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SAKO BRNO A.S.

Project
**High-efficient combined heat and power facility utilizing renewable sources (OHB
II - line K1)**

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PART III, APPENDIX A1

OVERALL SCOPE OF WORKS



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1. GENERAL

The Contract Object under this Contract comprise the full and final new EfW Line, utilizing mixed municipal waste and selected industrial waste (hereafter the Line), including design, manufacturing, construction, testing and commissioning. Moreover, the Contractor will be responsible for obtaining all needed permits and consents according to local Legal regulation legislation.

The Existing facility, consisting of line K2 and K3, will remain in continuous operation, receiving and treating waste seven (7) days per week, throughout the duration of the Works. The Employer operates the Existing facility and will also be the operator of the new Line, once built.

The design, construction, testing and commissioning of the Line shall to the extent possible be planned and executed without disturbance of the operation of the Employer's Existing facility.

The Line must be handed over to the Employer fully functional and ready to use.

The Contract Object must fulfil the functional requirements specified in the Employers Requirements.

The Contract Object comprise (not exhaustive):

- Incinerator/Boiler
- Flue Gas Treatment
- Steam Turbine and Generator
- DH connection
- Cranes
- Auxiliary Equipment
- Electrical equipment
- Control and Monitoring System (CMS)
- Connection to External Utilities
- Civil Contract Object and building installations
- Demolition Works
- Design, manufacturing, construction, testing and commissioning
- All needed permits and consents according to local Legal regulation

The Line shall be designed for utilizing mixed municipal waste and selected industrial waste as fuel according to the Capacity diagram enclosed in appendix A13 *Process and Design Data*.

The incineration unit shall include an incinerator based on a moving grate concept and a steam boiler with Selective Non-Catalytic Reduction (SNCR).

The flue gas shall be treated in a semi-dry Flue Gas Treatment system (FGT) consisting of a reactor and a bag house filter. The layout and all components in the flue gas treatment system shall be designed fully prepared for a future installation of a low-temperature economizer and flue gas condensation located downstream the bag-house filter and upstream the ID-fan for additional production of district heating.

The steam from the boiler shall be sent to the steam header serving the Line and subsequently send to the new turbine/generator set which includes a district heating system for combined power and heat production.

The layout of the Line shall be in accordance with the outlines of the layout enclosed in appendix D *Drawings*, which includes illustrations from the aggregate 3D model, enclosed within

Procurement procedure. However, it should be noted that the layout drawings are to be considered preliminary, and the layout may be changed by the Contractor subject to approval by the Employer and the Authorities.

The Contractor shall use the data listed in appendix A13 *Process and Design Data* as basis for his design of process equipment.

The specification and minimum functional requirements of the Contract Object to be supplied by the Contractor appear from these appendices and all other parts of the Contract.

The following chapters describe the Contract Object, the overall design and the design data.

1.1 Approvals, Permissions and Consents

The Contractor shall be responsible for applying for and obtaining all necessary Approvals, Permissions and Consents in accordance with Czech Legal regulation.

The Employer will obtain/or obtained the following Permissions:

- Zoning Permit for the Line
- Environmental impact assessment (EIA) for the Line
- Integrated permit for building permit for the Line

The integrated permit shall be updated and verified after erection and installation of technology will be completed according to the Legal regulation. Revision of integrated permit and its obtaining is part of Contract Object.

2. SCOPE OF CONTRACT OBJECT– INCINERATOR/BOILER

2.1 General

The scope of Contract Object includes the design, manufacture, supply, erection, testing, commissioning and documentation of a complete and fully functional incinerator/boiler unit, including incinerator, boiler and complementary systems as IBA (Incinerator Bottom Ash) and ash handling, component cooling etc.

2.2 Included in the Contract Object

The Contract Object shall include, but not be limited to the deliveries and services specified below. Special reference is made to the other documents in appendix A, e.g. appendix A2 *Technical Specifications for Incinerator/Boiler*, appendix A15 *Concept diagrams for Process*, appendix A16 *Concept diagram for Electrical system* and appendix A17 *Concept Diagram for Automation*.

2.2.1 INCINERATOR WITH AUXILIARY EQUIPMENT

The Contract Object shall include a complete incinerator with necessary auxiliary equipment, including:

- Incinerator with feed hopper and chute, hydraulic shut-off damper, feeding system, air-cooled grate including grate drives, casing and supporting steel structures, IBA chute and IBA extractor, grate riddling hoppers, grate riddling transport to the existing bottom ash storage.
- Manual discharge system using containers as back-up solution for IBA discharge and grate riddlings.

- Equipment on feed hopper and in the chute in the form of waste bridge detection system, feed signal generation system based on microwave and waste bridge removal system.
- Systems for combustion and cooling air, including primary, secondary and cooling air fans, air preheaters, ducts, control equipment, dampers, and necessary devices for noise reduction. Primary air shall be drawn from the waste bunker. Secondary air shall be drawn from the outlet of the IBA extractor and above IBA conveyers and remaining secondary air shall be drawn from the top of the boiler hall or the waste bunker.
- Complete furnace and secondary combustion chamber, designed as a gas tight welded membrane tube wall forming ceiling and walls of the furnace, covered with corrosion proof alloy cladding (Inconel or similar) and refractory/ceramic lining if needed.
- Complete system for gas fired auxiliary/ignition burners.
- Furnace cameras for inspection of the entire grate area.
- Large furnace doors, allowing entrance of equipment and personnel during revisions.
- Complete hydraulic stations with pumping systems.
- Installation of a fully automatic water-based spray cleaning systems for cleaning of 1st and 2nd boiler pass.
- Sky climber for inspection and repair of 1st and 2nd boiler pass.

2.2.2 STEAM BOILER WITH AUXILIARY EQUIPMENT

The Contract Object shall include a complete steam boiler with necessary auxiliary equipment, including:

- Drum-type steam boiler with two vertical radiation passes, succeeded by a horizontal convection pass including super heater, economizer, integrated upper drum, automatic soot cleaning system using rapping devices and supporting steel structures as well as equipment for venting, blow-down, boiler drainage system, system for preheating of boiler with medium pressure steam etc.
- Complete Selective Non-Catalytic Reduction (SNCR) NO_x reduction system, including computer-controlled multi injection nozzles in the first pass of the boiler and a pump/air system to atomize urea into the boiler.
- Complete system for make-up water including de-mineralizing units, make-up water tank, pumps, pipe and feeding of make-up water to feed water tank.
- Feed water tank/deaerator.
- Degassing condenser unit for steam exhaust from the deaerator.
- Pressure reduction station including piping from live steam pipe to deaerator/feed water tank including control valve for controlling the temperature in the deaerator/feed water tank.
- Two (2 x 100 %) electrical driven feed water pumps and one (1 x 100 %) direct diesel engine driven feed water pump.
- Sampling station (test bar) including cooling systems, measuring equipment etc. for monitoring of water chemistry.
- Equipment for automatic chemical dosage to the water/steam cycle for boiler water conditioning.
- Flue gas concentration measurements for surveillance of the operation of the boiler and SNCR system.

