WDP 2B -Technology

Part 1: Process information and target achievement

1. Technology description

In accordance with paragraph 6.2.1 of Schedule 2 (Output Specification) of the Contract, the Contractor shall adopt and implement in accordance with Good Industry Practice a mechanical and electrical (M&E) works specification for the design, construction and the commissioning and testing of the Works.

The solution is a single line energy from Waste (EfW) Facility which is able to process [redacted]. Third Party Waste will be accepted in order to fill the capacity excess left after the Acceptance of all Contract Waste. A detailed waste flow model is the basis for the design capacity and is included in Appendix WDP2B.1 to this Method Statement.

The Contractor has selected Babcock & Wilcox Vølund (BWV) for the grate, boiler, turbine and balance of plant and SECOLAB system from LAB S.A. for the flue gas treatment (FGT).

The guaranteed design data of the Facility is given in Table WDP2B.1 below.

[redacted]	
[redacted]	
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	
[redacted]	[redacted]
[redacted]	
[redacted]	[redacted]

Table WDP2B.1 – Guaranteed design data

2. The combustion diagram

The combustion diagram (Figure WDP2B.1 below) illustrates the connection between the Waste input amount (tonnes/h), the net calorific value (GJ/tonnes) and the thermal Waste input (GJ/h) for the Facility. The combustion diagram indicates the operational area where all environmental, guarantee and functional requirements will be met.

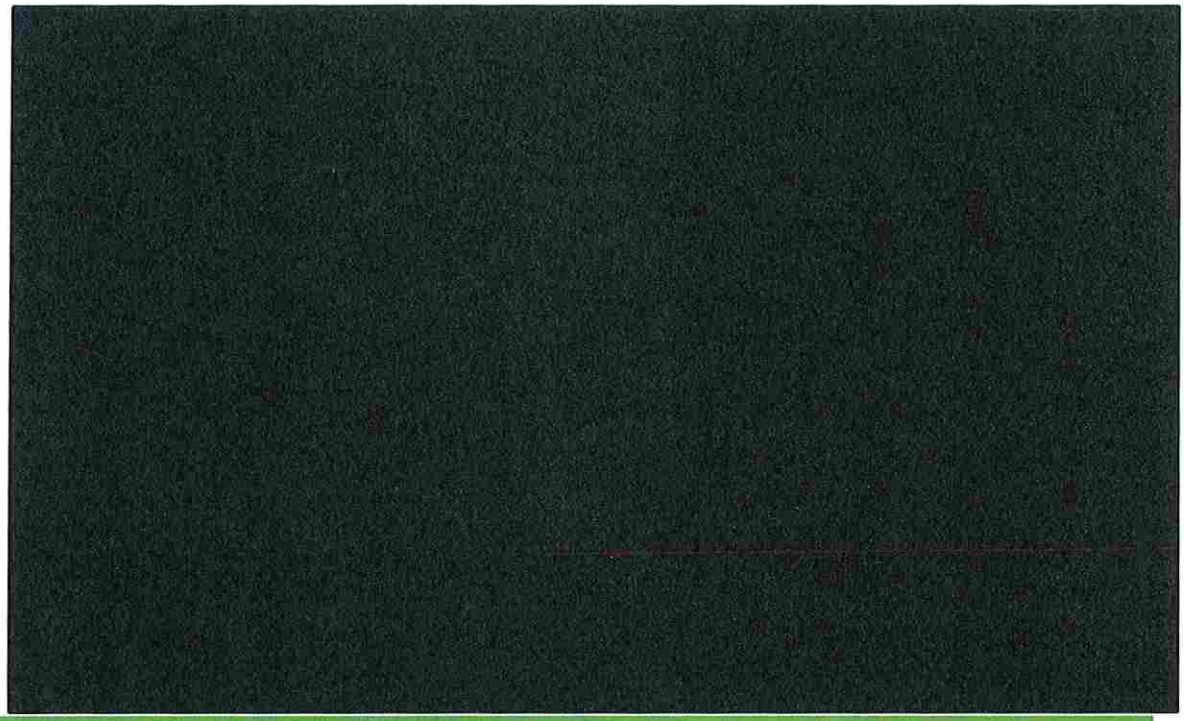

Figure WDP2B.1 - Combustion diagram

3. Main areas of the Facility

The Facility will comprise the main pieces of Equipment, fixed installations and areas detailed in Tables WDP2B.2 to WDP2B.7 below.

