SECTION 5A - Subsection 3: Facility Description

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3 Facility Description

The Contractor shall undertake the design and construction of following facilities of MBT facility, including supply and installation of machinery and equipment. This sub-section stipulates the minimum requirements of the facilities, machinery and equipment under the scope of this contract.

3.1 Existing Facilities

3.1.1 Leachate Treatment Plant

Leachate treatment facility is already available on the landfill site, leachate from the MBT facility will be treated by the existing treatment plant. Leachate treatment plant is not under the scope of this contract.

Floor washing wastewater from mechanical treatment facility, wheel washing unit wastewater will be generated at the MBT Facility.

Floor washing wastewater from mechanical treatment facility, wheel washing unit wastewater and percolate fermented product that does not reach the limits set by the Communique and must be disposed, will be transferred for treatment to the existing leachate treatment plant (ultrafiltration / nanofiltration) which serves the landfill.

3.2 Auxiliary facilities

Auxiliary works for the electricity distribution network, water distribution network, sewage - leachate collection system, fire detection and suppression system, internal roads, flood protection works, weighbridge building, weighbridge etc., will be constructed by the Contractor to facilitate the needs of the new MBT plant.

It is noted that currently in the site that the new MBT plant will be constructed there are a water tank and a generator. During the full development of the plant, the existing water tank has to be relocated by the Contractor, Gaziantep Metropolitan Municipality, will indicate the new position within the landfill area of the water tank.

3.2.1 Entrance and Weighbridge/Security Building

At the entrance of the area of the facility a weighbridge and security building will be installed. The personnel of the unit will be responsible to weigh and control the waste vehicles and the waste they bring.

3.2.2 Configuration Works

The formation works of the area for all the facilities concerning:

- Consolidation of the site (e.g. stone removal, bushes),

- Earthworks for the smoothing of the area (excavation and / or embankments) and creating gradients outwards for rainwater runoff. These are generally works that form the surface of the site, in order to reach the required height to accommodate individual facilities and in general of all infrastructures.

3.2.3 Administrative Building

The building will cover the administration needs of the MBT facility. The administrative building covers a surface of minimum 285 m^2. Indicatively, it will consist of the following (as minimum):

- 1 Control room
- 2 Offices
- Locker room
- Showers & WCs for men and women
- 1 Kitchen and staff rest area for at least 20 persons
- 1 meeting room
- 1 Laboratory
- 1 medical assistance room
- 1 prayer room
- Entrance halls

3.2.4 Wastewater, Excess Percolate and Leachate Collection, and Storage System

Wastewater generated in the facility, ground washing water of the mechanical separation plant and wastewater of the wheel washing unit (evaluated as leachate) will be collected and stored in a sealed septic tank.

The excess volume of the produced percolate will be collected in an underground concrete tank in which all the produced wastewater and leachate will be also collected and stored. The collected liquids will be transferred for further treatment in an appropriate wastewater treatment plant, according to the provisions of the Regulation on Surface Water Quality.

For the collection of all the above wastewater streams the necessary pipe network will be constructed with all the demanded equipment and works (inspection manholes, pumping stations, open channels, etc.).

The minimum slope of the sewer pipelines shall be 1%. Main inspection shafts for the sewer pipelines shall be standard Ø1000 mm concrete shafts (Typical Sewage Manhole) with cast iron manhole cover (40 tonnes wheel load capacity).

Domestic wastewater, washing water and similar wastewater generated during operation of the facilities will be purified to meet the discharge standards in accordance with the Regulation (Surface Water Quality published in the Official Gazette dated 30/11/2012 and numbered 28483 and Water Pollution Control Regulation published in the Official Gazette dated 31/12/2004 and numbered 25687).

3.2.5 Water Distribution Network

The facility must be supplied with clean water in order to cover the demands for its operational needs. The supply will be done through the existing network.

In the new facility a concrete tank of sufficient storage capacity will be constructed. Besides the wet chamber of the tank a pressure boosting system will be installed in order to supply with clean water all the consumers.

The water distribution pipes shall be laid in a trench bedding and backfilled. Compacting of backfill shall be done according to requirements for non-settling fill.

Service pipes to the different buildings shall be provided by tapping the water main with suitable tees and other required fittings from where the supply to the building can be connected.

3.2.6 Fire Protection System

The facility must be supplied with all the appropriate fire detection and protection equipment, according to Turkish legislation.

The site will be equipped with all the necessary equipment and protective measures in case of fire.

I. Fire detection system with all the necessary equipment such as:

   a. Addressable control panel

   b. Analog addressable optical smoke detectors

   c. Analog addressable optical smoke / heat of rise detectors

   d. Analog addressable Sirens with beacon

   e. Fire Detection Call Point

   f. etc.

II. Water Firefighting system which covers all the buildings and infrastructure and consists of:

   a. Water tank

   b. Fire fighting pressure booster system

   c. Necessary Piping for the water distribution

   d. Fire hose cabinets

   e. Portable fire extinguishers

III. Tools station (cabinet) with the necessary equipment

3.2.7 Electrical Power and Automation Works

All the electrical equipment and installations will meet the requirements of the appropriate EN, IEC and TS standards. A complete and effective system of low voltage supply and distribution shall be provided for the LV Electrical Installation. The low voltage system shall be in compliance with the national and international standards.

All feed cables up to 1 kV shall be of NYY type. All outgoing cables in the site shall be installed underground into appropriate HDPE pipes. The electrical cables will be in general unarmoured with double insulation and they will be supported and protected by cable trays, cable ladders or piping.

The electrical equipment shall include (but not limited to):

- ✓ MV equipment because of the high installed power of the facility (prefabricated kiosk, MV switchboards, MV/LV transformer, etc.)
- ✓ LV main distribution switchboard. This is the switchboard that feeds all the secondary distribution switchboards.
- ✓ LV electrical lines from the LV main switchboard to control switchboards and secondary distribution switchboards.
- ✓ Installation of new data system, with data outlets and cabling, connections, junction and distribution boxes in the Administration Building and mechanical pre-treatment building control room.
- ✓ Installation of new fire detection / alarm system, fire alarm control panel, manual pull stations, alarm horns and fire detectors.
- ✓ Installation of new exterior lighting system poles, pole mounted led fixtures, underground cabling and proper grounding system.
- ✓ LV secondary distribution switchboards for ancillary services (lights, socket outlets for maintenance, etc.…) and outgoing LV lines to machinery.
- ✓ Earthing and lightning – surge protection system for the whole plant.
- ✓ Automation electrical lines from the control switchboards to the machinery.
- ✓ UPS (Uninterruptible Power Source).
- ✓ A distribution switchboard for UPS power distribution and outgoing lines to PC, PLC and other instruments.
- ✓ Installation of a Diesel Generator for emergency and in case of mains failure.
- ✓ Installation of automation and instrumentation system

- ✓ Emergency Lighting
- ✓ Gas / methane detection system

In case of inadequacy of the existing electricity network of the landfill, installation of a new medium voltage substation will be required, in order to meet the needs of the plant.

All the machinery installed in the plant will be able to operate in automatic mode and to be controlled from dedicated PC – SCADA system, located in the control room.

All the equipment placed in hazardous areas must be designed according to ATEX regulations and provisions. The design and the installation for classified zones shall be carried out in accordance with the ATEX directive and the approved classification. All components for classified zones shall be selected in accordance with the ATEX directive (DIRECTIVE 94/9/EC OF THE EUROPEAN PARLIAMENT AND THE COUNCIL of 23 March 1994).