2.2.3 PIPE SECTIONS IN WATER/STEAM CYCLE

The Contract Object shall include various pipe sections with valves, instrumentation and meters in the water/steam cycle of the boiler (reference is made to appendix A15.3 *Concept Diagram for Water/Steam Cycle*), including:

- Live steam pipes from boiler outlet to:
 - Isolation valves before turbine and turbine bypass station inlet valves;
 - Pressure reduction station for auxiliary steam

- Start-up and safety valves; including exhaust pipe through roof and silencer
- Steam pipes from turbine bleed (MP header) to:
 - Air pre-heater
 - De-aerator/feed water tank
- Steam pipes from boiler drum to air preheater
- Pipes for degassing steam from deaerator to degassing condenser unit
- Condensate pipes:
 - From DH condenser to de-aerator/feed water tank, equipped with fine particle filter
 - From air pre-heater to de-aerator/feed water tank
 - From gland steam condenser to DH condenser
 - From degassing condenser to DH condenser
- Feed water suction pipe, equipped with particle filter
- Feed water pressure pipes
- Injection water pipes:
 - From connection point downstream feed water pumps to steam coolers in between superheaters
 - From feed water pumps (middle pressure take out) to turbine bypass station
 - From feed water pumps (middle pressure take out) to pressure reduction station
- Make-up water pipes
- Probe extraction pipes

2.2.4 INCINERATOR BOTTOM ASH (IBA) AND ASH HANDLING AND TRANSPORT SYSTEMS

The Contract Object shall include complete transport system for IBA and ash handling, including:

- IBA extractors of the water-filled pusher type
- Conveyor system for transporting the IBA from the IBA extractor to be discharged in Existing facility's IBA bunker. The first section of the transport solution shall consist of vibrating conveyors and include a scalper for separation of larger parts of the IBA.
- Emergency IBA handling system, incorporating a manual discharge system using skips.
- IBA sampling arrangement.
- Mechanical system for collection of the boiler ash underneath the 2nd and horizontal pass.
- System for transport of boiler ash and baghouse filter ash and residual product to the existing end-product silos.

2.2.5 COMPONENT COOLING SYSTEM

The Contract Object shall include a complete component cooling system for the new the Line including:

- Air coolers, circulation pumps, pressure holding system, filters, piping, shut off and control valves at each cooling water consumer etc.
- Frost protection with propylene glycol, system for collection of spillage (water/glycol mixture) and re-injection into the cooling circuit and complete mixing system for water/glycol including mixing tank, pumps, valves etc.
- Piping for the supply of cooling water to the Line including the incinerator/boiler system, flue gas treatment system and turbine/generator.
- Piping and connection to Employer's existing component cooling system including circulation pumps.

During normal operation cooling for the component cooling system shall be supplied by an existing cooling supply system based on a chiller which recovers the heat for district heating. The component cooling system included in the scope of Contract Object must not depend on cooling supply from the existing cooling system and shall have full cooling capacity for Line. Automatic safe switchover between the cooling suppliers shall be included in the Contract Object.

2.2.6 DISTRICT HEATING

The Contract Object shall include a complete DH system installation, including:

- Shut off valves up- and downstream of DH condensers
- Shut off and control valves
- Circulation pumps
- Reserve pressure maintenance system
- District heating energy meter installations (produced and delivered heat)
- Summer coolers (dry coolers) to dissipate excess DH production, including heat exchanger and circulation pumps.
- All necessary piping, pipe supports, insulation, valves, instrumentation, venting and drainage equipment
- Piping, pipe laying Contract Object and connection to the Employer's Existing facility and its DH system installations.

The DH system shall be connected to the local DH networks through a serial connection with the Employer's existing DH producers. The Employer's existing DH main circulation pumps shall be utilized for the Line. Reference is made to appendix A18 *Limits of Supply* for details on the DH supply limits.

2.2.7 MISCELLANEOUS

The Contract Object shall include, but is not limited to, the following:

- Automatic lubrication systems covering, but not limited to, the cut-off gate for the waste hopper, the grate, IBA extractor(s), conveyors.
- Central grease lubrication system for the selected components including the waste feeder.
- Complete, redundant hydraulic pump system for e.g. feeding pushers, grate drives, IBA extractor(s) etc.
- Technical water tank designed for collection of blow down water and boiler drain water.
- Wastewater pit designed for collection of technical water and wastewater from all the Line.

3. SCOPE OF CONTRACT OBJECT– FLUE GAS TREATMENT SYSTEM

3.1 General

The scope of Contract Object for the flue gas treatment system includes the design, manufacture, supply, erection, testing, commissioning and documentation of a complete and fully functional flue gas treatment system.

The flue gas treatment shall be a semi-dry system including an induced draught fan, flue gas duct and flue gas pipe inside the existing stack.

Furthermore, the Line includes all necessary heat exchangers, storage and handling of auxiliary chemicals and end products, electrical systems and CMS, and all attached auxiliary equipment for the fulfilment of all conditions of Contract.

No wastewater is accepted from the flue gas treatment system.

3.2 Included in the Contract Object

The Contract Object shall include, but not be limited to, the deliveries and services specified below. Special reference is made to the other documents in appendix A, e.g. appendix A3 *Technical Specifications for Flue Gas Treatment*, appendix A15 *Concept diagrams for Process*, appendix A16 *Concept diagram for Electrical system* and appendix A17 *Concept Diagram for Automation Concept*.

3.2.1 SEMI-DRY FLUE GAS CLEANING SYSTEM

The Contract Object shall include:

- A conditioning tower/reactor system for cooling of the flue gas, injection of reagents (lime and activated carbon) and reactions with the flue gas components shall be installed.
- A downstream bag house filter which removes the fly ash and the reaction products from the flue gas.
- The resulting residual product shall be recirculated to the reactor and a certain portion of the residue shall be transported to the existing residual product storage.

3.2.2 PREPARATION FOR FUTURE POLISHING SCRUBBER AND FLUE GAS CONDENSATION

- The FGT system shall be prepared for establishment of a low-temperature economizer and a scrubber system including flue gas condensation including space allocation for this purpose in the FGT hall.

3.2.3 HANDLING AND TRANSPORT SYSTEM FOR COLLECTION OF FLUE GAS TREATMENT RESIDUALS

- Complete collection and transport system for flue gas treatment residuals.

3.2.4 LOW TEMPERATURE ECONOMIZER AND FLUE GAS CONDENSATION (OPTION 1)

The following shall be offered as an Option:

- Low temperature economizer (LT ECO)
- Flue gas condenser and absorption heat pump
- Droplet fallout mitigation (e.g. flue gas re-heater)
- Condensate water treatment system
- All necessary connections to the DH system for heat transfer
- All necessary auxiliary equipment including heat exchangers, circulation pumps, pipes, valves
- All necessary modifications to the scope of Contract Object (including but not limited to ID fan, ducts and stack pipe) as a result of this option.

The LT ECO and flue gas condensation shall serve as heat recovery downstream the semi-dry system and upstream the ID-fan. The energy shall be transferred to district heating water, which acts as cooling media for the flue gas.

The condensate from the flue gas condenser shall as a minimum pass a particle filter and collected in a condensate buffer tank if necessary. The condensate shall, to the extent possible, be treated and reused within the Complete Line or treated to fulfil requirements for boiler water/district heating water quality in order to offer the Employer an alternative usage of the condensate.

Storage tanks for condensate and process water is included in the Contract Object.

Refer to appendix A21 *Options* for details.

