# SECTION 5A - Subsection 2: Design Basis

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# 2 Design Basis

## 2.1 General

The Gaziantep MBT Facility is planned to **be constructed in two phases** – **Phase 1 & Phase 2**.

In the first phase-**Phase 1-**, which is the main scope of this bid/contract, a MBT facility will be constructed with a minimum capacity of 100,000 t/y in a single process line. The facility will operate in two shifts in order to achieve this capacity, namely processing a flow of minimum 25 t/h (taking into consideration facility's availability). An AD facility will be designed and constructed with a minimum capacity of 22,000 t/y.

In the second phase-Phase 2, the capacity of mechanical – biological treatment plant will be extended so as to satisfy the treatment needs of an incoming MSW flow of at least 300,000 t/y with an extra processing line. It is planned that the facility will operate in three shifts in order to achieve this capacity, namely processing a flow of minimum 50 t/h (taking into consideration facility's availability). As it concerns the AD facility this will be capable to treat a capacity of approx. 130,000 t/y to be capable of processing all of the incoming organic fraction. Construction and complete engineering design of phase 2 are not in the scope of this contract. The Contractor shall only provide a conceptual design for phase 2 to ensure conformity of phase 1 with phase 2 extension.

In regard to Phase 2, the Contractor shall design and construct the structural buildings (i.e. metallic building and reception area) with a closed area to meet the requirements of both phase 1 and phase 2.

The design parameters for the Gaziantep MBT Facility are set out below.

Process design of the MBT Facility shall be designed according to European Norm (EN) or other international standards. The contractor should use related design standard values. If the Contractor intends to use a patented process that is also complied with this Schedule of Requirements and Technical Specifications/Statement of Works, he shall provide all relevant information about this system with his bid.

The MBT Facility should follow the Turkish legal framework and the respective European Union (EU) legislation and should comprise the following:

- The total minimum amount of waste to be treated is **100,000 t/y at the 1st phase** and 300,000 t/y at the 2nd phase.

- The entire facility should be automated in all of the processes in accordance with "Communique on Mechanical Separation, Biodrying and Biomethanization Facilities and Management of Fermented Outputs" by Republic of Turkey Ministry of Environment and Urbanization. (Dated 10.12.2105, numbered 29498)

- The MSW reception area and the metallic building for the mechanical shorting process of the waste should be constructed under the scope of this contract for both phases (1 & 2) of the project. The machinery and equipment for stage 2 is not in the scope of this contract. The proposed reception bunkers should be constructed as underground concrete pits and each one will be served by its own bridge crane – grab system. Two bunkers for phase 1 and phase 2 are in the scope of this contract.

- The biological technology of the MBT facility is from the "family" of the Anaerobic Digestion process and more specifically should be the "Dry Anaerobic Digestion". The 1st phase of the AD process must have a capacity of 22,000 t/y. The total capacity in the 2nd phase must be approx. 130,000 t/y. Construction of 1st phase of AD with a minimum capacity of 22,000 t/y is in the scope of this contract.

**Table 2-1: Scope of construction of the MBT Facility Main Units and Equipment (phase 1)**

| **MSW Mechanical Sorting Facility** | |
|---|---|
| **Units** | **Minimum 25 t/h** |
| MSW sorting process metallic building | ✓ |
| MSW reception bunker / storage area | ✓ |
| Control room | ✓ |
| Metallic hopper for MSW reception – Bag opener | ✓ |
| Rotary drum screen | ✓ |
| Ballistic separator | ✓ |
| Baler for plastics / paper | ✓ |
| Baler for metals | ✓ |
| Flip flop screen | ✓ |
| Electromagnets | ✓ |
| Eddy-current separators | ✓ |
| Optical sorters according to the contractors' proposed design | ✓ |
| Common equipment for both lines according to the contractors' proposed design | ✓ |
| Shredder for the 2D &3D Material sorted | ✓ |
| Different type of conveyors according to the contractors' proposed design | ✓ |
| Roll on/off containers according to the contractors' proposed design & needs | ✓ |
| Air compressors and air treatment system room / area for its installation | ✓ |
| Air compressors and air treatment system for | ✓ |