3.2.8 Flood Protection Works

The main aims of the flood protection works are:

- ✓ To avoid the inflow of storm water into the facility, protecting in this way its structural stability
- ✓ To protect the buildings and the roads of the landfill site from storm water erosion

The flood protection works of the site consist of the following:

- ✓ Ditches for the protection of facilities
- ✓ Ditches for the protection of internal road network
- ✓ Well for the drainage of the ditches and sewers

The ditches aim at collection and transporting the rainwater from the outside basins and the internal sub-basins. The flooding protection will be succeeded via perimetric insulated ditches outflow wells through which the water will be lead to the natural recipient.

The hydrological calculations should be made for a return period of 20 years. A safety factor has to be adopted for the maximum discharge that the ditches can convey.

It is clearly stated that rainwater that will occur throughout the facility will be collected separately from washing and similar waste waters.

3.2.9 Weighbridge and Sanitary Containers

The weighbridge & sanitary containers shall be located next to the weighbridge of the facility. Each of weighbridge & sanitary container has a surface of app. 17 m2. The weighbridge container will operate as office premises for the weight of the waste and the sanitary container will contain WC and locker room for the staff of the facility.

In the weighbridge container, the data recording system is formed which includes information such as source, code, amount of the waste accepted to the facility and the form of access to the facility.

The structures are fabricated containers which are fixed above the ground where as main support are metal columns.

Concrete elements should be made with concrete class C30/37 or as per structural analysis which will be made.

Also the concrete slab should have the thickness not less than 20 cm.

Doors and windows are made with PVC materials.

The building shall be equipped with a desk where the necessary equipment (for weighing of the incoming vehicles and recording of data) is to be installed.

3.2.10 Weighbridge

It will be installed at the entrance gate. The capacity will be minimum 60 tn with maximum intervals of 20 kg and its size approximately 69 m2. It will be automated and equipped with external weighing terminal for registration of all necessary data and information. A new weighbridge will be established, since the existing weighbridge is used for the landfill operation.

The supply must include a fully operational weigh bridge with equipment and registration system, installed and calibrated. The supply must also include all necessary signal and power supply cables between the weighbridge and the operator's office.

3.2.11 Tire Washing System

The purpose of the tire washing system is to wash out the tires of the waste collection vehicles from the internal roads of the MBT facility. The system may consist of two subsystems:

- ✓ washing subsystem equipped with:
  - movement monitoring system which starts the operation of the system
  - washing water nozzles
  - heavy duty grating for the collection of wastewaters
  - feeding pump for the washing water
  - filter
  - piping with necessary valves
- ✓ water recycling and sludge removal subsystem equipped with:

- separation of solids – clean water tank. The separation is accelerated through a PVC pipe, which leads the wastewater to the bottom of the separation tank.

- weir of clean water overflowing into the clean water tank

- excess sludge removal piping with isolation valve and hydraulic equipment

The tire washing system will be equipped with water nozzles, which create water pressure jets with appropriate pressure for the washing of the tires. A new tire washing system will be established, since the existing tire washing is used for the landfill operation and its purpose is to prevent pollution inside the facility.

The wastewater generated from the tire washing will collected in a tank (which is part of the equipment) and it will be regularly transferred to be treated in the leachate treatment plant.

3.2.12 Entrance Gate and Fence

The fence will cover the entire perimeter of the facility. It will be made of galvanized steel net (the length of the net rings > 40x40 mm) or similar. The height of the fence will be at least 2.0 m. As long as the conditions of soil allow, the fence will be dug in approximately 20 cm in the ground, in order to restrict animals from trespassing. The fence will be supplemented with a green zone of at least the same height.

The entrance gate will be of the same size as the fence, equipped with closing system. The entrance gate will be consisting of two doors. At the gate a sign with the main information of the site will be placed (operator, type of facility, working hours, phone, etc). The entrance doors will be opening, and their operation will be electrical.

3.2.13 Parking for Personnel and Visitors

The vehicles of the visitors and workers will be parked in an open parking next to the weighbridge & sanitary containers. The capacity of the parking should be at least 10 vehicles.

3.2.14 Landscaping

Inside the fencing and perimetric to the facility tree plantation is foreseen for the visual isolation of the site (average width of the plantation 3 m). An appropriate irrigation system will be developed.

<u>Grasses</u>

The type of grasses shall be proposed by the Contractor and approved by the Engineer/Employer.

Where the topsoil shall be sown with grass seed, the top 75 mm of the previously laid topsoil shall be brought to a fine tilt suitable for seeding, and sowing shall be carried out as soon as practicable after completion of top soiling having due regard to the season and the weather conditions.

After the seed has been sown uniformly, they shall be raked and lightly rolled into the surface. The young grass shall be kept free from weeds and any bare patches shall be reseeded until an even close turf is established. The grass shall be watered and rolled as required and maintained in good condition.

Trees and Shrubs

Trees and shrubs shall be of the species proposed by the Contractor and approved by the Engineer/Employer and shall be of the best quality and free from disease. They shall be young stock or in the case of shrubs may be established seedlings or cuttings. All must be sufficiently mature to survive transplanting from the supply nursery. The root systems of all plants shall be maintained intact in the soil in which they have been grown and may be supplied in containers.

Irrigation

After planting of native tree and shrub species they shall only be irrigated twice and thereafter only as required. Non-indigenous species shall be irrigated regularly until handover to the Engineer/Employer. Grassed areas shall be irrigated immediately after planting and regularly thereafter until handover. Watering of grass shall preferably be by night time sprinkler system. Irrigation shall be from overhead in all cases.

Maintenance

All new plants and grassing shall be maintained after planting. This shall take the form of irrigation, restacking, pruning, weeding, tilling, etc. to ensure sufficient growth is achieved by all plants up to handover to the satisfaction of the Engineer/Employer. Once grassed areas are sufficiently established they shall be kept cut or mown to provide a uniform depth of growth. Edges of grassed areas shall be trimmed as necessary. All new plants and grassed areas shall be protected to prevent damage from workmen, builders' plant and equipment, animals

3.2.15 General Formulation of the Area

For the communication among the infrastructure and their protection from corrosion of the soil from the rainfall, the area indicated by design drawings will be formulated with concrete or asphalt. The area will be constructed according to the ground slopes and the rainwater will be drained.

3.3 Main facilities

3.3.1 MSW Mechanical Separation Facility and Process

3.3.1.1 Introduction

The mechanical treatment facility consists of a process line composed of the following main equipment and areas:

⇒ MSW reception bunker / storage area,

⇒ Metallic hopper for MSW reception – Bag opener,

⇒ Chain conveyor for raw MSW transportation,

⇒ Rotary screen - separation size 80 / 300 mm (>300 mm to landfill),

⇒ Electromagnet for Fe separation before the ballistic separator (rotary’s screen 80-300mm fraction),

⇒ Ballistic separator with <40 mm screening that goes to the organic fraction,

⇒ NIR 2D [PVC separation] – rest of the stream to 2D sorted material,

⇒ NIR 3D [Mixed plastic],

⇒ ECS Eddy Current for aluminium separation – rest to landfill,

⇒ Electromagnet for Fe separation before the flip flop screen (<80mm stream),

⇒ ECS Eddy Current for aluminium separation before the flip flop screen (<80mm stream),

⇒ <u>Flip Flop Screen Ø20 mm for ash removal</u>

⇒ Compressors for the NIR’s feeding with air with the appropriate equipment (air tank, drier, oil filters, etc.)

⇒ Automatic bunkers for the recyclables collection (plastics),

⇒ Chain conveyor systems

⇒ Baler for recyclables (plastic),

⇒ Baler for metallic recyclables,

⇒ Fine shredder for the production of homogeneous raw 2D and 3D sorted material,

⇒ Conveyor systems for materials transportation, one way and reversible direction

⇒ Metallic supports, stairs, railings, etc. for the above-mentioned equipment.