3.2.5 INDUCED DRAUGHT FAN

The Contract Object shall include an induced draught fan (ID-fan) with frequency-controlled motors and silencer.

The ID-fan shall be able to ventilate the boiler in case of black-out. A back-up emergency power unit shall be included.

3.2.6 FLUE GAS MEASUREMENTS

The Contract Object shall include a complete emission monitoring station (CEMS).

In addition, the Contract Object comprises continuous monitors for, amongst others, HCl, SO₂ and H₂O in the raw flue gas upstream bag house filter.

3.2.7 DUCTS AND STACK

The stack of the Employer's Existing facility shall be used for the Line.

The Contract Object shall include internal stack pipe, all necessary duct work, expansion joints and all related equipment such as flange, fixtures, insulation and drains.

3.2.8 SILOS AND TANKS FOR CONSUMABLES AND PRODUCTS

The Existing facility has silos and storage tanks for activated carbon, urea, quick lime and dry slaked lime. The existing storage facilities have spare capacity which shall be utilized for the Line.

The Contract Object shall include establishment of necessary connection flanges at the existing storage facilities, all necessary distribution, dosing equipment (piping, valves etc.) and preparation devices and piping from the connection flange at the existing silos and storage tanks to the Line.

In case the Contractor does not utilize quick lime, but utilizes another absorbent such as hydrated lime, a new storage silo for the absorbent shall be included in the scope of Contract Object.

The Existing facility has two solidification silos for boiler ash, fly ash and FGT residue. The existing storage silos have spare capacity and shall be utilized for the Line.

The Contract Object shall include establishment of all necessary works for transport from the FGT system and connection to the existing silos, including but not limited to establishment of necessary connection flanges at the existing storage silos, all necessary distribution, dosing equipment (piping, valves etc.) and piping, for storage of the total amount of boiler ash and flue gas residue from the Line.

It shall be possible to transfer an end product stream to any of the two existing silos.

4. SCOPE OF CONTRACT OBJECT– TURBINE/GENERATOR

4.1 General

The scope of Contract Object for Turbine/Generator includes the design, manufacture, supply, erection, testing, commissioning and documentation of the Line, including the steam turbine system, generator, condensers, by-pass station, steam and condensate system and interconnecting piping.

Furthermore, the Contract Object include all attached auxiliary equipment for the fulfilment of all conditions of the Contract.

4.2 Included in the Contract Object

The Contract Object shall include, but not be limited to, the deliveries and services specified below. Special reference is made to the other documents in appendix A, e.g. appendix A4 *Technical Specifications for Turbine/Generator*, appendix A15 *Concept diagrams for Process*, appendix A16 *Concept diagram for Electrical system* and appendix A17 *Concept Diagram for Automation Concept*.

4.2.1 TURBINE

- Complete backpressure steam turbine system with at least one bleed for deaeration steam and air preheating.
- Steam strainer and all valves needed on the live steam supply piping in order to secure a safe operation and control of the turbine.
- Reduction gear between steam turbine and generator.
- Base frame(s) for steam turbine, gear and generator.
- All steel parts necessary for the mounting of the turbine on the concrete turbine table including foundation bolts and all required cast-in parts.
- Detailed design, supervision and dimension control of the concrete turbine table.
- Support system for the turbine table.
- Barring gear.
- Complete drain system.
- Evacuation equipment based on a water-ring pump.
- Lubrication and control oil system, including oil tank(s), coolers, filters, oil filter separator, pumps including motors and flushing oil as well as the first filling of lubrication oil and control fluid.
- All necessary internal connections and auxiliary equipment.
- Nozzles for connecting of equipment for dry air conservation.
- All necessary instrumentation and measuring equipment for a safe operation and control of the Line.

4.2.2 STEAM SYSTEM

- Complete turbine bypass station, including control valves and dump pipe to condenser. Bypass station shall include an upstream (actuated) safety valve to relieve (short term) pressure build up arising when bypass station is operated as a result of a turbine trip.
- Gland steam sealing system including gland steam condenser or equivalent steam recovery system.
- Steam piping and necessary valves.
- Blow-off pipe collecting all vents and safety valves exhausts within the Line, including design, layout, structural support, drainage, details in relation to penetration through the roof, as well as a noise hood. The Contract Object shall include protection against hot surfaces, for instance by insulation or a guard rail.

4.2.3 CONDENSATE SYSTEM

- Condensate piping from district heating condenser and condensate pumps.
- Complete condensate pump sets for each condenser, including all necessary minimum quantity pipes and valves for pumping the condensate between the condensers. Condensate pumps to pump the condensate to the de-aerator/feed water tank with frequency converters shall also be included.
- Condensate control valves for all operation modes.

4.2.4 FEED WATER SYSTEM

- HP water injection system for the turbine bypass station including control and shut-off valves, screener etc.

4.2.5 DISTRICT HEATING CONDENSERS

- Complete district heating condensers (one or two turbine condensers, one of which shall also act as turbine by-pass condenser) with all necessary connections for steam, district heating and instrumentation, as well as required thermal insulation.

4.2.6 GENERATOR

- Generator system consisting of a synchronous generator for connection to the steam turbine, including excitation and AVR equipment, control panel and measuring equipment, cooling and lubrication equipment etc.
- Generator, grid connection, protection equipment including current transformers and voltage transformers.
- Synchronisation equipment.
- Neutral earthing arrangement including cable between generator and neutral earthing box.
- Complete LV and cable installations including low voltage cables, control and measuring cables, cable ways, terminal boxes and other installation materials.
- Complete earthing system with earthing conductor, protective conductors and bonding of generator and equipment, incl. main earthing bars etc.

5. SCOPE OF CONTRACT OBJECT– ELECTRICAL AND CMS

5.1 General

The scope of Contract Object for the electrical system and Control and Monitoring system (CMS) includes the design, manufacture, supply, erection, testing, commissioning and documentation of a complete and fully functional electrical system and complete and fully functional CMS.

5.2 Included in the Contract Object

The Contract Object shall include, but not be limited to, the deliveries and services specified below. Special reference is made to the other documents in appendix A e.g. appendix A6 *Technical Specifications for Electrical Equipment*, appendix A7 *Technical Specifications for Control and Monitoring System*, appendix A16 *Concept diagram for Electrical system* and appendix A17 *Concept Diagram for Automation Concept*.

5.2.1 ELECTRICAL INSTALLATIONS AND EQUIPMENT GENERAL

The Contract Object shall include the following utility systems:

- Existing 22kV medium voltage R2 Switchboard
 - Extension of Switchboard R2 with two sections, each with a Circuit Breaker and protection equipment, for supplying a transformer for normal operation and supplying a redundant transformer
- 6.3 kV system
 - Main switchboard
 - Connection of the Turbine, with Generator Circuit Breaker, including all associated generator protection and synchronization system
 - 5 MVA transformers
 - Cables and cable routing
- 400/230 V System
 - MDB Section A
 - MDB Emergency Generator
 - MDB Section B
 - ACC(s)
 - Cables and cable routing
- 400 V Emergency Generator Supply System
 - 1250 kVA Emergency Generator Set
 - 400 V switchboard's
 - Cables and cable routing
- 400/230 V Uninterruptable power supply system
 - 2x100% UPS
 - Switchboard's for UPS
 - ACC(s)
 - Cables and cable routing

The Contract Object shall include an integration of the existing electrical system with the new electrical system in all aspects and in all operations modes for a fully integrate electrical system.