| | |
|---|---|
| Optical sorters air needs | |
| **Anaerobic Digestion Facility** | |
| **Units** | **22,000 t/y** |
| Civil works | ✓ |
| Electrical & mechanical works | ✓ |
| Process equipment | ✓ |
| Reception area and mechanical sorting facility polluted air treatment equipment, according to the bidder's proposed design & needs | ✓ |
| AD required air treatment system, according to the bidder's proposed design & needs | ✓ |
| Administrative Building | ✓ |
| Wastewater, Excess Percolate and Leachate Collection - Storage system | ✓ |
| General | |
| Water Distribution network | ✓ |
| Fire protection system | ✓ |
| MV/LV substation | ✓ |
| Stand by Diesel generator | ✓ |
| Electrical distribution works | ✓ |
| Automation system | ✓ |
| Flood protection works | ✓ |
| Weighbridge and Sanitary Containers | ✓ |
| Tyre washing system | ✓ |
| Entrance gate & fence | ✓ |
| Parking for personnel & visitors | ✓ |
| Landscaping | ✓ |
| General formation of the area | ✓ |

**The layout and design of Phase 1 shall be conducted to ensure well operating in combination with the Phase 2 extension, and design shall minimize the impact of single unit failure.**

The layout of the facility and machinery shall be designed to ensure spaces for maintenance.

Provision for the addition of the units and equipment in Phase 2 shall be incorporated in each and every design discipline i.e. layout, piping and electromechanical equipment of the first phase of the MBT Facility where necessary.

**The followings for smooth operation of the facility are not in the scope of this contract;**

- **Utility connection points (Utility connections shall be made by the Contractor)**
- **Vehicles, i.e. forklifts, trucks, loaders**
- **CHP.**

## 2.2 Schedule of Guarantees

The following table presents the guaranteed sizes of the project.

**Table 2-2: Guaranteed sizes of the project**

| | **Parameters** | **Target – Binding Size** |
|---|---|---|
| **1.** | **Installation Capacity** | |
| 1.1 | Minimum Treatment Capacity for the design (Phase 1+2) | 300,000 t/y |
| 1.2 | Minimum Treatment Capacity for this Contract (Phase 1) | 100,000 t/y |
| 1.3 | Number of process lines for the design (Stage 1+2) | 2 |
| 1.4 | Number of process lines for the design for this Contract (Stage 1) | 1 |
| 1.5 | Minimum Hourly Capacity per line including 80% availability | 25 t/hr |
| 1.6 | Minimum Reception Area capacity for both bunkers | 5,000 $m^3$ |
| 1.7 | Technology for Anaerobic Digestion | Dry AD |
| 1.8 | Biological Treatment Facility Capacity (Anaerobic Digestion)<br>a) Quantity for Treatment | a) 80% of the incoming organic material (after mechanical pre-treatment) |

