НАУЧНО-ИЗСЛЕДОВАТЕЛСКИ ЦЕНТЪР НА ХИМИКОТЕХНОЛОГИЧНИЯ И МЕТАЛУРГИЧЕН УНИВЕРСИТЕТ – СОФИЯ
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NON-TECHNICAL SUMMARY

ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR

INVESTMENT PROPOSAL

Development of an Integrated System of Facilities for Treatment of the Municipal Solid Waste of Sofia Municipality

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Sofia 2008

CONTETS

Introduction

The Environmental Impact Assessment Report (EIAR) of the investment proposal for Development of an Integrated System of Facilities and Equipment for Treatment of Sofia Municipality Solid Waste is in compliance with the requirements of the Environmental Protection Act (EPA), the Ordinance on the terms and procedure for implementing an environmental impact assessment (EIA) /SG No 3/2006 and the Instructions for preparation of an EIA for investment proposals drawn up on the Practical Application of Environmental Assessment of Plans and Programmes in Bulgaria Project, MATO/BG/9/1, Sofia 2002. The EIA Report also conforms to the current provisions of the remaining acts and bylaws concerning the protection of the environment of the Republic of Bulgaria.

The team of independent experts registered in accordance with Art. 83 of the EPA, that has drawn up this EIAR is indicated in ***Application 1***. ***Application 2*** contains copies of the experts' certificates and ***Application 3*** presents declarations of the team leader and members, according to Art. 83 of the EPA.

The aim of the environmental impact assessment of the investment proposal is to identify, describe, analyse and assess the direct and indirect impacts of the investment proposal for "Development of an Integrated System of Facilities and Equipment for Treatment of Sofia Municipality Solid Waste" on the people and the environment components, including biodiversity and its elements, soil, water, air and atmosphere, landscape, subsoil, natural objects, mineral diversity and their interaction.

The present EIA Report comprises all the phases of the investment proposal implementation: construction, operation, closure and recultivation. Other alternatives by location of site and situation of cells, as well as a "zero alternative" have been considered as well. Recommendations and measures have been proposed for the impact reduction and for solution of eventual environmental problems during the investment proposal implementation and its closing down, guaranteeing protection of the human health, the environment and the sustainable development of the municipality.

1. Annotation of the investment proposal for construction, activities and technologies

1.1. Investment proposal overview

The aim of Sofia Municipality's investment proposal is ***"Development of an integrated system of facilities for treatment of Sofia Municipality solid waste"***. The integrated system of

facilities involves treatment of municipal solid waste collected as mixed waste. Feasibility studies of five sites have been made to achieve this aim, which resulted in a proposal has been made to build the following facilities on the Han Bogrov and Yana – Sadinata sites:

Yana – Sadinata site

- **A mechanical and biological treatment (MBT) facility for municipal solid waste collected as mixed waste,** including machines and equipment with a total annual capacity for treatment of 410000 t/a (1200 t/d or 50 t/h) of waste collected as mixed waste through:
  - waste separation – separation of hazardous /fire-hazardous and combustible/ and large-size components – 1000t/a; separation of metal waste for recycling – 4000 t/a;
  - mechanical treatment of waste for the purpose of production of 126000 t/a of refuse-derived solid fuel (RDF) for placing on the market;
  - biological treatment of waste with the purpose of its stabilization and production of about 61000 t/a of non-standard compost;
- **Non-hazardous waste landfill** – for disposal of about 154000 t/a (450t/d or 19t/h) of non-hazardous waste containing up to 5% of stabilized biodegraded components of the original amount of biodegradable components. Waste to be disposed of is received after the MBT of waste collected as mixed waste;

Han Bogrov site

- **A composting facility for separately collected waste from parks and gardens (green waste)** – processing of 20000 t/a (60t/d or 2,5 t/h) green waste and production of 11851 t/a of compost for placing on the market;
- **A composting facility for separately collected food waste (bio-waste or biomass)** – processing of 20000t/a of bio-waste (60t/d or 2,5 t/h) production of 11338 t/a of compost for placing on the market;

Sofia Municipality's strategy foresees separate collection and funnelling of up to 160000 t/a of waste for recycling, which is beyond the scope of this EIA Report. Separately collected waste management is based on contractual relations between Sofia Municipality and the firms for separately collected waste management.

The investment proposal takes into account the following requirements:

- Compliance with the requirements of the national and the European legislation in the field of waste management and accomplishment of the waste-management and environmental commitments undertaken by the Republic of Bulgaria after its accession to the EU;
- development and implementation of technological and technical solutions applied at least in two regions in EU member-countries with production capacities and conditions similar to those of Sofia Municipality;
- applying the waste management hierarchy giving priority to prevention of waste generation followed by reuse, recycling and other forms of waste utilisation;
- the construction and commissioning of an Integrated System of Municipal Waste Treatment shall be completed within the shortest possible term (2009- 2011);
- land areas available and specific features of the sites under review;

- lack of a suitable site for a hazardous waste landfill construction;
- ensure that the waste management-related costs after the introduction of the "Integrated system of facilities and equipment for municipal waste treatment" would be acceptable to the citizens of Sofia Municipality.

1.2. Relation to other current/planned activities

The investment proposal is in line with the National Strategy for the Environment/National Action Plan 2000-2006 and the National Waste Management Programme 2003-2007, updated plan for 2008 with regard to waste management where the integrated approach to solving the problem is of priority. This approach is adopted by Sofia Municipality and complies with the Operative Programme "Environment" 2007-2013. The goals that underlie the waste management strategy are the following:

- Expand the municipal waste separate collection;
- Recycle municipal waste components;
- Use the energy potential of municipal waste as a renewable source of energy.

The Municipal Council of Sofia Municipality specified the activities on the above goals at its session held on 22 March 2007, with the approval of the Strategy for Long-Term Waste Management of Sofia for the municipal waste treatment in the municipality until 2011. The adoption of this Strategy allows Sofia Municipality to apply to the European funds for provision of the financial resources required for construction of the facilities and equipment necessary for collection and treatment of municipal waste in the municipality. The waste management project was included in the JASPERS Programme for 2007 and an expert team has already been working on it.