The Contract Object shall include the complete electrical installation, including:

- All connected auxiliary equipment
- Electrical installations
- Plugs and sockets
- High and Low voltage cables, control cables, signal cables, fibre optic cables and flexible cables
- Erection and installation work
- Cable pulling, termination and all adaptation work
- Cable routing, cable ladders, cable trays and cable conduits
- Earth system, Protection Earth (PE) and bonding installation
- Steelwork, racks and fittings
- Access equipment facilities, for example roller scaffoldings, cherry pickers etc.
- All temporary Materials and Equipment
- All temporary internal/external lighting and power sockets for the execution of the work
- All accessories as for example steel pipes, bolts, screws, nuts, cable racks, metal dowels, cable ferrule, flexible tubing, numbers, flexible cables, labels, cable lugs and cable glands, etc.
- Frequency converters for all large pumps and fans.

- Transformers e.g. for frequency converters, (if required)
- Local operation/control panels and junction boxes
- Motors
- Electrical actuators and valves
- Heaters
- Disconnect switches
- Emergency switches
- Equipment and component marking signs
- SAT/FAT tests of all supplies inclusive documentation
- Supply of O&M Data

5.2.2 CONTROL AND MONITORING SYSTEM (CMS)

The delivery according to this specification includes the planning, engineering, management, reporting, supply, erection, testing, commissioning and documentation of the complete CMS, including but not limited to the following:

- Overall net and control system net for main CMS between Application Servers and process stations
- Overall safe power supply to all CMS system units including communication equipment, process stations, remote IO's, local control panels/PLC's, etc.
- Process station for incineration unit/boiler, district heating system and water-steam cycle.
- Process station for utility/auxiliary systems (building, etc.).
- Overall firmware and user software for main CMS including process screen graphics, operator interface, alarms, events, trend curves and reports etc.
- Coding of process functions and HMI (Human Machine Interface) for integration of control systems for auxiliary systems and building systems.
- Coding of process functions and HMI for incineration unit/boiler/turbine/condenser/water-steam cycle/utility systems.
- Coding of process functions and HMI for waste crane.
- CCTV system for the Existing facility and the new Line.
- Process station for flue gas treatment.
- Emission measurement instruments and equipment.
- Coding of process functions and HMI for flue gas treatment.
- Turbine control system (local panel in turbine hall/cubicle room), turbine bypass station and other equipment within the scope of supply
- Coding of process functions and HMI for turbine control system.
- Design basis for coding of process functions and HMI for turbine/heat system/water-steam cycle in the main CMS.

The Employer will deliver the SPPA-T3000 CMS system and the hardware on level 2 and level 3, but all engineering, design, programming, implementation, etc., for fully functional and operating system on all levels (including level 2 and level 3) is in the Contractors scope of Contract Object, including all necessary license for Line implementing.

6. SCOPE OF CONTRACT OBJECT– AUXILIARY EQUIPMENT

6.1 Included in the Contract Object

The Contract Object shall include, but not be limited to, the deliveries and services specified below. Special reference is made to the other documents in appendix A, e.g. appendix A5 *Technical Specifications for Auxiliary Equipment*.

6.1.1 WASTE CRANES

The Contract Object shall include two complete redundant waste cranes (each of 100% capacity) equipped for fully automatic unmanned operation serving the Complete plant(all three lines K1+K2+K3) consisting of:

- Crane runways and rails.
- Absolute encoders for positioning and mechanical end stops on the crane.
- Crane bridges with frequency regulated crane travelling motor.
- Trolleys with frequency regulated trolley traversing motor.
- Frequency regulated grab hoists.
- Two hydraulic waste grabs (one for each crane) and one identical spare waste grab.
- Two grab carriages for transport/moving of the grabs
- Hydraulic pump station with hoses and connections
- A picking grab fixed on each crane.
- Weighing system for logging waste amounts.
- Equipment on each crane for registration of the height of the waste in the bunker.
- One crane operating chair with all necessary grips, buttons and displays for controlling the waste crane, plus an additional number of buttons for operating miscellaneous auxiliary equipment.
- One dedicated crane operator station located in the control room.
- Two portable wireless remote-control panels for grab change, repair and maintenance and with reserve batteries for each. All batteries are to be rechargeable.
- All galleries and platforms on the crane for appropriate maintenance and operation of the systems, without necessity to install scaffolding for maintenance purposes.
- Test weights for test loading and for semi-automatic calibration.
- Risk analysis and safety measures to access ways, working and maintenance areas on the crane and on the hopper decks in conjunction with the unmanned crane system. It shall be possible in all operational modes to work safely on the hopper decks, make repairs to a crane and change grabs.
- Complete electrical and control equipment, incl. all cabling and panels.
- Complete software for the crane control system, including control and monitoring programs for manual crane operation, semi-automatic crane operation and fully automatic 24 hours unmanned crane operation. All necessary software for communication between the components of the crane control system, including operator stations, PLC's, safety system and control cabinet for the crane chairs.
- Control of and signal exchange with reception hall equipment, i.e. traffic lights, bay load guards, emergency stops etc.

Existing cranes, runways and rails shall be removed and disposed of as part of the Contract Object.

6.1.2 AUXILIARY SYSTEMS AND EQUIPMENT IN RECEPTION HALL

The Contract Object shall include auxiliary systems and equipment for the waste reception hall for all eight (8) existing unloading bays, including but not limited to:

- Removal of existing traffic lights and installation of new traffic lights.

- Waste truck detection sensors if deemed necessary.
- Bay load guards for personnel protection.
- Emergency crane stop buttons for each unloading bay.
- Any other equipment to be installed for 24 hour fully automatic unmanned operation.
- All necessary signal exchange between the auxiliary systems and the new crane CMS, including necessary signal exchange between existing equipment (such as bay load guards) and crane CMS.

6.1.3 AUXILIARY SYSTEMS AND EQUIPMENT IN WASTE BUNKER

The Contract Object shall include auxiliary systems for the waste bunker:

- Fire detection system and automatic fire-fighting equipment for new and existing bunkers.
- Dust suppression system above hoppers and unloading bays.
- Railings to be installed on existing hopper deck.

6.1.4 SERVICE CRANES

- Turbine hall crane, including crane rails, runways and consoles as well as all necessary gangways, platforms and auxiliary equipment etc. Including a portable wireless remote-control panel with one reserve battery. All batteries are to be rechargeable. Crane runways and rails shall be mounted on consoles on the structure of the building.
- One overhead wireless remote-controlled monorail service tackle including railways for service of the waste cranes in the bunker area. The tackle shall run on a monorail above the hopper deck and service the waste crane and the grab service opening. Including a portable wireless remote-control panel with 1 reserve battery. All batteries are to be rechargeable.
- Necessary service cranes throughout the Line for maintenance

6.1.5 COMPRESSED AIR DISTRIBUTION SYSTEM

The Existing facility has spare capacity in the existing compressed air station, which shall be used for production of compressed air for the new the Line.