| | **Parameters** | **Target – Binding Size** |
|---|---|---|
| | b) Minimum Residence time | b) 20 days |
| 1.9 | Minimum RDF Production (before drying treatment) | >20% of the incoming waste quantity |
| 2 | **Recovery rates of Mechanical treatment facility from the MSW process** | |
| 2.1 | Total recovery of recyclable materials (plastics, ferrous metals, aluminum) [1] | ≥45% of the total incoming Recyclables (on wet basis) |
| 2.2 | Recovery rate on the corresponding incoming stream on wet basis [1] - Purity of materials<br>• Plastic<br>• Ferrous metals<br>• Aluminum | Recovery Rate on wet basis - Material Purity<br>≥65% w/w - ≥80%<br>≥80% w/w - ≥90%<br>≥80% w/w - ≥90% |
| **3** | **Maximum Residue to landfill [2]** | 60 % w/w of incoming MSW on wet basis (including the solid fermented material) |
| **4.** | **Specific Biogas Production [3]** | 90 $Nm^3/t$ of incoming organic waste to AD |
| **5.** | **Solid Fermented (post Digestion) material storage area** | Sufficient for storage of material for at least 30 days |
| **6.** | **Days of operation** | • 312 days per year<br>• 6 days/week<br>• Up to 3 shifts<br>As for the Anaerobic Digestion Facility and the electricity production facility from biogas, they will be operating 365 days a year on a 24-hour basis. |
| **8.** | **Availability** | The availability of the facility will be at least 80% of the hours resulting for 6 days per week operation with 8 hours per shift.<br>As for the Anaerobic Digestion and the biogas |

| | **Parameters** | **Target – Binding Size** |
|---|---|---|
| | | exploitation system, their availability should be at least 90% for 7 day operation (24 hours). |

The following are valid in order to certify the above sizes:

1) Recovery rates of the relevant incoming waste stream on wet basis results from the following formula:

**Recovery Rate (%) =**

**Recovered material (w/w on wet basis) / Amount of the material in the incoming mixed waste (w/w on wet basis)**

Proposed standard methods for determining the purity of recovered materials are:

- ASTM E889 - 82(2014) - Standard Test Method for Composition or Purity of a Solid Waste Materials Stream
- ASTM E1108 - 86(2009) – Standard Test Method for Determination of the Recovery of a Product in a Materials Separation Device

2) The percentage of residues will result from the following formula:

**Percentage of residues (%) =**

**Amount of residues to landfill (w/w on wet basis) / Incoming mixed waste (w/w on wet basis)**

3) Biogas production:

**Specific Biogas Production =**

**Produced biogas in** N**m$^3$ /** total amount of organic waste incoming to anaerobic digestion on yearly basis **(w/w on wet basis)**

4) The ability to meet the unit's operational requirements will be certified within the three-month trial period by operating the facility at full load for a given period to be determined by the Contractor and the Engineer/Employer, depending on the available incoming quantities. At the same time, consideration should be given to the other guaranteed sizes.

5) The minimum operating time per facility (mechanical treatment, anaerobic digestion, biogas utilization) will result from the following formula:

**Availability (%) =**

**Net hours of operation / (Net hours of operation + Stops for maintenance, repairs, etc.)**

## 2.3 Waste types & codes to be accepted by the facility

The waste entering the facility will be the municipal waste generated and collected from the Metropolitan Municipality of Gaziantep. The following tables show the types and codes of waste to be accepted into the relevant units of Mechanical Biological Treatment Facility. The Table below presents the waste types and codes to be accepted by the Mechanical and Biological Treatment facility. It is noted that the waste types and codes presented below are based on Annex-1A of the "Communiqué on Mechanical Sorting, Biodrying, Biomethanisation and Fermented Products Management", prepared by the Ministry of Environment and Urban Planning (published in the Official Gazette no. 29498 on 10.10.2015), and the Waste Management Regulation (no. 29314 of 02.04.2015).

**Table 2-3: Waste types and code to be accepted by the Mechanical Treatment Facility**

| Waste Code | Waste Code Description |
|---|---|
| *20 03 01* | *mixed municipal waste* |

**Table 2-4: Waste types and code to be accepted by the Anaerobic Digestion Facility**

| Waste Code | Waste Code Description |
|---|---|
| *19 12 12* | *other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11* |
| *20 01 25* | *Edible oil and fat* |

**Table 2-5: Waste types and code to be accepted by the RDF Facility**

| Waste Code | Waste Code Description |
|---|---|
| *19 12 12* | *other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11* |

### 2.3.1 Waste quality

The results of the seasonal waste composition analyses conducted from 2012-2018 in the Gaziantep landfill were used to calculate the waste composition of the area under study.

