**FICHTNER**
Consulting Engineers Limited

# Oldhall Energy Recovery Facility

## DY Oldhall Energy Recovery Limited

PPC application supporting information

ENGINEERING + CONSULTING

# Document approval

| | Name | Signature | Position | Date |
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# Contents

# 1 Introduction

DY Oldhall Energy Recovery Limited (Doveryard) (the Applicant) is applying to the Scottish Environment Protection Agency (SEPA) under the Pollution Prevention and Control (PPC) regulations for a PPC permit to operate an Energy Recovery Facility (ERF), (herein referred to as the Facility), on land at the Oldhall West Industrial Estate, North Ayrshire.

The Facility will comprise of an Energy Recovery Facility and associated infrastructure. The Facility will be fuelled by pre-processed municipal and commercial & industrial non-hazardous waste (herein referred to as residual waste). The residual waste accepted at the Facility will have been pre-treated off-site to remove recyclates.

This document and its appendices contain the supporting information for the application for a PPC permit for the Facility. They should be read in conjunction with the formal application forms. Presented in Section 1 is an overview of the Facility, with further information in response to specific questions in the application forms provided in Section 2.

The requirements of SEPA's Sector Guidance Notes S5.01 titled, 'Incineration of Waste and Fuel Manufactured from or Including Waste' (herein referred to as S5.01); S5.06 titled 'Recovery and disposal of hazardous and non-hazardous waste'; and any other relevant sector guidance (e.g. the Waste Incineration BREF) have been addressed throughout this document.

## 1.1 The applicant

DY Oldhall Energy Recovery Limited (herein referred to as Doveryard) is the Applicant for the Facility and is the SPV responsible for the delivery of the project.

Doveryard is a joint venture formed in 2017 between Waste Energy Power Partners Limited and Low Carbon W2E Limited, to develop and operate waste-to-energy facilities. Doveryard is registered in England (Company number: 12099664) and has a registered address of Oxygen House, Grenadier Road, Exeter Business Park, Exeter, England, EX1 3LH.

Doveryard has combined experience in the development of complex energy infrastructure developments including developments in gas, biomass and waste fuels. This includes the development of the Waste to Energy plants in Hoddesdon, Hertfordshire and the Bombardier site in Belfast, Northern Ireland.

CV's for the project development team are presented in Appendix K within a project summary presentation, which also provides further background to the Applicant and details their experience in the development of Waste to Energy facilities.

## 1.2 The site

The site comprises approximately 1.5 ha of land and is located to the south of Murdoch Place within the Oldhall West Industrial Estate in North Ayrshire. The site is located approximately:

- 2.3km south-east of Irvine;
- 3.4km north-west of Dundonald;
- 2.3km west of Drybridge; and
- 1.9km southwest of Dreghorn.

The national grid reference of the site is approximately NS33678 36537 with the nearest postcode listed as KA11 5AR. The site forms the south-eastern part of the Oldhall West Industrial Estate, with other industrial land lying to the north and west respectively. Open land lies to the east and south forming part of the Oldhall Ponds, which is designated as a Local Wildlife Site.

The site currently comprises a previously developed plot of industrial land. The site is currently occupied with 3 industrial buildings, which will be demolished prior to commencement of construction of the Facility. The land around the buildings are currently constructed of concrete hardstanding, the remainder of the site has been cleared of vegetation and forms a bare development plot.

Once operational, the Facility will be accessed via Murdoch Place, which joins Shewalton Road to the north.

A site location plan is presented within Appendix A alongside an Installation Boundary drawing. All the activities associated with the operation of the Facility will be undertaken within the Installation Boundary.

An Initial Site Report is presented within Appendix B which provides details on the ground conditions at the site at the time of submission of this PPC application. Due to the limited data currently available on the ground conditions, the Initial Site Report includes proposals to obtain more detailed data on the baseline ground conditions prior to commence of operation of the Facility.

### 1.2.1 The activities

Activities covered by this application include:

1. Single line residual waste incineration plant processing incoming residual waste delivered to the Facility.
2. Generation of power for export to the National Grid and local users, and the potential to export heat to local heat users.
3. Production of an inert bottom ash material that will be transferred off-site to a suitably licensed waste treatment facility for recovery or disposal.
4. Generation of an air pollution control residue that will be transferred to a suitably licensed hazardous waste facility for disposal or recovery.

Table 1 below lists the scheduled and directly associated activities in accordance with the Pollution Prevention and Control (Scotland) Regulations 2012:

*Table 1: Scheduled and directly associated activities*

| Type of Activity | Schedule 1 Activity | Description of Activity |
|---|---|---|
| Installation | Section 5.1, Part A, (b) | The incineration of non-hazardous residual waste in a waste incineration plant with a nominal design capacity of 22.8 tonnes per hour. |
| Installation | Section 1.1, Part B (d) | Burning any fuel in a medium combustion plant with a rated thermal input equal to or greater than 1 megawatt and less than or equal to 20 megawatts |
| **Directly associated activities** | | |
| Directly Associated Activities | | The export of electricity to the National Grid and local users, and the potential to export heat. |

| Type of Activity | Schedule 1 Activity | Description of Activity |
|---|---|---|
| Directly Associated Activities | | Standby electrical generation to provide electrical power to the plant in the event of an interruption in the supply requiring shutdown of the Facility. |
| Directly Associated Activities | | The receipt, preparation, storage and handling of non-hazardous residual waste prior to incineration. |
| Directly Associated Activities | | The handling, storage and transfer of residues for transfer off-site. |

A drawing showing the extent of the installation boundary is presented in Appendix A. All the activities associated with the operation of the Facility will be undertaken within the installation boundary.

The Facility will comprise of the following components:

- weighbridges;
- waste reception;
- waste storage;
- a single incineration line;
- boiler;
- steam turbine and generator set;
- air, natural gas and water supply systems;
- on-site facilities for the storage of residues and wastewater;
- a single flue stack;
- devices and systems for controlling combustion operations and recording and monitoring conditions;
- weighbridges;
- internal roads and car parking;
- site access points; and
- domestic and welfare facilities.

The Facility will have a nominal design capacity of approximately 22.8 tonnes per hour (tph) of residual waste, at a design NCV of 10.5 MJ/kg. Assuming an availability of 8,000 hours per annum, this equates to a design capacity of approximately 182,400 tonnes per annum (tpa). However, it is acknowledged that the planning permission for the Facility currently limits the capacity to 180,000 tpa.

The Facility will be designed to process a range of residual wastes with an NCV range of 8 – 14 MJ/kg. The hourly throughput of residual waste will vary in accordance with the NCVs that are processed. A firing diagram for the Facility is presented in Appendix A).

## 1.3 The Facility

The Facility will receive deliveries of residual waste by road. The main activities associated with the Facility would be the combustion of the residual waste to raise steam and the generation of energy via a steam turbine/generator set.

The waste incineration process will be based around process areas comprising the waste reception area; waste bunker; boiler hall with combustion chamber and heat recovery equipment; turbine hall with air cooled condenser; FGT systems; ash storage facilities; and a stack of 60m.

In addition, the Facility will include the following infrastructure:

- weighbridges;
- offices, control room and staff welfare facilities;
- site fencing and security barrier;
- external hard standing areas for vehicle manoeuvring/parking;
- internal access roads, car parking and covered cycle spaces;
- transformers;
- grid connection compound;
- emergency diesel generator; and
- firewater storage tanks

### 1.3.1 Waste reception, Preparation and Storage

Incoming residual waste will be delivered to the Facility in enclosed road vehicles which are suitable for the bulk transfer of waste. The incoming vehicles will access the site via Murdoch Place and will be weighed on a weighbridge at the gatehouse before being directed to the tipping hall.

The residual waste will periodically undergo a visual inspection in accordance with the requirements of S5.06. This may involve the tipping of residual waste in the waste reception area.

The waste reception area for the Facility will be a fully enclosed area, maintained under slight negative pressure to reduce any emissions of odour, dust or litter, with fast acting roller shutter doors to the entrance/exit of the tipping hall to be kept closed apart from periods when residual waste deliveries are occurring.

Residual waste delivered to the Facility will be tipped into the waste bunker. A grab crane will transfer the residual waste from the bunker to the feed hopper. The crane grab will also be used to homogenise the incoming residual waste and to identify and remove any unsuitable or non-combustible items.

Vehicles will be weighed when exiting the Facility, to determine the mass of the residual waste that has been delivered to the Facility.

The waste bunker in the Facility will have the capacity to store approximately 4 days of residual waste processing capacity, equivalent to approximately 9,000 $m^3$ of storage capacity (or 3,000 tonnes). This will enable the Facility to maintain operation during periods when residual waste is not delivered; this could include weekends or bank holiday periods. The maximum waste storage capacity will be clearly established and not exceeded, taking into account the characteristics of the residual waste and the treatment capacity of the Facility. The quantity of residual waste stored will be regularly monitored visually and compared against the maximum allowed storage capacity. Careful monitoring of bunker levels will be undertaken to allow for this.

### 1.3.2 Design parameters

As stated within section 1.3, the Facility will have a nominal design capacity of approximately 22.8 tonnes per hour (tph) of residual waste, at a design NCV of 10.5 MJ/kg. The boiler will have a thermal capacity of approximately 66.6 MWth. Assuming an availability of approximately

8,000 hours per annum, this equates to a capacity of approximately 182,400 tonnes per annum (tpa). However, as acknowledged previously, the planning permission for the Facility currently limits the capacity to 180,000 tpa.

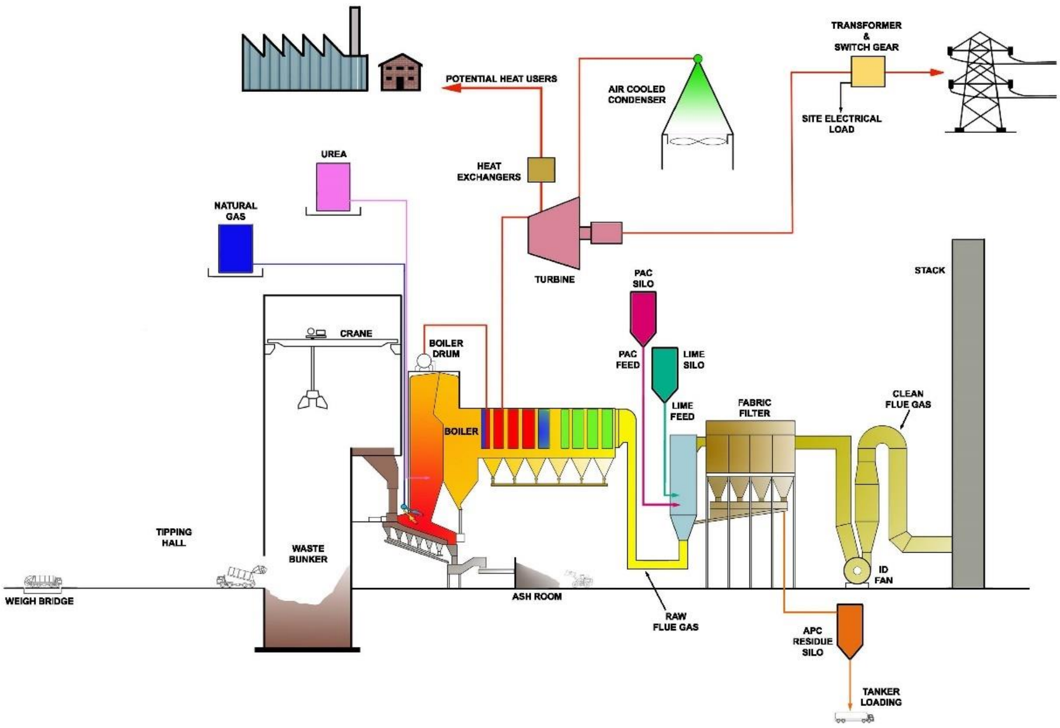
The Facility will be designed to process a range of residual wastes with an NCV range of 8 – 14 MJ/kg. The hourly throughput of residual waste will vary in accordance with the NCVs that are processed. A firing diagram is presented in Appendix A).

The Facility will generate up to approximately 19.3 MWe at the design point, with a parasitic load of 2MWe. Therefore, approximately 17.3 MWe will be available for export to the National Grid.

The Facility will be designed as 'CHP Ready' and will also have the potential to export up to approximately 10 MWth of heat to local heat users. A Heat and Power Plan which provides more detail on the identified heat users and export possibilities is presented in Appendix F. Whilst agreements for the export of heat are not in place at the time of submission of this application, discussions are ongoing, and it is hoped that formal agreements can be made with the identified heat users to enable the implementation of a heat export scheme within 5-7 years of the commencement of operation.

An indicative process diagram for the Facility is presented in Figure 1 below. A larger copy is also included within Appendix A.

*Figure 1: Indicative process schematic*




## 1.3.3 Raw materials

The main raw materials to be consumed at the Facility are as follows:

1. lime;
2. activated carbon;

3. urea;
4. auxiliary fuel; and
5. boiler treatment chemicals.

There will be other raw materials consumed at the Facility, but these are likely to be in small quantities.

#### 1.3.3.1 Reagents and Auxiliary Fuels

All consumables and reagents (lime, urea and activated carbon) will be delivered to the Facility by road. Any liquid chemicals will be stored in controlled areas, with secondary containment facilities having a volume of 110% of the stored capacity. In addition, areas where liquid raw materials are stored will be covered. Areas of hardstanding with kerbed containment will also provide additional containment, to prevent any potential spills from causing pollution of the ground/groundwater and/or surface water. The potential for accidents and associated environmental impacts, is therefore limited.

All storage facilities for chemicals will be designed in accordance with recognised industry good practice to prevent pollution and the relevant Pollution Prevention Guidance PPG/GPP documents (e.g. S5.01). The design of secondary containment measures will include for the following:

- All sumps/bunds will be designed to be impermeable and resistant to the liquids collected within them.
- All sumps/bunds will be subject to regular visual inspection, with any contents removed accordingly after checking for contamination.
- Should any concerns regarding the integrity of sumps/bunds be raised following programmed visual inspection or maintenance, this will be extended to water testing.
- Any sub-surface tanks and sumps/bunds, where appropriate, will be designed with leak detection systems. Preventative maintenance will be implemented for all subsurface structures. This may include, where appropriate, pressure tests, leak tests, material thickness checks, CCTV etc.

Lime (Calcium Hydroxide – $Ca(OH)_2$) and powdered activated carbon (PAC) will be delivered to the Facility and stored in silos. Both lime and the activated carbon will be transported pneumatically from their respective delivery vehicle to the correct storage silo. Exhaust air will be de-dusted using a fabric filter located at the top of the silo. Silos will be fitted with high level alarms to minimise the risk of releases from overfilling. The top of the silos will be equipped with a vent fitted with a fabric filter which will minimise any fugitive emissions. Cleaning of the fabric filter will be implemented automatically with compressed air after the filling operation. Fabric filters will be inspected regularly for leaks. There will be online monitoring of the pressure drop within bag filter compartments to identify when there has been bag filter failure. If a pressure drop is identified, bag filter compartments will be isolated to prevent uncontrolled emissions and repaired before being brought back on-line.

Urea solution will be used as a reagent in the NOx (oxides of nitrogen) abatement system and boiler dosing system and will be stored in a designated area provided with suitable secondary containment.

Auxiliary fuel (natural gas) will be used on site for the auxiliary support burners.

Boiler feedwater will be supplied from an onsite water treatment plant. Boiler treatment chemicals will also be present in small quantities on site, stored in suitable storage facilities.

Various maintenance materials (oils, greases, insulants, antifreezes, welding and fire-fighting gases etc.) will be stored in an appropriate manner.

Tanker off-loading of chemicals and raw materials will take place within areas where the drainage is contained with the appropriate capacity to contain a spill during delivery. The drainage from these areas will be contained within the process water drainage system and wastewater pit/process water tank or tankered off site should a spill occur. Isolation systems would prevent the release of contaminated liquids in the event of a spill or leak. In accordance with S5.01, all internal areas of hardstanding, including tanker offloading areas, will be designed in accordance with the requirements of BS EN 1992-3: '*Design of concrete structures - Liquid retaining and containment structures*'. External and internal hardstanding will be water-retaining structures constructed of impermeable materials, preventing the release of liquid pollutants into the ground/groundwater.

### 1.3.4 Combustion process

The combustion chamber will utilise a moving grate which will agitate the fuel bed promoting a good burnout of the residual waste and a uniform heat release. In a moving grate, the fuel is moved mechanically by means of inclined fixed and moving bars that move the residual waste from the feed inlet, through a drying zone, a main combustion zone and finally to a burn out zone.

The furnace will be designed to ensure that the exhaust gases are raised to a minimum temperature of 850°C, with a minimum of 2 seconds flue gas residence time at this temperature to ensure the destruction of dioxins, furans, PAHs and other organics. An adequate air supply will also be maintained to give the correct volume of oxygen for optimum combustion. The main source of airflow will be controlled through the grate. Flue gas temperatures within the furnace will be continually monitored and recorded, and audible and visible alarms will trigger in the control room if the temperature starts to fall towards 850°C. The control system will regulate and optimise combustion conditions and control the boiler.

Primary combustion air will be drawn from the waste reception area, tipping hall and waste bunker, maintaining negative pressure in the waste reception areas and fed into the furnace to feed the combustion process. Secondary combustion air will be injected into the flame bodies above the grate to facilitate the combustion of residual waste on the grates and to minimise levels of NOx emitted. Further up the furnace, above the combustion zone, liquid urea will be injected. The liquid urea reacts with the oxides of nitrogen formed in the combustion process forming water, carbon dioxide and nitrogen. By controlling the flow rate of urea introduced into the flue gas stream, the concentration of NOx will be reduced to achieve the required emission limit.

The combustion chamber will be provided with auxiliary burners, that will be of a low NOx design, and combust natural gas. The auxiliary burners will raise the temperature within the combustion chamber to the required 850°C prior to the feeding of residual waste into the furnace. There will be interlocks preventing the charging of residual waste until the temperature within the combustion chamber has reached 850°C. During normal operation, if the temperature falls below 850°C the auxiliary burners will be initiated to maintain the temperature above this minimum. Air flow for combustion will be controlled by measuring excess oxygen content in the flue gas. This will be set to maximise the efficiency of the heat recovery process while maintaining the combustion efficiency.

### 1.3.5 Energy recovery

Heat will be recovered from the flue gases by means of water tube boilers integral with the furnace. Heat will be transferred in each case through a series of heat exchangers. The hot gases from the furnace would first pass through evaporators that raise the steam. The hot flue gases would then pass into the boiler. The boiler will consist of a series of passes containing evaporators, superheaters and an economiser.

Superheated steam from the boiler will be supplied to a single high-efficiency turbine which, through a rotating shaft, turns a generator to produce electricity. The superheated steam will be supplied at a temperature of approximately 400°C under a pressure of 51 bar abs. The turbine will have a series of extractions at different pressure that will be used for preheating air and water in the steam cycle. The remainder of the steam will pass out of the final low-pressure condensing stage. To generate the pressure drop to drive the turbine, the steam will be condensed back to water. A fraction will condense at the exhaust of the turbine in the form of wet steam. The majority will be condensed in the air-cooled condenser (ACC) following the turbine at a pressure well below atmospheric. The condensed steam will be returned as feed water in a closed-circuit pipework system to the boilers.

The Facility will be constructed as 'CHP Ready' and will be capable of exporting heat to local heat users. The export of heat would reduce the electrical output of the installation; however, the net effect would be to increase the overall thermal efficiency of the Facility.

### 1.3.6 Flue Gas Treatment

The abatement of oxides of nitrogen (NOx) will be achieved by selective non-catalytic reduction (SNCR). NOx is formed in the boiler at high temperature from nitrogen in the residual waste and in the combustion air. Urea solution will be injected at the combustion chamber through a bank of nozzles installed at different places to provide flexibility of dosing, directly into the hot flue gases above the flame. NOx is chemically reduced to nitrogen, carbon dioxide and water by the urea solution. The SNCR system will be controlled through the Distributed Control System. During detailed design of the Facility, the location of SNCR dosing points will be optimised using CFD modelling to ensure that emissions of $NO_2$ and $NH_3$ are maintained within the proposed emission limits.

After heat recovery and NOx abatement, the flue gas will pass to the flue gas treatment (FGT) system.

The flue gas treatment process will consist of:

1. hydrated lime and activated carbon injection; and
2. a fabric filter.

Hydrated lime and powdered activated carbon (PAC) will be injected into the flue gases upstream of the fabric filter to abate acidic gases, heavy metals and any remaining dioxins and furans. The hydrated lime will abate the emission of acidic gases, including hydrogen fluoride, hydrogen chloride and sulphur dioxide. A dry FGT method using hydrated lime will be used, with the benefit that no liquid effluent is produced and energy efficiency is increased. The activated carbon will abate emissions of volatiles within the flue gases, including mercury, organic compounds and dioxins. Hydrated lime and activated carbon will be stored in separate silos, transported pneumatically, mixed in-line and introduced to the flue gas stream through a common injection point.

Following the injection of lime and activated carbon, the flue gas will then pass through the fabric filter, which will remove the particulates and reaction products, collectively known as Air Pollution Control residues (APCr). The residues cake the outside of the filter bags, with the units periodically cleaned by a reverse jet of air. This displaces the filtered solids into chutes beneath, which are then stored in silos. The dosing rate for the acid gas reagent will be controlled by the upstream acid gas pollutant concentration measurements and proportioned to the volumetric flow rate of the flue gases. As fresh reagents are added, an equivalent amount of residue collected from the bag filters will be removed.

There will be online monitoring of the pressure drop within bag filter compartments to identify when there has been a failure of a bag filter. If a pressure drop is identified, bag filter compartments will be isolated to prevent uncontrolled emissions and repaired before being brought back on-line. The flue gas treatment systems will be maintained to ensure optimal availability and will be operated within the design range.

The cleaned gas will be monitored for pollutants and discharged to atmosphere through a 60m stack.

### 1.3.7 Emissions monitoring

The cleaned gas released from the flue gas treatment plant will be monitored for pollutants and discharged to atmosphere through a 60m stack.

A Continuous Emission Monitoring Station (CEMS) will be installed to monitor concentrations of the following pollutants in the flue gas:

- particulates;
- sulphur dioxide;
- hydrogen chloride;
- carbon monoxide;
- nitrogen oxides;
- ammonia; and
- VOCs, expressed as total organic carbon.

In addition, periodic sampling and measurement will be carried out for the following pollutants:

- Group 3 heavy metals: antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V);
- cadmium (Cd) and thallium (Tl);
- nitrous oxide;
- mercury (Hg);
- hydrogen fluoride;
- dioxins and furans; and
- dioxin-like PCBs.

The Continuous Emission Monitoring (CEM) system will be MCERTS approved. The Facility will include for an installed back-up CEMS system which will be available in the event of a CEMS failure.