The Contract Object shall include a complete distribution system for service air and instrument air for the Line including:

- Necessary filters and buffer tanks etc. for service air and instrument air
- The system shall be divided according to requirements.
- Piping for service and instrument air including connection points to serve the Line.
- In addition to the connection points for service air and instruments air required in the Line, the Contractor shall include 50 additional connection points for service air and instrument air to be placed in other parts of the Line. The compressed air distribution systems for service air and instrument air shall be established as a separate ring line for each of the two compressed air qualities.

6.1.6 CENTRAL VACUUM CLEANING SYSTEM

The Contract Object shall include a complete central vacuum cleaning distribution system for the Line including all pipes, connections and hoses etc.

The distribution system shall be connected to the Employers existing vacuum cleaning system.

7. SCOPE OF CONTRACT OBJECT– CIVIL WORKS

7.1 General

The Contractor shall provide all necessary buildings and equipment necessary for successful operation, service and maintenance of the Works, including but not limited to:

- Site Layout related to the Line (access roads, carpark, fences etc.)
- Demolition works
 - Warehouses and structures in area of Works
 - Existing buildings affected by the Contract Object
- Civil works and building installations, including but not limited to:
 - New Waste Bunker connected to existing waste bunker
 - Boiler Hall
 - Flue Gas Treatment Hall
 - Turbine Hall/condenser room/pump room
 - Summer cooler support steel structure
 - Ancillary Rooms and pits
 - Control room/Offices/Staff facilities
- Flue Gas Duct and Stack Pipe including supports
- Landscaping and clean-up

All parts of the process equipment should be placed within a building envelope in order to control odour and to maintain a controlled environment for people and equipment in terms of temperature, moisture, odour and dust.

7.2 Included in the Contract Object

The Contract Object shall include, but not be limited to, the deliveries and services specified below. Special reference is made to appendix A9 *Technical Specifications for Building*.

7.2.1 INFRASTRUCTURE AND OUTDOOR WORKS

- Construction of roads including access roads, ramp, parking areas, fencing and general lighting.
- External utilities from connection points specified by the Employer including all necessary relocations, including pipe racks and concrete trenches.

7.2.2 CIVIL WORKS, STRUCTURES

- Waste Bunker
- Boiler Hall
- Flue Gas Treatment Hall
- Turbine hall/condenser room/pump room
- Summer cooler support steel structure
- Ancillary Rooms and pits
- Control room for the Complete plant(Line K1, K2 and K3)
- Offices/Staff facilities
- Flue Gas Duct and Stack Pipe including supports

7.2.3 CIVIL WORKS, BUILDING SERVICES

- HVAC
- Plumbing and drainage
- Fire protection and fire alarm systems
- Electrical and CMS installations

- Elevators
- Lighting
- Telephones and WiFi

7.2.4 CIVIL WORKS, MISCELLANEOUS

- All needed foundations
- Supporting steel constructions for the components of the system.
- Sole plates for support on concrete floors plinths of the steel structures of the Line structural as well as other ones.
- All suspensions and supports for ducts, pipes, safety valves, sound absorbers etc. as well as the exchanges necessary to transmit the suspension forces/support forces from the installations to the primary building structures.
- Insulation, cladding and surface treatment of the components supplied.
- All platforms, galleries and stairways necessary for operation, service and maintenance of the Line as well as galleries for escape routes in accordance with requirements from the HSE and Authorities, including platforms at all measuring points, valves, suspensions etc.
- Foundation bolts, templates for concreting as well as the necessary grouting of all machine/equipment supports, which support and transfer loads to the building structures. The Contractor is responsible for a correct arrangement, alignment and inspection of these prior to the concreting.
- Closing of all penetrations due to pipes, ducts and cables including fire protection. Each room is to be considered as a separate fire cell.

8. MISCELLANEOUS

8.1 Included in the Contract Object

The Contract Object shall include, but not limited to, the following:

- All necessary ventilators, pumps, filters etc., which may not be specified in the above items and, furthermore, all connecting parts such as ducts, pipes with attached taps, valves, dampers, compensators etc.
- All necessary equipment (pump(s), piping, control facilities etc.) for reusing of washing water and similar wastewater streams collected in the wastewater pit.
- Ventilation and equipment for cooling of motors, components, panels etc.
- All necessary crane facilities, tackles, hoists etc. for maintenance.
- All necessary special tools for operation and maintenance shall be included in the Contract Object.
- All chemicals, lubricants, hydraulic fluids and refrigerants needed for commissioning. The silos and tanks for chemicals (except consumables from existing silos and storage tanks i.e. activated carbon, urea, quick lime and dry slaked lime) shall be filled completely at the start Trial operation period by the Contractor.

8.1.1 WEAR AND SPARE PARTS

Wear and spare parts shall be supplied according to appendix A10 *Spare and Wear Parts*.

8.1.2 PROJECT EXECUTION, DOCUMENTATION AND TEMPORARY WORKS

The following activities related to project execution, documentation and temporary Works shall be included in the Contract Object:

- Project management, administration and coordination related to the execution of the Contract Object in compliance with the Contract.
- All work related to Quality Assurance.
- CE-marking and preparation of declaration of conformity for the entire Line.
- Participation in project meetings, site meetings and other meetings required by the Employer.
- All temporary works necessary for completion of the Line.
- Coordination related to health, safety and environment (HSE).
- Reviewable Project and Design Data in accordance with appendix C1 *Reviewable Project and Design Data*.
- Operation and Maintenance and As-built documentation in accordance with the Contract and appendix A14.7 *Documentation*.
- Training in accordance with appendix A12 *Training*.
- All transport and erection for execution of the Contract Object.
- Testing and commissioning of the Line in accordance with appendix A11 *End of Assembly, Commissioning, and Testing*.
- Assistance during Performance and Guarantee tests.
- Cleaning and clearing of the Site.

9. OVERALL DESIGN

In the following the overall basis for design of the Line is described. Further details appear from all other appendices and parts of the Contract.

The Contractor shall design the Line in accordance with the following overall goals:

- Best possible solutions for occupational safety and health
- Low environmental impact
- High energy production
- Low energy consumption
- High degree of flexibility in energy production (electricity and heat)
- Highest level of automation
- Short start-up and shut-down time
- Optimized layout for operation and maintenance
- High availability and continuous period of operation
- Components and systems with easy and minimum maintenance
- Standardised components.

9.1 General Requirements

The Line shall be designed in accordance with Authorities requirements. Reference is made to appendix A8 *General Technical Requirements for Process*.

The Contract Object shall be designed in accordance with the Contracts requirements, descriptions and conditions as well as the Contractor' experience from similar projects.

The Contract Object shall be designed, manufactured, transported, checked, installed, tested etc. on the basis of national and international standards and norms. Where applicable CSN EN standards exist, these shall take preference over EN standards.

The Contractor shall, at the request by the Employer, present all relevant detailed design documents for comments and/or approval by the Employer or his representative.

9.1.1 OPERATION CONDITIONS

The Line shall operate in every aspect satisfactorily with the Waste delivered to the waste treatment facility and be able to treat the delivered Waste without any sorting.

The daily operation shall ensure that the operating staff will have as little contact as possible with the waste, dust, dirt, liquids, moisture etc. The design of the Line shall ensure the best possible working conditions for the personnel. Reference is made to Employers specifications in appendix B2 *Requirements for Health, Safety, and Environment*.