The whole procedure will take place in a totally closed metallic building. The estimated area of the building shall be approx. 5,400 m^2. The waste reception bunkers will be closed and isolated from the rest of the facility and an air exchange of 2 times of the total air volume will take place.

The mechanical and sorting equipment will be installed in the rest of the area and the ventilation system will suck air above the equipment with suitable metallic chutes and the appropriate metallic pipes.

For a better understanding of the designed mechanical treatment facility, please refer to the relevant flow diagram and the drawings.

3.3.1.2 Analytical description

The collected MSW is discharged from the collection refuse trucks into the underground concrete bunkers.

The waste reception area shall consist of a permanent reinforced concrete construction with two underground bunkers. Each bunker shall have an effective volume of minimum 2,500 m^3 (7 meters below ground level) and occupies an area of maximum 400 m^2 (16 x 25 m). The bunkers shall be capable of storing the incoming MSW quantity for 2 days. The base of the waste reception unit shall be made of C30 reinforced concrete and non-ignitable material with a thickness of at least 30 cm to ensure tightness. In order to collect the leachate which will be formed in the waste reception area, the base shall be inclined accordingly. At the front side of each bunker, 5 heavy duty impactable doors shall be located, to allow easy, safe and fast unloading of waste trucks. Such doors and underground bunkers ensure minimization of odour and litter escapes.

The relevant calculations for the storage needs are presented below:

Table 3-1: MSW closed reception pit area characteristics

RECEPTION OF INCOMING WASTE STORAGE CALCULATION		
Total incoming yearly quantity of MSW	100,000 (Phase 1)	tn/yr
MSW density	0.40	tn/m^3
Total incoming yearly volume of MSW	750,000	m^3/yr
No of days for refuse trucks unloading	312	days/year
Daily MSW incoming quantity	961.5	tn/d
Daily MSW incoming volume	2,403.9	m^3/d
No of days for storage needs	2	days/year
Total volume for storage	4,807.8	m^3
Storage volume per bunker	2,500	m^3
Number of bunkers	2	
Total available storage volume	5,000	m^3

It is noted that any necessary removal of oversize/unwanted waste will take place at this phase with responsibility of the operator. Removal of the unwanted waste will be made by means of the hydraulic grab and the waste will be dropped in a metallic roll on/off container. Following removal, the aforementioned materials will be disposed of according to the relevant legislation.

From each reception bunker, and with the use of an automated weighbridge – hydraulic grab system, the MSW is unloaded in the metallic hopper above the bag opener whose function consists in tearing the plastic bags and releases the material which is inside them, in order to upgrade the sorting process. Use of this closed grab system prevents waste from contacting or infiltrating the ground water, sewage or surface water.

Figure 3-1: Bag opener - indicative photo

After the bag opener, the material is dropped on the chain conveyor in order to reach the pre-sorting conveyor which passes through the rotary screen.

Figure 3-2: Chain conveyor - indicative photo

The rotary screen can separate the following materials according to their size:

⇒ Fine fraction (< 80 mm)

⇒ Medium size fraction (> 80 mm and <300mm)

⇒ Coarse fraction (> 300 mm)

The fine fraction (< 80 mm)

It consists mostly of organic material and it is considered ready to proceed to the AD plant. Before that step it passes below an over belt electromagnet and an Eddy current separator in order to remove any metallic material and **gets into a flip flop screen with 20mm holes that it is mainly used for ash removal**. . It is estimated that at least 90% of ash is recovered with the flip flop screen, making ash approx. 1% of the incoming stream to the Anaerobic Digestion Facility. The ferrous and non-ferrous metals are collected in a 1 m^3 container (different for the two fractions) and the particles with size <20mm are collected in a metallic roll on/off containers.

Figure 3-3: Over belt Electromagnet – indicative photo

Figure 3-4: Flip flop screen - indicative photo

The material that passes through the above phases goes directly to the organic material reception area in the AD facility for further treatment.

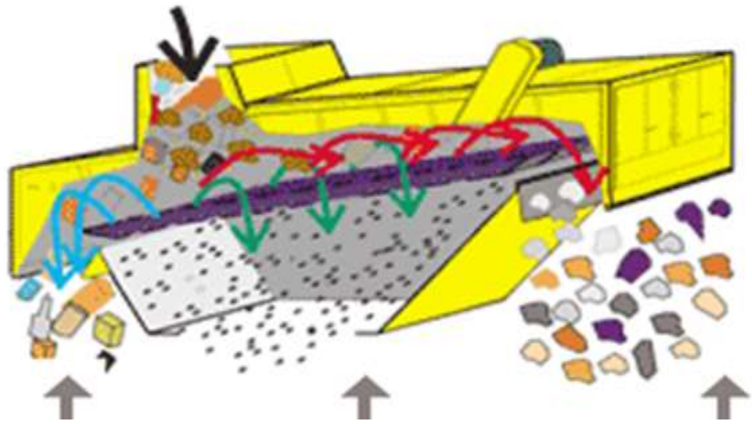
The coarse fraction (> 300 mm)

The collected materials are collected in metallic roll on/off containers and rejected to the landfill. In order to have a continuous operation, a reversible belt conveyor is used to fill the containers. When the first one is full, the conveyor starts to feed the second one.

The medium fraction (> 80 mm and <300mm)

It consists mostly of recyclable materials. This stream passes below an over belt electromagnet in order to remove any metallic material and then it is fed into the ballistic separator. The ferrous metals are also collected in a 1 m^3 container.

Ballistic also works additionally like a sieving machine. This happens because there is always a part of smaller particles that “escape” from the trommel and that needs to be removed in next steps in order to achieve streams as pure as possible. For this reason, the ballistic separator incorporates a plate with a mesh of 40 mm and this small fraction will be added to the < 80 mm fraction from the rotary screen. The parts smaller than 40 mm will be added to the organic fraction collected from the rotary drum and will be fed in the conveyor belt before the over belt magnet and the flip flop screen.



3D Heavy **Fine** **2D Light**

Figure 3-5: Ballistic separator working principle

The ballistic separator produces one 3D and one 2D fraction. The 3D fraction will get into the first optical NIR sorter for the separation of mixed plastic materials.

All the materials that are separated from the optical sorter are stored in specific storage bunkers for each material.

The rest of the above fraction will be conveyed to an eddy current separator in order to collect the nonferrous metals from the 3D fraction (mainly aluminium cans), whereas the remaining fraction will be also sent to the shredder for RDF production.

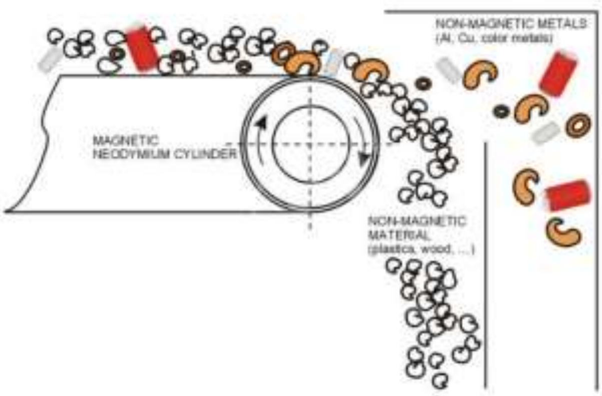


Figure 3-6: Eddy current separator working principle

The 2D fraction is generated at the upper ends of the ballistic separator. It is conveyed to an optical NIR separator in order to separate / remove any PCV plastic material.

The rest of the 2D fraction is conveyed directly to the fine shredder. The shredded material falls under the shredder and via the use of a wheel loader it is transferred in the temporary storage area. The shredded material is finally transferred in the RDF preparation facility in order to remove a percentage of the contained moisture, produce a material with ~20% moisture and to achieve the overall characteristics of RDF, according to the relevant legislation.