### 1.3.8 Ash handling

The main residue produced by the Facility will be bottom ash, which is the burnt-out residue from the combustion process. Bottom ash is collected at the end of the combustion grate and falls into the discharger, which comprises a water-filled trough (or ash quench). The purpose of the ash quench is to cool and moisten the bottom ash to limit particulate emissions (dust generation) and to ensure an airtight seal to the furnace to avoid air ingress to the combustion chamber from the boiler house. Boiler ash, the ash fraction that collects within a boiler, will also be conveyed to the discharger, and will mix with the bottom ash within the quench to form the residue known as Incinerator Bottom Ash (IBA).

The IBA will be transferred via a conveyor to a dedicated IBA storage area. The storage and handling of the IBA will be undertaken in enclosed buildings, with the IBA maintained wet to prevent the generation of fugitive dust emissions from the storage and handling of the IBA.

The APCr generated from the flue gas treatment process will be displaced from the bag filters and subsequently stored in silos. The APCr will be collected from the Facility in sealed tankers and transported off-site to a suitably licensed hazardous waste treatment or disposal facility.

### 1.3.9 Drainage

Surface water from areas of hardstanding and roads will be collected in the surface water drainage system. The surface water drainage system will include silt and oil interceptors, which will remove silt and hydrocarbons, prior to discharge into a surface water attenuation pond. The surface water pond will be lined and is anticipated to have a capacity of approximately 420 $m^3$. The surface water pond will have an emergency shut-off valve to prohibit the discharge of contaminated effluent off-site in the case of an emergency, such as a fire event or major spillage.

In the event of flooding at the site, additional surface water storage capacity will be available from the areas of external hardstanding.

The surface water pond will have a discharge to Scottish Water Sewer. The Facility surface water discharge point to sewer from the site is shown as S1 in the emissions points drawing in Appendix A of the application.

During normal operation, there will be no discharges of process effluents from the Facility – these will be reused, for example in the ash quench. In the event that there are excess effluents generated, such as those generated during boiler blowdown, these will either be tankered and transferred off-site for treatment in a suitably licensed facility, or discharged to sewer. Discussions are currently ongoing with the Sewerage Undertaker for securing a Trade Effluent Consent for the discharge of effluent to Sewer. Any constraints on the quality of effluent to be discharged to sewer to be imposed by Scottish Water through the Trade Effluent will be confirmed to SEPA prior to commencement of operation.

In addition, any overflow from the ash quench will be contained in the process effluent drainage system and hence there will not be any release to water of effluent from the ash quench system.

The use of rainwater harvesting (e.g. for use within the ash quench and domestic facilities) will be examined during the detailed design of the Facility. However, it is anticipated that the opportunities for rainwater harvesting will be minimal.

Domestic effluent from welfare facilities will be discharged to sewer.

### 1.3.10 Ancillary operations

The Facility will be a net consumer of water and will require a top-up water supply of approximately 3 tonnes per hour, which will be sources from the mains water supply. The primary requirement of water is to maintain the water level in the boiler systems (steam cycle). A water treatment plant will treat the mains water to produce high quality feedwater for use within the boilers. Water treatment chemicals will be stored within a bunded area within the on-site water treatment plant. The water treatment plant will be appropriately designed to consider maximum flow rate and pollutant concentrations, with regular maintenance undertaken to ensure optimal availability.

The Facility will be designed to minimise the use of water and re-circulate process water for re-use within the process, such as within the ash quench system.

Water for firefighting will be stored in a dedicated firewater tank with a duty electric pump and standby diesel pump.

An emergency diesel/fuel oil generator will provide power to safely shutdown the Facility in the event of an emergency. The generator will provide sufficient power to run or shut the plant down in the event of the loss of a grid connection. The diesel generator is only expected to operate for short-term periods (i.e. <50 hours per year) for testing purposes. It is anticipated that the emergency diesel generator will have a rated thermal input (RTI) of approximately 2- 3 MWth, and will combust low sulphur fuel oil (<0.1% sulphur content). The exact RTI of the generator will be subject to detailed design of the Facility, and will be confirmed prior to the commencement of commissioning of the Facility.

The emergency diesel generator will only be used for emergency situations and for testing purposes, and will not be used for generation or export of power.

### 1.3.11 Fire Prevention and Management Measures

The fire strategy for the Facility is subject to detailed design. However, it is assumed that either heat or smoke detectors will pick up the initial signs of a fire, sound the alarm and alert the control room. In the event of the alarm being activated, emergency procedures will be implemented for all personnel throughout the Facility to egress the building to their nearest fire evacuation muster point. The operators will then interrogate the main fire panel to determine the location of the fire. Dependant on the location of the fire, some of the suppression systems will automatically operate such as sprinklers and gas suppression systems. Within the waste bunker area of the Facility, however, manual intervention will be required to the control room, feed hopper sprinklers and the water cannons.

Fire detection and fire-fighting systems installed at the Facility will be in accordance with recognised standards. This may include the following standards/design requirements where appropriate:

- EN 671: Fixed fire-fighting systems (or NFPA equivalent);
- EN 12845: Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance;
- EN 14384: Pillar fire hydrants (if applicable);
- EN 15004: Fixed Firefighting systems – Gas extinguishing systems (or NFPA equivalent);
- BS 750: Specification for underground fire hydrants and surface box frames and covers;
- BS 5041: Fire hydrant systems equipment;
- BS 5266: Emergency Lighting;
- BS 5306: Fire extinguishing installations and equipment on premises;
- BS 5588: Fire precautions in the design construction and use of buildings (only in as much as referred to in the Building Regulations);
- BS 5839: Fire Detection and Alarm systems for buildings;
- BS 9990: Non-automatic fire-fighting systems in buildings – Code of practice;
- BS 9999: Code of Practice for Fire Safety in the design, management and use of Buildings;
- ISO 6182: Fire Protection – Automatic Sprinkler Systems;
- ISO 6183: Fire protection equipment – Carbon Dioxide systems;

- Building Regulations, in particular Approved Document B, Volume 2 – Buildings other than dwelling houses, Section B5, Access and facilities for the fire service;
- NFPA 850: Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations;
- NFPA 82: Standard on Incinerators and Waste and Linen Handling Systems and Equipment;
- Chubb Technical Guidance for Energy from Waste (EfW) – Fire Systems: "EIB_GD_EfW_Fire_10439_131122 issue 1.0 dated 26th March 2016" [*Note: The Chubb Technical Guidance is provided as a guide and may be superseded by the appointed insurers requirements*];
- any relevant standards and codes of practice as the local authority fire officer and/or the Applicant's insurers wish to apply.

The fire prevention and fire-fighting equipment which will be installed in the waste bunker of the Facility will include, but not be limited to, the following:

1. bunker fire detection system;
2. remote control operated fire cannons permanently mounted within the bunker area but outside of the normal crane operating window and positioned to provide full coverage of the bunker walls and floor;
3. automatic valves as required;
4. fire water sprays at each feed chute opening, automatically controlled on detection of fire or manually triggered on an individual basis from the Plant control room;
5. the complete piping, civil engineering works; and
6. all electric cabling, wiring, interlocks and alarms.

Due to the nature of the buildings and the risks therein, the design of the fire protection installation associated with the Facility will be undertaken by a suitably qualified and experienced fire protection specialist.

#### 1.3.11.1 Firewater

Section 1.3.11 provides detail on the storage measures for firewater containment on-site. Drainage systems will be fitted with an penstock valve or isolation system to prohibit the discharge of contaminated effluent off-site.

Following a fire event at the Facility, all firewater which is contained either within the site drainage systems or the waste bunker will be tested and analysed to establish its suitability for discharge to sewer. Should the effluent be considered unsuitable for discharge, it will be pumped out and collected in tankers for disposal at a suitable off-site waste management facility. The parameters which would be tested will depend on the water quality standards required by the water treatment/waste management company who will collect and dispose of the contaminated firewater. However, it is anticipated that typical 'trigger pollutants' such as ammonia, suspended solids and hydrocarbons will be included for in the analysis.

In the event of a fire the following measures have been allowed for within the drainage and firewater containment measures:

1. Fire water in the tipping hall and waste bunker area of the Facility will collect in the waste bunker or process water drainage system. The waste bunker will be designed as a water retaining structure.
2. Fire water in other indoor process areas will be directed towards a 'wastewater pit' or process water storage tank via the process drainage system.

3. The surface water attenuation storage will be fitted with an isolation valve to prevent the discharge of used firewater from the surface drainage system in the event of a fire.
4. The process drainage system will also be contained and have isolation measures in place to prevent the discharge of contaminated firewater off-site.
5. Additional storage will be available from the site kerbing and areas of hardstanding.

It is understood that the measures listed above are in accordance with the guidelines of PPG18 and CIRIA C736.

The capacity of the firewater containment systems is subject to detailed design, but the firewater containment systems will be designed to have a suitable capacity to contain the provisions of firewater in accordance with the requirements of NFP850 within the boundary of the installation.

All firewater containment systems will be design and installed in accordance with the requirements of PPG18 and CIRIA C736 in accordance with SEPA requirements.

## 1.4 Planning permission

Planning permission for the Facility was granted by North Ayrshire Council on 22 January 2020. The reference for the planning permission is 19/00539/PPM.

# 2 Other information for application form

## 2.1 Raw Materials

### 2.1.1 Types and amounts of raw materials

The main (>5 tonnes) raw materials which will be stored at the Facility are presented in Table 2, with indicative values for their annual tonnages. Information on the potential environmental impact of these raw materials is included in Table 3.

*Table 2: Types and amounts of raw materials and consumption rate at design load (for Schedule 1 Activities)*

| Scheduled Activity | Material | CAS Number | Approximate storage capacity and type | Annual throughput (approximate) | Description |
|---|---|---|---|---|---|
| Section 5.1 Part A (b) | Natural gas | 8006-14-2 | N/A | 220,000 $m^3$ | Auxiliary fuel for auxiliary firing |
| | Liquid Urea | 200-315-5 | 26 $m^3$, tank | 1,044 tonnes | 40% urea solution |
| | Hydrated Lime | 1305-62-0 | 205 $m^3$, silo(s) | 3,650 tonnes | Calcium hydroxide, powdered |
| | Activated carbon | 7440-44-0 | 65 $m^3$, silo | 55 tonnes | Powdered |
| | Boiler water treatment chemicals (hydrochloric acid, caustic soda) | N/A | Various | <50 tonnes | Solids and liquids including salts, oxygen scavenger, corrosion inhibitor, acid/alkali |

*Table 3: Raw materials and their effect on the environment*

| Environmental Medium | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Product** | **Chemical composition** | **Typical quantity** | **Units** | **Air** | **Land** | **Water** | **Impact potential** | **Comments** |
| Natural gas | - | 220,000 $m^3$ | $m^3$/year | 100 | 0 | 0 | Low impact | Natural gas will be used for auxiliary firing during periods of start-up and shutdown of the Facility. |
| Hydrated lime | $Ca(OH)_2$ | 3,650 tonnes | tonnes/ year | 0 | 100 | 0 | Low impact | Hydrated lime will be injected and removed with the APC residues at the bag filter and disposed of as hazardous waste at a suitable licensed facility. |
| Activated carbon | C | 55 tonnes | tonnes/ year | 0 | 100 | 0 | Low impact | Injected carbon will be removed with the APC residues at the bag filter and disposed of as hazardous waste at a suitable licensed facility. |
| Urea solution | $NH_3$(aq) or $NH_4OH$ | 1,044 tonnes | tonnes/ year | 100 | 0 | 0 | Low impact | Urea will be delivered to the Facility and stored in liquid form in tanks. The urea solution will be used as a reagent in the SNCR system. The urea solution will react with nitrogen oxides to form nitrogen, carbon dioxide and water vapour. Any unreacted ammonia that is formed (as a chemical intermediate) will be released to atmosphere at low concentrations. Dosing will be controlled as to minimise slip. |
| Water | $H_2O$ | 3 | tonnes/ hour | 0 | 0 | 100 | Low impact | Water will be used for various uses, including:<br>• Treated water make-up;<br>• Cleaning water;<br>• Ash quench. |
| Boiler water treatment chemicals | Various | <50 tonnes | tonnes/ year | 0 | 0 | 100 | Low impact | Various boiler water treatment chemicals will be used including salts, oxygen scavenger, corrosion inhibitor, pH balancers (acids/alkalis). |

Various other materials, which will be used in small quantities (<5 tonnes per annum), will be required for the operation and maintenance of the Facility, including but not limited to the following:

1. hydraulic oils and silicone-based oils;
2. isolation media within electrical switchgear;
3. refrigerant gases for the air conditioning plant;
4. glycol/antifreeze for cooling;
5. oxyacetylene, TIG, MIG welding gases;
6. $CO_2$ / firefighting foam agents; and
7. ignition, test and calibration gases.

These will be supplied to standard specifications offered by main suppliers. All chemicals will be handled in accordance with COSHH Regulations as part of the quality assurance procedures and full product data sheets will be available on-site. The air conditioning plant will comply with the European Union Ozone Depleting Substances Regulations.

Periodic reviews of all materials used will be made in the light of new products and developments. Any significant change of material, where it may have an impact on the environment, will not be made without firstly assessing the impact and seeking approval from SEPA.

The Operator will maintain a detailed inventory of raw materials used on-site and have procedures for the regular review of new developments/advancements in raw material availability/development.

### 2.1.2 Raw material & reagent storage

The details of the storage facilities for the storage of raw materials, reagents and residues are presented within the Initial Site Report, included in Appendix B. Materials will be stored in accordance with current guidance. Where appropriate, liquid chemicals will be stored in controlled areas, with suitably designed secondary containment facilities (such as bunds) having a volume of 110% of the stored capacity.

Boiler water treatment chemicals will be used to control water hardness, pH, scaling and boiler corrosion and will be delivered in sealed containers and stored in a bunded area within the water treatment room. There will also be portable bottles of oxygen and acetylene gas stored on site for welding purposes. Any compressed gas bottles will be kept secure in a separate compound.

The Facility will be subject to detailed design and development of documented management procedures for the operation of the Facility. These will include procedures associated with the storage and handling of raw materials and reagents.

### 2.1.3 Raw materials and reagents selection

#### 2.1.3.1 Acid gas abatement

There are several reagents available for acid gas abatement. Sodium Hydroxide (NaOH) or a lime-based reagent (CaO, $CA(OH)_2$ or $CaCO_3$) can be used in a wet FGT system with the addition of water. Hydrated lime ($Ca(OH)_2$) with water can be used in a semi-dry FGT system. Sodium bicarbonate ($NaHCO_3$) or hydrated lime ($Ca(OH)_2$) can be used in a dry FGT process.

The reagents for wet scrubbing and semi-dry abatement are not considered since these abatement techniques have been eliminated by the quantitative waste incineration technology assessment in Appendix E section 4.1. The two alternative reagents for a dry system – lime (hydrated) and sodium bicarbonate - have therefore been assessed further.

The level of abatement that can be achieved by both reagents is similar. However, the level of reagent used (and therefore residue generation and disposal) is different and requires a full assessment following the methodology in Horizontal Guidance Note H1. The assessment is detailed in Appendix E and is summarised in the table below.

*Table 4: Acid gas abatement BAT data*

| Item | Unit | $NaHCO_3$ | $Ca(OH)_2$ |
|---|---|---|---|
| Mass of reagent required | kg/h | 109.0 | 67.0 |
| Mass of residue generated | kg/h | 84.0 | 85.0 |
| Cost of reagent | £/tonne | 155 | 110 |
| Cost of residue disposal | £/tonne | 186 | 155 |
| Overall Cost | £/op.hr/kmol | 32.5 | 20.5 |
| Ratio of costs | | 1.58 | - |

*Note: Data based on the abatement of one kmol of hydrogen chloride.*

Whilst the use of sodium bicarbonate will lead to less residue than a lime-based system, this is significantly outweighed by the advantages of using lime as a reagent, which are as follows:

- Lime has higher removal rates of acid gases than sodium bicarbonate, which is reflected in the quantities of reagent consumed.
- Lime based APCr has a lower leaching rate than sodium bicarbonate based APCr. Therefore, there are greater waste management and recovery options available for lime based APCr, i.e. it can be recovered into substitute products displacing virgin materials. Doveryard Ltd are aware that currently the only 'available' option for the management of sodium bicarbonate APCr is disposal.
- The reaction temperature for lime systems match well with the optimum adsorption temperature for carbon, which is dosed at the same time.
- The lime system has a slightly lower global warming potential due to the reaction chemistry.
- The costs per kmol of hydrogen chloride abated are almost 58% higher for a sodium bicarbonate system.

Taking all the above into consideration, the use of lime is considered to represent BAT for the Facility.

#### 2.1.3.2 NOx abatement

NOx abatement systems can be operated with dry urea (prills), urea solution or aqueous ammonia solution. There are advantages and disadvantages with all options:

- urea is easier to handle than ammonia - the handling and storage of ammonia can introduce an additional risk;
- ammonia tends to give rise to lower nitrous oxide formation than urea;
- dry urea can be contained in Flexible Intermediate Bulk Containers (FIBCs or 'big-bags'), whereas ammonia solution is usually stored in silos and delivered in tankers; and
- ammonia emissions (or 'slip') can occur with both reagents, but good control will limit this.

The sector guidance note on waste incineration (S5.01) considers all options as suitable for NOx abatement. It is proposed to use urea solution as a reagent in the SNCR system. The urea will be delivered and stored as liquid urea.  Ammonia is a highly toxic chemical, and the transport and handling of ammonia can introduce additional risks and increase capital costs. The Operator considers that the storage and handling issues associated with ammonia solution outweigh the minor additional nitrous oxide formation associated with urea, which can be controlled through good process monitoring and reagent dosing. Taking this into consideration, the use of urea solution in the NOx abatement system is considered to represent BAT for the Facility.

#### 2.1.3.3 Auxiliary fuel

As stated in Article 50 (3) of the Industrial Emissions Directive:

> *"The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (1) OJ L 121, 11.5.1999, p. 13., liquefied gas or natural gas."*

Therefore, as identified by the requirements of IED the only available fuels that can be used for auxiliary firing are:

1. liquefied gas (LPG);
2. fuel oil; or
3. natural gas.

Auxiliary burner firing on a well-managed waste combustion plant is only required intermittently, i.e. during start-up, shutdown and when the temperature in the combustion chamber falls to the minimum 850°C.

LPG is a flammable mixture of hydrocarbon gases. It is a readily available product and can be used for auxiliary firing. As LPG turns gaseous under ambient temperature and pressure, it is required to be stored in purpose-built pressure vessels. If there was a fire within the Facility, there would be a significant explosion risk from the combustion of flammable gases stored under pressure.

LPG has a lower NCV than fuel oil. Therefore, if the Facility was to utilise LPG as an auxiliary fuel, the Facility would consume a larger amount of LPG (on a mass basis) for auxiliary firing. This would result in a higher number of vehicle movements for the delivery of LPG compared to fuel oil. In addition, in accordance with the Liquid Petroleum Gas Association COP 1 Part 4, the required capacity of an LPG tank to supply auxiliary fuel to the Facility would require an exclusion zone of 7.5m. The current layout and design of the Facility does not include space for a 7.5m exclusion zone surrounding an LPG tank.

Natural gas can be used for auxiliary firing and is safer to handle than LPG. As stated previously, auxiliary firing will only be required intermittently. When firing this requires large volumes of gas, which would need to be supplied from a high-pressure gas main within reasonable distance of the Facility. A high-pressure gas main with sufficient available capacity has been identified in close proximity to the site. Therefore, a supply of natural gas is considered to 'available' for the purposes of auxiliary firing for the Facility. It is understood that natural gas typically results in the 'lowest' levels of pollutants compared to the other auxiliary fuels. The combustion of natural gas produces mostly carbon dioxide and water, and the generation of sulphur dioxide is largely avoided compared to using fuel oil.

A low sulphur fuel oil tank will be easily installed at the Facility. It is acknowledged that fuel oil is classed as flammable; however, it does not pose the same type of safety risks as those associated with the storage of LPG. The combustion of fuel oil will lead to emissions of sulphur dioxide, but these emissions will be minimised as far as reasonably practicable through the use of low sulphur fuel oil.

Taking the above into consideration, the use of either natural gas or fuel oil is considered to represent BAT for auxiliary firing at the Facility. It is currently assumed that natural gas will be the auxiliary fuel for the Facility, however it is requested that a pre-operational condition is included within the permit which allows the choice of auxiliary fuel to be confirmed following detailed design of the Facility.

## 2.2 Incoming waste management

### 2.2.1 Waste to be processed in the Facility

The Facility will be used to recover energy from incoming non-hazardous residual waste, with European Waste Catalogue Codes listed in Table 5:

*Table 5: Waste to be processed in the Facility*

| EWC Code | Description of waste |
|---|---|
| **19** | **WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTEWATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE** |
| **19 12** | **wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified** |
| 19 12 10 | combustible waste (refuse derived fuel) |
| 19 12 12 | other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11 |

Residual waste which is delivered directly to the Facility will have been pre-sorted/pre-treated with recyclates removed, to produce a refuse derived fuel. Therefore, the waste will not require any further treatment in accordance with the Thermal Treatment of Waste Guidelines.

As stated in Section 1.3, the nominal design capacity of the Facility will be approximately 22.8 tonnes per hour of mixed non-hazardous residual waste, with an average 'design' net calorific value (NCV) of 10.5 MJ/kg. The Facility will have a nominal design capacity of approximately 182,400 tonnes per annum (tpa), assuming an availability of approximately 8,000 hours. However, it is acknowledged that the planning permission for the Facility currently limits the capacity to 180,000 tonnes tpa.

Should unacceptable waste be identified within the waste bunker, it will be removed from the bunker for further inspection and quarantine, prior to transfer off-site to a suitable disposal/recovery facility. The location of the quarantine area will be subject to detailed design of the Facility; however, it is anticipated that it will be within tipping hall.

The waste bunker will allow for back-loading of waste in the event of unplanned periods of prolonged shut-down, when the waste is unable to be treated. The crane maintenance arrangement can be used as a back-loading facility to remove any oversized items or non-combustible items identified within the waste bunker.

Any unacceptable waste will be rejected and stored in a designated area in the waste reception area. The management systems for the Facility will include procedures to control the inspection, storage and onward disposal of unacceptable waste. Unacceptable wastes could include items which are non-combustible, large/bulky items or items of hazardous waste. All unacceptable wastes will be loaded into a bulker or other appropriate vehicle for transfer off-site either to the producer of the waste or to a suitably licensed waste management facility. Certain unacceptable wastes will require specific action for safe storage and handling. The Environmental Management System (EMS) will also contain procedures for controlling the blending of waste types to avoid mixing of incompatible wastes.

### 2.2.2 Waste handling

#### 2.2.2.1 Waste Acceptance and Pre-Acceptance Procedures

Contracts will be held with a limited number of waste treatment facilities and waste providers that will supply residual waste to the Facility. Contracts will be in place with these suppliers to provide the incoming residual waste in accordance with a fuel specification.

Documented procedures for pre-acceptance and acceptance of all wastes will be developed prior to the commencement of operation of the waste treatment process, in accordance with the documented management systems for the Facility.

The pre-acceptance and acceptance checks on residual wastes being delivered to the Facility will include audits of waste producers and/or fuel suppliers to review their operations to confirm that the residual waste which they are transferring to the Facility is in accordance with the relevant waste descriptions, specifications and EWC codes. Procedures would be implemented to review incoming waste deliveries including inspecting the accompanying Waste Transfer Notes (WTN) at the weighbridge.

