production will depend on waste composition and the figure given here is considered to be conservative. Boiler ash production has decreased because of the grate type selected. As a consequence, more waste will stay in the furnace and pass into the bottom ash. Boiler ash and flue gas treatment residue will be stored in silos as previously. It is not envisaged that solidification will take place onsite unless suitable landfill capacity becomes available in Ireland, as explained in Attachment H.4.
D.2.8: Utilities	No water will be sourced from the public water mains. The connection to the distribution network will now be made to the 38kV line rather than the 20kV line. Natural gas will no longer be sourced for auxiliary firing.