Waste reception	
Waste bunker	The Waste bunker will accommodate Waste prior to treatment. The Waste bunker will be divided into unloading, mixing and storage areas. The Waste bunker will be of a contiguous piled wall to all four (4) sides which will resist infiltration of ground water and leaking of water to the ground outside the Waste bunker. The main structure of the Waste bunker will be of a steel frame structure and reinforced concrete. The Waste bunker will be held under-negative pressure by forced draft ventilation to mitigate the release of odour from the Facility. This air will be used as combustion air in the furnace. The Waste bunker will be designed in accordance with Good Industry Practice and will form part of the Design Review Procedure.
Grab cranes	Two (2) identical Waste grab cranes shall be installed that individually are sufficient for feeding the hopper. The grab cranes shall be capable of operating in fully automatic mode. The grab cranes shall be fitted with automatic weighing cells that feed data on the amount of Waste placed in the hopper to the control and monitoring system (CMS). A spare grab will also be kept on site.

Table WDP2B. 2 – Waste reception equipment/parts/fixed installations

Incinerator/grate system	
A single line EfW Facility which is able to process 185,000 t/y (annual nominal capacity) from BWV	
Feeding hopper	The hopper will receive the Waste from the grab crane and lead the Waste down into the charging chute succeeding the hopper. The design of the upper opening is similar to the expected diameter of the grab crane in open position.
Furnace and moving grate	The furnace design is based on a "centre flow boiler configuration", in order to meet the Project design requirements. The grate will be of a rigid design, especially developed for heavy-duty and high temperature operation with a high availability and operational reliability to ensure minimal shutdown for routine maintenance and cleaning. The combustion grate for the Facility is of a type especially designed for the thermal treatment of waste incorporating BWV's DynaGrate® grate technology. The grate will consist of two (2) parallel grate lanes with each grate lane consisting of four (4) sections. The grate will be air-cooled whilst the mid-section, between the two (2) parallel grate lanes, will be water-cooled. All sections will be operated and controlled individually. This means that each section will have its own grate drive and control system for combustion air. The furnace and grate has been designed to maximise burnout and to minimise total organic content (TOC) of the residue.
Furnace and secondary combustion chamber	The combustion air systems shall be designed to ensure a correct amount of excess air in the flue gas, both in order to ensure high combustion efficiency and to avoid a reducing (corrosive) atmosphere and incomplete burnout of the flue gases. The furnace and secondary combustion chamber will comply with the retention time and temperature requirements of the Waste Incineration Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 (WID) and be equipped with auxiliary burners.
Horizontal boiler type (the "tail-end")	The horizontal boiler type (the "tail-end") is characterised by the radiation pass being followed by a horizontal convection pass and economiser. The boiler will be designed to operate at 60 bar/425 °C. The horizontal convection pass of the boiler will be equipped with a mechanical rapping device.

Incinerator/grate system	
Internal corrosion protection to the furnace and boiler	Corrosion protection in the furnace and boiler shall be provided by the incorporation of Inconel lining where required in areas with a high potential for corrosion.

Table WDP2B. 3 – Incinerator equipment/parts/fixed installations

Energy recovery	
The energy recovery heat exchanger (boiler) uses heat recovered from the combustion gases to raise steam which drives the steam turbine generator, thereby producing electricity.	
Turbine	The turbine will recover the energy content of the steam produced in a condensing turbine with a generator for power production. The turbine shall be designed to handle 110% nominal thermal load and there shall be a by-pass function designed to protect the turbine when operating outside normal steam parameters. A turbine steam by-pass shall be installed to allow for boiler operation whilst the turbine is inoperable. The turbine will be equipped with one steam extraction bleed which will be used for the provision of up to 10MW of heat as part of any future water based heating system.
Air-cooled condensers (cooling system)	Cooling system for condensing the steam via air cooling and return it to the boiler in the optimum temperature in order to increase the efficiency. The air cooled condensers shall be capable of condensing all steam production whilst the turbine steam by-pass is in full operation.