Periodic visual inspections of the waste will be undertaken to check the waste consignments against the agreed specifications – this may involve tipping a waste delivery onto the tipping hall floor for further inspection prior to processing. To enable the waste to be tipped onto the tipping hall floor to enable the inspection, it will be necessary to keep the doors of the tipping hall open whilst the waste is being tipped.

In accordance with BAT 11 of the Final Draft Waste Incineration BREF, the following waste monitoring will be undertaken at the Facility.

**Municipal solid waste and other non-hazardous waste**

It is not anticipated that the incoming waste will be radioactive, therefore radioactivity detection will not be undertaken at the Facility. Waste deliveries will be weighed at the weighbridges upon arrival, with vehicles weighed again upon exit from the Facility. Where possible, periodic visual inspection of the waste will be undertaken as it is tipped into the bunker, with the crane operator able to identify and remove any unsuitable non-combustible items. Periodic samples of the waste will be taken to analyse for key properties such as caloric value.

**Sewage Sludge**

There will be no sewerage sludges accepted at the Facility.

**Hazardous waste and clinical waste**

There will be no hazardous waste or clinical waste accepted at the Facility.

#### 2.2.2.2 Receiving Waste

In accordance with the Indicative BAT requirements in SEPA's Guidance Note (S5.01), procedures for the receipt of waste will be developed which will include, but not be limited to ensuring that:

- A high standard of housekeeping will be maintained in all areas and suitable equipment will be provided and maintained to clean up spilled materials.
- Vehicles will be loaded and unloaded in designated areas provided with impermeable hard standing. These areas will have appropriate falls to the process water drainage system.
- The integrity of hardstanding surfaces will be periodically verified as far as technically possible.
- Fire-fighting measures will be designed in consultation with the Local Fire Officers, with particular attention paid to the waste reception and storage areas.
- Delivery and reception of residual waste will be controlled by a management system that will identify all risks associated with the reception of waste and shall comply with all legislative requirements, including statutory documentation.
- Incoming residual waste will be:
  - delivered in enclosed vehicles; and
  - unloaded in the enclosed waste reception areas.
- Design of equipment, buildings and handling procedures will ensure there is insignificant dispersal of litter.
- Inspection procedures will be employed to ensure that any wastes which would prevent the Facility from operating in compliance with its PPC Permit are segregated and placed in a designated storage area pending transfer off-site.
- Further inspection will take place by the plant operatives during vehicle tipping and waste unloading.
- To minimise odour:
  - fast acting shutter doors will be provided on the tipping hall;
  - waste will be stored inside: i.e. within enclosed buildings to prevent odour release;
  - during shutdown, doors will limit odour spread whilst still allowing vehicle access;
  - following detailed design of the Facility, should it be deemed necessary, odour abatement techniques may be utilised);
  - the waste reception and tipping hall / waste bunker, will be kept under negative pressure by extracting air using an induced draft (ID) fan for use in the combustion process; and
  - procedures will be in place to divert waste away from the installation during shutdowns if deemed necessary.

### 2.2.3 Waste minimisation (minimising the use of raw materials)

A number of specific techniques will be employed to minimise the generation of residues, focusing on the following:

1. feedstock homogeneity;
2. prevention of dioxin and furan reformation;
3. furnace conditions;
4. flue gas treatment control; and
5. waste management.

All these techniques meet the Indicative BAT requirements from the Sector Guidance Note on Waste Incineration.

#### 2.2.3.1 Feedstock homogeneity

Improving feedstock homogeneity will improve the operational stability of the Facility, leading to reduced reagent use and reduced residue production. The mixing of incoming residual wastes within the waste bunker will improve the homogeneity of the waste input into the boiler. The mixing of waste within the bunker is standard practice at UK waste incineration plants and helps avoid the generation of hotspots and anaerobic conditions.

#### 2.2.3.2 Dioxin & furan reformation

As identified within S5.01, there are a number of BAT design considerations required for the furnace. The furnace has been designed to minimise the formation of dioxins and furans as follows:

- Slow rates of combustion gas cooling would be avoided via boiler design to ensure the residence time would be minimised in the critical cooling section, to minimise the potential for de-novo formation of dioxins and furans.
- The gas residence time in the critical temperature range would be minimised by ensuring high gas velocities exist in these sections. The residence time and temperature profile (between 450 and 200°C) of flue gas would be considered during the detailed design phase to ensure that dioxin formation would be minimised throughout the process.
- It is reported in the guidance that the injection of ammonia compounds into the furnace – an SNCR NOx abatement system – inhibits dioxin formation and promotes their destruction. An SNCR system to abate emissions of NOx will be utilised at the Facility.
- Activated carbon will be injected to enhance the capture of dioxins as well as heavy metals.
- Transfer surfaces would be above a minimum temperature of 170°C subject to other reaction considerations.
- Computational Fluidised Dynamics (CFD) will be applied to the design, where considered appropriate, to ensure gas velocities are in a range that negates the formation of stagnant pockets / low velocities. A copy of the CFD model will be supplied to SEPA following detailed design and prior to commencement of commissioning. However, an example CFD Report for a facility with a boiler of the same technology supplier as proposed for the Facility is presented in Appendix H This demonstrates that the requirements for temperature and residence time can be achieved with the proposed design.
- Minimising the volume in the critical cooling sections will ensure high gas velocities.
- The design of the boiler will prevent boundary layers of slow-moving gas along boiler surfaces and on-line boiler cleaning techniques will remove the build-up of any deposits.

In accordance with BAT 30 of the Final BREF, the following elements will be incorporated into the design of the Facility to reduce emissions of organic compounds including PCDD/F and PCBs:

- Optimisation of the incineration process to promote oxidation of organic compounds and prevent reformation;
- Control of the residual waste feed to ensure (as far as possible) homogeneous and stable incineration conditions (this will be achieved by accepting pre-treated residual waste at the Facility prior to incineration);
- On-line and off-line boiler cleaning to reduce dust residence times and accumulation in the boiler, therefore reducing PCDD/F formation in the boiler;
- Rapid flue gas cooling to prevent de-novo synthesis of PCDD/F; and
- Dry sorbent injection of lime and activated carbon.

#### 2.2.3.3 Furnace conditions

Furnace conditions will be optimised to minimise the quantity of residues arising for further disposal. Burnout in the furnace will either reduce the Total Organic Carbon (TOC) content of the bottom ash to less than 3%, or Loss on Ignition (LOI) of the bottom ash to less than 5%, by optimising residual waste feed rate and combustion air flows.

#### 2.2.3.4 Flue gas treatment control

Close control of the flue gas treatment system will minimise the use of reagents and hence minimise the quantity of APCr generated. The dosing rate for urea within the SNCR system will be optimised to minimise ammonia slip.

Lime usage will be minimised by trimming the lime dosing rate to accurately match the acid load using fast response upstream acid gas monitoring. The preventative maintenance regime for the Facility will include regular checks and calibration of the lime dosing system to ensure optimum operation. Back-up feed systems will be provided to ensure no interruption in the lime dosing system. The bag filter is designed to build up a filter cake of unreacted acid gas reagent, which acts as a buffer during any minor interruptions in dosing. Load cells will be included in the design of the injection system to identify any blockages in the reagent injection system.

Activated carbon dosing will be based on flue gas volume flow measurements. The activated carbon dosing screw speed frequency control responds automatically to the increase and decrease of flue gas volumes. Maintaining a steady concentration of activated carbon in the flue gas and consequently on the filter bags will maintain the adsorption rate for gaseous metals and dioxins.

Activated carbon and lime will be stored in separate silos. The feed rates for the activated carbon and lime dosing systems will have independent controls.

#### 2.2.3.5 Waste management

The arrangements for the management of residues produced by the Facility are presented in Section 2.9. IBA and APCr from the flue gas treatment system will not be mixed and will be transferred off-site as separate waste streams.

The procedures for handling of the wastes generated by the Facility will be in accordance with the Indicative BAT requirements in the SEPA Guidance Note S5.01, refer to Section 2.2.2.

#### 2.2.3.6 Waste charging

The Facility will meet the indicative BAT requirements outlined in SEPA Guidance Note S5.01 for fuel charging and the specific requirements of the IED:

- The combustion control and feeding system will be fully in line with the requirements of the IED. The conditions within the furnace will be continually monitored to ensure that optimal conditions are maintained and that the BAT-AEL emission limits are not exceeded. Auxiliary burners fired with natural gas will be installed and will be used to maintain the temperature in the combustion chamber.
- The waste charging and feeding systems will be interlocked with the furnace conditions so that charging cannot take place when the temperatures drop below 850°C, both during start-up and if the temperature falls below 850°C during operation.
- If emissions to atmosphere exceed an ELV, the Operator will be required to prohibit the waste charging and feeding systems.

- The isolation doors that prevent the fire burning back up the chute will be double doors and/or have a water-cooling system, to prevent ignition of waste in contact with the outside of the door.
- Following loading into the feeding chutes by the grab, the waste will be transferred onto the grates by hydraulic powered feeding units.
- The backward flow of combustion gases and the premature ignition of waste will be prevented by keeping the feed chute full of waste and by keeping the furnace under negative pressure.
- A level detector will monitor the amount of waste in the feed chute and an alarm will be sounded if the fuel falls below the safe minimum level. Secondary air will be injected from nozzles in the wall of the furnace to control flame height and the direction of air and flame flow.
- In a breakdown scenario, operations will be reduced or ceased as soon as practicable until normal operations can be restored.

The residual waste feed rate to the furnace will be controlled by the combustion control system. If there is an intermediate waste feed-stop, requiring the auxiliary burners to operate to maintain the operation of the Facility without entering shutdown, the flue gas treatment systems will remain in operation.

## 2.3 Water use

### 2.3.1 Overview

The main use of water at the Facility will be to make up the water for the boilers (referred to as boiler feedwater). Other water consuming processes include the ash quench and the SNCR system injection nozzles in the Facility. The following key points for the Facility should be noted:

- The Facility will consume approximately 3 tonnes per hour of water.
- Most of the steam generated in the boiler will be recycled as condensate. The remainder will be lost as blow-down to prevent build-up of sludge and chemicals, through soot blowing, the ash quench system and the FGT system. Lost condensate will be replaced with treated water.
- Where practicable, waste waters generated from the Facility process would be reused/recycled within the process. These would be collected in an intermediate storage vessel (a wastewater pit or process water tank). Wastewater treatment will be carried out on contaminated water from boiler blowdown, demineralisation unit, cleaning/draining of equipment etc, with the treated water to be re-used in the Facility.
- Under ‘normal operations’, there will not be any process effluent discharged from the Facility.
- Should excess process effluents be generated from the Facility (e.g. from emptying the boiler), these will be discharged to sewer in accordance with a Trade Effluent Consent (however it is acknowledged that this is subject to detailed design and agreements with the Sewerage Undertaker).
- Water from vehicle movement areas and areas of hardstanding will be discharged via oil interceptors into the site surface water pond.
- The water system has been designed with two key objectives:

  – minimal process water discharge; and

  – minimal consumption of potable water.
- Firewater will be provided by an on-site water tank which is connected to the mains water supply.

- The Facility will have separate process water, foul water and surface/storm water systems.

#### 2.3.1.1 Potable Water and Domestic Effluents

Water for drinking supplies for the offices and mess facilities will come from a potable water supply. The quantity of this water is expected to be small compared to the other water uses on site.

At the Facility, wastewater from domestic uses, such as showers, toilets, and mess facilities, will be discharged to foul sewer.

#### 2.3.1.2 Process Water and Process Effluents

Process water for the Facility will be supplied by the mains potable water system, the water treatment plant, or the recirculation of used water dependent on usage.

Water for firefighting will come from the mains supply and be stored in dedicated firewater storage facilities at the Facility.

Boiler feedwater will be used to compensate for boiler blow down losses. Boiler feedwater will be provided by an on-site water treatment plant, fed by mains water and utilising ion exchange resins to produce high-quality demineralised water. The water treatment plant will be designed to continuously supply high-quality treated water for use in the boiler.

Process effluents from the Facility will be collected in a wastewater pit or process effluent tank. Effluent collected in the wastewater pit will be re-used in the process, likely in the ash quench system. Under normal operating conditions, wastewater will be generated from the following processes:

1. effluent from the water treatment plant;
2. process effluent collected in site drainage systems (e.g. boiler blowdown);
3. condensate from the condensate tank;
4. effluent generated through washing and maintenance procedures; and
5. water run-off collected from the bottom ash quench.

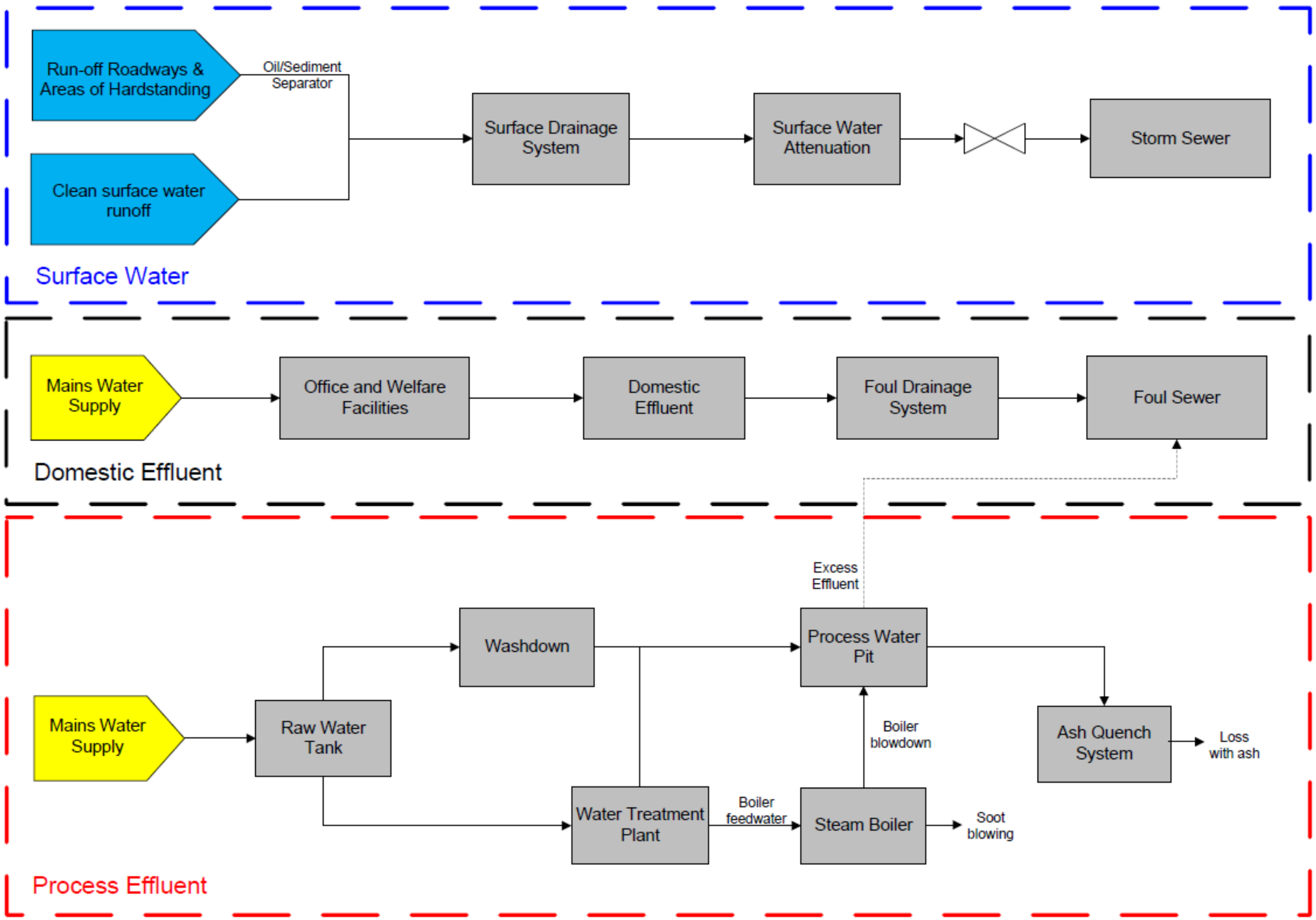
The wastewater pit will provide acid dosing for pH adjustment and settlement of process effluents so that it can be re-used within the ash quench.

Should any excess process effluents be generated from the Facility, it is anticipated that these will be discharged to sewer in accordance with a Trade Effluent Consent (subject to detailed design of the Facility and discussions with the Sewerage Undertaker).

Washdown water consumption will be minimised using trigger controls on all wash hoses.

An indicative water flow diagram for the Facility is presented within Figure 2 below.

*Figure 2: Indicative water flow diagram*



## 2.4 Emissions

The source of point source emissions from the Facility are presented in the table below:

*Table 6: Proposed emission points*

| Emission Point Reference | Source |
|---|---|
| A1 | Air emissions stack |
| A2 | Odour control stack |
| A3 | Emergency diesel generator |
| S1 | Surface water to sewer |
| S2 | Foul water from domestic facilities<br>Excess process effluents to sewer |

The emergency diesel generator will only operate for short-term periods (i.e. <50 hours per year) for testing purposes or to provide power to safely shutdown the Facility in the event of an emergency. Therefore, it will not be subject to emission limits under the Medium Combustion Plant Directive (MCPD). However, the operation of the emergency diesel generator will comply with SEPA BAT requirements where appropriate.

The arrangements for the discharge of excess process effluents from the Facility are subject to detailed design of the Facility and discussions with the Sewerage Undertaker. It is currently proposed to discharge excess process effluents to sewer in accordance with a trade effluent consent.

The emissions point drawing in Appendix A should be considered indicative and will be updated to reflect the 'true' emissions points upon completion of detailed design should any changes be made.

### 2.4.1 Emissions to air

The full list of proposed emission limits for atmospheric emissions from emission point A1 is shown in the table below.

*Table 7: Proposed emission limit values (ELVs)*

| Parameter | Units | Half Hour Average | Daily Average | Periodic Limit |
|---|---:|---:|---:|---:|
| **Continuously monitored pollutants** | | | | |
| Particulate matter | $mg/Nm^3$ | 30 | 5 | - |
| VOCs as Total Organic Carbon (TOC) | $mg/Nm^3$ | 20 | 10 | - |
| Hydrogen chloride | $mg/Nm^3$ | 60 | 6 | - |
| Carbon monoxide | $mg/Nm^3$ | 100 | 50 | - |
| Sulphur dioxide | $mg/Nm^3$ | 200 | 30 | - |
| Oxides of nitrogen (NO and $NO_2$ expressed as $NO_2$) | $mg/Nm^3$ | 400 | 120 | - |
| Ammonia | $mg/Nm^3$ | - | 10 | - |
| **Periodically monitored pollutants** | | | | |
| Hydrogen fluoride* | $mg/Nm^3$ | - | - | 1 |

| Parameter | Units | Half Hour Average | Daily Average | Periodic Limit |
|---|---|---|---|---|
| Cadmium & thallium and their compounds (total) | $mg/Nm^3$ | - | - | 0.02 |
| Mercury and its compounds** | $mg/Nm^3$ | - | - | 0.02 |
| Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total) | $mg/Nm^3$ | - | - | 0.3 |
| PCDD/F*** | ng I-TEQ $/Nm^3$ | - | - | 0.04 |
| PCDD/F + dioxin-like PCBs*** | ng WHOTEQ$/Nm^3$ | - | - | 0.06 |
| *All expressed at 11% oxygen in dry flue gas at standard temperature and pressure.* | | | | |

The BAT Reference Document on Waste Incineration (herein referred to as the Waste Incineration BREF) and the European Union Commission Implementing Decision (EU) 2019/2010 dated 12 November 2019 (establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) were published in December 2019. Therefore, in accordance with the Waste Incineration BAT Conclusions, the Facility will be required to comply with the BAT-AELs, for a 'new' facility, from commencement of operation. The emission limits being applied for are in accordance with the upper end of the BAT-AEL ranges for a 'new' facility.

The proposed supplier of the combustion system is Standardkessel Baumgarte (SKB). The Waste Incineration BREF presents performance data from all operational waste incineration facilities within Europe, which provided data in the BREF review process. The performance data for the operational SKB facilities has been extracted from the BREF and is presented in Appendix I. As can be seen from the table presented within Appendix I, there is not a single plant which can demonstrate compliance with all the BAT-AELs. This is due to the facilities being operated to the emission limits which they are required to comply with. Therefore, only the relevant data from each plant (i.e. those which demonstrate compliance with the relevant BAT-AELs using the same abatement technologies proposed for the Facility) has been presented. The data provided demonstrates compliance with the BAT-AELs for each pollutant with the exception of HCl, $SO_2$, dust and dioxin-like PCBs. Additional data is presented within Appendix I for an operational SKB facility (Widmerpool Biomass facility) which demonstrates compliance with the BAT-AELs for dust and dioxin-like PCBs respectively.

In addition to the above, data is provided in Appendix I from the SKB Bernburg waste-to-energy plant, which employs the same combustion technology as the Facility. This demonstrates compliance with BAT-AELs for all pollutants, with the exception of HCl and NOx. It is acknowledged that annual HCl concentrations at the Bernburg plant range between 9.15 and 9.64 $mg/m^3$. This is in compliance with the 10 $mg/m^3$ limit for HCl imposed within the plant's permit. It is considered that the Oldhall Facility will be able to meet the required BAT-AEL of 6 $mg/m^3$ for HCl through careful control of the acid gas abatement system and optimum reagent dosing.

From the emissions data presented within Appendix I, it can be seen that the Bernburg plant has an annual average NOx concentration of between 186.43 – 190.84 $mg/m^3$, which is in compliance with the limit of 200 $mg/m^3$ within the plants permit. It is acknowledged that the Oldhall Facility will be required to meet the BAT-AEL of 120 $mg/m^3$ for NOx. The measures which will be employed within the SNCR system at the Facility for the abatement of NOx to meet the BAT-AEL limit are outlined as follows:

- The SNCR system will be based on the controlled injection of a NOx abatement reagent into a defined temperature range of the flue gas. There will be multiple injection levels within the boiler, with the system able to control the delivery of the reagent to specific injection points/levels, or in groups.
- Furnace temperature measurement and the measurement of furnace temperature distribution will be improved with the use of an advanced acoustic temperature measurement system. This will enable the SNCR system to adapt to spacious temperature and load conditions, in order to achieve high NOx-reduction and low ammonia slip values.
- An efficient control system will be employed, which will enable measurements of furnace temperature distribution, to be used to select the most appropriate locations/injection points for adjusting the dosing rate of reagent.

The careful control and optimisation of the SNCR system as described above, coupled with guarantees to be provided by the technology supplier to achieve the required emission limits, will ensure that BAT-AEL limits for NOx and ammonia are met.

Further to the above, it is also understood that SEPA have recently granted permits for the NESS EfW facility in Aberdeen and Baldovie EfW facility in Dundee, which also use the SKB combustion technology.