The facilities and technologies proposed in the investment proposal are in compliance with the goals laid down in the ***National Strategic Plan for Staged Reduction of Biodegradable Waste Going to Landfill***. At the same time, the results from the investment proposal implementation correspond to Art. 5, paragraph 2 of Council Directive 1999/31/EC which provides for reduction of the biodegradable waste going to landfill as compared to 1995 or the last year of which Eurostat data is available:

- up to 75% – until 16th July 2006;
- up to 50% – until 16th July 2009;
- up to 35% – until 16th July 2016.

"Member States which in 1995 or the latest year before 1995 for which standardised EUROSTAT data is available put more than 80 % of their collected municipal waste to landfill may postpone the attainment of the targets... by a period not exceeding four years". Greece and Great Britain are among these member-countries. Bulgaria falls into the same category.

The investment proposal for Development of an Integrated System of Facilities and Equipment for Treatment of the Municipal Waste of Sofia Municipality" envisages building of two composting facilities – one for biodegradable waste from parks and gardens (green waste) and the other one for separately collected biodegradable food waste, which conforms to:

- The National Strategic Plan and the applications to it which say that waste from public parks, cemeteries, roadside plantations (leaves, branches, grass) etc. is usually collected separately, most often by municipal planting and landscaping firms. This waste is transported separately from the other municipal waste and is disposed of in landfills. None of the municipalities in Bulgaria have announced that composting or another kind of utilizing the garden waste is being applied within the framework of the preparation of the draft of the Strategic plan. It appears that such kind of practice has been introduced in some municipalities, Composting is usually done "in a heap", without cutting the branches and leaves in advance. For this reason the process takes long (more than a year) and the ready product is used as mulch in parks (municipality of Troyan). There are several reasons for not utilizing green waste:
    - A waste composting site is required, in compliance with Ordinance No 7/2004;
    - Municipalities have to invest money in waste cutting and screening machines, in additional jobs etc.
    - Funds are required for this investment and for operating costs, which is related to increasing local "municipal waste" charges. As local disposal charges are low now and the possible returns on the investment, which may come from the sale of compost, are so small that the municipalities prefer disposing of their green waste.
    - Last but not least, there is not enough experience in green waste composting and there is no compost market.

  Technically, green waste composting is not difficult, but it requires a lot of funds. That is why the plan envisages priority introduction of separate collection and composting (or another form of utilizing of) the green waste. Chapter 6 of the Plan specifies the measures to be taken to encourage green waste collection and recovery, as well as the amounts that need to be utilized in 2010, 2013 and 2020, and Sofia Municipality's proposal is in conformity with these measures.
- Treatment of the biodegradable fraction of municipal waste (separated from the mixed municipal waste or collected separately), which is done mostly through burning and mechanical and biological treatment (MBT). Neither method is applied yet in the municipal waste treatment in Bulgaria. So far, interest in building municipal waste MBT facilities has been taken by Plovdiv, Ruse and Veliko Tarnovo. The implementation of an Enterprise with

a Municipal Waste Treatment Facility project is in an advanced phase of its preparation, including waste separation and composting facilities, as well as a landfill with 4 disposal cells. The project will be implemented within the territory of the village of Shishmantsi in the municipality of Rakovski, on an area of 32 hectares of land. The planned capacity is 125000t/a, and there is a possibility to increase it up to 275000t/a. The municipality of Ruse has developed a "Building of Waste Composting and Separation Facilities – Ruse" project, which includes a separation facility applying a Biodegma's technology, with a planned capacity of 15000t/a.

The different countries' experience in mixed municipal waste composting followed by separation of the organic fraction from the other waste has shown that, regardless of the technological progress in compost refining or screening, the complete separation of all pollutants is impossible, the heavy metal concentration in the end product is high and use of such kind of compost may threaten the soil quality. Producers have accepted the separate collection of garden and biodegradable waste as the only way of obtaining "pure" compost.

Suitable for composting is considered to be separately collected municipal waste with less than 5% pollution. Paper and cardboard can only be composted if the printing ink does not contain heavy metals. But in this case the specific quality of the final product is lost and for this reason the collection of paper as a separate fraction is preferable. Extation of the system for separate collection of paper in Sofia will support the achievement of higher recycling rates.

Biodegradable waste separate collection and recovery has been a part of the waste management system in Germany, Austria and Switzerland, and in many municipalities of Italy since the middle of the 1990s. The effect of collection of biodegradables in the central parts of cities and towns is very small because of the use of common containers by big groups of people and the lack of conditions for controlling the "purity" of separately collected waste. The experience in separate collection of biodegradables in the central parts of Berlin shows that the degree in which biodegradables are utilized is about 30%, or 20 kg per citizen per year. These results come from 30% of the inhabitants who collect nearly 100% of their biodegradable waste, in a very "pure" state, while the remaining 70% do not take part in the process. One of the specific aims of the collection of biodegradables in these zones is to avoid throwing mixed municipal waste into the containers for non-compostable waste by those who are reluctant to participate in the system.