Table WDP2B. 4 – Energy recovery equipment/parts/fixed installations

Flue gas treatment (FGT)	
A SECOLAB dry system with a quench/reactor for $Ca(OH)_2$/CaO and activated carbon/activated lignite HOK®, injection followed by the main specific areas set out below.	
Conditioning spray tower	A conditioning spray tower for flue gas cooling.
Dry reactor (LAB-LOOP)	A dry reactor for the intensive and turbulent mixing of pollutant-carrying flue gases, fresh lime absorbent, powdered activated carbon and recycled residues from the bag filter.
Bag filter	A bag filter for separation of all particle-type pollutants.

Flue gas treatment (FGT)	
Humidifier and recycling screw	A heavy-duty recycling system to return part of the bag filters' residues to the reaction duct, with humidification of the recycled residues.
Induced draft fan (IDF)	An IDF, including silencer, for compensation if the plant pressure drops.
Nitrogen Oxide (NO_x) removal system	Selective non-catalytic reduction (SNCR) to ensure compliance with strict NO_x removal requirements. SNCR is based on the chemical reduction of the NO_x into molecular nitrogen (N_2) and water vapour (H_2O) through the injection of a reagent, such as ammonia or urea, injected into the post combustion flue gas.
APC Residue storage	The APC Residue will be collected in bulk silos.
Continuous emissions monitoring station	A continuous emission monitoring station with the complete necessary sampling system, including extractive heated probe and connecting piping to a multigas analyser, will be installed downstream of the flue gas cleaning system. In addition, a dust monitoring device will be provided.
Stack	This stack will contain one (1) flue gas duct. The gas will then be exhausted to the atmosphere via a self supporting 70 m high stack. The height of the stack is based on comprehensive air dispersion modelling studies. Further detail can be found in Schedule 29 (Basic Design Proposal) of the Contract.

Table WDP2B. 5 – FGT equipment/parts/fixed installations

Incinerator Bottom Ash (IBA) treatment
Minimal dependence on Landfill will be ensured by on-Site treatment for IBA, where after drying (for approximately ten (10) days), the IBA will be classified by size by means of well proven mechanical Equipment. Ferrous and non-ferrous materials will be recovered by means of automatic Equipment connected by means of conveyor belts. • Sieve feeder • Disc screen • Magnetic separator • Eddy current separator The classification of the IBA will be followed by a six (6) week maturation period that ensures a final marketable Product. Suitable quality controls will be included to optimise treatment for quality market outlets.

Table WDP2B. 6 – IBA treatment equipment/parts/fixed installations

Control and monitoring system (CMS)	
The CMS will be used to control and monitor all the processes and components and support automatic operation of the Facility. The CMS will: • perform the dedicated control and monitoring tasks for specific equipment in the Facility and support operator control of the said equipment; • support full-automatic and semi-automatic operation and control of the various process sections of the Facility; • support plant operation Personnel in operation, control and monitoring of the entire Facility; • support operating Personnel in reporting to internal as well as external parties (for example, supervising authorities); • support maintenance Personnel in planning, organisation and performance of maintenance of the Facility; and • compile emissions data and enable the generation of reports to satisfy the obligations of the Environmental Permit. A redundant control network for communication between all process stations will be established. It will be possible to access all information from each operator station. This process network will also be the interface to the network of the administrative system. The network will be constructed with intelligent firewalls, routers and switches to separate the process network from the administrative network. Wireless network will not be allowed, except for maintenance purpose (Services laptops). The routers and the components on the network will allow diagnosis and operational information from the individual components to be transferred for further processing in the operating and maintenance (O&M) system. Surveillance monitors of the CCTV system will be installed in the control room. The CMS will be constructed with a number of operator stations from where operation and monitoring of all the installations will be performed. The operator stations will mainly be located in the control room. The process control stations will be established as autonomous processor-based units, which, independently of any fault in the overall process network or operator stations, will be able to control, monitor and protect the Facility.	

Table WDP2B. 6 – CMS description

Auxiliary systems	
Emergency power/ uninterruptible power supply (UPS)	A diesel generator and UPS shall be installed to provide emergency power to protect the Facility from damage and failure during any failure of electricity supply.
Shredder	A 35 tonne per hour waste shredder for size reduction of oversized items and protection of the hopper and grate from blockage shall be installed adjacent to the Waste bunker.

Auxiliary systems	
Ancillary hoisting equipment	Ancillary hoists will be strategically installed throughout the Facility in such a way that all major pieces of equipment and plant can be serviced and replaced efficiently.