The RDF Preparation Plant is planned to be established in Phase 2. The derived residual waste from the mechanical treatment process in Phase 1 will be carried to licensed cement factories of Gaziantep and its surroundings, under waste code 19 12 12 (Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11).

The required flow of pressurized air for the operation of the optical sorting systems is provided by rotary air compressors of capable flow and pressure.

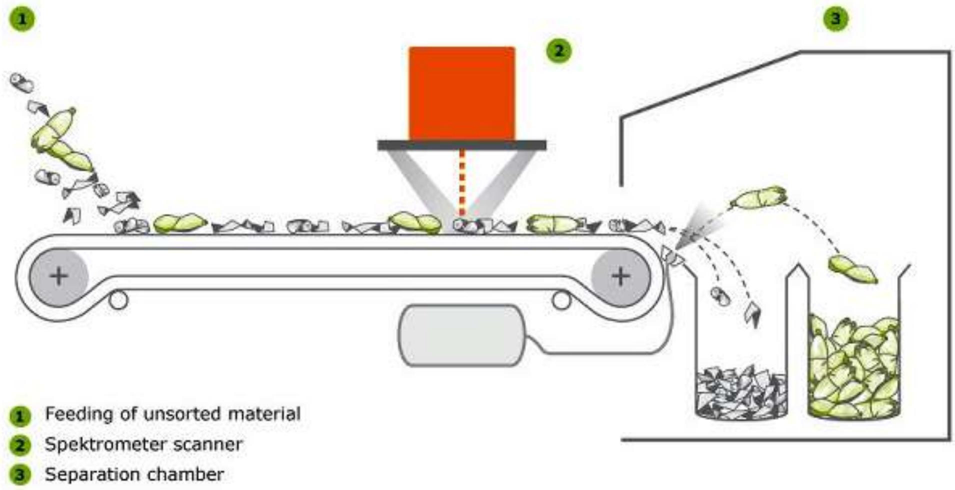


Figure 3-7: NIR separator working principle

The last process is the compaction of the recyclables. A baler press for different plastics and a baler press for ferrous and nonferrous materials are installed in the facility.

Figure 3-8: Baler press for recyclables - indicative photo

Figure 3-9: Baler press for metals - indicative photo

The several fractions that are stored in dedicated bunkers for each one of the collected recyclables are pushed by a small loader (bobcat indicative type) to the chain conveyor which transports the material into the press baler, in order to compact the material in high density bales.

The metal fractions, ferrous and nonferrous, are transported to an inclined conveyor, which discharges the material into the metal baler, in which the material is compacted in high density metal bales.

Calculations for storage of baled recyclables

Phase 1

Amount of mixed plastics recovered: 15,192 t / year

Amount of PVC recovered: 651 t /year

Dimensions of plastic baled pack: 0.6 m x 0.6 m x 0.6 m

Density of pressed and baled mixed plastic: 0.4 t /m^3

Density of pressed and baled PVC: 0.3 t /m^3

Annual production of baled blocks of mixed plastic: 37,981 m^3

Annual production of baled blocks of PVC: 2,170 m^3

Total annual production of baled blocks of mixed plastics and PVC: 40,151 m^3

Area available for plastic storage: 2 areas x 6 m length x 18 m width = 216 m^2

Height of storage: 3m

Available storage capacity for baled plastics: 216 m2 x 3 m height = 648 m^3

Days of operation: 312

Necessary emptying per year: 40,151 m^3: 648 m^3 storage capacity = ~62 emptyings

Required frequency of emptying: 312 days of operation : 62 emptyings = ~5.03 days

Given the above calculations, plastics need to be removed during Phase 1 every 5 days.

Amount of Ferrous metals recovered: 607.8 t / year

Amount of Aluminium recovered: 333.3 t /year

Dimensions of metal baled pack: 0.4 m x 0.4 m x 0.3 m

Density of pressed and baled ferrous metals: 2.4 t /m^3

Density of pressed and baled Aluminium: 1.2 t /m^3

Annual production of baled blocks of ferrous metals: 253 m^3

Annual production of baled blocks of Aluminium: 303 m^3

Total annual production of baled blocks of ferrous metals and Aluminium: 556 m^3

Area available for metals storage: (6m x 6m) + (6 m x 12 m) = 108 m^2

Height of storage: 3m

Available storage capacity for baled metals: 108 m^2 x 3 m height = 324 m^3

Days of operation: 312

Necessary emptying per year: 556 m^3: 324 m^3 storage capacity = ~1.72 emptyings

Required frequency of emptying: 312 days of operation: 1.72 emptyings = ~181 days

Given the above calculations, metals need to be removed during Phase 1 twice a year. Considering that parameter, the storage area of metals can be used to store some plastics and increase a little the storage capacity of plastics, making it once a week.

Phase 1 + 2

Amount of mixed plastics recovered: 45,577 t / year

Amount of PVC recovered: 1953.1 t /year

Dimensions of plastic baled pack: 0.6 m x 0.6 m x 0.6 m

Density of pressed and baled mixed plastic: 0.4 t /m^3

Density of pressed and baled PVC: 0.3 t /m^3

Annual production of baled blocks of mixed plastic:113,943 m^3

Annual production of baled blocks of PVC: 6,510 m^3

Total annual production of baled blocks of mixed plastics and PVC: 120,454 m^3

Area available for plastic storage: 2 areas x 6 m length x 18 m width = 216 m^2

Height of storage: 3m

Available storage capacity for baled plastics: 216 m2 x 3 m height = 648 m^3

Days of operation: 312

Necessary emptying per year: 120,454 m^3: 648 m^3 storage capacity = ~186 emptyings

Required frequency of emptying: 312 days of operation: 186 emptyings = ~1.7 days

Given the above calculations, plastics need to be removed during Phase 1+2 every 1.7 days.

Amount of Ferrous metals recovered:1,823.3 t / year

Amount of Aluminium recovered: 1,000 t /year

Dimensions of metal baled pack: 0.4 m x 0.4 m x 0.3 m

Density of pressed and baled ferrous metals: 2.4 t /m^3

Density of pressed and baled Aluminium: 1.2 t /m^3

Annual production of baled blocks of ferrous metals: 760 m^3

Annual production of baled blocks of Aluminium: 909 m^3

Total annual production of baled blocks of ferrous metals and Aluminium: 1,669 m^3

Area available for metals storage: (6m x 6m) + (6 m x 12 m) = 108 m^2

Height of storage: 3m

Available storage capacity for baled metals: 108 m^2 x 3 m height = 324 m^3

Days of operation: 312

Necessary emptying per year: m^3: 324 m^3 storage capacity = ~ 5.2 emptyings

Required frequency of emptying: 312 days of operation : 5.2 emptyings = ~ 60.6 days

Given the above calculations, metals need to be removed during Phase 1+2 every two months. Considering that parameter, the storage area of metals can be used to store temporarily some plastics and increase a little the storage capacity of plastics, making

it 2 days.

It is noted that in case that such regular removal of recyclables from the facility may not be possible, the baled recyclables will be stored in additional closed containers as indicated in the relevant drawings.

The following provisions that are given in the Communiqué Article 5.g shall be observed.

The provisions of the relevant legislation shall be applied in the management of such wastes, other than biodegradable waste, that may be treated from mechanical treatment facilities.

The provisions of the Communique on Fuels, Additional Fuels and Alternative Raw Materials Derived from Waste, shall be applied for the use of biodegradable wastes, residual wastes and / or non-residual product for RDF.

Appropriate areas shall be generated for the products and residual wastes that come out of the plant and which are not suitable for processing.