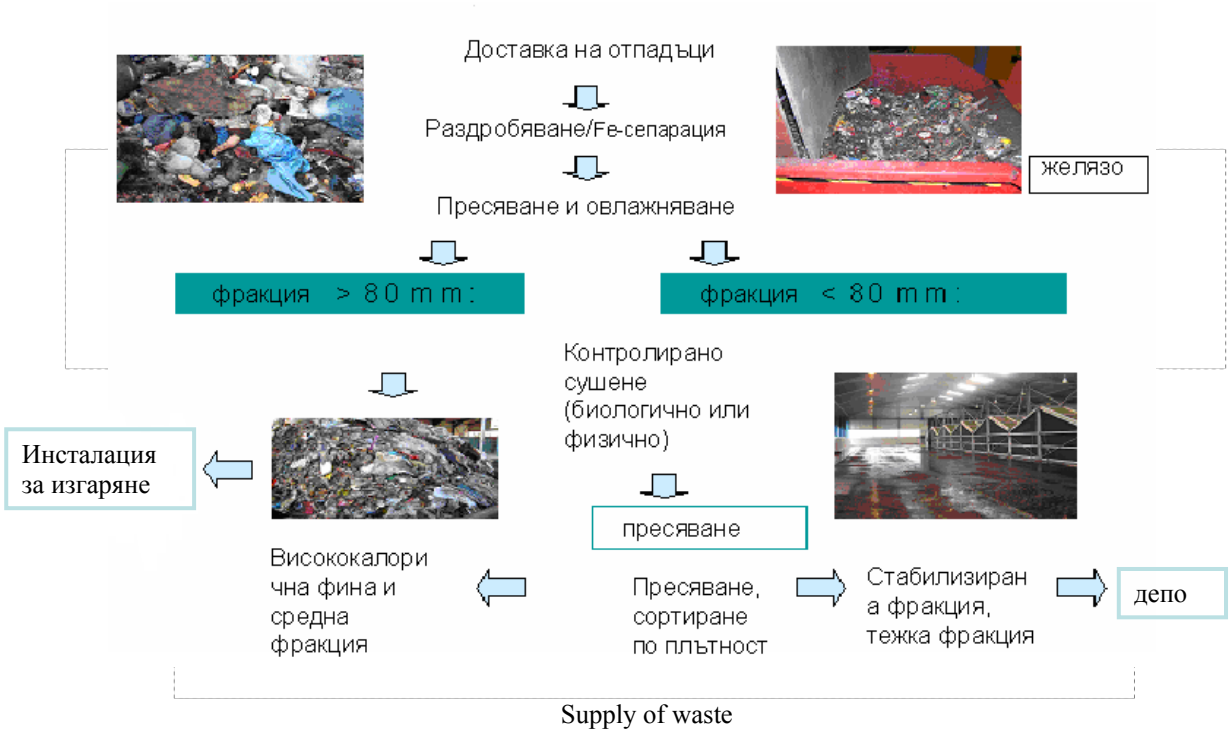
Covering of the biodegradable waste generated by commercial outlets will contribute to achievement of the goals of biodegradable waste reduction within the terms fixed. Food waste generated by big commercial sites (hotels, restaurants, supermarkets, fruit and vegetable markets)

has to be collected in separate containers. This is Sofia Municipality's idea in its investment proposal for treatment of separately collected municipal waste from big commercial establishments and markets.

The investment proposal complies with the applications to the National Strategic Plan for reduction of the biodegradable part of waste to be disposed of through mechanical and biological treatment. This is not an independent technology for waste disposal. It separates waste by dividing it in different fractions and preparing it for further recovery or disposal. The alternatives using MBT require combination with other methods of disposal of the waste fraction obtained.

This technology has two main variants. After the separation of metals and high-energy materials, the classical MBT methods produce a fraction which is disposed of after the biological treatment. The methods using stabilization, where nothing or a very small part is disposed of, aim at producing alternative fuel. Residual waste is divided in utilizable fractions (alternative fuel, metals and other). Both methods require free capacity available for co-incineration in industry, where the high-energy fractions/ alternative fuel are utilized.

Fractions like metal, plastics, paper, cardboard and textiles are first separated through screening, screening and manual sorting and the fraction enriched in organic matter and the inert materials are sent for biological treatment – composting or anaerobic fermentation. With this method of treatment, the waste biological activity decreases to 5%, compared to that of the original material and the product may be disposed of without any further adverse effects on the environment. A scheme of this process is shown in *Fig. 1.2.1.*



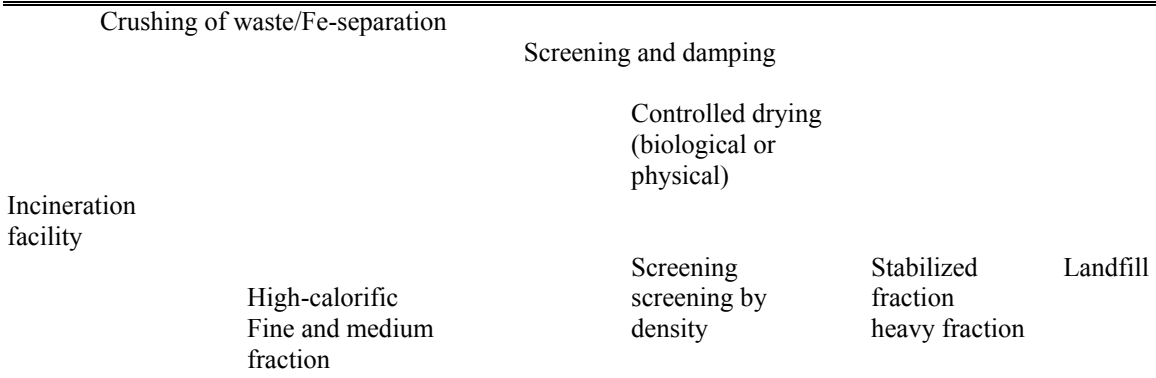


Fig.1.2.1- A typical MBT process according to the best available techniques for waste treatment industries (*shown in the Applications to the National Strategic Plan for Staged Reduction of Biodegradable Waste Amounts to be Disposed of, MOEW, 2006)*

The main MBT task is to stabilize the biodegradable fraction of waste because during the anaerobic degradation occurring in the landfill body, the following are formed in this fraction:

- Greenhouse gas which, if not captured, is released into the atmosphere;
- Leachate – if it is not treated, surface and groundwater may be polluted.

In the case of MBT treatment, the volume of disposed waste is reduced by 50 to 80%, and even more, depending on the technological solution and the type of waste, and the residual fraction to be disposed of is densified in a higher degree and more easily than non-treated waste.

MBT may combine the advantages of the thermal treatment of waste for utilization of the energy and the biological degradation of the low-calorific fraction (a fraction with high-water content). The MBT advantages to incineration consist in the possibility of applying it for a wider quantity range of waste.

Sofia Municipality's investment proposal for "Development of a System of Facilities for Municipal Solid Waste Treatment" complies with the requirements laid down in the *Programme for the implementation of Directive 1999/31/EC on the landfill of waste*, which provides for pre-treatment as an obligatory requirement of the directive. Municipal waste pre-treatment should be dealt with together with applying the requirements for biodegradable waste. In the short-term aspect efforts will be directed into the following areas:

- Pre-treatment of hazardous waste with a view to limiting the hazardous substance leachability from landfills;
- Pre-treatment of waste, for example by sorting, processing etc., which may lead to a higher degree of recycling and/or recovery of waste;
- Pre-treatment of waste from big industrial generators and reduction of the waste amounts for ultimate disposal.

1.3. Location

The investment proposal is related to treatment of Sofia Municipality waste and the location of facilities will be within its territory.