Table WDP2B. 7 – Auxiliary systems/equipment/fixed installations

4. Best Available Techniques (BAT) assessment

According to the Environmental Permit and the BAT assessment appended to the Environmental Permit, it has been assumed that the Facility will operate at maximum throughput of approximately 23.75 tonnes per hour of Waste with an estimated calorific value 9.65 MJ/kg and an estimated availability of around 8,000 hours per year.

The Contractor has taken into consideration the conclusions reached in the BAT assessment, which followed the structure of the Environment Agency's Technical Guidance Note EPR-H1, as to the choice of the systems and/or technologies that will comprise the Facility (see Table WDP2B.8 below).

BAT technologies according to the BAT assessment	
Combustion technique	Moving grate
Acid gas abatement	Dry system
Reagent selection	Lime ($Ca(OH)_2$)
Nitrogen Oxides abatement	SNCR

Table WDP2B. 8 - BAT technologies for the Facility

5. Energy efficiency

In compliance with paragraph 2.1.4 of Schedule 2 (Output Specification) of the Contract, the Contractor has developed key performance targets (see Part 3 of this Method Statement) for this Contract that will contribute to the Authority's climate change agenda (including carbon reduction and energy efficiency).

Energy efficiency will be addressed, in particular, by:

- ensuring that the appropriate O&M system is in place;
- ensuring that all plant is adequately insulated to minimise energy loss or gain;
- ensuring that all appropriate containment methods, (for example seals and self-closing doors) are employed and maintained to minimise energy loss;
- employing appropriate basic controls, such as simple sensors and timers, to avoid unnecessary discharge of heated water or air; and
- installation, identifying and employing the appropriate energy efficiency techniques for building services.

5.1. R1 status

As referenced in section 7.1 of WDP 1 (Planning and Permitting), the Facility will be designed to achieve 'recovery status' (R1) as defined under the Waste Framework Directive 2008/98/EC, which means that the Facility will achieve an R1 coefficient of 0.65 or greater. The Contractor will follow the procedure described in paragraph 7.3.2.13 of WDP1 (Planning and Permitting) in order to gain and maintain R1 status during the Contract Period.

Part 2: Service Utilities

1. Detailed drainage and sewerage requirements

Please refer to drawing number 18917 –SK- 500-01 Drainage Plan in Schedule 29 (Basic Design Proposal) of the Contract.

2. Easements and wayleaves

The Contractor will liaise with all relevant utility supply companies, land owners and planning authorities as required to plan for and subsequently provide all the utility services required to serve the Facility.

2.1. Electricity supply

If wayleaves, easements or servitudes and the Electricity Act 1989 section 37 consents are required for new cables or lines, the Contractor will:

- negotiate the undertaker's technical and practical agreement to the Contractor's proposed alignment and engineering solution and to the wayleave provisions the undertaker will require before formal legal negotiations are started; and
- commence formal negotiations as early as possible.

The strategy for the choice of supply route will avoid, if possible, railway lines, major roads, rivers and canals (as these can incur significant delays and attract higher costs, for example directional drilling).

The Contractor's key early strategic approach will include:

- an early quotation from the network operator with a preferred route and alternative options;
- a meeting with the relevant Planning Authority;
- a route survey;
- an environmental review of the route to highlight any areas of concern; and
- a visit to private land owners to discuss any areas of concern.

Early engagement with the network operator to discuss any building works or modifications required to the existing connection point substation, to enable land lease/purchase requirements, will be initiated.

The Contractor will use overhead lines or underground cables (as appropriate and subject to the Planning Permission and Environmental Permit) to ensure the exportation of electricity to the grid.

The Contractor will review an alternative route plan in the event that an impasse with landowners affected by the original route occurs.

2.2. Water supply and sewerage connection

The Contractor has undertaken negotiations with landowners for the signing of wayleaves to run water pipelines and sewerage connection to the Javelin Park pumping station across land into the Site boundary and sections of pipeline where the pipe size requires upgrading by the water supply company to accommodate the Contractor's water supply maximum flow rate demand. The water company has handled the initiation of wayleaves/consents. The Contractor has been involved in this process.

2.3. Telephone line connections

This strategy will be similar to the electrical supply strategy.

The Contractor will review the choice of overhead lines or underground cables.