The following table presents the waste composition of the area under study.

**Table 2-6: Solid waste composition in Gaziantep**

| WASTE COMPONENTS | % NET |
|---|---|
| Kitchen wastes | 46.6% |

| WASTE COMPONENTS | % NET |
|---|---|
| Paper | 7.6% |
| Cardboard | 1.3% |
| Volume Cardboard | 0.1% |
| Plastic | 21.4% |
| Glass | 2.8% |
| Metal | 1.1% |
| Volume Metal | 0.2% |
| Waste Electric And Electricity Equipment | 0.2% |
| Hazardous waste | 0.1% |
| Garden And Park wastes | 1.1% |
| Other Not Burnable | 4.6% |
| Other Burnable | 4.9% |
| Other Burnable Volume wastes | 1.1% |
| Other Not Burnable Volume wastes | 0.3% |
| Ash (Dust. Sand. Sawdust including) | 6.8% |
| Total | 100.0% |

As it can be observed, organic is the dominant waste fraction, followed by plastic. A fact that should not be ignored is the significant amount of ash included in the waste, as well as the value of the "others" stream.

### 2.3.2 Waste quantity

The main sources regarding waste generation are the records for the solid waste disposal facility of Gaziantep. The table below presents the incoming waste loads at the solid waste landfill of Gaziantep, from 1996 until September 2018.

**Table 2-7: Incoming waste loads in Gaziantep solid waste disposal facility (1996 – 9/2018)**

| Year | Incoming solid waste (tn/yr) |
|---|---|
| 1996 | 129,300 |
| 1997 | 158,903 |
| 1998 | 179,478 |
| 1999 | 196,678 |
| 2000 | 211,538 |
| 2001 | 199,388 |
| 2002 | 224,421 |
| 2003 | 240,910 |
| 2004 | 275,233 |
| 2005 | 295,397 |
| 2006 | 364,991 |
| 2007 | 381,871 |

| Year | Incoming solid waste (tn/yr) |
|---|---|
| 2008 | 358,377 |
| 2009 | 351,488 |
| 2010 | 385,555 |
| 2011 | 438,612 |
| 2012 | 488,778 |
| 2013 | 503,734 |
| 2014 | 516,238 |
| 2015 | 547,075 |
| 2016 | 494,136 |
| 2017 | 585,701 |
| 2018 | 560,603 |

The main factors affecting waste production are: i) population growth, ii) economic development and iii) legislation. Population growth affects total waste production in such a way that the amount of waste generation per capita is multiplied by the population. Concerning the economic development, several European countries and studies have identified an interrelationship between GDP and waste generation. As for legislation, it is the factor that determines the targets for recycling, recovery and prevention of waste, thus affecting the overall waste production.

The table below presents the estimates for total waste production in the Municipalities of Gaziantep that will be served by the facility, for the period from 2019 to 2030.

**Table 2-8: Waste production estimates for the municipalities of Gaziantep that will be served by the MBT facility**

| | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|
| Araban | 10,125 | 10,442 | 10,769 | 11,107 | 11,455 | 11,815 |
| Islahiye | 20,860 | 21,514 | 22,189 | 22,884 | 23,602 | 24,342 |
| Nurdağı | 12,376 | 12,764 | 13,165 | 13,577 | 14,003 | 14,442 |
| Oğuzeli | 10,065 | 10,381 | 10,706 | 11,042 | 11,388 | 11,745 |
| Şahinbey | 279,281 | 288,037 | 297,069 | 306,384 | 315,990 | 325,898 |
| Şehitkamil | 238,635 | 246,117 | 253,834 | 261,793 | 270,002 | 278,468 |
| Yavuzeli | 6,841 | 7,055 | 7,276 | 7,504 | 7,740 | 7,982 |
| **Total** | **578,181** | **596,310** | **615,008** | **634,292** | **654,180** | **674,692** |
| | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
| Araban | 12,185 | 12,567 | 12,961 | 13,367 | 13,787 | 14,219 |
| Islahiye | 25,105 | 25,892 | 26,704 | 27,542 | 28,405 | 29,296 |
| Nurdağı | 14,895 | 15,362 | 15,844 | 16,340 | 16,853 | 17,381 |
| Oğuzeli | 12,113 | 12,493 | 12,885 | 13,289 | 13,706 | 14,135 |
| Şahinbey | 336,117 | 346,656 | 357,526 | 368,736 | 380,298 | 392,223 |
| Şehitkamil | 287,199 | 296,205 | 305,492 | 315,071 | 324,950 | 335,139 |
| Yavuzeli | 8,233 | 8,491 | 8,757 | 9,032 | 9,315 | 9,607 |
| **Total** | **695,848** | **717,666** | **740,169** | **763,377** | **787,313** | **812,000** |