As a result of the feasibility studies made, the environmental assessments and the comparative analysis of the advantages and disadvantages of the different alternatives for sites /***Fig.1.3.1***/, Sofia Municipality suggests that the "Integrated System of Facilities for Municipal Solid Waste Treatment" should be built on two of them, as follows:

- ***The Han Bogrov site*** is located in the Milo Livade area, within the territory of the village of Gorni Bogrov in the region of Kremikovtsi, landed property №134001 and landed property №134002 with a total area of 70240m^2 of agricultural land of the V category under non-irrigated conditions. The landed properties are private municipal property and are outside the borders of urbanized areas. According to the Master Plan of the city of Sofia, the site falls into the T_{cm} development zone – areas to be used for landfills and waste treatment facilities. In a straight line from the site to the nearest built-up areas are: the village of Dolni Bogrov – 2,7 km, the village of Gorni Bogrov – 2 km, the village of Musachevo – 1,5 km, the Han Bogrov area – 1,7 km and, the village of Ravno Pole – 2,7 km (***Fig.1.3.2).*** Radioactive contamination of the soil has been established as a result of deposition of industrial waste from uranium ore processing. The contaminated areas will be scooped up to 1 m in depth and the material will be disposed of in the tailings pond near Buhovo. There is an opinion on environmental assessment No CO-01-01 of 2008, expressed by the Regional Inspectorate of Environment and Water (RIEW) – Sofia about coordination of the Zoning and Development Plan for assigning a place for municipal waste processing. The investment proposal envisages that the two facilities for composting of separately collected biodegradable waste should be located in it.
- ***The Yana – Sadinata site*** **–** located in the Sadinata area within the territory of Yana in the region of Kremikovtsi. It includes the following landed properties: № 400001, 440012, 440020, 440021, 440039, 440041, 440061 and 38001, which are private municipal property, and two landed properties – No 380011 and 3800123 – belonging to natural persons from the map of restored property (***Fig.1.3.3***). The distance from Sofia Airport is 13200 m, which meets the requirements of Ordinance No 14 of 2000. The investment proposal plans to locate the mechanical and biological treatment facility for municipal solid waste collected as mixed waste and the non-hazardous waste landfill on this site. A procedure of making an environmental assessment of the Detailed Site Development Plan (PUP) and the Zoning and Development Plan (PRZ) has been carried out for the two facilities mentioned above, in accordance with a letter from the RIEW – Sofia (***Application 7)***.

Bearing in mind the restrictive conditions, laid down in Art. 9 of Ordinance 7/2004 on the requirements for sites determined for placing of waste treatment facilities (*promulgated in SG*

81/17.09.2004), there are no archaeological or architectural monuments on either of the sites, no unfavourable engineering and geologic conditions (landslides, landslips, etc.) and no karst have been found on them; they are not located on derelict mines and they are not in danger of sliding or falling in; they are not situated in belts I and II of sanitary guarded areas of water sources and drinking water supply facilities, or mineral water sources; they do not affect any open-pit mining mineral deposits; they are bounded by the protection dike of an irrigation canal. The location of the alternative sites studied is shown in ***Fig.1.3.1***, and the distance from the sites proposed to the nearest populated areas is shown in ***Fig. 1.3.2*** and ***Fig.1.3.3***.

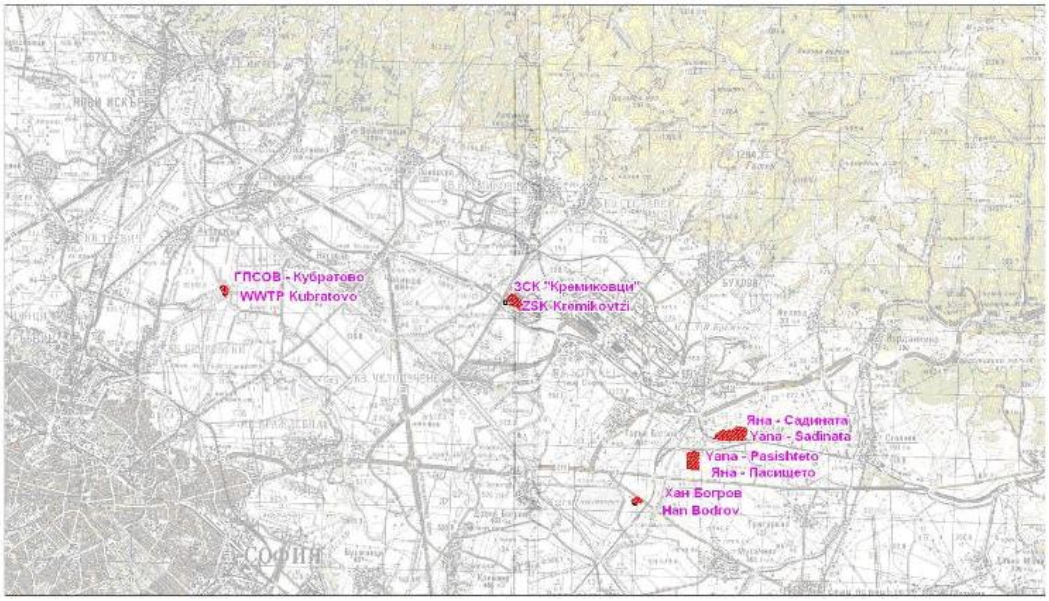


Fig. 1.3.1 – Location of the sites proposed (***Yana-Sadinata*** and ***Han Bogrov***) for placing of waste treatment facilities and their alternatives