The Line shall operate in compliance with all guarantee and environmental requirements, including requirements for emissions, temperatures, retention time, turbulence etc. according to Directive 2010/75/EU of the European Parliament and the Council of 24th November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control) and to the specifications enclosed in the Procurement documents.

9.1.2 INFLUENCE ON LOCAL CLIMATE

The Line shall be designed to ensure that no dust and odour nuisances can be detected outside the building. Special attention shall be made to the IBA system and the waste bunker.

The Line shall be designed in such a way that no dust or dirt can be emitted to the surroundings or internally, for instance by installing effective filters on all exhaust systems.

The components shall be designed or shielded to ensure that the required noise limits are complied with, cf. appendix A14.3 *Acoustic Noise and Vibrations*.

The integrated permit for building permit shall be included in the Contract in Part II.j, *Planning and Permitting*. Should the requirements in the integrated permit, which shall be obtained before commencing of Line operation be more rigorous than the present descriptions and conditions, the Contractor shall comply with the requirements in this integrated permit as part of the Contract object.

9.1.3 MATERIALS AND DESIGN

The design and sizing of the Line shall take into consideration the demand for operational reliability, service friendliness and a lifetime of minimum 200,000 hours for all non-wear parts.

Generally, only well proven solutions are accepted. Where newly developed systems and components are offered, it shall be explicitly stated in Contractor's specification.

The architecture and external appearance of all materials and equipment shall be prepared in cooperation with and approved by the Employer.

For all parts included in the Contract Object the most suitable materials shall be applied. The Contractor shall clearly state the materials applied for all vital parts of the Line, including, but not limited to, tanks, pipes and other pressure parts. The information shall include specifications of the chemical composition as well as strength and other material properties. The material properties both at ordinary room temperature and at the highest possible temperature during operation shall be specified.

A high degree of automation is to be included in the Line in terms of the Line's ability to operate without operator interaction and for the operator via the CMS to follow the operations performed, to get alarms or notes in case of malfunction as well as to receive historical data of measurements performed throughout the Line.

All functions which can be automated shall be automated. If the Contractor identifies functions for which this is inappropriate these shall be presented for the Employer for his decision.

The design shall include on-line monitoring of equipment and process systems over the CMS. The extent of the on-line monitoring and process systems shall meet the Employer's philosophy which is that process operators and maintenance engineers shall be able to analyse the condition of a piece of equipment and/or process system over the CMS system (condition and performance based monitoring). All measurements shall be available in the CMS system.

Critical or vital components for the operation of the Line shall generally be implemented with suitable redundancy in accordance with the Contractor's experience, unless otherwise specified. Requirements to redundancy are further described in pppendix A8 *General Technical Requirements for process*.

Standardisation of makes and types of components shall be considered to the extent possible with the aim of increasing the operational availability and facilitating the maintenance of the Line as well as limiting the requirement for spare part stock, see appendix A8 *General Technical Requirements for process*.

Standardisation of local safety works switches shall be included and approved by the Employer.

Where necessary, Materials and Equipment shall be equipped with replaceable wear plates and linings.

9.1.4 CLEANING

The Employer pays high attention to cleanliness of the Line in the entire lifetime of the Line. This shall be considered in the detailed design of the Contract Object.

All components must be designed in order to allow cleaning with water and water sprays.

It shall be possible to drain and empty all components completely.

Everywhere in the design, the build-up of dust shall to the extent possible be avoided by establishing smooth surfaces, a minimum of projections etc.

9.2 Layout and arrangement of material and equipment

In the design the Contractor shall to the extent possible consider the layout of the building as illustrated in the layout drawings in appendix D *Drawings*. However, it should be noted that the layout drawings are to be considered preliminary.

The building shell cannot be changed, but minor changes to the concrete structure e.g. moving walls and doors can be proposed. The Contract Object shall be designed to avoid any lifting of equipment through the building shell during the lifetime of the Line. However, if necessary, this shall be done without affecting the primary steel structure of the building shell.

The arrangement of the Line shall be prepared by the Contractor in cooperation between the Contractor and the Employer and finally approved by the Employer.

In the arrangement of material, equipment and galleries, consideration must be given to obtaining easy and free access for operation, cleaning, testing, service and maintenance, working area and storage area for materials used for maintenance.

The Contractor shall supply all utility connections required for optimal operations and maintenance conditions, including power sockets (400/230V), water, compressed air and vacuum cleaner connections.

Stairs, platforms, railings and ladders shall be carried out as described in appendix A14.10 *Standard for Staircases and Galleries*.

The arrangement of the building shall comply with any Authority requirements for access and escape routes.

All materials and equipment which in the future will require replacement due to wear and tear must be arranged in such a way that a replacement or repair can be made easily and quickly. Special consideration must be given to the components which in case of breakdown will cause operational disruption of the Line.

The layout shall ensure good access possibilities for operator inspections, also facilitated by logical and short inspection routes. The layout of platforms, galleries, etc. shall ensure proper and safe working conditions, if needed additional platforms shall be applied to secure this purpose.

Wherever operation, maintenance and repair work so require, access doors with suitable heat and acid-proof sealing and an effective closure device shall be installed. Location and number of doors shall be agreed upon with the Employer as part of the layout. At all locations where it is necessary for the execution of repair and maintenance of the Line, the location of eyebolts and lifting arrangements, possibly in the form of tackles etc., shall be carefully considered. All gallery levels shall include lay down areas for components hoisted in by any lifting arrangements.

Contractor shall arrange all equipment in a way facilitating lifting and transportation with the overhead cranes.

The Contractor shall be responsible for optimising the Line layout and arrangement, including the galleries and working platforms necessary for operation and maintenance.

The Contract Object shall include all necessary galleries, staircases, ladders, etc. Extra galleries staircases, stairs etc. (not specified in the specifications) which the Employer finds necessary for proper access, service and maintenance of the Contract Object shall not entitle the Contractor to extra payment.

All pipes that penetrate the roof shall end minimum 2.5 m above the final roof. Safety shielding is included in the Line.

When arranging the material and equipment, the Contractor shall ensure best possible access to the individual parts. The following shall be complied with: in gangways minimum 2.5 m free vertical space from the floor, 1.0 m between main components and a width of the main access passages of 2.5 m. The number of columns and staying crosses limiting these requirements are not accepted.

To the extent possible all steel structures shall be supported on foundations along the periphery of the building, but the Contractor must expect that it may be necessary to arrange load bearing and supporting structures, especially columns in the boiler and flue gas treatment areas.

9.3 Foundations and other Building Works

Generally, all supports shall have plinths with a height of 150 mm. However, for components which require regular maintenance the plinth heights shall be adjusted to ensure good working conditions for the maintenance work. The Contractor shall suggest plinth heights for all equipment as basis for discussion and agreement with the Employer. At all penetrations and holes through floors etc. a ridge of 150 mm shall be presumed.

By means of control measurements the Contractor shall verify compliance with the specified tolerance requirements of all embedded parts, mark outs of foundation bolts and other embedded parts carried out by a Contractor or Subcontractors.

Requirements to future crane arrangements to facilitate exchange of super heater through the roof shall be described by the Contractor, especially with focus on necessary design (loads, free access etc.) of the area for the crane location.