## 2.4 Environmental Requirements

The MBT Facility shall fulfil the requirements in the Environmental Impact Assessment Report.

Furthermore, the MBT Facility shall fulfil the following additional environmental requirements.

### 2.4.1 Fermented Products Specifications

Based on the Communique on "Mechanical Separation, Biodrying and Biomethanation Facilities and Management of Fermented Output", the fermented products resulting from biomethanation should meet the following requirements.

**Table 2-9: Liquid fermented product quality criteria**

| Parameter | Limit |
|---|---|
| Organic Matter content | > 30% of dry matter |
| Stability | It meets at least one of the following extreme stability criteria:<br>• <50 mmol $0_2$ / kg organic matter / hour respirometric index<br>• <1,500 mg / 1 total acetic acid content organic acid<br>• Maximum 0.25 l / g volatile solid residue biogas potential. |
| Pathogens | 25g sample Salmonella spp. E. coli 1000 CFU / g fresh fermented product |
| Herb Seeds & Structure Providing Growth of Plants | 2 Live grass seeds / 1 Lt fermented product |
| Foreign Materials | Foreign substance (glass, metal, plastic and other non-biodegradable) <0.5% based on dry matter |
| Heavy metals and permanent organic compounds (Dry weight in mg / kg) | Cd: 1.5<br>Cr: 100<br>Cu: 200<br>Hg: 1<br>Ni: 50<br>Pb: 120<br>PAH16*: 6 |

**Table 2-10: Solid fermented product quality criteria**

| Parameter | Limits |
|---|---|
| pH | 5.5-8.5 |
| Value of hygiene | Uninterrupted |

| **Parameter** | **Limits** | |
|---|---|---|
| | 2 weeks at 55 ° C or<br>1 week at 60 ° C or<br>5 days at 65 ° C or<br>1 hour at 70 ° C<br>process will be seen | |
| | **Pathogens** | |
| | Total Bacteria | $1x10^3$ cfu / g or cfu / ml |
| | Enterobactericea group bacteria | < 3cfu/ml |
| | Mycobacterium spp | None (25 g or ml) |
| | Total yeast and mold | l<$10^4$ cfu / g or ml |
| | Salmonella spp | None (25 g or ml) |
| | Staphylococcus aureus | None (25 g or ml) |
| | Bacillus cereus | None (25 g or ml) |
| | Bacillus anthracis | None (25 g or ml) |
| | Clostridium spp | <2 cfu / g or cfu / ml |
| | Clostridium perfringens | None |
| | Listeria spp | None |
| | Staphylococcal Enterotoxin | None |
| | E.coli | None |
| | E.coli | 0157 None |
| Trace elements | **Parameter** | **ppm (mg/kg) Dry matter** |
| | Arsenic | 20 |
| | Cadmium | 3 |
| | Chromium | 350 |
| | Copper | 450 |
| | Mercury | 5 |
| | Nickel | 120 |
| | Lead | 150 |
| | Zinc | 1100 |
| | Tin | 10 |
| Moisture content | <30% | |
| Carbon / Nitrogen Ratio (C/N) | 10-30 | |
| Organic content (dry matter) | >35% | |
| Salts in the form of mineral ions | <10dS / cm | |
| Content of non-biodegradable foreign matter (as dry weight) | <2% | |
| Weed value | <5 pcs / lt | |
| 90% of the product will pass through a 10 mm sieve. | | |
| The presence of plastic materials or other possibly non-recycled material will not exceed 10 mm. | | |