### 2.4.2 Fugitive emissions to air

In addition to the point source emissions to air, there will be potential fugitive emissions to air from refilling of raw material storage facilities, such as tanks and silos. Where appropriate, fugitive emissions will be prevented by venting the displaced air to the tanker during refilling.

#### 2.4.2.1 Waste handling and storage

Waste reception and handling will be undertaken in enclosed waste reception areas which prevent the release of litter and dusts. The residual waste will then be tipped into and stored within an enclosed waste bunker.

All residual waste will be delivered to the Facility in enclosed and contained waste delivery vehicles, which will contain any fugitive emissions from the delivery of waste to the Facility

Primary combustion air for the Facility will be drawn from the waste bunker area to maintain negative pressure in waste bunker area and fed into the combustion chamber beneath the grate. Additional bunker management procedures, and the regular cleaning down of the waste reception areas, will minimise the release of litter and dusts.

#### 2.4.2.2 Silos

Silos will be fitted with bag filter protection where appropriate, to prevent the uncontrolled release to dusts during refilling. Maintenance procedures will be developed for routine inspection and testing of the bag filters.

The lime and activated carbon silos will be filled by bulk tanker, offloaded pneumatically with displaced air vented through a reverse pulse jet filter. The delivery driver will be responsible for connecting the filling pipe to the silo/tanker, with the site operatives responsible for checking that the loading chute is closed following unloading. The silos will be fitted with high-level alarms and equipped with a vent fitted at the top with a fabric filter. Filter residues will be returned to the silo(s), with cleaning of the filter done automatically with compressed air after the filling operation. Filters will be inspected regularly for leaks.

#### 2.4.2.3 Ash handling and storage

Hot bottom ash from the combustion process is quenched using water prior to storage. The transfer of IBA from the combustion process to its dedicated storage area will be undertaken in an enclosed building. The quenching and cooling of the IBA enables its safe removal and minimises the generation of dust and odour. The ash will be maintained wet from quenching to prevent the fugitive release of any dust emissions off site. If possible, moisture content of the IBA will be optimised to minimise dust release. The IBA will be stored in a dedicated ash hall prior to transfer off-site for recovery or disposal.

The APCr silos will be unloaded by a chute system. The height of discharge will be limited where possible. Dusty air from the unloading of silos will be extracted and vented via bag filters fitted to prevent the release of dusts from silos unloading operations. The hose from the APCr silo will be designed with an inner core (used for the unloading of APCr from the silo) and an outer 'bellow' which will extract displaced air from the silo and pass it through the filter before subsequently venting the air back into the silo. This type of arrangement is typically used on EfW plants, as well as numerous other applications for unloading dusty materials from one vessel to another. All APCr unloading operations will be supervised by site operatives and undertaken on areas of hardstanding, with any run-off contained in the process water drainage systems. The site operatives will assist the delivery vehicle driver in positioning the tanker in a suitable location beneath the unloading chute. The delivery driver will be responsible for connecting the unloading chute to the tanker. Following completion of unloading, the site operatives will be responsible for checking that the loading chute is closed following unloading.

The area for the unloading of APCr will not be enclosed, however the measures listed above will ensure that potential fugitive emissions from the unloading process are contained within the tanker/silo.

### 2.4.3 Point source emissions to water

There will be no point source emissions to water from the Facility.

### 2.4.4 Point source emissions to sewer

Surface water from the Facility will be collected in an attenuation pond designed for SUDS requirements, prior to discharge to an existing Scottish Water combined sewer which currently serves the site. All surface water runoff from roadways and vehicle movement areas will pass through oil interceptors prior to discharge to the attenuation pond. There will be periodic monitoring of surface water discharge to sewer to confirm compliance with any relevant emission limits imposed by Scottish Water.

Areas where reagents and residues are stored or loaded/unloaded will have isolated drainage with links to the process water drainage system. In addition, areas where liquid raw materials are stored will be covered. Under normal operation, the Facility will be designed to be 'zero discharge', with process effluents re-used within the process. If excess process effluents are generated, for example during boiler blowdown, it is currently proposed to discharge these to sewer in accordance with a Trade Effluent Consent. However, this is subject to discussions with the Sewerage Undertaker and detailed design of the Facility.

The discharge point to the Scottish Water combined sewer is shown in the drawing presented in Appendix A.

### 2.4.5 Contaminated water

Process water drains within the Facility will drain to a wastewater pit or process water tank. The process water drainage system will be fitted with a penstock valve or similar isolation measure that will inhibit the discharge of contaminated effluent should a fire or significant spill occur.

The surface water drainage system will have a penstock valve (anticipated to be at the outlet of the attenuation pond) to inhibit the discharge of contaminated effluent should a fire or significant spill occur.

Areas where the spillage of any stored substance could be harmful to the environment will be appropriately kerbed or bunded. Adequate quantities of spillage absorbent materials will be made available at easily accessible location(s), where chemicals are stored. It is anticipated that external areas where fuel and chemicals are offloaded will be connected to the process drainage network. Any spillage that has the potential to cause environmental harm or to leave the Facility will be reported to the site management and recorded in accordance with installations inspection, audit and reporting procedures. The relevant regulatory authorities (SEPA/ Health and Safety Executive) will be informed should the spillage/leak be significant. A site drainage plan, including the location of process and surface water drainage will be made available on-site following completion of detailed design.

Periodic preventative maintenance will be undertaken on the site drainage systems including any penstock valves or isolation measures in accordance with the manufacturer's recommendations and instructions, to ensure that they remain fully operation.

### 2.4.6 Noise

A noise assessment for the Facility is presented in Appendix C. This includes further details on the noise modelling undertaken for the Facility. It should be noted that the noise assessment refers to a Materials Recovery Facility (MRF) reception hall. It is no longer proposed to have a MRF at the Facility, however this area is instead proposed to make up the tipping hall and waste bunker (the waste reception area) at the Facility. It is understood that a MRF would be a noise operation/activity than the proposed waste reception area; therefore, the noise assessment is considered to be a conservative assessment of noise impacts associated with the operation of the Facility.

There are many aspects associated with noise mitigation which need to be considered, including the following:

- general approach and experience of the Technology Provider;
- tonal noise;
- low frequency noise;
- noise associated with operational emergency steam relief and commissioning steam venting; and
- general design measures.

The following sections present details on noise mitigation measures proposed for the Facility.

#### 2.4.6.1 Approach & experience of the technology provider

The EPC Contractor responsible for the design and construction of the Facility (STC) has significant experience in the design and build of thermal power plants including Waste to Energy technology over many years. This includes the recent Bridgwater Resource Recovery facility, which is now under construction and expected to commence operation in 2021. The EPC contractor will optimise the plant selection to ensure that it selects the most efficient and `quietest' technology.

Plant areas which contain higher than ambient noise sources (e.g. the Turbine Hall, Boiler and Flue Gas Treatment rooms) contain a significant number of individual items of process plant. Trying to abate noise from all of them independently is impracticable, and creates problems with temperature control, access for online operational maintenance, routine observation and ventilation requirements which further limits attenuation at source. Therefore, suitable and efficient layouts and design solutions will be employed, including acoustically designed plant rooms, which will limit noise emissions to the acceptable levels needed comply with all relevant regulations.

The noise assessment presented in Appendix C concludes that noise and vibration "*should not pose a significant constraint to the construction and operation*" of the Facility with the noise mitigation proposed.

#### 2.4.6.2 Principal noise sources and mitigation measures

The principal operational noise sources from the Facility will be as follows:

- flue gas treatment area;
- air cooled condenser unit (ACC);
- stack outlet;
- ID Fan (enclosed);
- boiler hall;
- turbine hall;
- waste bunker;
- waste reception area or 'tipping hall' (previously MRF reception hall);
- IBA area; and
- vehicle movement on site.

The principal noise sources and mitigation measures assumed in the noise modelling for each of these areas are set out in the subsequent sections. As the design specification for internal and external plant has yet to be finalised, the noise assessment presented within Appendix C makes reference to an operational noise impact assessment for a similar sized energy recovery facility. For the purposes of the assessment, it has been assumed that the majority of the identified sound sources would operate continuously and simultaneously, during both the daytime and night-time periods. However, at night it has been assumed that there would be no reception of residual waste, hence it has been assumed that there will be no on-site vehicle movements for the assessment of night-time operational sound.

The noise assessment concluded that, for the closest residential receptors, the operational noise level will result in no significant effect. Therefore, no mitigation measures are proposed other than those already embedded within the design of the Facility. Specific design mitigation measures will be subject to detailed design of the Facility, but the following sections describe general measures and techniques.

**Flue gas treatment building**

Noise source: Flue gas treatment building

Type: Daytime and night-time operation and general noise, no tonal or impulse noise emanating from the building enclosure. A sound level of 100 dB was assumed in the modelling.

Noise mitigation: Enclosed building using acoustic cladding (walls and roof) with acoustic louvres to mitigate the risk of noise `break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 25dB assumed within the noise assessment. Further details on the building construction materials and the roller shutter doors/louvre systems and associated sound reduction indices assumed within the noise model are presented within Appendix C.

**Air cooled condenser unit (ACC)**

Noise source: Air Cooled Condenser fans

Type: Day and night-time operation (and broad band noise), with no tonal or impulse noise based on other operational sites in the UK. A sound level of 100 dB was assumed in the modelling.

Noise mitigation: The proposed noise mitigation measures for the ACCs are subject to detailed design of the Facility. However, the mitigation measures could include wind screens, low noise fans, silencers for bypass etc.

**Stack outlet (and ID fan)**

Noise source: ID fan and Stack

Type: Day and night-time operation. General broadband noise – no tonal noise is anticipated, however other characteristic sound from the stack has the potential to be readily distinctive against residual sound levels at night. A sound level of 88 dB was assumed in the modelling.

Noise Mitigation: The ID fan will be enclosed and located within the FGT building which will be acoustically clad. It is anticipated that the stack will be fitted with a dedicated silencer. The stack will be designed to ensure that the flue gas flow rate is approximately 15 m/s but always less than 30 m/s (beyond which, in some circumstances, there can be a 'whistle' from the top of the stack).

**Boiler hall**

Noise source: Boiler Hall plant

Type: Daytime and night-time, general noise is not tonal or impulsive. A sound level of 87 dB was assumed in the modelling.

Noise mitigation: The proposed noise mitigation measures for the boiler hall is subject to detailed design of the Facility, however may include silencers on steam vents and pressure relief valves and only undertaking operational tests during daytime periods. The boiler hall will be an enclosed building using acoustic cladding (walls and roof) with acoustic louvres to mitigate the risk of noise `break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 25dB assumed within the noise assessment. Further details on the building construction materials and the roller shutter doors/louvre systems and associated sound reduction indices assumed within the noise model are presented within Appendix C.

**Turbine Hall**

Noise source: Turbine Hall including generator within the hall.

Type: Day and nighttime operation, potential tonal and general noise. Low frequency sound has been considered within the noise assessment and it was concluded that there will be no significant low frequency sound transmission through the building structure and that the proposed mitigation measures will provide the required level of attenuation for low frequency noise transmission. A sound level of 94 dB was assumed in the modelling.

Noise mitigation: Enclosed building using acoustic cladding (walls and roof) with acoustic louvres to mitigate the risk of noise `break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 25dB assumed within the noise assessment. Further details on the building construction materials and the roller shutter doors/louvre systems and associated sound reduction indices assumed within the noise model are presented within Appendix C. Further noise mitigation measures for the turbine hall are subject to detailed design of the Facility, however may include acoustic doors (providing noise attenuation) kept shut except during maintenance or emergency occurrences, the use of a turbine table with mounts to reduce vibration and the location of the turbine hall providing further noise screening.

**Waste bunker and waste reception area/tipping hall**

Noise source: Tipping Hall with mobile plant and HGVs operating inside.

Noise type: Potential intermittent impulse noise offloading during daytime only, reversing alarms. A sound level of 87 dB was assumed in the modelling.

Noise mitigation: Enclosed building using acoustic cladding (walls and roof) with acoustic louvres to mitigate the risk of noise `break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 25dB assumed within the noise assessment. Further details on the building construction materials and the roller shutter doors/louvre systems and associated sound reduction indices assumed within the noise model are presented within Appendix C.

**Bottom ash handling building**

Noise source: Bottom Ash Storage

Type: Noise from conveyors generating low-level broad-spectrum noise levels which will not be tonal or impulsive (broadband only). A sound level of 85 dB was assumed in the modelling.

Noise mitigation: Enclosed building using acoustic cladding (walls and roof) with acoustic louvres to mitigate the risk of noise `break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 25dB assumed within the noise assessment. Further details on the building construction materials and the roller shutter doors/louvre systems and associated sound reduction indices assumed within the noise model are presented within Appendix C.

**Vehicle movement on site**

Noise Source: Staff vehicles, HGV movements (such as turning/reversing), residual waste delivery, IBA export, chemical delivery, APCr export.

Type: Daytime operation. General vehicle noise. Intermittent during daytime. Various sound power levels between 73 dB and 109 dB were assumed in the noise modelling depending on the type of vehicle.

Noise Mitigation: The noise assessment concluded no significant noise impacts were anticipated due to vehicle movements within the site. Therefore, no mitigation measures specific to vehicle noise are considered necessary. However, it should be noted that the Facility has been designed with a mostly circular vehicle access route around the perimeter of the Facility to minimise reversing and consequent reversing alarms during the delivery of residual waste and reagents and during the removal of residues.

#### 2.4.6.3 Tonal noise

As detailed in section 2.4.6.2, the Facility will be designed to minimise tonal noise.

#### 2.4.6.4 Low frequency noise

Low frequency noise generation is typically associated with wind turbines due to the slow rotation speed of long turbine blades passing their supporting masts in an outdoor location, and is not typically a problem associated with steam turbines.

A steam turbine operates at high steam pressures and is fully enclosed within a casing, rotating at 3,000 rpm to be synchronous with the grid frequency at 50 Hz. All moving components and blades are enclosed and shrouded, giving rise to limited low and high frequency noise given the speed of rotation. In addition, the turbine will be located at high level on a turbine table or similar with the turbine hall itself acoustically clad and designed to limit noise transmission. In this way, it is possible to achieve acceptable working noise levels within the Turbine Hall at all times, potentially avoiding the need for ear defenders or other personal protective equipment (PPE). The noise spectra from a steam turbine are anticipated to have higher frequency components and any noise mitigation is automatically achieved by thermally insulating the steam turbine casing.

Steam turbines are not a noise concern for most thermal power plants. In contrast, the noise associated with the ACC unit or ID fans can present noise sources because of their outdoor location generating (on occasion) low frequency spectra. However, the mitigation measures described in section 2.4.6.2 will reduce the noise impact of the Facility from these components.

Nevertheless, the noise assessment presented within Appendix C takes into consideration low frequency noise by analysing measurements from the turbine and generator within the turbine hall of a reference facility. Although a prominent tone at a certain frequency is identified, there is no significant low frequency sound transmission through the building structure to measurements taken outside the turbine hall. It is assumed that the Facility will have a similar façade to the reference facility and is therefore concluded that the required level of attenuation can be incorporated to mitigate any potential for low frequency noise transmission.

Notwithstanding the above, Condition 5 of the planning permission for the Facility requires the development to be in accordance with details set out in the 'Design Principles Briefing Note – Acoustics' (presented in Appendix G alongside a copy of the planning decision notice). This imposes a requirement to reduce the possibility of low-frequency noise generation by using a high-massing attenuation solution within the main hall structure to enclose the turbine and generators. The turbine and generators will be mounted on a solid concrete raft and enclosed within a concrete walled structure. It is understood that these proposals are acceptable to SEPA following discussions during the planning process.

The emergency diesel generator will rotate at high speed and will therefore generate high frequency noise. The emergency diesel generator will be isolated for safety reasons and located in its own dedicated enclosure.

#### 2.4.6.5 Noise associated with operational emergency steam relief and commissioning steam purging

Steam purging (or "steam blowing") is a critical hot commissioning activity that occurs once in the lifetime of the plant following first energisation of the plant and following chemical passivation of the boiler internals. Its purpose is to "shock" and remove all internal piping corrosion and scale deposits between the boiler and the steam turbine inlet. The steam purge is a cyclical process of pressuring the boiler at high temperature and pressure. The steam is released in an uncontrolled manor to “blow” through the piping and systems over many cycles. This process, after chemical passivation of the boiler internals, can take up to 2 weeks to complete and is concluded when an adequate steam quality free of particulate/scale is achieved. The residues within the boiler during construction would causes damage to the steam turbine internal blades if not removed prior to the steam being passed to the turbine for the first time during commissioning. This process is achieved using a temporary commissioning dedicated sacrificial pipework system and silencer that is specifically installed for this process. For the avoidance of doubt, it is not possible to undertake steam purging during normal operation of the plant.

The boiler will be designed strictly in accordance with the Pressure Systems Safety Regulations which require any pressurised system to be fitted with emergency pressure relief valves to prevent over pressurisation and an uncontrolled rupture of the boiler. Pressure relief systems and valves are utilised for emergencies only and are not used for normal operation and control of the boiler meaning their use is to prevent an uncontrolled event. During any normal operation of the plant the pressure relief valves will not need to operate. In an exceptional circumstance (i.e. equipment failure elsewhere within the plant) the control system may not be able to prevent an over pressurisation of the steam system and the last line of defence is the pressure release valves within the boiler which will lift and vent the system pressure. The pressure relief cycle if initiated will last for approximately 4-6 minutes when normal operating pressure limits within the boiler are returned to 'normal' levels and safe shut-down or ongoing operations can be maintained. The pressure relief system will be fitted with silencer(s) specifically designed to reduce noise from this abnormal event to approximately 50 dB at the boundary of the plant. It is understood from previous experience that is simply not feasible to reduce noise levels below this level given the nature and requirement for this system to be safely effective.

The pressure relief valves will be safety tested on a periodic basis. The frequency of testing will be determined by the Pressure Equipment Directive written scheme of examination, defined within the UK pressure systems regulations. The frequency of testing will be determined by the written scheme of examination. The frequency of testing is usually between 12-24 months.

Steam purging is a planned event that will occur only during commissioning. Testing of the safety relief valves again is a planned operational activity with a frequency driven by legislation. All of these events will be planned to occur during day-time hours.

If there is an exceptional circumstance operationally where the plant control systems and operators cannot rectify an exceptional event, then an unplanned pressure relief event would occur for 2-4 minutes thereby avoiding a significant incident and risk to personnel safety.

Taking this into consideration and in conclusion, following commencement of operation of the Facility, steam purging will not occur during operation of the Facility. If there is an over pressurisation and uncontrolled event within the pressurised boiler, the pressure relief valve system will function to release the pressure to safe levels within the boiler. If the cause of the over pressurisation has been understood, resolved and stable conditions resumed within the boiler then normal operation will resume. However, if the cause of the over-pressurisation is not resolved, the boiler will shut down safely to enable the issue to be investigated and resolved prior to restarting the plant.

### 2.4.7 Odour

The storage and handling of incoming residual waste is considered to have potential to give rise to odour. The Facility will include controls to minimise odour during normal and abnormal operation.

The controls to minimise odorous emissions from the Facility are discussed in the following sections.

#### 2.4.7.1 Waste reception

In the Facility, combustion air will be drawn from above the waste pit, so that odours and airborne dust are drawn from the waste reception area/waste bunker into the incineration line (thus preventing their escape to atmosphere). This ensures that a slight negative pressure is maintained, hence reducing the chance of odours escaping the building. It can be confirmed that the system will meet the SEPA requirement for at least 3 air changes per hour.

Odour will also be controlled by keeping the doors between the waste tipping area and the waste bunker closed when there are no waste deliveries occurring.

Bunker management procedures (mixing and periodic emptying and cleaning) will be developed and implemented to avoid the development of anaerobic conditions in the waste bunker, which could generate odorous emissions.

In the event of a plant shutdown, which might result in residual waste being held in the waste bunker for a period of time, the doors to the waste reception hall will be kept shut.

The quantities of fuel within the waste bunker will be run down prior to periods of planned maintenance, until there is minimal residual waste retained within the waste bunker. In addition, during short periods of unplanned maintenance, the doors to the Facility building will be closed to prevent the escape of odour.

Should an extended period of unplanned shutdown occur, there will be facilities in place for residual waste to be backloaded from the waste bunker if required for transport off-site to suitable waste treatment facilities.

During periods of shutdown, odour will be monitored at the installation boundary through olfactory checks by site personnel.

**Odour abatement system**

An odour abatement system will be in place to deal with odourous emissions should they be identified during periods of shutdown. It is anticipated that an odour abatement system utilising carbon filtration will be used at the Facility. This will extract potentially odorous emissions from waste storage areas and treat the air prior to release from a dedicated odour abatement stack. The odour abatement system will be designed to provide three air charges per hour, in accordance with SEPA's Odour Guidance, from waste reception areas. The stack for the odour abatement stack will be located on top of the Waste Reception Hall. The odour abatement stack will be 3m (or more subject to detailed design), than the height of the Waste Reception Hall.

The odour abatement system will be designed to ensure that odour impacts at sensitive receptors are less than 1.5 $OU_e$. The odour abatement system will be subject to detailed design of the Facility.

#### 2.4.7.2 Plant process

During normal operation emissions from the process will be released from the main stack.

The Industrial Emissions Directive (IED) requires that any combustion gases passing through a waste incineration plant must experience a temperature of 850°C or more for at least two seconds. Due to the high temperature experienced by the gases, most odorous chemicals would be destroyed. Any surviving odorous chemicals may become trapped on the bag filters.

The flue gases from the waste treatment/energy recovery process will pass through a flue gas treatment (FGT) system, which includes bag filters to reduce the particulate content of the flue gas.

Urea solution injected into the furnace as part of the NOx abatement system, which converts into ammonia during the process and there may be some occasional "ammonia slip" during operation.

The release of the flue gases from the stack will assist with dispersion of the flue gases. Taking this into consideration, there will not be any malodorous air from Facility that will be detectable at sensitive human receptors. Furthermore, as demonstrated within the air quality assessment, emissions of ammonia are predicted to have an insignificant impact upon sensitive human receptors.

#### 2.4.7.3 Incinerator Bottom Ash storage

Incinerator bottom ash (IBA) is the residue which is left from the combustion of waste. This means that it will have reached a temperature of 850°C or higher during combustion for at least two seconds and that it will have a Loss on Ignition (LOI) of less than 5% or a Total Organic Carbon of less than 3%, as required by the IED. Therefore, no organic or putrescible solid material would be present within the IBA. Consequently, there will be no odour from the storage of IBA.

#### 2.4.7.4 APCr storage

APCr is the residue which is collected in the bag filters and will be stored in a silo. This residue will consist of ash which will have reached a temperature of 850°C or higher during combustion within the boiler or the flue gas treatment chemicals (lime or activated carbon) within the FGT system. Therefore, no organic or putrescible solid material would be present within the APCr silos. Consequently, there will be no odour from the storage of APCr.

## 2.5 Monitoring methods

### 2.5.1 Emissions monitoring

Sampling and analysis of all regulated pollutants will be carried out to the relevant CEN or equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality.