9.4 Overall Operation Strategy

The waste incineration unit is expected to operate continuously at 100 % nominal thermal load, but it shall be possible to operate the Line continuously in all load points (≤ 100 % nominal thermal load) stated in the capacity diagram in appendix A13 *Process and Design Data* and with short peak load variations in the overload range (≤ 110 % of nominal thermal load). Please note that full compliance with the guarantee requirements shall be guaranteed for operation within the entire capacity diagram.

A steady steam production with minimum variations in steam flow, temperature and pressure in all load points of the capacity diagram is given high priority. As a basis for the design, the design data specified in appendix A13 *Process and Design Basis* shall be applied.

It shall be possible for the turbine/generator set to operate in any load point within the capacity diagram. Foreseen main continuous operation modes for the normal operation of the Line are:

1. Turbine operation where the turbine inlet control valve controls the live steam pressure and the bypass remain closed.
2. Turbine bypass operation where the turbine inlet valve is closed causing the bypass valve to control the live steam pressure.
3. Combined turbine and bypass operation with two sub modes:
 - It shall be possible to operate the turbine in power control mode, where the turbine inlet control valve adjusts the live steam flow to match an externally determined power generation set point (live steam pressure control by the bypass station)
 - If/when during above mode 1 operation thermal peak loads > 110 % occur the turbine inlet control valve shall limit the steam admission not to exceed to the max electric power output corresponding to 110% thermal load (live steam pressure control by the bypass station).

Regardless of the turbine/generator operation mode, the function of the bypass control valve is always to control the live steam pressure to a set point slightly above the nominal set point of the turbine inlet valve (except ramping up/down live steam pressure during start/stop of the boiler)

10. DESIGN DATA

General reference is made to the tables in appendix A13 *Process and Design Data* as well as the guarantee and environmental requirements stated in part II.h *Guarantees*. Furthermore the capacity diagram in appendix A13 *Process and Design Data* shall be used for dimensioning.

Process concept diagrams are enclosed in appendix A15 *Concept Diagrams for Process*, and may be used as an overview of the Line and the main components.

The dimensioning of the flue gas treatment system shall be based on the application of commercially available additives available in the Czech Republic and shall to the extent possible be based on similar consumables as used for the Existing facility.

The auxiliary equipment of the flue gas treatment system shall be capable of processing the additives so that all operational parameters as well as all consumption and guarantee data can be complied with.

The Line shall be designed to fulfil as minimum the requirements to availability and continuous period of operation stated in appendix A13 *Process and Design Data*.

10.1 Waste Characteristics

The Line shall be capable of handling minimum the types of waste listed below:

- Municipal solid waste (0-100%)
- Commercial and industrial waste (0-100%)
- Other waste fractions (as defined in appendix E8 *Approved Waste Types for Employer's Existing Line*) in excess of mixed municipal solid waste and mixed commercial and industrial waste (0-30%)

10.2 Capacity diagram and operation modes

It shall be possible to handle variations in the thermal load of the incineration unit/boiler in the range from 70 % to 100 % with short peak load variations (half hour mean values) up to 110 % of nominal thermal load according to the capacity diagram in appendix A13 *Process and Design Data*. Furthermore, it shall be possible to handle variations in the calorific value of the waste in the range from 7 MJ/kg to 13 MJ/kg.

Within the area limited by the lines through points 2-5-6-7-8-9 and 2 in the capacity diagram in appendix A13 *Process and Design Data*, the Line shall operate continuously in compliance with all guarantees, functional and environmental requirements. Furthermore, the below listed operation shall be in compliance with all guarantees, functional and environmental requirements:

- a) Operation with short peak thermal load variation (half hour mean value) within the area limited by the lines through points 2-3-4-5 and 2 in the capacity diagram (the thermal overload area).
- b) Operation with short peak mechanical load variation (half hour mean values) within the area limited by the lines through points 2-9-10-11-3 and 2 in the capacity diagram (the mechanical overload area).

It is not intended or planned to operate the Line continuously at set points at thermal overload. The variations in steam production must not result in that the Line is not able to obtain planned average nominal thermal effect and the expected/guaranteed steam and electricity production.

10.2.1 FEED WATER TEMPERATURE

The feed water temperature specified in appendix A13 *Process and Design Data* shall be used for dimensioning at the nominal load.

10.2.2 THERMAL EFFICIENCY

The incineration unit/boiler and turbine shall be designed for a maximum thermal and electrical efficiency.

Calculation of the thermal efficiency shall consider the dimensioning data for e.g. outdoor temperature, IBA temperature, IBA quantities etc. stated in appendix A13 *Process and Design Data*. Moreover, a uniform basis for calculation of the thermal efficiency is specified in appendix A20 *Procedure for Guarantee Test*.

10.3 Ambient Conditions

10.3.1 CLIMATE AT SITE

Installations affected by the outside climate shall be designed for the conditions stated in appendix A13 *Process and Design Data* and in appendix B6 *Site and Working Conditions*. Furthermore, the Contractor is responsible to make himself acquainted with the weather conditions in the Czech Republic including periods with high and low temperatures.

10.3.2 CONDITIONS INSIDE THE BUILDING

Temperatures to be taken into account when designing miscellaneous parts of the Line are stated in appendix A13 *Process and Design Data*.

10.4 Supplies and discharges

Refer to appendix A18 *Limits of Supply* for further details regarding connection to supplies at the Existing facility.

10.4.1 WATER

Fresh water and technical water supply shall be connected to the supply pipe for fresh water.

The freshwater consumption shall be minimised with consideration for the operation of the Line.

Process water will be a mixture of boiler water, clean condensate, filtered condensate, reject from make-up water system and fresh water.

The process water is to be used for the flue gas treatment in the reactor and for other users at the Line.

Please refer to appendix E2 *Quality of Water Flows* for further information on quality of water flows.

Please refer to appendix A15.4 *Concept Diagram, Water Flows* for an overview of the water flows of the Line.

10.4.2 WATER DISCHARGE

To the extent possible the process wastewater shall be returned to the process and recycled. Discharge of process wastewater is generally not accepted. However, discharge of technical water such as boiler blow down, boiler drain and boiler water from the sampling station to the Employer's existing IBA wastewater pit is allowed in case of surplus of process water/condensate under special operational conditions upon Employer's acceptance and upon fulfilment of temperature requirements.

Discharge directly to public sewer is not allowed. The Employer's existing IBA wastewater pit is connected to public sewer through a retention tank.

Recycling of process water shall be given first priority before fresh water for flue gas treatment and cooling of IBA etc. is used.

Please refer to appendix E2 *Quality of Water Flows* for further information on process water flows.

10.4.3 COMPRESSED AIR

The Existing facility has spare capacity in the existing compressed air station, which shall be used for production of compressed air for the Line. Refer to section 6.1.5.

Service and instrument air shall be supplied for the Line. appendix A13 *Process and design data* states the design values for the available compressed air.

The Contract Object shall include establishment of necessary connection points to the existing compressed air station, all necessary distribution and preparation devices.

10.4.4 COMPONENT COOLING WATER SUPPLY

The Line shall include a complete component cooling water installation. Refer to section 2.2.5.

Normally the cooling water will be supplied from the existing cooling water supply. However, full back-up cooling supply must be delivered with full continuous stand-alone functionality and safe change-over in case of failures in the supply from the existing cooling water supply.

appendix A13 *Process and design Data* states the design values for the component cooling system.