Recyclable wastes, such as paper-cardboard, plastic, glass and metal separated in the recycling conveyor will be pressed. They will be sold to licenced companies.

The RDF Preparation Plant is planned to be established in Phase 2. The derived residual waste from the mechanical treatment process in Phase 1 will be carried to licensed cement factories, of Gaziantep and its surroundings, under waste code 19 12 12.

3.3.1.3 MSW mechanical pre-treatment facility flow diagram

In this paragraph the mechanical pre-treatment facility flow diagrams per Phase 1re presented. The flow diagrams show, in a simple way, all the details that are described in the previous paragraphs.

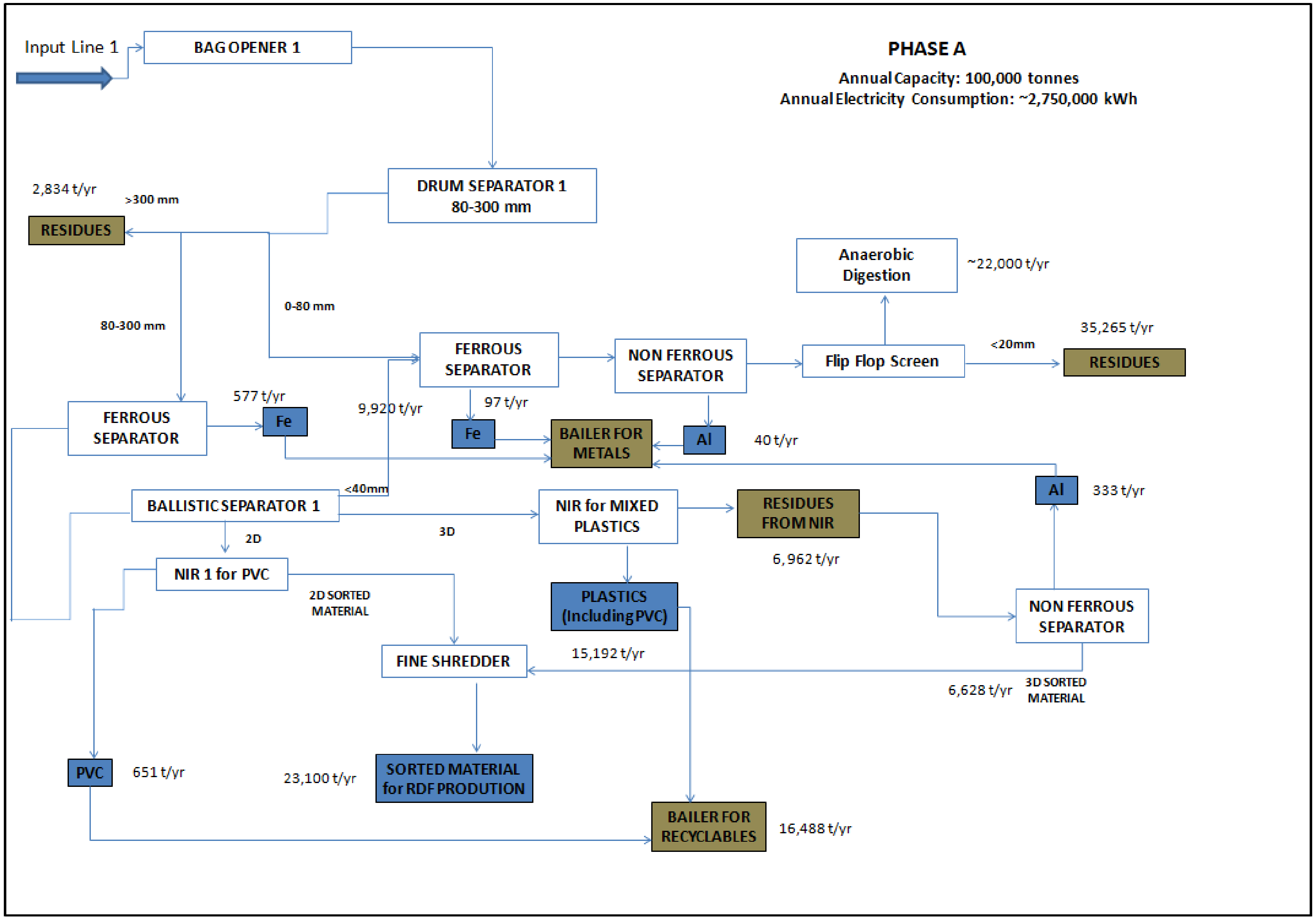


Figure 3-10: MSW mechanical pretreatment facility flow diagram – Phase 1

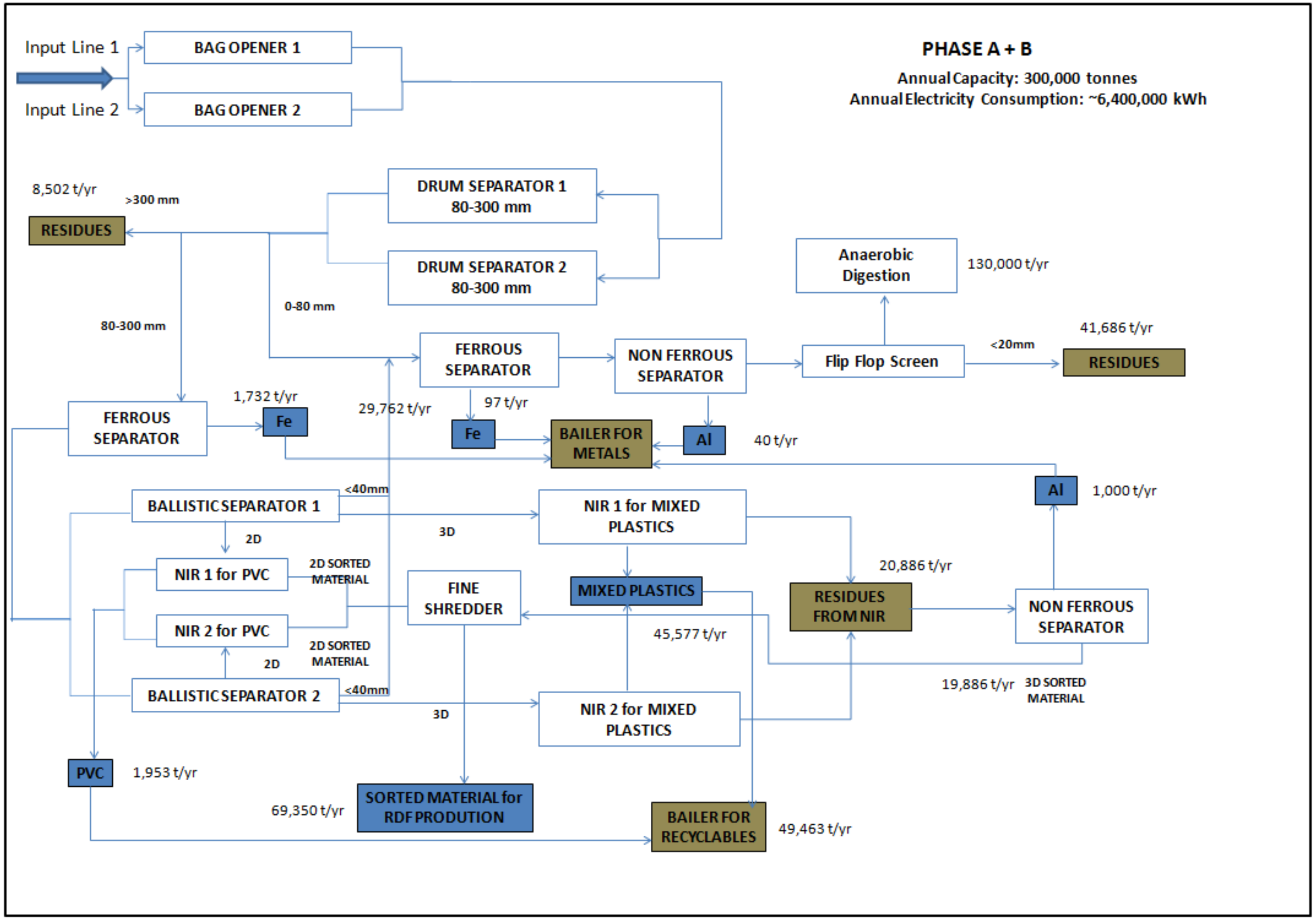


Figure 3-11: MSW mechanical pretreatment facility flow diagram – Phase 1 + 2

3.3.1.4 Polluted Air Treatment System

The aim of this chapter is to describe all the necessary measures that will be taken in order the facility to be in full compliance with the provision of the Regulation on the "Control of Odor Forming Emissions" published in the Official Gazette dated 19/7/2013 and numbered 28712, in all emission sources that cause odors.