The Facility will be equipped with modern monitoring and data logging devices to enable checks to be made of process efficiency.

The purpose of monitoring has three main objectives:

1. to provide the information necessary for efficient and safe plant operation;
2. to warn the operator if any emissions deviate from predefined ranges; and
3. to provide records of emissions and events for the purposes of demonstrating regulatory compliance.

#### 2.5.1.1 Monitoring emissions to air

The following parameters for the emissions from the main stack will be monitored and recorded continuously using a Continuous Emissions Monitoring System (CEMS):

1. oxygen;
2. carbon monoxide;
3. hydrogen chloride;
4. sulphur dioxide;
5. nitrogen oxides;
6. ammonia

7. volatile organic compounds (VOCs); and
8. particulates.

In addition, the flow, oxygen content, water vapour content, temperature and pressure of the flue gases will be monitored so that the emission concentrations can be reported at the reference conditions required by the Industrial Emissions Directive (IED).

Once operational, in addition to the CEMS system, emissions to air from the Facility will be subject to periodic surveillance tests by independent testing company's at frequencies to be agreed with SEPA.

In addition to the CEMS system, the following emissions from the Facility will also be monitored by means of periodic spot sampling at frequencies agreed with SEPA and in accordance with the UK regulatory authorities BREF implementation plan:

1. group 3 Heavy Metals [antimony (Sb), arsenic (As), lead (Pb); Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni), Vanadium (V)];
2. nitrous oxide;
3. cadmium (Cd) and thallium (Tl);
4. mercury (Hg);
5. hydrogen fluoride;
6. dioxins and furans; and
7. dioxin like PCBs.

It is not proposed to undertake continuous monitoring of emissions of mercury or dioxins and furans. The BREF states that for plants incinerating wastes with a proven low and stable mercury content (e.g. mono streams of waste of a controlled composition), the continuous monitoring of emissions may be replaced by long-term sampling or periodic monitoring.

It is proposed to undertake periodic monitoring of hydrogen fluoride. The BREF states that continuous measurements of HF may be replaced by periodic measurements if HCl levels are proven to be sufficiently stable.

With regards monitoring requirements for emissions of dioxins and furans and dioxin-like PCB's (herein referred to as dioxins and furans), the BREF states that the monitoring does not apply if the emission levels are proven to be sufficiently stable.

At the time of writing this application, it is understood that the UK regulatory authorities have not published the UK's BREF interpretation and implementation plan for compliance with the requirements of the BREF. However, the Environmental Services Association (ESA) is working with the UK regulatory authorities to develop a method to rapidly demonstrate that facilities classified as 'new plants' for BREF compliance purposes, such as the Facility, will have low and stable emissions of mercury and dioxins and furans. It is understood that this will likely be similar in nature to the bottom ash protocol, with a programme of intensive testing at the commencement of operation – assumed to be monthly for the first year of operations - to establish that emissions of mercury and dioxins and furans are proven to be low and stable.

The methods and standards used for emissions monitoring will be in compliance with SEPA Sector Guidance S5.01 and the IED. In particular, the CEMS equipment will be certified to the MCERTS standard and will have certified ranges which are no greater than 1.5 times the relevant daily average emission limit.

Sampling and analysis of all pollutants including dioxins and furans will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality.

The frequency of periodic measurements will comply with the emission limits within the PPC Permit as a minimum. The flue gas sampling techniques and the sampling platform will comply with Environment Agency Technical Guidance Notes M1 and '*Monitoring stack emissions: technical guidance for selecting a monitoring approach*' (formerly part of the M2 guidance document).

It is anticipated that the following equipment will be used for emissions measurements, however this will be confirmed during detailed design of the CEMS system:

- hydrogen chloride, carbon monoxide, sulphur dioxide, oxides of nitrogen and ammonia will be measured by an FTIR type multi-gas analyser;
- VOCs will be measured by an FID type analyser;
- particulate matter will be measured by an opacimeter; and
- oxygen will be monitored by a zirconium probe.

All monitoring results shall be recorded, processed and presented in such a way as to enable SEPA to verify compliance with the operating conditions and the regulatory emission limit values within the PPC Permit.

Periodic monitoring will be undertaken by MCERTS accredited stack monitoring organisations.

**Reliability**

IED Annex VI Part 8 allows a valid daily average to be obtained only if no more than 5 half-hourly averages during the day are discarded due to malfunction or maintenance of the continuous measurement system. IED Annex VI Part 8 also requires that no more than 10 daily averages be discarded per year.

These reliability requirements will be met primarily by selecting MCERTS certified equipment.

Calibration of the CEMS will be carried out at regular intervals as recommended by the manufacturer and by the requirements of BS EN14181 and the BS EN 15267-3. Regular servicing and maintenance will be carried out under a service contract with the equipment supplier. The CEMs will be supplied with remote access to allow service engineers to provide remote diagnostics.

There will be one dedicated CEMS and a stand-by CEMS in the event of a CEMS failure. This will ensure that there is continuous monitoring data available even if there is a problem with the duty CEMS

**Start-up and Shutdown Procedures**

The emission limits do not apply during start-up and shutdown under the IED, but the abatement equipment will be required to operate during start-up and shutdown. Therefore, a signal will be sent from the main plant control system to the CEMS system to indicate when the Facility is operational and burning waste. The averages will only be calculated when this signal is sent, but raw monitoring data will be retained for inspection.

It is anticipated that the following conditions will define when start-up ends:

1. the auxiliary burners are turned down quickly (as there is a slight overlap between the burning of waste and the auxiliary burner operation);
2. the feed chute damper is open and the feeder, flue gas cleaning plant, control systems, monitoring equipment, grate and ash extractors and all other necessary devices of the entire facility like the water stream cycle are running;
3. the flue gas temperature after the last injection of combustion air is greater than 850°C and will be kept for 2 seconds; and
4. start up ends with the beginning of feeding waste onto the empty grate.

It is anticipated that the following conditions will define when a scheduled shutdown begins:

1. the feed chute damper will be closed and the ram feeders will stop operation;
2. the flue gas treatment systems and all other systems/devices necessary for shutdown of the entire Facility are running; and
3. the auxiliary burner is in service since the flue gas temperature after the last injection of combustion air has dropped below 850°C (and will remain in operation at least until all waste on the grate is completely burned out).

**Emergency diesel generator**

The emergency diesel generator will only operate for short-term periods (i.e. <50 hours per year) for testing purposes, or will operate in the event of an emergency. Therefore, it will not be subject to emission limits under the Medium Combustion Plant Directive (MCPD). However, it is proposed that periodic monitoring of NOx and CO will be undertaken for the EDGs.

#### 2.5.1.2 Monitoring Emissions to Water and Sewer

There will be regular monitoring undertaken of surface water at the Facility to ensure that discharges from the surface water attenuation pond to sewer are acceptable and within the limits imposed by the Trade Effluent Consent. Should a consent be obtained from Scottish Water for the discharge of excess process effluents to sewer, regular monitoring would be undertaken to ensure that the discharge of process effluents is within the acceptable limits imposed by the Trade Effluent Consent.

### 2.5.2 Monitoring of process variables

The Facility will be controlled from a dedicated control room. A modern control system, incorporating the latest advances in control and instrumentation technology, will be utilised to control operations, optimising the process relative to efficient heat release, good burn-out and minimum particle carry-over.

The system will control and/or monitor the main features of the plant operation including, but not limited to the following:

- combustion air;
- fuel feed rate;
- SNCR system;
- flue gas oxygen concentration at the boiler exit;
- flue gas composition at the stack;
- combustion process;
- boiler feed pumps and feedwater control;
- steam flow at the boiler outlet;
- steam outlet temperature;
- boiler drum level control;
- flue gas control;
- power generation; and
- steam turbine exhaust pressure.

The response times for instrumentation and control devices will be designed to be fast enough to ensure efficient control.

The following process variables have particular potential to influence emissions:

- fuel throughput will be recorded to enable comparison with the design throughput. As a minimum, daily and annual throughput will be recorded;
- combustion temperature will be monitored at a suitable position to demonstrate compliance with the requirement for a residence time of 2 seconds at a temperature of at least 850°C;
- the differential pressure across the bag filters will be measured, to optimise the performance of the cleaning system and to detect bag failures; and
- the concentration of hydrogen chloride in the flue gases upstream of the flue gas treatment system will be measured to optimise the performance of the emissions abatement equipment.

Water use will be monitored and recorded regularly at various points throughout the process to help highlight any abnormal usage. This will be achieved by monitoring the incoming water supplies and the boiler water makeup.

In addition, electricity and auxiliary fuel consumption will be monitored to highlight any abnormal usage.

IBA will be sampled and analysed at regular intervals to ensure its composition is suitable for it to be recovered/processed at a suitable facility. The monitoring of the IBA will be in accordance with the requirements of BAT 7 of the BREF.

#### 2.5.2.1 Validation of Combustion Conditions

The Facility will be designed to provide a residence time, after the last injection of combustion air, of more than two seconds at a temperature of at least 850°C. This criterion will be demonstrated using Computational Fluid Dynamic (CFD) modelling during the design stage and confirmed by the recognized measurements and methodologies during commissioning in accordance with S5.01.

It will also be demonstrated during commissioning that the Facility can achieve complete combustion by measuring concentrations of carbon monoxide, VOCs and dioxins in the flue gases and TOC of the bottom ash.

During the operational phase, the temperature at the 2-seconds residence time point will be monitored to ensure that it remains above 850°C. The location of the temperature probes will be selected using the results of the CFD model. If it is not possible to locate the temperature probes at precisely the 2-seconds residence time point, then a correction factor will be applied to the measured temperature. The CFD model for the design will be made available to SEPA following detailed design of the boiler. An example CFD report is presented within Appendix H.

Urea solution will be injected into the flue gases at a temperature of between 850 and 1,050°C. However, the optimum temperature range will be between 850 and 950°C. This narrow temperature range is needed to reduce NOx successfully and avoid unwanted secondary reactions. This means that multiple levels of injection points will be required in the radiation zone of the furnace.

Sufficient nozzles will be provided at each level to distribute the urea solution correctly across the entire cross section of the radiation zone. CFD modelling will be used to define the appropriate location and number of injection levels as well as number of nozzles to make sure the SNCR system achieves the required reduction efficiency for the whole range of operating conditions while maintaining the ammonia slip below the required emission level.

The CFD modelling will also be used to optimise the location of the secondary air inputs into the combustion chamber.

#### 2.5.2.2 Measuring oxygen levels

The oxygen concentration at the boiler exit will be monitored and controlled to ensure that there will always be adequate oxygen for complete combustion of combustible gases. Oxygen concentration will be controlled by regulating the combustion airflows and the residual waste feed rate.

## 2.6 BAT review

Within this section, qualitative and quantitative BAT assessments have been presented for the following:

- combustion technology;
- NOx abatement technology;
- acid gas abatement technology;
- particulate matter;
- steam condenser; and
- drainage arrangements.

Where appropriate, the quantitative assessments draw on information and data obtained by Fichtner from a range of different projects using the technologies which have been identified as potentially representing BAT from an initial qualitative assessment.

### 2.6.1 Combustion technology

It is proposed that the residual waste treatment/energy recovery technology for the Facility will be a moving grate furnace. This is the leading technology in the UK and Europe for the combustion of the fuel types likely to be treated by the Facility. The moving grate comprises of inclined fixed and moving bars that will move the fuel from the feed inlet to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all fuel is exposed to the combustion process.

The Waste Incineration BREF and the BREF for Large Combustion Plants identify several alternative technologies for the combustion of waste fuels. The suitability of these technologies has been considered including different waste incineration technologies, as follows:

1. **Grate furnaces**

   As stated in the Sector Guidance Note, these are designed to handle large volumes of waste.

   Grates are the leading technology in the UK and Europe for the combustion of non-hazardous waste, such as that proposed to be treated at the Facility. The moving grate comprises an inclined fixed and moving bars (or rollers) or a vibrating grate that will move the fuel from the feed inlet to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all waste is exposed to the combustion process.

   Grate systems are designed for large quantities of heterogeneous waste and so would be appropriate for the fuel to be processed at the Facility.

2. **Fixed hearth**

   These are not considered suitable for large volumes of waste. They are best suited to low volumes of consistent waste. Therefore, these systems are not considered suitable for the proposed design capacity and have not been considered any further.

3. **Pulsed hearth**

   Pulsed hearth technology has been used in the past for the combustion of waste derived fuels, such as those proposed in the ERC. However, there have been difficulties in achieving reliable and effective burnout of the waste and it is considered that the burnout criteria required by Article 50 (1) of the IED would be difficult to achieve. Therefore, these systems are not considered practical and have not been considered any further.

4. **Rotary and oscillating kilns**

   Rotary kilns are used widely within the cement industry which uses a consistent fuel feedstock and they have been used widely within the healthcare sector in treating clinical waste, but they have not been used in the UK for large volumes of waste derived fuels. The energy conversion efficiency of a rotary kiln is lower than that of other thermal treatment technologies due to the large areas of refractory lined combustion chamber. Rotary kilns can operate at higher temperatures than other systems due to the absence of exposed metal surfaces and can therefore be used to incinerate hazardous, clinical and industrial wastes.

   An oscillating kiln is used for the incineration of municipal waste at only two currently known sites in England and some sites in France. The energy conversion efficiency in these systems is lower than that of other thermal treatment technologies due to the large areas of refractory lined combustion chamber.

5. **Fluidised bed combustor**

   Fluidised beds are designed for the combustion of relatively homogeneous fuel. They are sensitive to inconsistencies within a fuel. Fluidised beds are appropriate for waste which has been pre-processed to produce an RDF.

   While fluidised bed combustion can lead to slightly lower NOx generation, the injection of a NOx reagent is still required to achieve the relevant BAT-AEL's.

   Fluidised beds can have elevated emissions of nitrous oxide, a potent greenhouse gas. Some have been designed to minimise the formation of nitrous oxide.

6. **Pyrolysis/Gasification**

   In pyrolysis, the waste is heated in the absence of air, leading to the production of a syngas with a higher calorific value than from gasification. However, the process normally requires some form of external heat source, which may be from the combustion of part of the syngas.

   Various suppliers are developing pyrolysis and gasification systems for the incineration of waste derived fuels, however, systems such as these are not considered to be a robust and proven technology. Therefore, these systems have not been considered any further.

A quantitative assessment for a grate, a conventional fluidised bed and a rotary kiln has been undertaken and is presented in Appendix E, section 2. The conclusions of the assessment are summarised in the table below.

*Table 8: BAT Assessment - Combustion techniques*

| Parameter | Units | Grate | Fluidised bed | Rotary kiln |
|---|---:|---:|---:|---:|
| Global warming potential | t $CO_2$ eq p.a. | -51,200 | -50,500 | -33,000 |

| Parameter | Units | Grate | Fluidised bed | Rotary kiln |
|---|---|---|---|---|
| Urea consumption | t.p.a. | 1,040 | 710 | 1,300 |
| Residues (total ash) | t.p.a. | 45,480 | 47,670 | 45,480 |
| Annual total materials cost (reagents plus residues) | p.a. | £2,590,000 | £2,780,000 | £2,640,000 |
| Annual power revenue | p.a. | £6,893,100 | £6,793,200 | £4,495,500 |

All combustion technologies will produce similar quantities of residue, although the fluidised bed produces more residue due to the losses of sand from the furnace.

The grate has a similar global warming potential to the fluidised bed but would consume more urea during 'typical' operations. The two combustion systems will produce similar quantities of residues, although the fluidised bed produces more residue due to the losses of sand from the furnace. The rotary kiln has a lower global warming potential, however it is less efficient which has a significant impact on the associated operating costs and power revenues. In addition, the capital cost associated with a rotary kiln is likely to be significantly higher as additional streams will be required to achieve the proposed processing capacity.

The material costs are approximately 7% higher for the fluidised bed than the grate, whereas the grate system will have a slightly higher power revenue. However, it is acknowledged that it is marginal. It should be noted that if the incoming waste requires any additional treatment to be suitable for combustion within a fluidised bed, then this will significantly increase the material costs associated with the fluidised bed.

As stated above within the qualitative BAT assessment, grate combustion systems are designed for large quantities of heterogenous waste, whereas fluidised bed systems are more sensitive to inconsistencies within the fuel. Due to the robustness of grate combustion systems, they are considered to represent BAT for the Facility.

### 2.6.2 NOx abatement systems

As stated within S5.01, there are three recognised technologies available for the abatement of emissions of NOx:

1. Flue Gas Recirculation (FGR);
2. Selective Non-Catalytic Reduction (SNCR); and
3. Selective Catalytic Reduction (SCR).

**Flue gas recirculation (FGR)**

For the purposes of this report, it is currently assumed that the Facility will not employ FGR.

It is important to understand that FGR is not a bolt-on NOx abatement technique. The recirculation of a proportion of the flue gases into the combustion chamber to replace some of the secondary air changes the operation of the plant in various ways, by changing the temperature balance and increasing turbulence. This requires the boiler to be redesigned to ensure that the air distribution remains even.

Some suppliers of grates have designed their combustion systems to operate with FGR and these suppliers can gain benefits of reduced NOx generation from the use of FGR. Other suppliers of grates have focussed on reducing NOx generation through the control of primary and secondary air and the grate design and these suppliers gain little if any benefit from the use of FGR.

It is also important to emphasise that, even where FGR does improve the performance of a combustion system, it does not reduce NOx emissions to the levels required by IED. Therefore, it would not alleviate the need for further NOx abatement systems.

**Selective non-catalytic reduction**

SNCR involves distributing a spray containing urea solution (the SNCR reagent) into the flue gas flow path at an appropriate location (typically the secondary combustion chamber), at a gas temperature of 850 to 1,050°C. The urea solution reacts with the NOx formed in the combustion process to produce a combination of nitrogen, water and carbon dioxide (when urea is used as the reagent). NOx levels are primarily controlled by monitoring the combustion air.

Extensive dosing of urea solution or low reaction temperatures can lead to ammonia slip, resulting in the formation of ammonia salts downstream in the flue gas path and discharge to atmosphere of unreacted SNCR reagent, referred to as '*ammonia slip*'. Ammonia emissions may be controlled under the plant's permit and can lead to secondary problems, so should be kept to a minimum. This can be addressed by employing systems to control the rate of reagent dosing.

SNCR is widely deployed across waste, biomass and coal power plants in the UK and Europe. It is proposed to use SNCR for the Facility to control NOx levels, alongside the monitoring of combustion air. Urea will be used as the SNCR reagent for the abatement of NOx at the Facility.

**Selective catalytic reduction**

The use of Selective Catalytic Reduction (SCR) has also been considered. In this technique, ammonia or urea solution is injected into the flue gases immediately upstream of a reactor vessel containing layers of catalyst. The NOx is converted into nitrogen, water and carbon dioxide, with the reaction most efficient in the temperature range 200 to 350°C.

The catalyst is expensive and to achieve a reasonable working life it is necessary to install the SCR downstream of the flue gas treatment plant. This is because the flue gas treatment plant removes dust which would otherwise cause deterioration of the catalyst.

The reaction takes place at lower temperatures than SNCR methods, however, since the other flue gas cleaning reactions take place at an optimum temperature of approximately 140°C, the flue gases must be reheated before entering the SCR. This requires some thermal energy which would otherwise be converted to electrical power output, reducing the overall energy recovery efficiency of the ERC. The catalytic reactor also creates additional pressure losses to be compensated by a bigger exhaust fan, reducing further the overall energy efficiency.

SCR systems are considerably more complicated and more capital intensive than SNCR systems. However, space will be allowed within the design and layout of the flue gas treatment system allow for the installation of an SCR system in the future if required. Suitable space and provision would be made for access for maintenance and cleaning.

A quantitative BAT assessment of the available technologies has been undertaken and is presented in Appendix E, section 3. This assessment uses data obtained by Fichtner from a range of different projects using the technologies proposed in this application.

*Table 9: BAT assessment – NOx abatement*

| Parameter | Units | SNCR | SCR | SNCR + FGR |
|---|---|---|---|---|
| NOx released after abatement | t p.a. | 130 | 90 | 130 |
| NOx abated | t p.a. | 280 | 320 | 240 |

| Parameter | Units | SNCR | SCR | SNCR + FGR |
|---|---|---|---|---|
| Photochemical Ozone Creation Potential (POCP) | t ethylene-eq p.a. | -5,000 | -3,400 | -5,000 |
| Global Warming Potential | t CO2 p.a. | 600 | 2,100 | 800 |
| Urea used | t.p.a. | 1,040 | 360 | 890 |
| Total annualised cost | £ p.a. | £341,000 | £1,229,000 | £399,000 |
| Average cost per tonne NOx abated | £ p.t NOx. | £1,220 | £3,840 | £1,660 |

As can be seen from the table above, applying SCR to the Facility:

1. increases the annualised costs by approximately £888,000 compared to an SNCR system;
2. abates an additional 40 tonnes of NOx per annum compared to an SNCR system;
3. reduces the benefit of the Facility in terms of the global warming potential by approximately 1,500 tonnes of $CO_2$ per annum;
4. reduces urea consumption by up to 680 tonnes per annum compared to an SNCR system;
5. costs approximately £2,620 more per tonne of NOx abated; and
6. costs an incremental £22,200 per 'additional' tonne of NOx abated,

when compared to an SNCR system.

The additional costs associated with SCR are not considered to represent BAT for the Facility. On this basis, SNCR is considered to represent BAT.

Including FGR to the SNCR system to abate NOx increases the cost per tonne of NOx abated by approximately 36%. It has no effect on the direct environmental impact of the plant, but it increases the impact on climate change by approximately 200 tonnes of $CO_2$ per annum while reducing urea consumption by approximately 150 tonnes per annum.

It is currently understood that the proposed designs do not include FGR. Allowing for the increase in the costs of NOx abatement for a SCR system, and the climate change impact associated with FGR, an SNCR system without FGR is considered to represent BAT for the abatement of NOx within the Facility.

It is requested that a pre-operational condition is included within the permit which allows a final decision on the NOx abatement reagent to be made following completion of detailed design of the Facility.

### 2.6.3 Acid gas abatement system

There are currently three technologies widely available for acid gas treatment on similar plants in the UK.

1. Wet scrubbing, involving the mixing of the flue gases with an alkaline solution of sodium hydroxide or hydrated lime. This has a good abatement performance, but it consumes large quantities of water, produces large quantities of liquid effluent which require treatment and has high capital and operating costs. It is mainly used in the UK for hazardous waste incineration plants where high and varying levels of acid gases in the flue gases require the buffering capacity and additional abatement performance of a wet scrubbing system.

2. Semi-dry, involving the injection of quick lime as a slurry into the flue gases in the form of a spray of fine droplets. The acid gases are absorbed into the aqueous phase on the surface of the droplets and react with the quick lime. The fine droplets evaporate as the flue gases pass through the system, cooling the gas. This means that less energy can be extracted from the flue gases in the boiler, making the steam cycle less efficient. The quick lime and reaction products are collected on a bag filter, where further reaction can take place.
3. Dry, involving the injection of lime or sodium bicarbonate into the flue gases as a powder. The reagent is collected on a bag filter to form a cake and most of the reaction between the acid gases and the reagent takes place as the flue gases pass through the filter cake. In its basic form, the dry system consumes more reagent than the semi-dry system. However, this can be improved by recirculating the flue gas treatment residues, which contain some unreacted lime and reinjecting this into the flue gases.