Group (A) Tests: $C0_2$ Formation and Respiration, $0_2$ Requirements, Dewar Tests. It is imperative that the products provide stability properties for the market.

**Table 2-11: Stability Indicators**

| | Unit | | | Stability |
|---|---|---|---|---|
| Oxygen Consumption Rate (OCR) Test | mg $0_2$ / gr OM / hour | | | <0.4 |
| $CO_2$ Content Rate | mg $CO_2$-r C / gr OM / day | | | <2 |
| Dewar Test | Temperature Class | | | V |
| | Dewar Index: | | | |
| | Temperature Elevation | Class | Stability Identification | |
| | 0-10°C | V | Fully stable compost, storable | |
| Solvita Test | Index Value | | | 7-8 |

* OM: Organic Substance

### 2.4.2 Noise

The maximum acceptable noise levels are given in the next tables and are based on Annex 7 of "Regulation on Assessment and Management of Environmental Noise".

**Table 2-12: Environmental noise limits generated by industrial facilities (**Operation Phase)

| **Receptor** | **$L_{day\text{-}time}$ (dBA)** | **$L_{/evening\text{-}time}$ (dBA)** | **$L_{/night\text{-}time}$ (dBA)** |
|---|---|---|---|
| Noise sensitive areas – with training, culture and health areas, summer houses and camps | 60 | 55 | 50 |
| Combination of commercial and noise sevsitive areas – with dense residential buildings | 65 | 60 | 55 |
| Combination of commercial and noise sensitive areas with dense commercial buildings | 68 | 63 | 58 |
| Industrial areas | 70 | 65 | 60 |

**Table 2-13: Environmental noise limits generated by construction sites (Construction phase)**

| **Activity (construction, demolition and renovation)** | **$L_{day\text{-}time}$ (dBA)** |
|---|---|
| Building | 70 |
| Road | 75 |
| Other sources | 70 |

In case that during operation noise level is above the specified limits, all necessary measures to mitigate noise shall be taken. These measures include planting of trees, covering of equipment etc.

All the aspects presented in the Environmental Permit should be respected/

### 2.4.3 Odor

The Mechanical and Biological Treatment Facility shall not cause odour problems inside or outside the site's boundaries.

It is noted that the design of the facility shall be in full compliance with the provisions of the Regulation on the "Control of Odor Emissions" published in the Official Gazette dated 19/7/2013 and numbered 28712, in all emission sources that cause odors.

For this purpose, 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.

The following data need to be considered 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 dry 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. The main building shall remain in under-pressure conditions 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.

Air Humidifier

Humidifiers shall be 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 shall be mounted on the output side to prevent too much water being transported to the biofilters.

Biofilters

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

The biofilter shall consist of a concrete basin. The biofilter floor shall consist of perforated concrete slabs supported by walls which allow the air to flow evenly under the complete field. The polluted air shall be 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 shall be 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.

A dust collection and suppression system shall 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.

All the aspects presented in the Environmental Permit should be respected.

The following acceptance criteria at 24 hour average, measured at a height of 2 meters above the ground and at a lateral distance of 1.5 m away from the odor treatment unit shall be applied jointly:

- ✓ 99% removal of hydrogen sulphide (or lower than 0.5 ppmv)
- ✓ 95% ammonia removal,
- ✓ lower than 1000 OU

When respective axial fan/s of a building/tank is running, the odor value shall not be more than 1000 OU inside the buildings and at max. 1 m distance to the tanks and other odor sources. The duct dimensions shall be so selected that the minimum velocity in any duct shall not be less than 8 m/s to avoid clogging by settlement of solids.