The closed areas (e.g. MSW reception area, etc.) need to be ventilated in order to obtain a certain hourly air exchange. The collected air has to be treated so to reduce dust and/or odours before it will be discharged in the environment.

In the specific study the following data has been used for the de-dusting and deodorizing systems:

⇒ For the MSW reception area 2 air changes / hour (dust & odor removal)

⇒ For the organic fraction storage area 2 air changes / hour (odor removal)

The proposed works include:

⇒ Air ducts from inox or plastic pipes

⇒ Centrifugal fans or other type fans

⇒ Bag filter for the de-dusting of the collected air from the reception area and the mechanical sorting facility

⇒ Biofilter for the deodorization of the collected air from the reception area, the mechanical sorting facility and the AD facility

It should be noted that the MSW reception and mechanical processing shall take place in closed areas with all the doors closed, in order to avoid any dust and odour emissions escaping in the environment.

As it concerns the mechanical sorting facility, the polluted air is sucked locally, with metallic hoppers which are placed above the points where materials drop from one machine to another or above machines which because of their operation generate quantities of polluted air (e.g. trommel, ballistic separator, flip flop screen, etc.).

A collection pipe network shall be provided for the removal of the polluted air from all dust and odours emerging points. <u>The main building shall be remain to under-pressure conditions</u> in order to avoid emissions to escape through the building's openings. Polluted air will be sucked by a centrifugal fan and will be discharged initially to a bag filter where dust will be collected. The air de-dusted air then flows through a biofilter for deodorization and finally is released to the atmosphere. The dust concentration after the bag filter must be < 5 mg/m^3.

As it concerns the AD facility, the ventilation system provides sufficient ventilation for the fermenter chamber opening process. Ventilation is accomplished with a controlled piping system (stainless steel, resistant to methane gas and electrical conductivity), backpressure valves and ventilation units. The exhaust air within both the fermentation chamber is combined with the buildings air which is ultimately discharged to the atmosphere via a bio-filter.

Both de-dusting and deodorizing systems must have an efficiency level in the pollutants removal of at least 95% in accordance with the initial values.

3.3.1.4.1 Air humidifier

Humidifiers are installed on the exhaust air.

These units are used to saturate the air flowing to the biofilters in consideration of the fact that a high air humidity level is essential for the correct operation of the biofilter. The water is absorbed by the air because of the close contact and of the temperature difference between the process water and the air.

After the air humidifying process, the air flows to the biofilters. Droplet discharger is mounted on the output side to prevent too much water being transported to the biofilters.

3.3.1.4.2 Biofilter

The collected air is guided through the biofilter in order to reduce the smell before it is discharged in the environment.

The biofilter consists of a concrete basin. The biofilter floor consists of perforated concrete slabs supported by walls which allow the air to flow evenly under the complete field. The polluted air is blown into an air plenum, flows under the biofilter floor and from here through the biofilter material which consists of a mixture of wood chips and compost. The biofilter material is selected in order to optimize purification capacities, life, limited pressure losses and a good moisture holding capacity.

The micro-organisms are only active in a humid environment. Therefore, the biofilter material must be able to retain water. The target value for the humidity level of the biofilter material is between 50 - 70%. This is obtained by flowing the air through the air humidifier before passing it through the biofilter. The humidity level of the air is then in excess of 95%. The biofilter material is sprinkled regularly with clean water to wash out the ammonia poisoning.

The presence of solid substances in the air flow (dust) also has a negative effect on the operation of the biofilter material. These particles block-up the biofilter, preventing the air from flowing through. Also for this reason the air flowing from the process buildings is scrubbed in the humidifier to reduce the dust content.

Anyway a dust collection and suppression system needs to be installed on the pre-treatment and refining equipment in order to prevent excessive dust content from entering the central air treatment system.

The biofilter material has a rather long life (up to four years); however it does shrink and must therefore be topped up regularly.

3.3.2 The Anaerobic Digestion Facility Process

3.3.2.1 Introduction

As it was already mentioned, the organic fraction which is separated from the incoming MSW (the fraction with size <80mm separated at the rotary screen and the fraction with size <40mm coming from the ballistic separator) feeds the anaerobic digestion facility. As for paper, it is noted that its recovery takes place at the ballistic separator and the organic waste recovered at the first phases of the mechanical treatment contains very little paper. The overall estimated paper input in the AD process is around 2% and it shall be taken into consideration when designing the facility.

It is noted that the CHP unit is not in the scope of this contract ; however, for completeness purposes it is included in the description.

The anaerobic digestion facility consists of the following main equipment and areas:

⇒ Organic fraction reception pit / area in closed metallic building

⇒ Insulated & heated anaerobic digestion tunnels

⇒ Insulated & heated fermenter tanks – gas holders

⇒ "Lean" biogas holders

⇒ Air and gas systems for anaerobic plant operation (pipes, valves, blowers, etc.)

⇒ Automated hydraulic tunnel doors, including sealing systems and accessories

⇒ Temperature control system to monitor the tunnels temperature

⇒ Heating system for tunnels and fermenter - percolate tanks (thermal energy from CHP will be used)

⇒ Mixers or pumps where is needed in the process

⇒ Percolate collection & storage system

⇒ Percolate spraying system in the AD tunnels

⇒ Biofilters for exhaust air treatment

⇒ Early warning system for the prevention of possible gas leakage

⇒ Biogas utilization system for electricity production that consists of:

- Biogas treatment system
- Biogas blowers
- Biogas flare

In addition, temperature, pressure, pH, solids content, organic loading values, alkalinity, volatile fatty acids and biogas production in the reactors in which the fermentation process takes place will be continuously monitored.

For a better understanding of the AD facility, please refer to the relevant flow diagram and drawings. In the next paragraphs a detailed description is presented.

3.3.2.2 Analytical description

Phase 1:

⇒ AD tunnels

- ~22,000 tn/yr input material
- Minimum 21 days AD retention time
- ~16,000 tn/yr produced solid fermented material

⇒ Percolate fermenter tanks – gas holders

- Effective Volume for percolate ~ 660 m^3
- Gas storage volume ~ 500 m^3
- Lean biogas holders with volume of ~ 400 m^3

Phase 1 + 2:

⇒ AD tunnels

- ~130,000 tn/yr input material
- 30 AD tunnels of 30m x 4.5m
- 3.2m filling height, total height of tunnel is 5m
- 21 days AD retention time
- ~95,960 tn/yr produced solid fermented material

⇒ Percolate fermenter tanks – gas holders

- Effective Volume for percolate ~ 3,300 m^3
- Gas storage volume ~ 2,500 m^3
- Lean biogas holders with volume of ~ 2,000 m^3

Biogas production

Biogas production depends on actual waste composition. Biogas yield may range from 75-200 m^3/tone of incoming waste. Additionally, methane content may range from 50-75%.[1] A safe estimation is that a min. volume of 90 m^3 biogas per ton of incoming waste in the AD facility can be produced, with a 55% methane content. Considering that Methane Net Calorific Value is 9.95kWh/m3 and assuming an efficiency of electricity engine ~38%, the electricity production calculations per phase of implementation are described below.