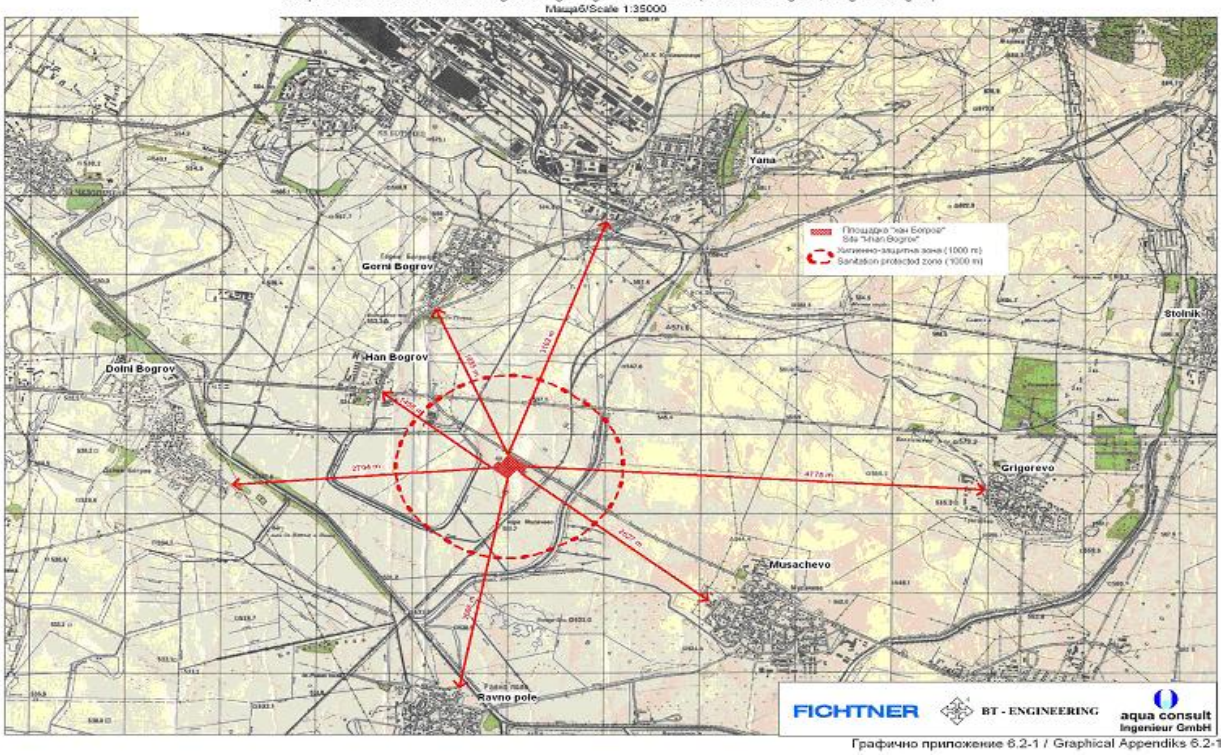
The Detailed Site Development Plan (PUP) and Zoning and Development Plan (PRZ) elaborated for the ***Han Bogrov*** and ***Yana-Sadinata*** sites for assigning a place for a municipal waste treatment plant comply with and are bound by the aims and activities described in the Master Plan of the city of Sofia approved in 2006, as well as its subsequent amendments. The transport accessibility of the Han Bogrov site is solved by the Sofia – Elin Pelin intercity road. Access is also possible by the adjoining country roads leading to the southeast and the northwest (Opinion of the Road Infrastructure Agency).

The transport accessibility of the ***Yana-Sadinata site*** is regulated with Letter № 26-00-3697/0910.2006 of Sofia Municipality to the Chief Architect of Sofia concerning the need for preparing a Detailed Site Development Plan (***Application 6.).*** The Botevgradsko Shose Boulevard has been pointed as a possible access outside the boundaries of the main urban part, which joins the Hemus highway in the out-of-town part and from there, through the off-highway junction in the area after the village of Yana, it joins a country road which is 1000 m from the Hemus highway and

is 3 m wide, which is to connect the future site with the republican road network through Hemus Highway.

The country road is not wide enough to ensure two-way movement of the vehicles. For this reason the route scheme will include it for use as a one-way access and a possibility is to be sought to design a road for exit from the area of the future site.

Фиг. 1.3.2 Карта на отстоянията на площадката от съседните населени места (м. "Хан Богров", с. Горни Богров)
Map for the distance between neighbouring villages and the site (area "Han Bogrov", vilage G. Bogrov)
Мащаб/Scale 1:35000



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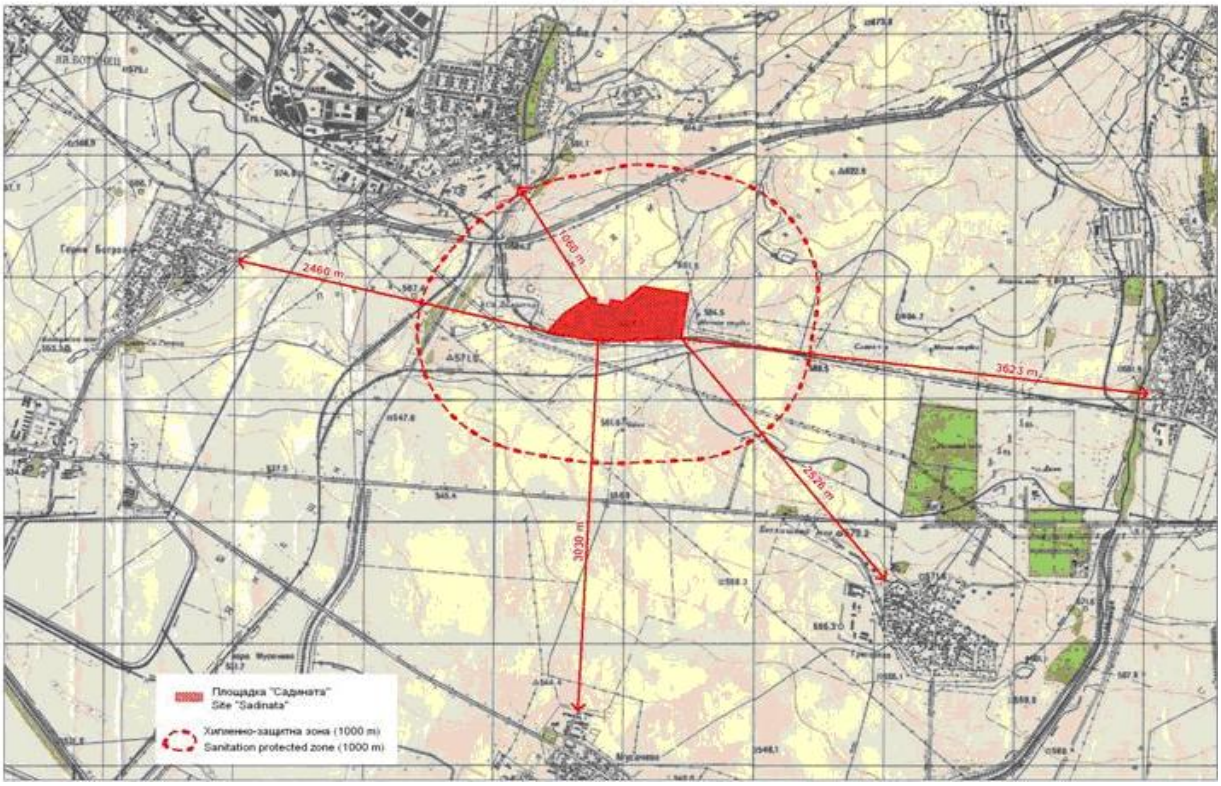
Фиг.1.3.3 Карта на отстоянията на площадката от съседните населени места (м. "Садиматa, с. Яна)
Мащаб 1:25000



Access may also be provided through a turn-off to the north of the highway, along the village of Yana, and to the south under the highway bridge. A part of the road is covered with asphalt, the other part is macadam and about 500 running metres are a cart road. The road load of this route is heavy – the road network parameters have been determined for the traffic intensity of a highway – and in case of using the above route the vehicles waste transporting have to use the right-most lane of the highway.