Wet scrubbing is not considered to be suitable for the Facility, due to the production of a large volume of hazardous liquid effluent, a reduction in the power generating efficiency of the plant and the generation of a visible plume.

Dry and semi-dry systems can easily achieve the BAT AELs required by the WI BREF and both systems have been demonstrated to achieve the proposed emission limits on operational plants in the UK and Europe, as presented within the BREF. Furthermore, both are considered to represent BAT within S5.01. The advantages and disadvantages of each technique are varied which makes assessment complex. Therefore, the assessment methodology described in Horizontal Guidance Note H1 has been used and is detailed in Appendix E section 4.

A quantitative assessment of the available technologies has been undertaken and is presented in Appendix E, section 4. This assessment uses data obtained by Fichtner from a range of different projects using the technologies proposed in this application.

The table below compares the options available:

*Table 10: BAT assessment – acid gas abatement*

| Parameter | Units | Dry | Semi-dry |
|---|---|---|---|
| $SO_2$ abated | t.p.a. | 450 | 450 |
| Photochemical Ozone Creation Potential (POCP) | t-ethylene eq | 140 | 140 |
| Global Warming Potential | tn-$CO_2$ eq p.a. | 2,000 | 4,200 |
| Additional water consumption compared to a dry system | t.p.a. | - | 16,000 |
| APC residues | t.p.a. | 7,300 | 6,600 |
| Annualised cost | £ p.a. | £4,161,000 | £4,214,000 |

The performance of the options is very similar.

The dry system only requires a small quantity of water for conditioning of the lime so that it is suitable for injection into the reaction chamber, whereas the semi-dry system requires the lime to be held in solution (quick lime). This requires significantly more water than a dry system.

The dry system has a lower global warming potential and annualised cost compared to the semi-dry system. In addition, within a semi-dry system recycling of reagent within the process is not proven, but it is proven in a dry system. However, the semi-dry option benefits from medium reaction rates which mean that a shorter residence time is required in comparison with a dry system.

Due to the low water consumption and proven capability for recycling of reagents, the dry system is considered to represent BAT for the Facility.

### 2.6.4 Particulate matter abatement

The ERC will use a multi-compartment fabric filter for the control of particulates. There are several alternative technologies available, but none offer the performance of the fabric filter. Fabric filters represent BAT for this type of thermal treatment plant for the following reasons:

1. Fabric filters are a proven technology and are used in a wide range of applications. The use of fabric filters with multiple compartments, allows individual bag filters to be isolated in case of individual bag filter failure.
2. Wet scrubbers are not capable of meeting the same emission limits as fabric filters.
3. Electrostatic precipitators are also not capable of abating particulates to the same level as fabric filters. They could be used to reduce the particulate loading on the fabric filters and so increase the acid gas reaction efficiency and reduce lime residue production, but the benefit is marginal and would not justify the additional expenditure, the consequent increase in power consumption and significant increase in the carbon footprint of the ERC.
4. Ceramic Filters have not been proven for this type of waste incineration plant design and are regarded as being more suited to high temperature filtration.

Fabric filters are considered to represent BAT for the removal of particulates for the Facility.

### 2.6.5 Odour abatement technology

The guidance on odour identifies the following techniques for the abatement of odour:

1. adsorption;
2. dry chemical scrubbing;
3. wet chemical scrubbing;
4. biological treatment;
5. thermal treatment;
6. odour modification systems;
7. ozone treatment;
8. condensation;
9. open systems; and
10. new systems.

The guidance considers that, for very odorous air, it is common to use a combination of these methods. However, considering that odour from the Facility is not expected to be a significant issue, and that combination systems can be expensive and complex requiring significant maintenance, it is proposed to use a single abatement technique – adsorption through a carbon filtration system.

Adsorption is a process in which gas molecules are removed from a gaseous stream via capture on the surface of a solid adsorbent. Adsorbents are chosen so that they preferentially adsorb specific chemical compounds. When a gaseous stream passes through a bed of appropriate adsorbent material, odorous molecules that contact the adsorbent surface are captured. Common adsorbents include granular activated carbon (GAC), zeolites, macro-porous polymer particles, silica gel, and sodium-aluminium silicates.

In general, adsorption is a relatively simple, robust, efficient and economic technology. Although the technology is sensitive to high temperatures (approximately 100°C), humidity, and high particulate content, this should not be a concern for air extracted from the waste reception area.

The adsorbent typically has to be replaced after its surface is saturated. Due to the low frequency which the adsorbent will be used, it is estimated that it will require replacement every 12 months.

Adsorption is an appropriate odour abatement technique for gas streams with low concentrations of organic compounds, such as those associated with the Facility. Adsorption is used in various types of facilities for odour abatement, such as sewage treatment plants, petrol stations, and food processing facilities. Some operators of adsorption abatement systems have experienced problems with saturation of the filters; however, a preventative maintenance regime will minimise the chance of problems occurring.

It is understood that the EA consider the use of carbon filtration systems to represent BAT for the abatement of odours.

Taking the above into consideration, the use of an adsorption system is considered to be a proven technology for the abatement of odours compared to the alternative odour abatement technologies, and has been accepted as representing BAT for other facilities.

On this basis, the use of an adsorption system is considered to represent BAT for the Facility.

### 2.6.6 Steam condenser

There are three potential BAT solutions considered in S5.01 as representing indicative BAT for the Facility, which are:

- Once-Through Cooling (OTC);
- Evaporative Condenser (EC); and
- Air Cooled Condenser (ACC).

Water cooling can be achieved through once-through cooling systems or by a recirculating water supply to condense the steam. Both cooling systems require significant quantities of water and a receiving watercourse for the off-site discharge of cooling water. In addition, a water abstraction source is needed, with mains water not an economically viable option.

There is a wetland feature directly to the southeast of the site however standing bodies of water are not considered to be an available source for water abstraction and discharge. In addition, seasonal variability in the amount of water present within the feature, coupled with the associated biodiversity and ecological benefits of wetlands, means that the feature is not suitable for water abstraction/discharge.

The nearest watercourse to the site is the River Irvine which runs approximately 650 – 700m to the north of the site. This lies a considerable distance from the site, with numerous industrial presences and roads in between. In addition, the most direct route to the river from the site would involve running through the Dundonald Burn SSSI, which would unlikely be consented. Running a pipeline an alternative route between the river and the site would be extremely complex and costly. The river also appears to be shallow in depth from satellite data, and would therefore likely not be suitable for accepting large volumes of discharged cooling water.

In addition, water cooling is typically not used in EfW plants within the UK due to a number of key objections, described as follows:

- It can be difficult to obtain a licence for abstraction from and discharge to a river. If one is obtained, it may have restrictions on temperature rise.

- It can be difficult and expensive to route pipes across land not controlled by the Facility owner, and this may pose a delay risk to the project.
- There is an additional cost and liability associated with preventing legionella formation within the cooling water circuit.

Taking the above into consideration, water cooling is not considered to be available technology for cooling at the Facility.

Evaporative condenser systems use water which is evaporated directly from the condenser surface and lost to the atmosphere to provide the required cooling. They also require large volumes of water and can create a visible plume from the condenser which will have a visual impact. Evaporative condenser systems can create a visible plume from the condenser which will have a visual impact. Objections may be raised to plume formations, and it is not possible to eliminate the risk of a plume even with hybrid cooling towers. As stated above, an 'available' source for the abstraction and discharge of cooling water has not been identified. Taking this into consideration, alongside the potential for the generation of a visible plume, the use of evaporative condenser systems is not considered to represent BAT for the Facility.

ACCs do not require significant quantities of water. It is acknowledged that ACC's can have noise impacts, but mitigation measures can be applied to the design to ensure that the noise impacts associated with the ACC's are at an 'acceptable' level – refer to section 2.4.6. Furthermore, ACC's do not create a visual impact (visible plume), unlike that from evaporative cooling.

The ACC Unit will be designed and guaranteed by the technology supplier with enough additional capacity to maintain turbine efficiency during any warmer summertime periods. The ACC Unit will not contain any substances which are known ozone depleting substances and will comply with the European Union Ozone Depleting Substances Regulations.

Taking the above into consideration, ACC is considered to represent BAT for the Facility.

### 2.6.7 Surface water arrangements

There are 3 possible solutions for the discharge of surface water from the site:

1. discharge to a watercourse or waterbody;
2. discharge to groundwater; or
3. discharge to surface water sewer.

The River Irvine lies approximately 750m from the site, however it is understood that there are currently no existing drainage channels which lead to this watercourse. Therefore, if this option was to be progressed for the discharge of surface water, significant groundworks (including culverts) would be required. This would likely introduce significant initial costs for the development of the Facility.

The Initial Site Report presented within Appendix B provides information on the groundwater conditions underlying the site. It is understood that groundwater levels are between 1.12 and 2.25m bgl which is considered to be relatively shallow. Due to the shallow nature of the groundwater, discharge of surface water via infiltration is not considered to be appropriate for the site.

The existing drainage at the site provides a connection to the local Scottish Water surface water sewer. It is proposed to utilise the existing drainage at the site, and discharge surface water from the site to sewer. SEPA have previously submitted a scoping response to the planning application, which included the following comments on surface water drainage:

> *"It is our understanding that the site currently has a connection to the Scottish Water combined sewer. It is therefore our expectation that the drainage from the development will be discharged to the sewer network with agreement from Scottish Water rather than the water environment."*

Therefore, the proposed arrangements for the discharge of surface water are understood to be in line with SEPAs expectations.

The use of an interceptor (or hydrocarbon separator) is understood to be in accordance with the requirements of SEPA guidance for SUDS systems (Ref: WAT-RM-08). The design of the surface water pond has considered the requirements for Sustainable Urban Drainage Systems (SUDS) – the pond will be appropriately sized to contain the 3.3% AEP (Annual Exceedance Probability) event, in line with Scottish Water and North Ayrshire Requirements.

The SUDS will be designed in accordance with CIRIA C753. This is understood to be in accordance with the requirements of SEPA guidance for SUDS systems. In addition, the attenuation pond will also provide an additional biodiversity benefit.

The use of rainwater harvesting (e.g. for use within the ash quench and domestic facilities) will be examined during the detailed design of the Facility. However, it is anticipated that the opportunities for rainwater harvesting will be minimal.

Prior to the commencement of commissioning, quality assurance (QA) checks will be undertaken for the site drainage systems (including process areas) and hardstanding to confirm their integrity. Water stop joints will be included for within the design to ensure the integrity of all areas of hardstanding.

### 2.6.8 Process effluent and foul effluent arrangements

The effluents which will be generated by the Facility are identified in sections 2.3.1.1 and 2.3.1.2

With regards potential options for the disposal of foul and process effluents, these are listed as follows:

1. discharge of effluent (treated or untreated) to sewer;
2. discharge of treated effluent to surface water; or
3. discharge of effluent (treated or untreated) via tankering off-site.

The industrial estate on which the Facility is located is currently served by a connection to Scottish Water foul sewer. As part of the development of the Facility, it is proposed to utilise the existing drainage arrangements at the site and discharge foul effluents and excess process effluents to sewer in accordance with a Trade Effluent Consent first obtained from Scottish Water. SEPA guidance WAT-SG-12 states that where *"Scottish Water does not allow connection to the foul sewer, it may be possible to contain such drainage and tanker it away for treatment or authorised disposal"*, and that only when none of the other options are feasible and *"discharge to the water environment is the only possibility"* then this activity will require to be licensed. This indicates SEPA's order of preference as follows:

1. foul sewer;
2. tankering off-site; and
3. discharging to surface water.

Therefore, the arrangements for the discharge of foul and excess process effluents from the Facility is understood to be in line with SEPA's preference.

## 2.7 The Legislative Framework

### 2.7.1 The Industrial Emissions Directive

This section presents information on how the Facility will comply with the Waste Incineration requirements of the Industrial Emissions Directive (IED) (2010/75/EU).

Chapter IV of the IED includes 'Special Provisions for Waste Incineration Plants and Waste Co-incineration Plants'. Review of provisions for waste incineration as presented in the IED has identified that the following requirements could be applicable to the DERC:

- Article 46 – Control of Emissions;
- Article 47 – Breakdown;
- Article 48 – Monitoring of Emissions;
- Article 49 – Compliance with Emission Limit Values;
- Article 50 – Operating Conditions;
- Article 52 – Delivery & Reception of Waste;
- Article 53 – Residues; and
- Article 55 – Reporting & public information on waste incineration plants and waste co-incineration plants.

Table 11 identifies the relevant Articles of the IED and explains how the Facility will comply with them. Many of the articles in the IED impose requirements on regulatory bodies, in terms of the permit conditions which must be set, rather than on the operator. The table below only covers those requirements which the IED imposes on 'Operators' and either explains how this is achieved or refers to a section of the application where an explanation can be found.

*Table 11: Summary table for IED compliance*

| Article | Requirement | How met or reference |
| --- | --- | --- |
| 15(2) | Without prejudice to Article 18, the emission limit values and the equivalent parameters and technical measures referred to in Article 14(1) and (2) shall be based on the best available techniques, without prescribing the use of any technique or specific technology. | The Waste Incineration BREF was published in December 2019. A detailed review of the BAT requirements has been undertaken. Refer to section 2.7.2. |
| 22(2) | Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013.<br>The baseline report shall contain the information necessary to determine the state of soil and groundwater contamination to make a quantified comparison with the state upon definitive cessation of activities provided for under paragraph 3.<br>The baseline report shall contain at least the following information:<br>(a) information on the present use and, where available, on past uses of the site;<br>(b) where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned.<br>Where information produced pursuant to other national or Union law fulfils the requirements of this paragraph that information may be included in, or attached to, the submitted baseline report. | Refer to Appendix B – Initial Site Report |
| 44 | An application for a permit for a waste incineration plant or waste co-incineration plant shall include a description of the measures which are envisaged to guarantee that the following requirements are met:<br>(a) the plant is designed, equipped and will be maintained and operated in such a manner that the requirements of this Chapter are met taking into account the categories of waste to be incinerated or co-incinerated; | Refer to section 2.2.1 of the Supporting Information. |

| Article | Requirement | How met or reference |
|---|---|---|
| | (b) the heat generated during the incineration and co-incineration process is recovered as far as practicable through the generation of heat, steam or power; | Refer to section 1.3.5 of the Supporting Information and Appendix F. |
| | (c) the residues will be minimised in their amount and harmfulness and recycled where appropriate; | Refer to section 2.9 of the Supporting Information. |
| | (d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Union law. | Refer to section 2.9 of the Supporting Information. |
| 46 (1) | Waste gases from waste incineration plants and waste co-incineration plants shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment. | Refer to Appendix D – Air Quality Assessment. |
| 46 (2) | Emissions into air from waste incineration plants and waste co-incineration plants shall not exceed the emission limit values set out in parts 3 and 4 of Annex VI or determined in accordance with Part 4 of that Annex. | Refer to section 2.4.1 of the Supporting Information. |
| 46 (5) | Waste incineration plant sites and waste co-incineration plant sites, including associated storage areas for waste, shall be designed and operated in such a way as to prevent the unauthorised and accidental release of any polluting substances into soil, surface water and groundwater.<br>Storage capacity shall be provided for contaminated rainwater run-off from the waste incineration plant site or waste co-incineration plant site or for contaminated water arising from spillage or fire-fighting operations. The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary. | Refer to section 2.4.5 of the Supporting Information. |
| 46 (6) | Without prejudice to Article 50(4)(c), the waste incineration plant or waste co-incineration plant or individual furnaces being part of a waste incineration plant or waste co-incineration plant shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded.<br>The cumulative duration of operation in such conditions over 1 year shall not exceed 60 hours.<br>The time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device. | Refer to Abnormal Emissions Assessment - Appendix D. |
| 47 | In the case of a breakdown, the operator shall reduce or cease operations as soon as practicable until normal operations can be restored. | Refer to sections 2.2.3.6 and 1.3.10 of the Supporting Information. |

| Article | Requirement | How met or reference |
|---|---|---|
| 48 (2) | The installation and functioning of the automated measuring systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI. | Refer to section 2.5.1.1 of the Supporting Information. |
| 48 (4) | All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit. | Refer to section 2.5.1 of the Supporting Information. |
| 49 | The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled. | There will be no emissions from flue gas treatment systems to water/sewer from the waste incineration plant. |
| 50 (1) | Waste incineration plants shall be operated in such a way as to achieve a level of incineration such that the total organic carbon content of slag and bottom ashes is less than 3% or their loss on ignition is less than 5% of the dry weight of the material. If necessary, waste pre-treatment techniques shall be used. | Refer to section 2.5.2.1. TOC or LOI testing. |
| 50 (2) | Waste incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the incineration of waste is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850oC for at least two seconds. | Refer to section 2.2.3.6 of the Supporting Information. |
| 50 (3) | Each combustion chamber of a waste incineration plant shall be equipped with at least one auxiliary burner. This burner shall be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below the temperatures set out in paragraph 2. It shall also be used during plant start-up and shut-down operations to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber.<br>The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (OJ L 121, 11.5.1999, p. 13.), liquefied gas or natural gas. | Refer to sections 2.2.3.6 and 2.1.3.3 of the Supporting Information. |
| 50 (4) | Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations: | Refer to section 2.2.3.6 of the Supporting Information. |

| Article | Requirement | How met or reference |
| --- | --- | --- |
| | (a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) has been reached; | |
| | (b) whenever the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) is not maintained; | Refer to section 2.2.3.6 of the Supporting Information. |
| | (c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices. | Refer to section 2.2.3.4 and 2.2.3.6 of the Supporting Information. |
| 50 (5) | Any heat generated by waste incineration plants or waste co-incineration plants shall be recovered as far as practicable. | Refer to section 1.3.5 of the Supporting Information and Appendix F. |
| 50 (6) | Infectious clinical waste shall be placed straight in the furnace, without first being mixed with other categories of waste and without direct handling. | This requirement will not apply as the Facility will not process or receive infectious clinical waste. |
| 52 (1) | The operator of the waste incineration plant or waste co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable the pollution of air, soil, surface water and groundwater as well as other negative effects on the environment, odours and noise, and direct risks to human health. | Refer to section 2.2 and of the Supporting Information. |
| 52 (2) | The operator shall determine the mass of each type of waste, if possible according to the European Waste List established by Decision 2000/532/EC, prior to accepting the waste at the waste incineration plant or waste co-incineration plant. | Refer to section 2.2.1 of the Supporting Information. |
| 53 (1) | Residues shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside. | Refer to section 2.2.3 and 2.9 of the Supporting Information. |
| 53 (2) | Transport and intermediate storage of dry residues in the form of dust shall take place in such a way as to prevent dispersal of those residues in the environment. | Refer to section 2.9 of the Supporting Information and Appendix B. |
| 53 (3) | Prior to determining the routes for the disposal or recycling of the residues, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the residues. Those tests shall concern the total soluble fraction and heavy metals soluble fraction. | Refer to section 2.9 of the Supporting Information. |

### 2.7.2 Requirements of the Final Draft Waste Incineration BREF

The Final Waste Incineration BREF was published by the European IPCC Bureau in December 2019. As the facility had not been granted a PPC permit when the WI BREF was published, SEPA require the Operator to demonstrate that the Facility will be able to comply with the requirements set out in the BREF. Table 12 below identifies the requirements of the BAT conclusions and explains how the Facility will comply with them.