Phase 1

90 m^3 per ton of incoming waste in the AD facility x (~21,685 t/yr incoming organic waste in the AD) = 1,951,639 m^3 / yr of biogas

Methane Net Calorific Value: 9.95 kWh / m^3

Phase 1+2

90 m^3 per ton of incoming waste in the AD facility x (~130,109 t/yr incoming organic waste in the AD) = 11,709,832 m^3 / yr of biogas

Methane Net Calorific Value: 9.95 kWh / m^3

Available Energy: 11,709,832 m^3 / yr of biogas x 55% (methane content) x 9.95 kWh / m^3 (Methane Net Calorific Value) = 64,082,054 kWh or 64,082 MWh / yr

Engine Efficiency: 38%

Energy recovered from CHP: 38% x 64,082 MWh / yr = 24,351.18 MWh / year

Estimated CHP Capacity: 3,273 kW_e

The organic fraction from the pre-treated MSW will be transferred to the AD facility with a belt conveyor and disposed in a temporary storage area from which a front wheel loader loads it and feed the AD tunnels.

The AD process takes place inside closed concrete tunnels and recirculated percolate is added to provide humidity. The different phases of degradation (i.e. hydrolysis, acid and methane formation) take place each time in the same digester.

As soon as one of the Anaerobic Digestion (AD) tunnels is ready to be filled, the wheel loader transfers the material from the temporary storage bunker into the tunnel.

Continual inoculation with bacterial matter occurs through recirculation of produced liquid, which is sprayed over the organic matter in the digester. No stirring of the organic matter is necessary during the fermentation process. The process is operated in a batch manner.

Each AD tunnel consists of a sealed concrete structure equipped with a special gas tight automated hydraulic door. The procedure is running under airtight conditions.

[1] https://www.globalmethane.org/documents/AD-Training-Presentation_Oct2016.pdf

Into the concrete floor a number of parallel plastic and flex pipes is installed. These pipes are provided with the appropriate number of spigots. In order to avoid clogging problems during the filling phase of the AD tunnel air will pass through the spigots in order to keep them open and avoid organic material to enter into the pipes. The spigots will be regularly cleaned in order to preserve their functionality. The whole piping system will be constructed in such a way that it will be easy to maintain it clean and minimize fugitive.

The reinforced concrete fermentation chamber is gas tight to prevent the infiltration of oxygen (the presence of which would cause the methane producing bacteria to become inactive). This also prevents the leakage of biogas.

The percolate from the AD tunnels is stored in insulated and heated percolate – fermentation tanks with a gas holder on the top of them.

The tunnels are equipped with an irrigation system which re-circulates the collected in the fermentation tank percolate. The irrigation system is used in the beginning of the process in order to activate the anaerobic process by inoculating the fresh material with the bacterial activity present in the fermentation tanks.

The tunnels are equipped with a number of pipes, pneumatic valves, blowers, etc., which are used to perform different actions according to the phase of the AD procedure and the provided technology.

Regarding potential incidents of ammonia inhibition, it is noted that such incidents are dealt automatically with the software installed by the provider. In any case, this is an element that is related to the operation of the AD facility and the conditions (temperature, pH, load rate, etc.) that the process takes place.

The retention time in the AD tunnels will be at least 21 days.

The produced biogas is collected from the tunnels and mixed with the biogas generated in the percolate – fermentation tanks.

At the end of the anaerobic process and in order to ensure that the anaerobic tunnel will not be opened before the methane gas is completely drawn from the chamber and safe atmospheric levels of CO_2 and H_2S are reached, the air inside the chamber is continuously measured and analyzed. The values are communicated to the SCADA system which controls the tunnels doors and the whole process. With the exception of the material loading and unloading procedures in the fermentation tunnels, the entire plant will be fully automated and controlled by PLC.

After the completion of the AD process the produced digestate is stored in a closed building or bunker which must have a capacity for one-month storage. According to legislation (Articles 10 and 11 of Law 29498), the aim of this building is to store the fermented product for at least a month in a way that will not be affected by the meteorological events.

The storage area consists of a closed metallic building which has a total surface of approx. ~2,800 m^2 and can store the incoming digestate quantity for 30 days. Below the relevant calculation of the storage needs:

Table 3-2: Digestate storage closed metallic building characteristics

DIGESTATE STORAGE NEEDS – CALCULATION		
Total yearly produced quantity of digestate	96,000	tn/yr
Digestate density	0.60	tn/m³
Total yearly produced volume of digestate	160,000	m³/yr
No of days for storage needs	30	days
Monthly digestate production	13,333	m³/m
Total volume for storage	13,333	m^3
Height of MSW stack	4.50	m
Needed surface / area	2,800	m²

The closed digestate storage building incorporates an air collection system with air exchange of 2 times of the total air volume. The collected air is further treated in the AD's deodorization system.

The percolate fermented product will be stored in tanks with a total capacity for a one-month storage. Gas collection system for collecting the biogas will be in these tanks.

In accordance with the Official Gazette (No, 29498 of 10/10/2015) on Mechanical Separation, Biochemical and Biomonitoring Facilities and Fermented Product Management Communique, Article 11.3, the following will be available at the facility:

⇒ Sealed reactor to be used for fermentation works

⇒ Temperature control system to monitor reactor temperature

⇒ The gas storage unit where the obtaining gas is collected

⇒ Unit with gas treatment system

⇒ Early warning system to prevent possible gas leakage

In the facility, a closed product warehouse will exist, where the solid fermented product will accumulate for at least one month. Rainwater, wastewater etc., will be separately collected.

Annex-3 of the Communiqué on "Organic, Organomineral Fertilizers and Soil Modifiers and Microbial, Enzyme Content and Other Products of Organic Origin, Import, Export and Export to the Market", published in the Official Gazette dated 29/3/2014 and numbered 28956, provide the criteria for the solid fermented materials and the percolate produced in anaerobic digestion facilities.

As determined by the Communiqué, the percolate fermented product will be transferred at appropriate distance and, using appropriate tools and equipment, will be injected on the ground, so as not to pollute the environment, provided that the maximum nitrogen content ending on the soil is 170 kg N / ha year. If the percolate fermented product is unable to meet these requirements, drying will be applied in order to separate solid from liquid phase.

Representative samples of the product shall be taken on a quarterly basis, based on the sampling methods specified in the Regulation on Market Surveillance and Control of Fertilizers published in the Official Gazette dated 29/3/2014 and numbered 28956. In case that input with different waste characterizations might be treated in the waste facility, the percolate and the solid fermented product quality resulting from each input will be sampled separately.

The percolate or the solid fermented material is packaged and made available in the market. It is preferred the packaging to be suitable for recovery. The above mentioned condition is not required (to be put in market) if the percolate or the solid fermented product are used directly on the producer's own land or on another land, when transferred by suitable means.

In case the percolate or solid fermented product are placed on the market the provisions of the Regulation on the Production, Import, Export and Supply to the Market of Organic, Organomineral Fertilizers and Soil Regulators and Other Products of Microbial, Enzymatic and Organic Origin shall be valid, the necessary applications shall be made and all the necessary permits shall be obtained.

In case of failing to meet the above mentioned requirements, the solid fermented product shall be disposed of in facilities having Environmental Permit and License and the percolate fermented product shall be transported from the storage tank by sewage truck to be treated to the leachate treatment plant.