It is also possible to use railway transport to carry modified refuse-derived fuel (RDF), depending on the arrangements with the users.

1.4. Land areas necessary for construction, operation, closing down and recultivation

The investment proposal for Development of an Integrated System of Facilities for Treatment of the Municipal Solid Waste of Sofia Municipality envisages implementation on two ***sites***: 2 composting facilities on the ***Han Bogrov site*** and an MBT facility and a non-hazardous waste landfill on the ***Yana-Sadinata site***.

The ***Yana-Sadinata site*** covers an area of 33, 2835 hectares of land and is bounded: by municipal properties to the west; by private properties to the north; by the Yaninski Valog River to the east and by an irrigation canal and the Sofia – Burgas railway line to the south. According to a

sketch made by the land registry service, the land of the site belongs to Sofia Municipality, the Mayor's Office of Yana. The ownership of land is "municipal private". Two of the properties that are within the boundaries of the site are privately owned and the municipality has carried out the procedure necessary to acquire ownership of them. The site under review comprises landed properties №№: 440013, 440021, 440020, 440039, 400001, 440041, 440061, 380013, 380012 and 380011. (See ***Fig.1.4.1)*** A large part of the site land belongs to the "arable land" group. The type of permanent use of the land of the properties included is of the IV category "fields" (Act No 14 of 19.07.2006 for categorization of agricultural land at change of its designation – ***Application 11***) under non-irrigated conditions). No procedures for changing the designation of the land use, forestry-related procedures or other kind of activities have been carried out in the scope of the site studies.

The lands necessary for and the location of waste treatment facilities on the ***Yana-Sadinata site*** are shown in ***Fig. 1.4.2.*** and are as follows: receiving premises (Building 1) – 0,5 ha; biofilter (B1 and B2) – 2 in number, 0,2 ha; mechanical treatment (Building 2) – 0,3 ha; biological treatment (Building 3) – 2,8 ha; production of modified refuse-derived fuel (Building 4) – 0,3 ha; post-biological treatment (Building 5) – 1,44 ha; refining the compost produced from the mechanical and biological treatment (Building 6) – 0,2 ha; non-hazardous waste landfill: Cell 1 – 3,6604 ha ; Cell 2 – 2,5823 ha; Cell 3 – 3,9865 ha; Cell 4 – 3,366 ha;