*Table 12: Summary Table for WI BREF BAT Conclusions Compliance*

| # | BAT Conclusion | How met or reference |
|---|---|---|
| 1 | To improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates all the features as listed in BAT 1 of the BREF. | A general summary of the proposed EMS is presented in Section 2.10 of the Supporting Information. The EMS will be developed throughout the development stage of the project and will be accredited to a suitably recognised standard.<br>It is proposed that a pre-operational condition in included within the PPC Permit which requires Doveryard to provide a summary of the proposed EMS prior to commencement of operation. |
| 2 | BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the boiler efficiency of the incineration plant as a whole or of all the relevant parts of the incineration plant. | As stated in section 2.8.2.4 of the Supporting Information, the gross electrical efficiency of the plant is calculated to be approximately 29.02%. Therefore, Doveryard understands that this satisfies the requirements of BAT 2. |
| 3 | BAT is to monitor key process parameters relevant for emissions to air and water including those given in BAT 3 of the BREF. | As set out in Section 2.5.2 of the Supporting Information, the process parameters for monitoring of emissions to air are as follows:<br>• water vapour content<br>• temperature; and<br>• pressure.<br>The oxygen content and flow rate of the flue gases will also be monitored. Temperature will be monitored in the combustion chamber.<br>There will be no emissions of water from FGC systems and there will be no bottom ash treatment undertaken at the Facility – therefore, the process parameters to be monitored for emissions to water as listed in BAT 3 do not apply to the Facility.<br>Doveryard can confirm that the Facility will include for monitoring of the key process parameters relevant for emissions to air in accordance with BAT 3. |
| 4 | BAT is to monitor channelled emissions to air with at least the frequency given in BAT 4 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality. | As set out in section 2.5.1.1 of the Supporting Information, emissions to air will be monitored with frequencies in accordance with the requirements of the BREF. The methods and standards used for emissions monitoring will be in compliance with BREF requirements and other appropriate requirements.<br>Doveryard considers that the proposals for monitoring of emissions to air are in accordance with the requirements of BAT 4. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| 5 | BAT is to appropriately monitor channelled emissions to air from the incineration plant during Other Than Normal Operating Conditions (OTNOC). | Doveryard Ltd understand that the UK regulatory agencies are currently consulting with the UK waste incineration industry on the definition of 'appropriate monitoring' of emissions to air during OTNOC. On this basis, Doveryard Ltd are not able to confirm how the Facility will comply with BAT 5.<br>Doveryard propose that a Pre-Operational Condition is included within the PPC permit which requires confirmation of the proposals for monitoring of emissions to air during OTNOC. |
| 6 | BAT is to monitor emissions to water from Flue Gas Cleaning (FGC) and/or bottom ash treatment with at least the frequencies set out in BAT 6 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality. | As explained in section 1.3.6 of the Supporting Information, the Facility will utilise a dry flue gas treatment system. Therefore, there will not be any emissions to water from the FGC systems.<br>Furthermore, there will not be any emissions to water from the treatment or handling of bottom ash.<br>Therefore, it is understood that the requirements of BAT 6 are not applicable to the Facility. |
| 7 | BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency as given in BAT 7 of the BREF (at least once every 3 months) and in accordance with EN standards. | Refer to section 2.5.2.1 of the Supporting Information. Doveryard considers that the proposals for monitoring of slags and bottom ashes are in accordance with the requirements of BAT 7. |
| 8 | For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g. slags and bottom ashes, flue-gas, wastewater) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams. | The Facility will not incinerate hazardous waste. Therefore, Doveryard does not consider that the requirements of BAT 8 are applicable to the Facility. |
| 9 | In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is to use all of the techniques (a) to (c) as listed in BAT 9 of the BREF, and, where relevant, also techniques (d), (e) and (f). | The relevant techniques are described in section 2.2 of the Supporting Information.<br>It is understood that technique (f) of BAT 9 does not apply as the Facility will not incinerate hazardous waste.<br>Doveryard considers that the proposed arrangements for the receipt and segregation of residual waste complies with the requirements of BAT 9. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| 10 | To improve overall environmental performance of the bottom ash treatment plant, BAT is to include output quality management features in EMS (see BAT 1). | The Facility will not include a bottom ash treatment plant within the installation boundary. Therefore, Doveryard does not consider that the requirements of BAT 10 apply to the Facility. |
| 11 | In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9c) including, depending on the risk posed by the incoming waste, the elements as listed in BAT 11 of the BREF. | Periodic monitoring of residual waste deliveries will be undertaken at the Facility - refer to section 2.2 of the Supporting Information.<br>The Facility will not undertake radioactivity detection tests as it is not anticipated that any radioactive waste will be received.<br>Doveryard considers that the proposed arrangements for monitoring the residual waste deliveries as part of the waste acceptance procedures complies with the requirements of BAT 11. |
| 12 | To reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the following techniques:<br>Use impermeable surfaces with an adequate drainage infrastructure; and<br>Have adequate waste storage capacity. | The surfaces of the waste reception, handling and storage areas have been designed and will be constructed as impermeable structures. Adequate drainage infrastructure will be fitted to areas where receipt, handling and storage of waste takes place – these areas will have appropriate falls to the process water drainage system. The integrity of areas of hardstanding will be periodically verified by visual inspection. Regular maintenance of the drainage systems will be undertaken in accordance with documented management procedures to be developed for the Facility.<br>Adequate waste storage capacity will be available on site – the maximum waste storage capacity of the waste bunker will be clearly established and not exceeded. The quantity of residual waste will be regularly monitored against the maximum storage capacity. During periods of planned maintenance, quantities of fuel within the bunker will be run down. During extended periods of shutdown, provisions will be made for the residual waste to be backloaded from the bunker and transferred to alternative licensed waste management facilities.<br>Doveryard considers that the proposed arrangements for environmental risks associated with the reception, handling and storage of residual waste comply with the requirements of BAT 11. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| 13 | To reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques as listed in BAT 13 of the BREF. | The Facility will not be dedicated to the processing of clinical waste. In addition, the Facility will not receive hazardous clinical waste.<br>Therefore, Doveryard considers that the requirements of BAT 13 are not applicable to the Facility. |
| 14 | In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given as listed in BAT 14 of the BREF: | Bunker crane mixing and advanced control systems will be employed at the Facility.<br>A modern and advanced control system, incorporating the latest advances in control and instrumentation technology, will be utilised at the Facility to control operations, optimise the process relative to efficient heat release, good burn-out and minimum particle carry over. As described in Section 2.5.2 of the Supporting Information, the system will control and/or monitor the main features of the plant operation including, but not limited to the following:<br>• combustion air;<br>• fuel feed rate;<br>• SNCR system;<br>• flue gas oxygen concentration at the boiler exit;<br>• flue gas composition at the stack (including HCl measurements);<br>• combustion process;<br>• boiler feed pumps and feedwater control;<br>• steam flow at the boiler outlet;<br>• steam outlet temperature;<br>• boiler drum level control;<br>• flue gas control (including differential pressure across the bag filters);<br>• power generation; and<br>• steam turbine exhaust pressure. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| | | Water, electricity and auxiliary fuel usage will also be monitored to highlight any abnormal usage.<br>Doveryard considers that the proposed arrangements for ensuring the overall environmental performance of the incineration of residual waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of residual waste comply with the requirements of BAT 14. |
| 15 | In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings e.g. through the advanced control system, as and when needed and practicable, based on the characterisation and control of the waste (See BAT 11). | The Facility will be controlled from a dedicated control room, with an advanced control system to optimise the process. The system will control and/or monitor the main features of the plant operation, as described in the response to BAT 14 above. Emissions to air will be reduced by the adjustment of the plants settings through the advanced control system (refer to section 2.2.3.4).<br>Doveryard considers that the proposed control systems will ensure that the Facility is designed to allow for the adjustment of the plant's settings to comply with the requirements of BAT 15. |
| 16 | In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations. | The Facility will operate continuously, with planned shutdowns for maintenance limited as far as reasonably practicable. Residual waste will be kept at suitable levels in the waste bunker to maintain operation during holiday periods. Operational procedures will be developed to limit as far as practicable shutdown and start-up operations.<br>Doveryard considers that the operation of the Facility will limit as far as practicable shutdown and start-up operations to comply with the requirements of BAT 16. |
| 17 | In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the wastewater treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentration), operated within their design range, and maintained so as to ensure optimal availability. | The FGT and wastewater treatment systems will be appropriately designed and operated within the design range. The FGC and wastewater treatment systems will be subject to regular maintenance through the implementation of documented management procedures.<br>Doveryard considers that the design and operation of the FGC and wastewater treatment plants will ensure that emissions to air (and water where applicable) are |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| | | reduced, and will ensure their optimal availability, to comply with the requirements of BAT 17. |
| 18 | In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the EMS (See BAT 1) that includes the elements as identified in BAT 18 of the BREF. | A risk based OTNOC management plan will be incorporated into the Facility EMS. This will include the following elements:<br>• Identification of potential OTNOC, root causes and potential consequences.<br>• Regular update of the list of identified OTNOC following periodic assessment.<br>• Appropriate design of critical equipment (the Facility will utilise compartmentalisation of the bag filter and ensure that the bag filter is not bypassed during periods of start-up or shutdown).<br>• Implementation of preventative maintenance plans for critical equipment.<br>• Monitoring and recording of emissions during OTNOC and associated circumstances.<br>• Periodic assessment of the emissions and circumstances occurring during OTNOC and implementation of corrective actions if necessary.<br>Doveryard considers that the incorporation of a risk based OTNOC management plan will ensure the Facility compliance with BAT 18. |
| 19 | To increase resource efficiency of the incineration plant, BAT is to use a heat recovery boiler. | The Facility will use a heat recovery boiler to produce steam which is used to produce electricity. The Facility will also have the provision to export heat to local users.<br>Doveryard considers that the use of a heat recovery boiler is in direct compliance with the requirements of BAT 19. |
| 20 | To increase energy efficiency of the incineration plant, BAT is to use an appropriate combination of techniques as listed in BAT 20 of the BREF. | The Facility will use techniques as described in section 2.8 to increase the energy efficiency of the plant.<br>Doveryard considers that the techniques listed above will increase the energy efficiency of the plant and ensure that the Facility will comply with the requirements of BAT 20. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| 21 | To prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to use the methods as stated in BAT 21 of the BREF. | In accordance with the BREF, the Facility will employ the following measures to reduce odour emissions:<br>• Residual waste in the Facility will be stored in an enclosed building under negative pressure. The extracted air will be used as combustion air for incineration.<br>• The operation of the Facility will not give rise of odorous liquid wastes. Therefore, the requirement to store liquid wastes in tanks under controlled pressure and duct the tank vents to the combustion air feed or other suitable abatement system will not apply to the Facility.<br>• Odour will be controlled during shutdown periods by minimising the amount of residual waste in storage. Residual waste will be run-down prior to periods of planned maintenance, and there will also be provisions in place to back-load residual waste from the waste bunker during extended periods of unplanned shutdown. In addition, doors to the tipping hall will be kept shut during periods of shutdown.<br>The measures listed above to reduce odour emissions will ensure that the Facility will comply with the requirements of BAT 21. |
| 22 | In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile substances at incineration plants, BAT is to feed them to the furnace by direct feeding. | Gaseous wastes will not be accepted by the Facility. It is not anticipated that liquid wastes will be received at the Facility, but should any liquid wastes be received, they will be delivered in containers suitable for incineration (such as drums) and fed directly into the furnace.<br>Therefore, the requirements of BAT 22 do not apply to the Facility. |
| 23 | To prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the EMS the diffuse dust emission management features as listed within BAT 23 of the BREF: | There will not be treatment of slags and/or bottom ashes undertaken on-site.<br>Therefore, the requirements of BAT 23 do not apply to the Facility. However, identification of the most relevant diffuse dust emissions, and definition and implementation of appropriate actions and techniques, will be included within the scope of the EMS at the Facility. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| 24 | To prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as given in BAT 24 of the BREF. | There will not be treatment of slags and/or bottom ashes undertaken on-site. Therefore, the requirements of BAT 24 do not apply to the Facility. However, it can be confirmed that the following techniques will be employed at the Facility to minimise dust emissions:<br>• All ash handling including conveying undertaken within enclosed buildings.<br>• Where possible, minimising the height of ash discharge.<br>• Use of a water ash quench to minimise the generation of dusts from ash handling activities. |
| 25 | To reduce channelled emission to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 25 of the BREF. | In accordance with the BREF, the following techniques will be utilised at the Facility to reduce channelled emissions to air:<br>• Bag filters – to reduce particulate content of the flue gas.<br>• Dry sorbent injection – adsorption of metals by injection of activated carbon in combination with injection of dry lime to abate acid gases.<br>The concentrations of metals and metalloids will be monitored in accordance with the PPC Permit for the Facility. It is considered by Doveryard that the techniques listed above to reduce channelled emissions to air will ensure that the Facility will comply with the requirements of BAT 25. |
| 26 | To reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air (See BAT 24 f), BAT is to treat the extracted air with a bag filter. | There will not be treatment of slags and/or bottom ashes undertaken on-site. Therefore, the requirements of BAT 26 do not apply to the Facility. The bottom ash hall will not be held under negative pressure, however the methods as listed in response to BAT 24 will enable dust emissions to be minimised from the handling of bottom ash. |
| 27 | To reduce channelled emissions of HCl, HF and SO2 to air from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 27 of the BREF. | In accordance with the BREF, the following techniques will be utilised at the Facility to reduce channelled emissions to air of HCl, HF and $SO_2$:<br>• Dry sorbent injection – adsorption of metals by injection of activated carbon in combination with injection of dry lime to abate acid gases. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| | | It is considered by Doveryard that the use of dry sorbent injection to reduce channelled emissions to air of acid gases is in compliance with the requirements of BAT 27. |
| 28 | In order to reduce channelled peak emissions of HCl, HF and $SO_2$ to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use optimised and automated reagent dosage, or both the previous technique and the recirculation of reagents. | In accordance with the BREF, the following techniques will be employed at the Facility to reduce peak emissions of HCl, HF and $SO_2$ whilst limiting reagent consumption and residue generation form dry sorbent injection:<br>• The concentration of hydrogen chloride in the flue gases upstream of the flue gas treatment system will be measured to optimise the performance of the emissions abatement equipment, including automated reagent dosage.<br>• A proportion of the APC residues will be recirculated to reduce the amount of unreacted reagent in the residues.<br>• The concentrations of HCl, HF and $SO_2$ released from the Facility will comply with BREF limits.<br>The techniques listed above to reduce channelled peak emissions to air of acid gases will ensure that the Facility will comply with the requirements of BAT 28. |
| 29 | In order to reduce channelled NOx emissions to air while limiting emissions of CO and $N_2O$ from the incineration of waste, and the emissions of $NH_3$ from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques as listed in BAT 29 of the BREF. | The following elements have been incorporated into the design of the Facility:<br>• optimisation of the incineration process via the use of an advanced control system and monitoring of process parameters (refer to the response to BAT 14);<br>• an SNCR system; and<br>• optimisation of the design and operation of the SNCR system (through CFD modelling to optimise the location and number of injection nozzles, and optimisation of reagent dosing to minimise ammonia slip).<br>As justified in section 2.6.2 of the Supporting Information, it is currently assumed that flue gas recirculation will not be employed at the Facility.<br>The design elements listed above to reduce channelled NOx emissions to air (whilst limiting emissions of CO, $N_2O$ and $NH_3$) will ensure that the Facility will comply with the requirements of BAT 29. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| 30 | In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) as listed in BAT 30 of the BREF. | The Facility will employ the following techniques to reduce channelled emission to air of organic compounds:<br>• Optimisation of the incineration process – the boiler will be designed to minimise the formation of dioxins and furans as follows:<br>• Minimise residence time in critical cooling section to avoid slow rates of combustion gas cooling, minimising the potential for 'de-novo' formation of dioxins and furans.<br>• Utilisation of an SNCR system which inhibits dioxin formation and promotes their destruction.<br>• Keep transfer surfaces above a minimum 170°C subject to other reaction considerations.<br>• Apply CFD modelling to the design where appropriate to ensure gas velocities are in a range that negates the formation of stagnant pockets/low velocities.<br>• Minimise volume in critical cooling sections.<br>• Prevent boundary layers of slow-moving gas along boiler surfaces via good design and regular maintenance.<br>• Online and offline boiler cleaning through a regular maintenance schedule to reduce dust residence time and accumulation in the boiler, thus reducing PCDD/F formation in the boiler.<br>• Dry sorbent injection using activated carbon and dry lime, in combination with a bag filter.<br>The concentrations of dioxins and furans released from the Facility will comply with BREF limits.<br>The techniques listed above to reduce channelled emission to air of organic compounds will ensure that the Facility will comply with the requirements of BAT 30. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| 31 | To reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 31 of the BREF. | In accordance with the BREF, dry sorbent injection of activated carbon will be employed at the Facility in combination with a bag filter. It is considered by Doveryard that the use of these techniques will ensure that the Facility will comply with the requirements of BAT 31. |
| 32 | To prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase resource efficiency, BAT is to segregate wastewater streams and to treat them separately, depending on their characteristics. | There will be separate foul/domestic water, process water and surface water drainage systems at the Facility.<br>Foul effluents from domestic sources will be discharged to foul sewer.<br>It can be confirmed that there will be no wastewater arising from flue gas treatment. Bottom ash handling will be undertaken in an enclosed building with a dedicated drainage system.<br>The drainage in the Facility waste reception, handling and storage areas will be contained, with any process water collected reused within the process (e.g. in the ash quench). Process water will be collected in an intermediate storage vessel prior to re-use.<br>Uncontaminated water streams, such as surface water run-off, will be segregated from other wastewater streams requiring treatment. Surface water runoff from roadways and vehicle movement areas will pass through interceptors to contain oil and sediments prior to discharge. Areas where liquid raw materials are stored (e.g. liquid urea) will be covered to prevent contaminated surface water from leaving the site.<br>An indicative water flow diagram depicting the segregation of different water streams for the Facility is presented in Appendix A.<br>It is considered by Doveryard that the segregation and treatment of different wastewater streams, as described above, will ensure that the Facility will comply with the requirements of BAT 32. |
| 33 | To reduce water usage and to prevent or reduce the generation of wastewater from the incineration plant, BAT is to use one or a combination of the techniques as listed in BAT 33 of the BREF. | In accordance with the BREF, the following techniques will be utilised at the Facility to reduce water usage and prevent wastewater generation:<br>• Use of an FGC system that does not generate wastewater – by utilising dry sorbet injection of lime and PAC. |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| | | • Water reuse and recycling in the process – effluents generated by the process will be re-used within the process, e.g. in the ash quench. Under normal operation the Facility will not generate process effluent.<br>It is considered by Doveryard that the techniques listed above to reduce water usage and prevent/reduce the generation of wastewater will ensure that the Facility will comply with the requirements of BAT 33. |
| 34 | In order to reduce emissions to water from FGC and/or from the storage and treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 34 of the BREF, and to use secondary techniques as close as possible to the source in order to avoid dilution. | There will be no treatment of slags and bottom ashes undertaken on-site. In addition, there will be no emission to water from FGC.<br>The risk of emissions to water from the storage of bottom ash at the Facility will be minimised – any overflow from the ash quench will be contained in the process effluent drainage system and hence there will not be any release of effluent from the ash quench system.<br>In accordance with BAT 34 (a), the incineration process and the FGC process will be optimised to target pollutants such as dioxins and furans, and ammonia – refer to the responses to BAT 29 and 30 above.<br>It is considered by Doveryard that the Facility will comply with the requirements of BAT 34 by reducing emissions to water from the storage of bottom ash as per the design measures described above. |
| 35 | To increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues. | It can be confirmed that bottom ash and APCr will be handled and disposed of separately at the Facility, refer to section 2.9.<br>Doveryard considers that the Facility will comply with the requirements of BAT 35. |
| 36 | In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 36 of the BREF, based on a risk assessment depending on the hazardous properties of the slags and bottom ashes. | There will be no bottom ash treatment undertaken at the Facility. Therefore, it is understood that the requirements of BAT 36 do not apply to the Facility. |
| 37 | To prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques as listed in BAT 37 of the BREF. | In accordance with the requirements of BAT 37, it can be confirmed that the following techniques will be employed at the Facility to prevent or reduce noise emissions: |

| # | BAT Conclusion | How met or reference |
|---|---|---|
| | | • Appropriate location of equipment and buildings – in accordance with normal industry practice, the technology provider will implement an efficient layout to result in relatively quiet operational noise levels.<br>• Operational measures – regular inspection and maintenance of equipment will be undertaken. Doors to buildings will remain closed as far as is reasonably practicable. Residual waste deliveries will take place primarily during daytime hours.<br>• Low-noise equipment – the proposed technology provider will optimise plant selection to ensure that the most efficient and 'quietest' technology is selected.<br>• Noise attenuation – plant rooms will have been acoustically designed for limiting noise emissions to acceptable levels for compliance with relevant workplace regulations.<br>• Noise-control equipment/infrastructure – where appropriate, acoustic cladding will be used on buildings.<br>For a detailed list of principal noise sources and mitigation measures – refer to Section 2.4.6 of the Supporting Information. In addition, refer to the Noise Assessment presented in Appendix C.<br>It is considered by Doveryard that the techniques listed above to reduce noise emissions will ensure that the Facility will comply with the requirements of BAT 37. |

# 2.8 Energy efficiency

## 2.8.1 General

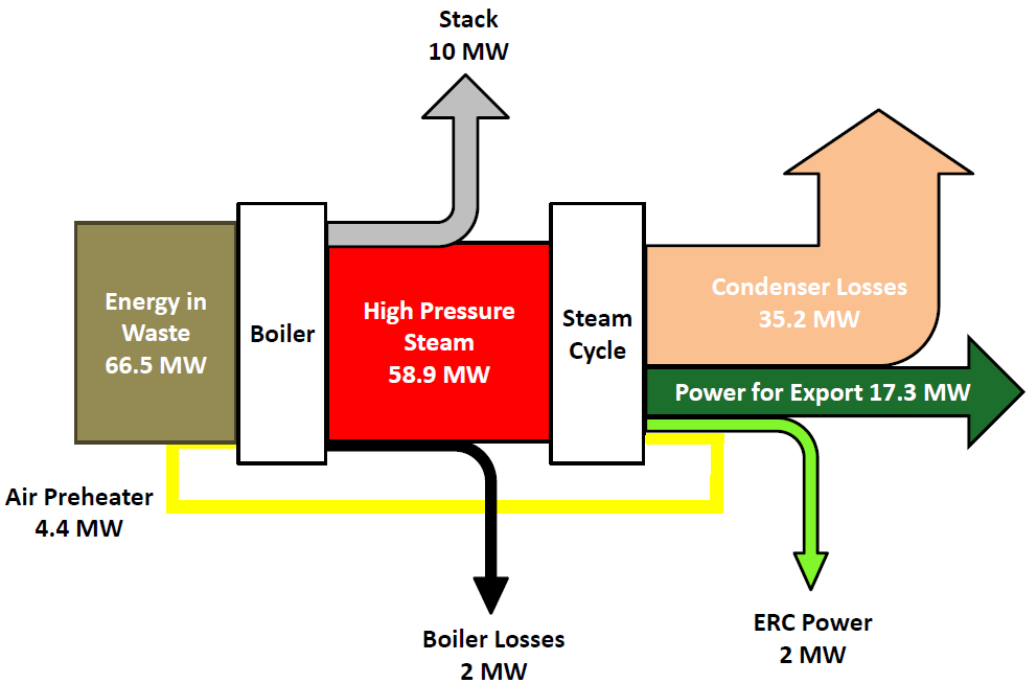
The Facility will utilise a steam boiler which will generate steam to be supplied to a turbine, for electricity generation and subsequent export off-site. Electricity will be supplied to the local electricity grid via a power transformer which increases the voltage to the appropriate level. The Facility has been designed as a combined heat and power plant, and will also have the capacity to provide heat to potentially export heat generated off-site. Further details of the heat export opportunities are provided in the Heat and Power Plan within Appendix F.

In considering the energy efficiency of the Facility, due account has been taken of the requirements of the Horizontal Guidance Note H2 on Energy Efficiency and subsequent guidance '*Energy efficiency standards for industrial plants to get environmental permits*'.

## 2.8.2 Basic energy requirements

An indicative Sankey Diagram for the Facility for the 'no heat export' case is presented in Figure 3 below.

*Figure 3: Indicative Sankey Diagram - No Heat Export*




The Facility has been designed to generate up to approximately 19.3 MWe gross power at the design point and is capable of exporting up to approximately 10 MWth of heat. However, from the heat users identified in the Heat and Power Plan (refer to Appendix F), it is anticipated that the potential heat export identified is an annual average of approximately 9.39 MWth.

The Facility will have a parasitic load of approximately 2 MWe, therefore it will be capable of exporting approximately 17.3 MWe of power assuming that no heat is exported. The power exported will fluctuate depending on whether heat is exported or not.

The Facility will have a nominal design capacity of approximately 22.8 tonnes per hour (tph) of residual waste, at a design NCV of 10.5 MJ/kg. Assuming an availability of 8,000 hours per annum, this equates to a design capacity of approximately 182,400 tonnes per annum (tpa). However, it is acknowledged that the planning permission for the Facility currently limits the capacity to 180,000 tpa.

At the nominal design capacity of 182,400, the Facility will annually generate approximately 154,400 MWh and export 138,400 MWh of electricity.

#### 2.8.2.1 Energy Consumption and Thermal Efficiency

The most significant energy consumers are anticipated to be the following:

- primary and secondary combustion air fans;
- Induced Draft fans;
- boiler feed water pumps;
- ACC fans;
- air compressors;
- fuel loading systems and residue conveying systems; and
- offices and ancillary rooms.

The Facility has been designed with careful attention being paid to all normal energy efficiency design features, such as high efficiency motors, high efficiency variable speed drives, high standards of cladding and insulation etc.

Flue gas flow will be reduced through improving primary and secondary combustion air distribution, therefore reducing the energy demand of the plant (for ID fans). The use of flue gas recirculation (FGR) will be examined during detailed design of the Facility however it is currently assumed that the Facility will not employ FGR.

Superheated steam will be supplied to the turbine at a temperature of approximately 400°C under a pressure of 51 bar abs – these high steam conditions allow for high electrical conversion efficiency.

The Facility will be designed to achieve a high thermal efficiency. In particular:

- the boiler will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste fuel that is combusted;
- unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemicals and the heat contained within the steam and water;
- low grade heat will be extracted from the turbine and used to preheat combustion air to improve the efficiency of the thermal cycle;
- provision will be made for heat to be exported to local heat users where viable;
- steady operation will be maintained where necessary by using auxiliary fuel firing; and
- boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat recovery.