3.3.2.3 Anaerobic Digestion Flow Diagram

The flow diagrams below show, in a simple way, all the details that are described in the previous paragraph.

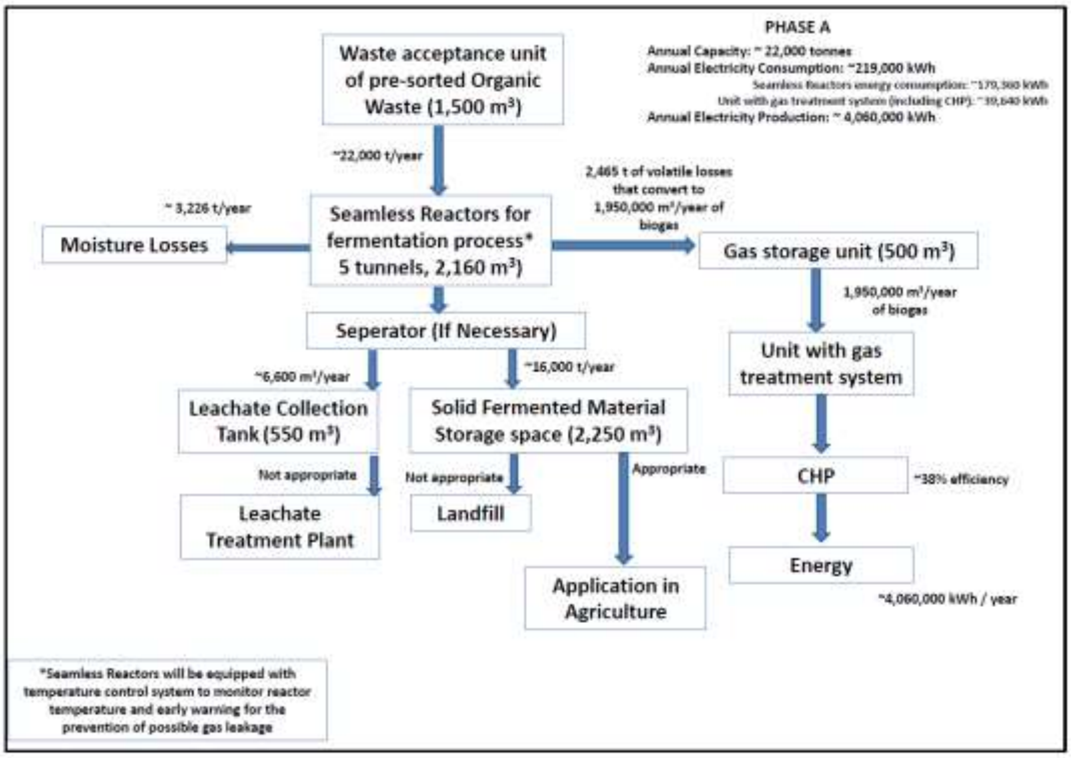


Figure 3-12: AD facility flow diagram – Phase 1

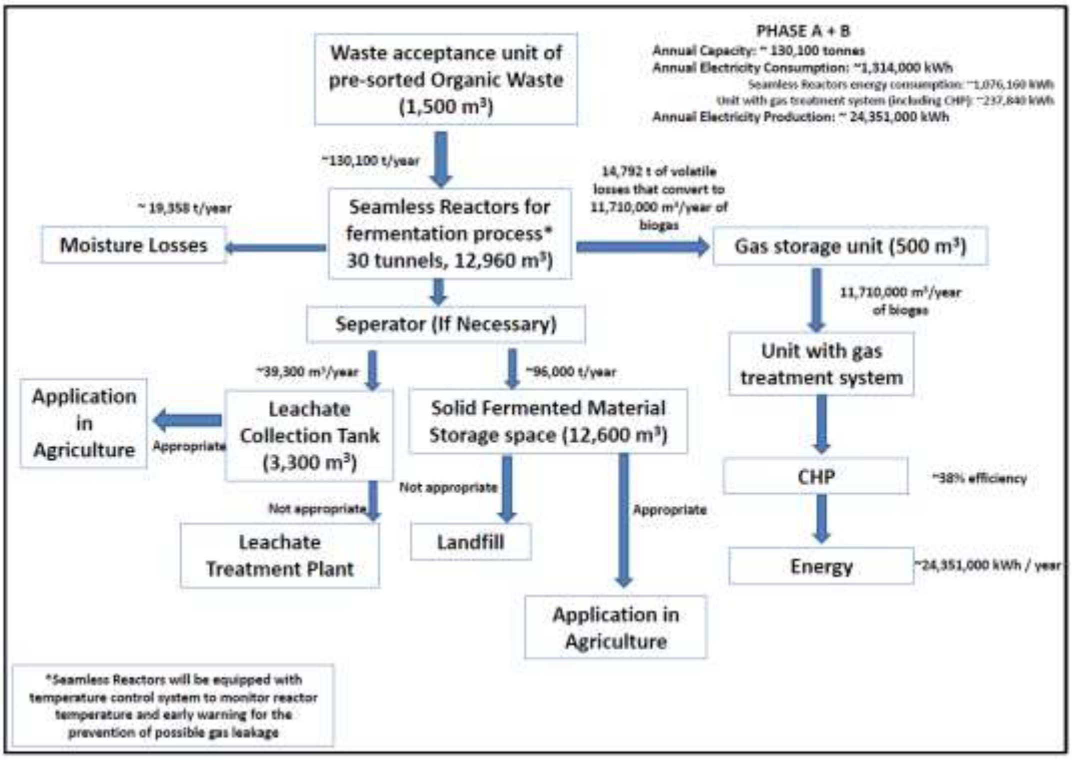


Figure 3-13: AD facility flow diagram – Phase 1 + 2

3.3.3 Emergency Combustion (Flare)

CHP is not in the scope of this contract, therefore an emergency combustion will burn the biogas produced from the facility. In emergency burning process (flare) the gas produced in the tunnels is burned safely to the atmosphere without causing any emission. The gas combustion chimney to be used shall be automatically controlled and has low gas emissions. The start / stop command of the facility will be activated and it will start automatically by opening the related valves and ignition systems. The flame will be continuously monitored with a UV sensor in the combustion chamber. The start or standby command of the chimney will be monitored.

For the purpose of the current project, considering that there is no flare in the existing facility, a flare unit with a capacity of 500 m^3 / hour is sufficient for Phase 1, while an additional flare unit with a capacity of 1,000 m^3 / hour should be installed in Phase 2. As a result, the total flare capacity for Phase 1 + 2 is estimated to be 1,500 m^3 / h.
The technical features of the flare unit to be used in the facility are given below.

- Combustion temperature: 800°C
- Methane content: 35-95% CH_4
- Gas pressure: Min. 20 mbar (without compressor) / Min. 1 mbar (with compressor)
- Connection: DN50-DN250

- Ignition: 10 kV
- Combustion control: UV Sensor

Figure 3-14: Burning Chimney (Flare) Indicative Photo

3.3.4 RDF Preparation Facility

Within the scope of this contract, the contractor shall design and construct RDF preparation facility with a NIR 1 and a fine shredder to produce raw RDF from sorted 2D. Please refer to figure 3.10 for details. Fuel will be produced from unrecoverable materials with high calorific value. The RDF Drying Facility is planned to be established in Phase 2 and is not in the scope of this contract.

The mechanical pre-treatment, through its equipment ensures the production of the 2D and 3D sorted material, which should be conveyed to the RDF Preparation Facility. In order this sorted material to be transferred it is necessary to equip the facility with a loading equipment, namely conveyor belt and a wheel loader.