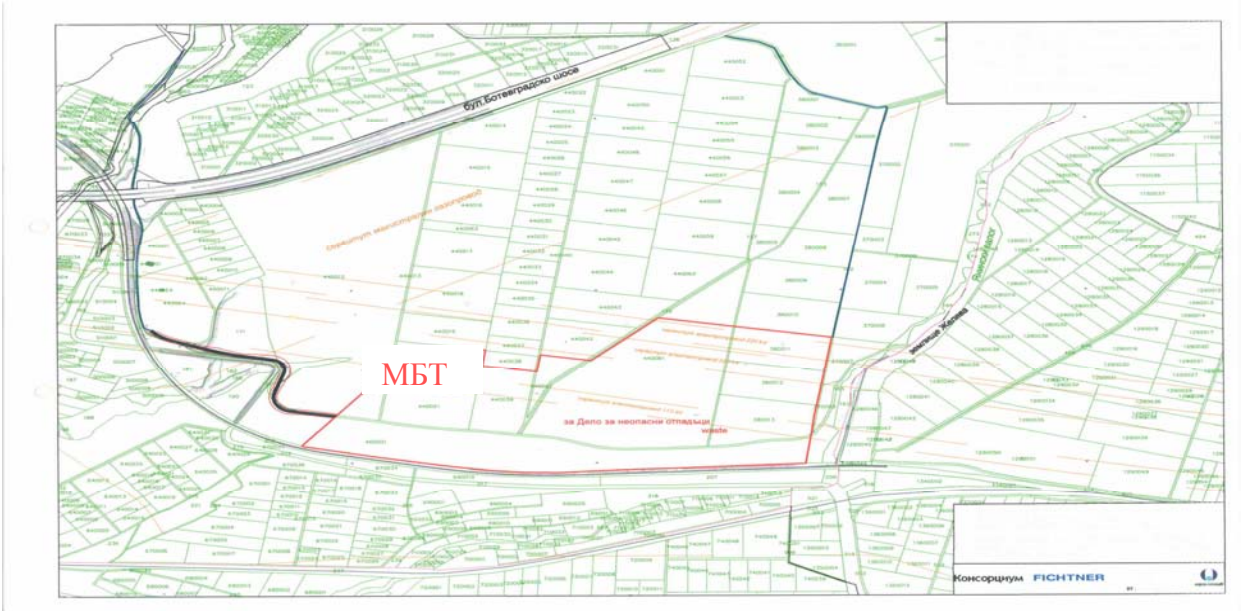


Fig. 1.4.1 – Lands the ***Yana-Sadinata site*** is located on

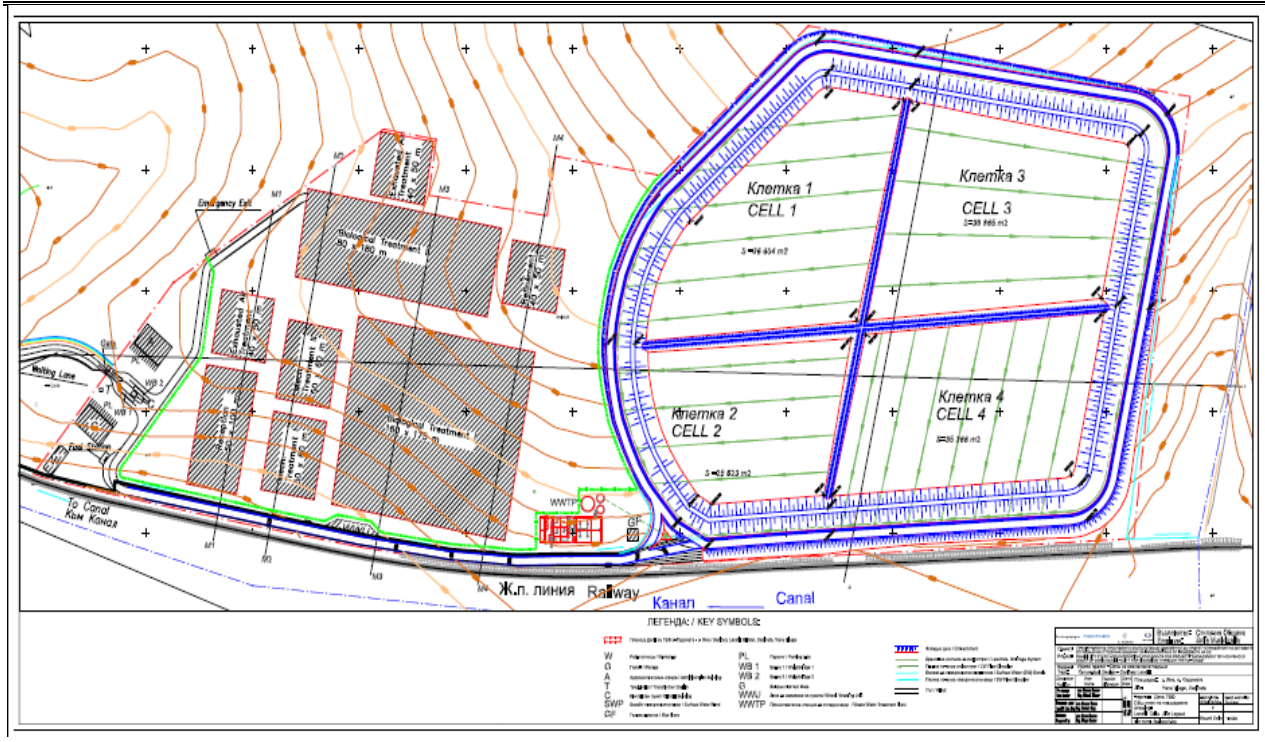


Fig. 1.4.2 – Equipment layout on the ***Yana-Sadinata site***

The ***Han Bogrov site*** covers an area of 7, 0238 hectares of land. The landed properties the site is located on are shown in ***Fig.1.4.3*** and this land is enough for the envisaged composting facilities. The ownership of land is entirely municipal (landed property № 134001) after the private plot (landed property № 134002) was purchased by Sofia Municipality in 2007. The site comprises non-urbanized area within arable agricultural land of the V category under non-irrigated conditions. A Detailed Site Development Plan and a Zoning and Development Plan (PUP-PRZ) have been worked up and an environmental assessment has been made, and then approved by the RIEW – Sofia (***Application 10***). The location of main facilities and auxiliary equipment is shown in ***Fig.1.4.4.***