10.4.5 DISTRICT HEATING CONNECTION

The DH system shall be connected to the local DH networks through a serial connection with the Employer's existing DH producers.

The district heating system is shown in appendix A15.3 *Concept Diagram for Water/Steam Cycle and DH Connection*. The design data appear from appendix A13 *Process and Design Data*.

Requirements for inlet temperature and maximum variation appear from appendix A13 *Process and Design Data*.

The quality of the district heating water is stated in appendix E2 *Quality of Water Flows*.

10.4.6 CONSUMEABLES

The Existing facility has silos and storage tanks for activated carbon, urea and quick lime. All storage silos have spare capacity which shall be utilized for the Line. All existing silos cover injection systems, filling arrangements, weighing system and preparation devices (if applicable).

The limits of supply are described in appendix A18 *Limits of Supply* and illustrated in appendix A15 *Concept Diagrams for process*.

Reference is made to appendix E3 *Specifications for Employers consumables* for information of the consumables used in Existing facility and the existing storage tanks and silos.

10.4.7 NATURAL GAS

Natural gas shall be supplied for the auxiliary burners of the Line. The Contractor shall supply gas pressure let down, metering and supply system and all necessary infrastructure to safely supply natural gas to all consumers of the Line.

The gas system and metering shall comply with the requirements of the gas utility, the gas supplier and local or national Authorities requirements. Any needed Authorities approvals shall be obtained by the Contractor. Reference is made to appendix E1 *External Utilities Specifications*.

10.4.8 ELECTRICAL SUPPLY

The Line will be connected to the existing medium voltage switchboard R2 (22 kV), where the contractor must extend the R2 Switchboard with two sections, each with a Circuit Breaker and protection equipment, for supplying a transformer for normal operation and supplying a redundant transformer also for normal operation (see appendix A16 *Concept Diagram for Electrical System*).

Standby emergency generator supply system including UPS system, shall be established to supply selected equipment in order to secure a safe shut-down of the Line, in case of power failure.

The 22kV/6,3kV/400 V network must be expected to have voltage normally fluctuating within 90-110 % of the nominal voltage and with frequency variations between 47.5 and 51 Hz.

The electrical system and equipment shall be able to operate stable under these conditions.

The electrical system and equipment shall be designed to ensure that temporary power failures up to 1 second shall not cause any disturbances to the operation of the Line, which shall continue automatically upon resumption of normal power supply.

11. LIMITS OF SUPPLY

This section contains a definition of the supply limits. Reference is made to appendices A15 *Concept Diagrams for Process*, A16 *Concept Diagrams for Electrical System*, A17 *Concept Diagrams for CMS* and A18 *Limits of Supply*.

For specifications on external utilities are referred to appendix E1 *External Utilities Specifications*.

The major supply limits are as follows. The components mentioned as well as the coupling/connection (welding, flanges, etc.) are included in the Contract Object unless otherwise specified.

1. Combustion air
 - Primary air inlets at the waste bunker top.
 - Secondary air inlets at the IBA extractor and above the IBA conveyors.
 - Secondary air inlets at the waste bunker top or top of boiler hall.
2. Flue gas
 - Existing free stack flue gas pipe.
3. Fresh Water
 - Connection point (located nearby the Line) on the existing fresh water supply pipe.
4. Air evacuation equipment
 - Outlet to open air outside the building.
5. District Heating
 - Welded connection to pipe at connection point for DH return water downstream Employer's existing DH pumps.
 - Welded connection to pipe at connection point for DH forward water upstream Employer's existing DH condensers.
6. Compressed air
 - Welded connection to existing discharge pipe at compressed air station for instrument air
 - Welded connection to existing discharge pipe at compressed air station for service air
7. Component cooling Water
 - Outlet flange for forward component cooling water from existing component cooling system.
 - Inlet flange for return component cooling water to existing component cooling system.
8. Discharge, drains etc.
 - Connection Employer's existing IBA wastewater pit
(*Discharge only allowed under special operational conditions upon Employer's acceptance*)
9. IBA
 - Inlet to Employer's existing IBA storage facility.

10. Fly ash and residual product
 - Connection to top of Employer's existing end product silo 1 and 2 (solidification silos).
11. Natural gas
 - Connection to existing gas distribution pipe upstream existing main gas shut-off valve.
12. Urea
 - Connection to forward pipe close to Employer's existing urea storage tank.
13. Lime
 - Connection to Employer's existing quick lime storage tank.
14. Activated carbon
 - Connection to Employer's existing activated carbon storage silo.
15. Electrical
 - The termination points of the Contract Object are in general terms indicated and marked by dotted line in appendix A16 *Concept Diagrams Electrical System, "Single line diagram"* and are detailed described in the appendices A18 *Limits of Supply* and A6, *Technical Specification for Electrical Equipment*.
16. CMS
 - The termination points of the Contract Object are in general terms indicated and marked by dotted line in appendix A17 *Concept Diagrams for Automation* and are detailed described in appendices A18 *Limits of Supply* and A7 *Technical Specifications for Control and Monitoring Systems*.

12. OPTIONS

Options describe other elements of the Work not described above. The following shall be offered as options:

- | | |
|----------|--|
| Option 1 | Low temperature economizer and flue gas condensation for heat recovery from the flue gas to the DH system. Economizer and flue gas condenser to be located downstream bag-house filter and upstream ID-fan. |
| Option 2 | Design of steam system for the Line (i.e. spare threads in new headers, live steam pipe stress analysis accounting T-piece and pipe routing to the existing headers etc.) to allow for a future interconnection of steam header for the Line with steam header for Existing facility (lines K2 and K3) including all effects on the water/steam cycle of the Line. |
| Option 3 | New big-bag system for activated carbon. |
| Option 4 | New quick lime silo. |
| Option 5 | Document Management System (DMS). |

Refer to appendix A21 *Options* for specifications of the options.

13. OUTSIDE THE CONTRACT OBJECT

The Employer will be responsible for the following construction, building and electromechanical work, which is thus not included in the Contract Object:

- Existing IBA bunker and IBA treatment hall.
- Existing compressed air station
- Existing storage of urea-solution.
- Existing storage silo for quick lime.
- Existing storage for activated carbon.
- Existing storage silos/solidification silos for fly ash and residual product.
- Existing natural gas reduction station
- Stack (existing concrete structure)

14. PROCEDURE FOR REVIEWABLE DESIGN DATA

Submission of Reviewable Design Data shall serve as one of the Employer's methods for supervision of the work progress of the Contractor and verification of compliance with the requirements and conditions for the project. The progress will be supervised using both a quantitative and qualitative approach.

The Reviewable Design Data shall be submitted continuously during the process of the project and demonstrates the interconnection and optimisation of the Line design to the layout, mechanical, electrical and automation requirements of the project. The delivery of the Reviewable Design Data marks the completion of milestones in the project.

Reviewable Design Data shall comply with the agreed content and be delivered within the agreed milestones.

Reviewable Design Data shall be prepared for the following five categories:

- Project Management Data (PD)
- Layout Data (LD)
- Buildings and Civil Data (CD)
- Mechanical Data (MD)
- Electrical Data (ED)
- Automation Data (AD)

Refer to appendix C1 *Reviewable Project and Design Data* for further details.