Due consideration will be given to the recommendations given in SEPA Sector Guidance S5.01.

#### 2.8.2.2 Operating and maintenance procedures

An Operations and Maintenance Manual and associated procedures (referred to as the O&M manual) will be developed for the Facility. The O&M manual will include for the following aspects:

1. Good maintenance and housekeeping techniques and regimes across the whole plant.
2. Plant Condition Monitoring will be carried out on a regular basis. This will ensure, amongst other things, that motors are operating efficiently, insulation and cladding are not damaged and that there are no significant leaks.
3. Operators will be trained in energy awareness and will be encouraged to identify opportunities for energy efficiency improvements.

#### 2.8.2.3 Energy efficiency measures

An energy efficiency plan will be built into the operation and maintenance procedures of the Facility ensuring maximum practical, sustainable, safe and controllable electricity generation. This plan will be reviewed regularly as part of the environmental management systems.

During normal operation, procedures will be reviewed and amended, where necessary, to include improvements in efficiency as and when proven new equipment and operating techniques become available. These are assessed on the implementation cost compared with the anticipated benefits.

#### 2.8.2.4 Energy efficiency benchmarks

In accordance with the nominal design capacity, the Facility will generate up to 19.3 MWe assuming electricity-only operation.

As stated previously, it is assumed that the Facility will be available for up to 8,000 hours per annum at the nominal design capacity, i.e. assuming is processes 182,400 tpa. On this basis, allowing for periods of start-up and shutdown, the Facility will generate approximately 154,400 MWh per annum.

As presented in Table 13, these figures are compared with the benchmark data for MSW incineration plants, given in the Sector Guidance Note S5.01 and in the BREF for Waste Incineration (BREF WI).

*Table 13: Facility design parameters comparison table*

| Parameter | Unit | The Facility | Benchmark |
|---|---|---|---|
| Gross power generation, design capacity (182,400 tpa and 8,000 hours) | MWh/t waste | 0.85 | 0.415-0.644 |
| Net power generation, design capacity (182,400 tpa and 8,000 hours | MWh/t waste | 0.75 | 0.279-0.458 |
| Internal power consumption, design capacity (182,400 tpa and 8,000 hours | MWh/t waste | 0.088 | 0.15 |
| Power generation (assumed gross) for 100,000 tpa of waste | MWe | 10.6 | 5-9 |
| Gross electrical efficiency | % | 29.02 | 25-35 |

In accordance with BAT 2 of the BREF, during commissioning of the Facility, the Performance Test will be undertaken at full load to assess the energy efficiency of the Facility.

### 2.8.3 Thermal treatment of waste guidelines

The Thermal Treatment of Waste Guidelines (2015) require that a Heat and Power Plan be developed and submitted with the PPC application. A Heat and Power Plan for the Facility is presented within Appendix F.

### 2.8.4 Further energy efficiency requirements

The Facility will not be subject to a Climate Change Levy agreement.

## 2.9 Residue recovery and disposal

The main residue streams arising from the Facility are:

1. Incinerator Bottom Ash; and
2. Air Pollution Control Residues.

As described below, the residue recovery and disposal techniques will be in accordance with the indicative BAT requirements. The residues generated from the operation of the Facility are summarised in Table 14.

Prior to the transfer of residues to any residues off-site, where appropriate, the residues will be tested in accordance with the requirements of Technical Guidance 'WM2: Hazardous Waste: Interpretation of the definition and classification of hazardous waste'.

Any materials which are to be transferred to landfill from the Facility will be Waste Acceptance Criteria (WAC) tested - leachability tested - to ensure that they meet the WAC for the landfill that they are to be transferred to.

In accordance with the requirements of Article 4 of the Waste Framework Directive, Doveryard will periodically review the options for the recovery and recycling of residues generated by the Facility.

### 2.9.1 Incinerator Bottom Ash

Ash which is collected in the boiler (boiler ash) will be mixed with ash which comes off the end of the grate (bottom ash). The mixture of boiler ash and bottom ash is normally a non-hazardous waste which can be recycled and is referred to as Incinerator Bottom Ash (IBA). If the boiler ash were to be mixed with the APCr, the mixture would be defined as hazardous waste and this would restrict the ability of the operator to transfer the boiler ash for recovery.

The IBA will be stored in an enclosed ash hall. Initial ash handling will be undertaken in enclosed buildings, with the ash maintained wet from quenching to prevent the fugitive release of any dust emissions off site. In addition, any overflow from the ash quench will be contained in the process effluent drainage system and hence will not be released off-site.

It is currently proposed to transfer IBA off site for recovery or recycling.

### 2.9.2 APCr

APCr is predominantly composed of calcium as hydroxide, carbonate, sulphate and chloride/hydroxide complexes. Typical major element concentration ranges for the UK residues are as follows:

- 30-36% w/w calcium;
- 12-15% w/w chlorine;

- 8-10% w/w carbonate (as C); and
- 3-4% w/w sulphate (as S).

Silicon, aluminium, iron, magnesium and fluorine are also present in addition to traces of dioxins and the following heavy metals: zinc, lead, manganese, copper, chromium, cadmium, mercury, and arsenic.

APC residue is classified as hazardous (due to its elevated pH) in accordance with technical guidance *'WM3: Waste Classification – Guidance on the classification and assessment of waste'*. Hazardous Waste and requires specialist landfill disposal or treatment. It may be possible to send the residue to an effluent treatment contractor, to be used to neutralise acids and similar materials. Using the residues in this way avoids the use of primary materials. If these options are not available, then it will be sent to a suitably licensed hazardous waste landfill for disposal as a hazardous waste.

### 2.9.3 Summary

The expected quantities and properties of the main residue streams generated from the operation of the Facility are summarised in Table 14.

*Table 14: Key residue streams from the facility*

| Source/ Material | Properties of Residue | Storage location/ volume stored | Future annual quantity of residue produced (estimate) | Disposal Route and Transport Method | Expected Frequency |
|---|---|---|---|---|---|
| Bottom Ash | Grate ash. This ash is relatively inert, classified as non-hazardous. | Ash hall, approximately 600 tonnes capacity | 38,180 tonnes | Transferred off-site for recycling or recovery (e.g. for use as a secondary aggregate). | 1 – 7 days |
| Fly Ash / APCR | Ash from the boiler and flue gas treatment, may contain some unreacted lime | Silo(s), approximately 270 $m^3$ capacity | 7,300 | Transferred to a suitably licensed APCr treatment facility or alternatively a hazardous disposal facility. | 1 – 7 days |

## 2.10 Management

As defined in Part 1 of the Pollution Prevention and Control Regulations (2012), the operator is 'the person who has control over the operation of the installation or plant'. Doveryard will retain control and ownership of the Facility.

Doveryard expect that the day-to-day operation of the Facility will be subcontracted to a third-party organisation through an operation and maintenance (O&M) contract. Doveryard will ensure that under the O&M contract they retain control and ownership of the Facility and it will be operated to the exact instruction of Doveryard.

Doveryard will oblige the O&M contractor to implement environmental management systems in accordance with BS EN ISO 14001:2015 Environmental Management System Standard and with the operating and maintenance instructions of the EPC contractor responsible for the design of the Facility.

Doveryard regards the ISO 14001 certification to be of considerable importance and relevance to a waste treatment facility. It is an assurance to the local authority, regulator, neighbours, and others alike that the facility operation is undertaken in strict compliance with the regulations in force and with the management seeking continual improvements. It requires the company to work in a transparent way, to maintain and improve the confidence of regulators and neighbours, and to have a proactive approach to environmental improvement.

Sections 2.10.1 to 2.10.5 provide a general overview of the management systems to be implemented at the Facility.

### 2.10.1 Accident Management

It can be confirmed that Doveryard will develop a formal structured accident management plan in accordance with the indicative BAT requirements of Sector Guidance S5.01, prior to the commencement of commissioning of the Facility. The plan will include the following aspects:

- Identification of hazards.
  - For example, overfilling of vessels, failure of containment and wrong connections made to drains.
- Assessment of risks.
  - This will include an assessment of the likelihood of the event occurring, a risk evaluation, pathways, consequences, overall significance and prevention measures.
- Identification of techniques to reduce risks.
  - This will include inventories of substances, procedures for handling substances, suitable storage arrangements and containment among other techniques.

It is considered that the proposed systems represent BAT for accident management. An indicative accident management plan is presented within the Environmental Risk Assessment – refer to Appendix N. The documented management plan will to be used to identify, assess and minimise the environmental risks and hazards of accidents and their consequences and will be subject to further review/updates following completion of detailed design, construction and throughout the lifetime of the Facility.

### 2.10.2 Scope and structure

The scope of the EMS ISO 14001 certification will cover two key areas:

- the operation of the plant; and
- the processing of controlled waste (including transport, storage, treatment and disposal).

Where applicable, documented procedures will detail specifically how each activity is to be controlled. These will be contained in the Environmental Procedures Manual and identified related documents.

The site EMS will contain procedures for accident management that comply with the requirements set out in S5.01. This will be in the form of an accident management plan that will be developed before the Facility is commissioned.

- Monitoring and recording of emissions during OTNOC and associated circumstances.
- Periodic assessment of emissions occurring during OTNOC and implementation of corrective actions if necessary.

### 2.10.3 General requirements

Doveryard will require the O&M contractor to maintain the EMS in accordance with the ISO 14001 standard. The EMS objectives and scope will ensure that requirements are met by:

- identifying potential environmental impacts;
- documenting and implementing standard procedures to mitigate and control these impacts;
- determining a procedural hierarchy that considers the interaction of the relevant processes;
- ensuring adequate responsibility, authority and resources to management necessary to support the IMS;
- establishing performance indicators to measure the effectiveness of the procedures;
- monitoring, measuring and analysing the procedures for effectiveness; and
- implementing actions as required based on the results of auditing to ensure continual improvements of the processes.

The documented procedures within the EMS will include for scenarios of OTNOC and abnormal operation as required by the IED and WI BREF.

### 2.10.4 Personnel

Day-to-day operation and maintenance of the Facility will be undertaken by the O&M contractor under the instruction of Doveryard. Doveryard will ensure that sufficient numbers of staff, in various grades, are provided to manage, operate and maintain the plant on a continuous basis, seven days per week throughout the year. The Facility will be managed, operated and maintained by experienced managers, boiler operators and maintenance staff.

The key environmental management responsibilities will be allocated as described below (job titles stated as examples).

- The General Manager will have overall responsibility for management of the site and compliance with the operating permit. They will also be responsible for waste management and scheduling. The general manager will have extensive experience relevant to their responsibilities.
- The Environment Manager will be responsible for the development and management of the EMS, for the monitoring of authorised releases and for interaction with SEPA.
- The Health and Safety manager would be responsible for the management of health and safety systems on-site.

- The Operations Manager will have day-to-day responsibility for the operation of the plant, to ensure that the plant is operated in accordance with the permit and that the environmental impact of the plant's operations is minimised. In this context, they will be responsible for designing and implementing operating procedures which incorporate environmental aspects.
- The Maintenance Manager will be responsible for the management of maintenance activities, for maintenance planning and for ensuring that the plant continues to operate in accordance with its design.

Numerous other staff will be employed in various roles, such as technicians, store managers, shift and day operators, team leaders and supervisors, finance and administration staff.

### 2.10.5 Competence, training and awareness

Doveryard will aim to ensure that any persons performing tasks for it, or on its behalf, which have the potential to cause significant environmental impact, are competent based on appropriate education and training or experience.

Doveryard will implement training procedures to make employees aware of:

- the importance of conformity with the environment policies and procedures and with the requirements of the EMS;
- potentially significant environmental aspects associated with their work;
- their roles and responsibilities in achieving conformity with the requirements of the EMS, including emergency preparedness and response requirements;
- the relevance and importance of their activities and how they contribute to the achievement of the environmental and quality objectives; and
- the potential consequences of the departure from specified procedures.

Doveryard will ensure that the operation of the Facility will comply with industry standards or codes of practice for training (e.g. WAMITAB or similar), where they exist. This will include ensuring that a suitable number of employees have achieved a suitable qualification to be agreed with SEPA. At this stage, Doveryard do not currently employ any staff with the relevant qualifications to demonstrate technical, such as WAMITAB or equivalent qualifications. Therefore, CV's for team responsible for the development of the project are presented in Appendix K. This shows that the team involved in the development of the project are experienced in the development of power and energy from waste projects.

#### 2.10.5.1 Competence

The O&M contractors line management will identify the minimum competencies required for each role. These will then be applied to the recruitment process to ensure that key role responsibilities are satisfied. Particular attention will be paid to potential candidate's experience, qualifications, knowledge and skills.

#### 2.10.5.2 Induction and awareness

Staff induction programmes are location and job role specific and will include, as a minimum, the induction of:

- the Environmental Policy;
- the Health and Safety Policy and Procedures; and
- the EMS Awareness Training.

#### 2.10.5.3 Training

Staff training will be completed during commissioning of the Facility and prior to commencement of operation. Line Managers or similar will identify and monitor staff training needs as part of an appraisal system. The training needs of employees will be addressed using on-the-job training, mentoring, internal training and external training courses/events.

Training records will be maintained onsite. Doveryard will ensure that the O&M contractor complies with industry standards or codes of practice for training (e.g. WAMITAB or similar), where they exist.

## 2.11 Closure

### 2.11.1 Introduction

The Facility is designed for an operational life of more than 25 years, but the actual operational lifetime is dependent on a number of factors including:

- the continued supply of residual waste; and
- the development of alternative methods competing for the same residual waste fuels.

When the Facility has reached the end of its operational life, it may be redeveloped for extended use or demolished as part of a redevelopment scheme and the site cleared and left in a 'satisfactory state', as defined in *TG2: PPC Technical Guidance Note Content and Scope of Site Reports*.

Doveryard recognises that the design, operation and the maintenance procedures facilitate decommissioning in a safe manner without risk of pollution, contamination or excessive disturbance to noise, dust, odour, groundwater and surface watercourses.

To achieve this aim, a site closure plan will be prepared. It is anticipated that the closure plan will include the information listed below.

### 2.11.2 Site closure plan

The following is a summary of the measures to be considered within the closure plan to ensure the objective of safe and clean decommissioning. A detailed Site Closure Plan will be developed and submitted to SEPA prior to the commencement of operation.

#### 2.11.2.1 General requirements

- underground pipework to be avoided except for supply and discharge utilities such as towns water, sewerage lines and gas supply;
- safe removal of all chemical and hazardous materials;
- adequate provision for drainage, vessel cleaning and dismantling of pipework;
- disassembly and containment procedures for insulation, materials handling equipment, material extraction equipment, fabric filters and other filtration equipment without significant leakage, spillage, release of dust or other hazardous substance;
- where practicable, the use of construction material which can be recovered (such as metals);
- methodology for the removal/decommissioning of components and structures to minimise the exposure of noise, disturbance, dust and odours and for the protection of surface and groundwater;

- soil and groundwater sampling and testing of sensitive areas to ensure the minimum disturbance (sensitive areas to be selected with reference to the initial site report and any ongoing monitoring undertaken during operation of the Facility).

#### 2.11.2.2 Specific details

- a list of recyclable materials/components and current potential outlet sources;
- a list of materials/components not suitable for recycle and potential outlet sources;
- a list of materials to go to landfill with current recognised analysis, where appropriate;
- a list of all chemicals and hazardous materials, location and current containment methods; and
- a bill of materials detailing total known quantities of items throughout the site such as:
  - steelwork;
  - plastics;
  - cables;
  - concrete and civils materials;
  - oils;
  - chemicals;
  - consumables;
  - contained water and effluents; and
  - IBA and APCr.

#### 2.11.2.3 Disposal routes

Each of the items listed within the Bill of Materials will have a recognised or special route for disposal identified; e.g. Landfill by a licensed contractor, disposal by high sided, fully sheeted road vehicle or for sale to a scrap metal dealer, disposal by skip/fully enclosed container, dealer to collect and disposal by container via road.

## 2.12 Improvement programme

Doveryard is committed to continual environmental improvement of all their operations and is therefore proposing that a small number of Pre-Operational Conditions and Improvement Conditions be incorporated into the final PPC permit. These have been set out in the sections below. It is understood that the proposed conditions are consistent with PPC Permits which have been granted for other waste incineration facilities in Scotland.

### 2.12.1 Prior to commissioning

Prior to commencement of commissioning of the Facility, Doveryard will comply with the typical Pre-Operational Conditions which will be included for this type of facility, as follows:

- Submit a written report to SEPA, on the details of the Computational Fluid Dynamic (CFD) modelling used in the design of the boiler. The report will demonstrate whether the BAT design stage requirements, given in the sector S5.01, have been completed. In particular, the report will demonstrate whether the residence time and temperature requirements will be met.
- Submit to SEPA for approval a protocol for the sampling and testing of bottom ash for the purposes of assessing its hazard status. Sampling and testing shall be carried out in accordance with the protocol as approved.

- Provide a written commissioning plan, including timelines for completion, for approval by SEPA. The commissioning plan shall include the expected emissions to the environment during the different stages of commissioning, the expected durations of commissioning activities and the actions to be taken to protect the environment and report to SEPA in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.

In addition, Doveryard will provide SEPA with confirmation of the thermal input of the emergency diesel/fuel oil generator prior to the commencement of commissioning of the Facility.

### 2.12.2 Post commissioning

Following commissioning of the Facility, Doveryard will comply with the typical Improvement Conditions which will be included for this type of facility, as follows:

- Submit a written report to SEPA describing the performance and optimisation of the NOx abatement system and combustion settings to minimise oxides of nitrogen (NOx) emissions within the emission limit values described in this permit with the minimisation of nitrous oxide emissions. The report will include an assessment of the level of NOx and $N_2O$ emissions that can be achieved under optimum operating conditions.
- Submit a written summary report to SEPA to confirm by the results of calibration and verification testing that the performance of Continuous Emissions Monitoring System (CEMS) complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3.
- Submit a written report to SEPA on the commissioning of the installation. The report will summarise the environmental performance of the Facility as installed against the design parameters set out in the Application.
- Carry out checks to verify the residence time, minimum temperature and oxygen content of the exhaust gases in the furnace whilst operating under the anticipated most unfavourable operating conditions. Results will be submitted to SEPA.
- Provide a written proposal to SEPA, for carrying out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air, identifying the fractions in the $PM_{10}$ and $PM_{2.5}$ ranges from the Facility. The report will detail a timetable for undertaking the tests and producing a report on the results.

# Appendices

# A Plans and Drawings

# B Initial Site Report

# C Noise Assessment

# D Air Quality Assessments

# E BAT Assessment

# F Heat & Power Plan

# G Planning Permission

# H Example CFD Report

# I Example Emissions Monitoring Data

*Table 15: Emissions data from operational facilities demonstrating compliance with the BAT-AELs from the WI BREF*

| Plant name | Plant ref | Capacity of plant | FGT | Pollutant | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | HCl (CM) | $SO_2$ (CM) | Dust (CM) | NOx (CM) | $NH_3$ (CM) | TVOC (CM) | HF (PM) | PCDD/F (PM) | Dioxin-like PCBs (PM) | Hg (PM) | Group 3 heavy metals | Cd + Tl (PM) |
| | | | | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Average ($mg/Nm^3$) | Max (ng I-TEQ/$NM^3$) | Daily base (ng WHO-TEF/$NM^3$) | Average ($mg/Nm^3$) | Max ($mg/Nm^3$) | Max ($mg/Nm^3$) |
| Müllheizkraftwerk Pirmasens | DE64.2R | 24 tph | SNCR with $NH_3$ | | | | 100 | | | | | | | | |
| Sleco | BE08.1R | 71 tph | SNCR with $NH_3$ | | | | 120 | | | | | | | | |
| PD energy GmbH | DE36.1R | 134,400 tpa | SNCR with $NH_3$, DSI with lime, BF, PAC | | | | | 9 | | 0.1 | 0.005 | | <0.001 | 0.12 | 0.005 |
| EEW Stavenhagen GmbH & Co. KG | DE73R | 11.5 tph | SNCR with $NH_3$, DSI | | | | | 8 | 2.5 | | 0.005 | | | 0.03 | 0.001 |

| Plant name | Plant ref | Capacity of plant | FGT | | | | | | | | | | | | Pollutant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | HCl (CM) | $SO_2$ (CM) | Dust (CM) | NOx (CM) | $NH_3$ (CM) | TVOC (CM) | HF (PM) | PCDD/F (PM) | Dioxin-like PCBs (PM) | Hg (PM) | Group 3 heavy metals (PM) | Cd + Tl (PM) |
| | | | | Daily base (mg/Nm³) | Daily base (mg/Nm³) | Daily base (mg/Nm³) | Daily base (mg/Nm³) | Daily base (mg/Nm³) | Daily base (mg/Nm³) | Average (mg/Nm³) | Max (ng I-TEQ/Nm³) | Daily base (ng WHO-TEF/Nm³) | Average (mg/Nm³) | Max (mg/Nm³) | Max (mg/Nm³) |
| | | | with PAC, BF | | | | | | | | | | | | |
| Allington Incinerator | UK07.1R | 3 tph | DSI with PAC | | | | | | 1 | | | | | | |
| Allington Incinerator | UK07.2R | 3 tph | SNCR with $NH_3$ | | | | | 2.5 | | | | | | | |
| Allington Incinerator | UK07.3R | 3 tph | SNCR with $NH_3$ | | | | | 4 | | | | | | | |
| Abfallwirtschafts gesellschaft mbH Wuppertal | DE69 | 406,933 tpa | DSI with lime | | | | | | | 0.1 | | | | | |
| MHKW Würzburg | DE70 | N/A | DSI with lime, | | | | | | | 0.2 | | | | 0.025 | 0.002 |

| Plant name | Plant ref | Capacity of plant | FGT | | | | | | | | | | | | Pollutant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | HCl (CM) | $SO_2$ (CM) | Dust (CM) | NOx (CM) | $NH_3$ (CM) | TVOC (CM) | HF (PM) | PCDD/F (PM) | Dioxin-like PCBs (PM) | Hg (PM) | Group 3 heavy metals | Cd + Tl (PM) |
| | | | | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Daily base ($mg/Nm^3$) | Average ($mg/Nm^3$) | Max (ng I-TEQ/$NM^3$) | Daily base (ng WHO-TEF/$NM^3$) | Average ($mg/Nm^3$) | Max ($mg/Nm^3$) | Max ($mg/Nm^3$) |
| | | | BF, PAC | | | | | | | | | | | | |
| Biostoom Oostende nv | BE06R | 31.25 tph | BF, PAC | | | | | | | | | | | 0.06 | |

*Key: CM= Continuous monitoring. PM= periodic monitoring. SNCR= Selective Non-Catalytic Reduction. DSI= Dry Sorbent Injection. BF= Bag filter. PAC= Powder Activated Carbon.*

# J Financial Provision Calculation

# K Curriculum Vitae of Project Development Team

# L Certificate of Incorporation

# M Environmental Statement

# N Environmental Risk Assessment

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