3. Requirements for water service and electricity service (see Table WDP2B.9 below)

Estimations on services consumptions		
Water supply	Total estimated water consumption	[redacted]
Grid connection	Total estimated parasitic load	[redacted]
	Total net export power	[redacted]

Table WDP2B.9 – Estimated annual services consumptions and net power (electricity) export

Part 3: Key guarantees and key assumptions

1. Key guarantees (table WDP2B.10)

Parameter	Value
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

Parameter	Value
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	

Table WDP 2B.10 - Key guarantees

2. **Key assumptions** (see Table WDP2B.11 below)

Parameter	Value
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

Parameter	Value	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	

Table WDP 2B.11 - Key assumptions

3. Combustion diagram

Please refer to the combustion diagram in Figure WDP 2B.1 in Part 1 of this Method Statement.

4. Flue gas treatment

4.1. Emissions standard

The Facility will comply with the WID. The guaranteed emissions are shown in Table WDP2B.12 below.

Guaranteed emissions in stack values in 11 % O_2 dry flue gas				
Parameter	Unit	Guarantee value (11% O_2 dry)		
		Daily average	Half hour average 100 %	Half hour average 97%
Total dust	mg/Nm³	10	30	10
HCl	mg/Nm³	10	60	10
TOC	mg/Nm³	5	10	10
CO	mg/Nm³	25	50	50
HF	mg/Nm³	1	4	2
$SO_2 + SO_3$	mg/Nm³	50	200	50
NO_x	mg/Nm³	200	400	200
NH_3	mg/Nm³	10	20	10
Hg	mg/Nm³	0.05 Result of spot sampling (three (3) samples of times 1 hr at least) (0.05)		
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	mg/Nm³	0.5 Result of spot sampling (three (3) samples of times 1 hr at least) (0.5)		
Cd+Tl	mg/Nm³	0.05 Result of spot sampling (three (3) samples of times 1 hr at least) (0.05)		

Guaranteed emissions in stack values in 11 % O_2 dry flue gas		
Dioxins and furans	ng/Nm³ (PCDD/F ekv.)	0,1 Result of spot sampling (two (2) samples of each of 6-8 hr) (0.1)

Table WDP 2B.12 – Environmental guarantees – air emissions

Part 4: Adaptability

1. Flexibility

In accordance with paragraph 1.3 of Schedule 2 (Output Specification) of the Contract, the Contractor will deliver a flexible waste management service capable of responding to usage, technical, regulatory, environmental and economic developments within the waste management industry during the Contract Period.

The Contractor shall provide a system with sufficient capacity and flexibility to manage Contract Waste and achieve the Contract targets during the Contract Period, as detailed in paragraph 2.2.5 of Schedule 2 (Output Specification) of the Contract. This will be achieved by means of:

- the developed technology that will deal with Waste in the range of [redacted]
- the high capacity storage areas that will allow the Contractor to deal with contingencies; and
- the management of Third Party Waste to optimise operations of the boiler.

The Facility will not recover recyclates with the characteristics described in NI192. [redacted]

2. Changes in future Waste strategy

In accordance with paragraph 2.2.6 of Schedule 2 (Output Specification) of the Contract, the Contractor will make allowances for future changes in Waste arisings and composition. The designed combustion diagram will be able to accommodate variations in Contract Waste and Third Party Waste:

- the Facility will be able to process from [redacted] of Waste; and
- the Facility will be able to deal with Waste ranging from [redacted].

The FGT, which will have an advanced SNCR NO_x system, will provide flexibility to accommodate potential changes in regulation and better levels of performance according to WID standards.

The Site layout itself will allow additional flexibility by leaving well arranged, landscaped space on the Site which, subject to the required permissions, could be developed for additional facilities, for instance selective catalytic reduction (SCR) Equipment and equipment for the export of heat.

3. Changes in collection practices/timetable

In accordance with paragraph 3.4 of Schedule 2 (Output Specification) of the Contract, the Works will be designed and constructed to be suitable and efficient for all Authorised Vehicles bringing Contract Waste to the Site and vehicle egress from the Site.

As a minimum, the Facility will be capable of accepting all vehicles up to and including 44 tonne GVW articulated vehicles. The vehicle type and design of the discharge arrangements may change during the Contract Period and therefore the Facility will be reasonably flexible and capable of accepting or be readily adaptable to accept a wide range of vehicles providing such vehicles are not greater than 16.5 metres in length, 2.5 metres in width or have a turning circle greater than 6 metres in diameter. The Works will provide for ease of manoeuvring for these vehicles so that they can efficiently and promptly discharge Contract Waste.