These parameters shall be measured with sensors those are connected to SCADA system. Instant measurement and periodic measurement options should be available for these sensors. The measurement ranges of these sensors and the sensor installation point/area shall be subjected to the approval of The Engineer. Since the toxic gas measurement has a priority for the labor safety, there should be back-up system for these measurements. In addition, the communication system of these sensors should have alternatives such as Ethernet, GSM, and 3G etc.

## 2.5 Design Lifetime

The MBT Facility shall be designed so that the various components have lifetimes as set out below. These lifetimes shall apply for 24 hours continuous operation per day and also for discontinuous operation under all local climatic conditions:

- Concrete structures: 50 years
- Steel constructions: 50 years *(based on application of periodical maintenance)
- Pipes: 50 years
- Machine units, machines, fittings: 20 years
- Cables: 25 years
- Electrical equipment: 15 years
- Process control equipment, PLCs: 10 years
- Process control equipment, PCs: 5 years
- Instrumentation: 10 years.

## 2.6 Directives, Norms and Standards

The Contract shall be executed in compliance with the directives and international standards and norms listed below and all other directives and international standards and norms referred to in other parts of these Schedule of Requirements and Technical Specifications/Statement of Works.

The requirements of Turkish Standards (TS) and other Turkish regulations shall be applied if they require higher standards or specify higher quality than the Employer's Requirement or the standards referred to therein.

Any standard, which fulfils the same functionality and describes the same quality level or better, can replace any of the mentioned standards.

All structures and buildings shall be designed to withstand earthquake loads in accordance with the Turkish Regulation for Constructions to be built in Seismic Areas.

American standards will be valid in case of inadequate of standards which are specified in document.

### 2.6.1 EU Directives

- Directive 97/23/EC on the approximation of the laws of the Member States concerning pressure equipment
- Directive 2006/42/EC on machinery
- Directive 2006/95/EC on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits
- Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC
- Directive 94/9/EC on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres
- Directive 1999/92/EC on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres.

### 2.6.2 International standards and norms

- EN 14121-1 Safety of machinery - Risk assessment - Part 1: Principles
- EN 12100 Safety of machinery - Basic concepts, general principles for design
- EN 13850 Safety of machinery - Emergency stop - Principles for design
- EN 60204-1 Safety of machinery. Electrical equipment of machines. General requirements
- EN 14122 Safety of machinery. Permanent means of access to machinery
- EN 61000 Electromagnetic compatibility
- IEC 60073 Basic and Safety Principles for Man-Machine Interface, Marking and Identification - Coding Principles for Indicators and Actuators
- IEC 60439 Low-voltage switchgear and control gear assemblies
- IEC 60947 Low-voltage switchgear and control gear
- IEC 60255 Measuring relays and protection equipment
- IEC 61131 Programmable logic controllers

- IEC 61082 Preparation of documents used in electro technology
- IEC 60617 Graphical symbols for diagrams
- IEC 60076 Power transformers
- IEC 60364 Low-voltage installations
- IEC 61024 Protection of structures against lightning.

- IEC 61537-Cable management -Cable tray systems & cable ladder system

### 2.6.3 CE marking

The total installation and all parts of the MBT Facility shall be CE-marked in accordance with the Machinery Directive and related directives, norms and standards.

### 2.6.4 Installations in explosive atmospheres

All localities at the treatment plant shall be classified in EX zones in accordance with the local laws, the ATEX Directive and other related directives, norms and standards. The Contractor shall have the classification approved by the relevant local authorities. The Contractor shall obtain an ATEX Report from authorized accredited institutions.

The design and the installation shall be carried out in accordance with the ATEX Directive and the approved classification. All components shall be selected in accordance with the ATEX Directive.