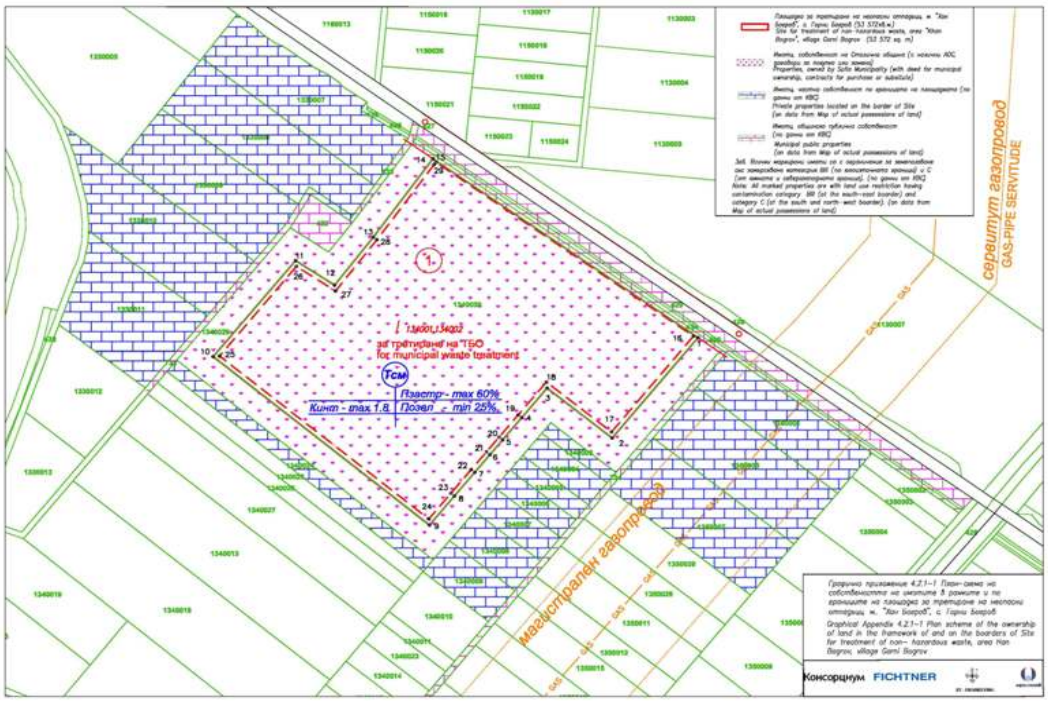


Fig. 1.4.3 – Land properties the ***Han Bogrov site*** is located on

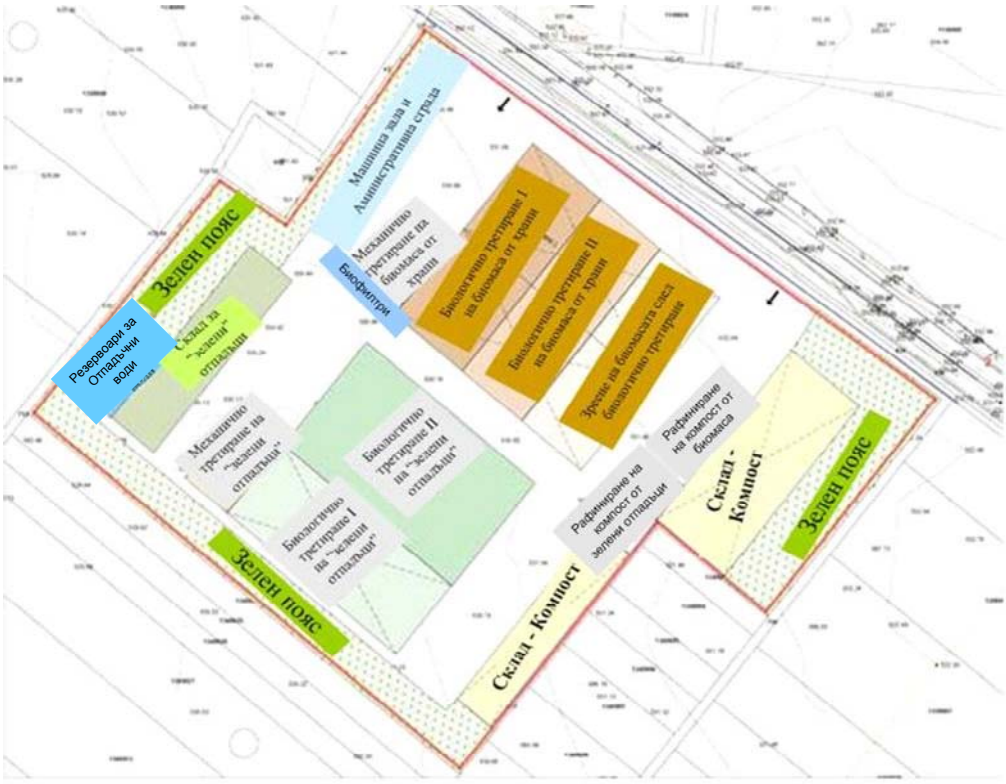


Fig. 1.4.4 – Location of the waste treatment facilities on the ***Han Bogrov site***

The construction of two composting facilities has been planned here. One facility is for composting of garden waste collected by planting and landscaping firms, the so called "green waste", and the other one is for composting of biomass from food waste collected from large commercial outlets (hotels, restaurants, markets etc.). The lands required for the above facilities are:

- ***Biological treatment (composting) of garden waste (green waste)***
  - Incoming waste storage – 0,25 ha;
  - Mechanical treatment of waste – 0,1125 ha;
  - Biological treatment, I phase – 0,4950 ha;
  - Biological treatment, II phase – 0,6820 ha;
  - Screening, separation – 0,05 ha;
  - Ready compost from "green waste" storage – 0,25 ha;
- ***Biological treatment (composting) facility for food waste from large commercial outlets like restaurants, markets, etc. (biomass)***
  - Mechanical treatment of waste – 0,125 ha;
  - Biological treatment, I phase – 0,4 ha;
  - Biological treatment, II phase – 0,35 ha;
  - Maturation – 0,35 ha;
  - Screening, separation – 0,05 ha;
  - Ready compost from "biomass" storage – 0,2275 ha;

As can be seen from ***Fig. 1.4.4***, other auxiliary facilities related to the normal operation of the main facilities and equipment will be located on the site as well, such as an administrative and an engine building, waste water reservoir, biofilter, site internal infrastructure, a car park and other. The site is to be partially fenced by a green belt (1, 13 ha) which will contribute to the site fitting into the environment.

What is typical of the waste to be treated on this site is that it is collected separately and the compost produced from it is not going to be polluted with heavy metals or other impurities, i.e. its quality meets the requirements for a soil improver.

Waste mechanical treatment through cutting, crushing and grinding of the waste is envisaged prior to the biological treatment. There will be biofilters for removing the smell from the premises and a waste water collection reservoir, which water is then to be treated at the waste water treatment plant on the ***Yana-Sadinata site***.

1.5. Phases in the investment proposal implementation

1.5.1. Construction

It has been planned to start the construction and assembly work at the end of 2009 or the beginning of 2010 and finish it in 2011, i.e. this phase is planned to continue for 12 months. Different number of workers and specialists will participate in the construction phase and in the most heavily-loaded periods the total number of workers may reach 150 people. Sofia Municipality follows a policy of assigning the construction activities to one contractor who will assume the complete responsibility for the design, construction and operation of the facilities and equipment.

This period will start with infrastructure activities, laying the facility foundations and buildings, as well as the contours of the non-hazardous waste landfill. There will be no need for additional land areas during the periods of construction and operation.

As far as the non-hazardous waste landfill is concerned, the following sequence of the activities is envisaged: forming the body of the future facility, foundation of the landfill bottom area at least 1 m above the average ground water level, making the landfill excavation slopes, undertaking measures necessary to improve the foundation base, consolidation of the landfill bottom with heavy construction machines, levelling and consolidation of the slopes with a tractor-drawn roller. The bottom liner laid along the slopes of the excavations and embankments is calculated for general stability against slip (sliding) together with the geomembrane (the foil) and its protective layer.

The new production facilities and equipment will be designed and built according to the good practice in the European Union and in compliance with the corresponding legal requirements that are in force in the country.

1.5.2. Operation

The composting and mechanical and biological treatment facilities will operate in continuous duty and for the other equipment another suitable operating mode will be determined, so that optimal use of the capacity of production facilities and equipment is achieved, according to the generated waste load.

About 70-80 persons will be permanently employed in the operation phase; 15 persons of them will work on the Han Bogrov site and the rest, on the Yana-Sadinata site. The operating staff will be qualified. The staff members' duties will be described in their job descriptions and they will do a specialized training course in facility operation and in working at the non-hazardous waste landfill as a preventive measure with regard to the environment and a minimum health risk, in fulfilment of the legal requirements for the maintenance personnel training and qualification.

Depending on the terms of the authorization for waste-related activities or the integrated waste permit, but not less than once a year, based on the data received, the operator will report to the competent authority that has granted the authorization or issued the integrated waste permit, respectively, all the results of the monitoring with the aim to prove fulfilment of the terms of the authorization (the integrated waste permit) and to determine the behaviour of waste in the landfill (Art. 40, paragraph 2 of Ordinance No 8/ 2004).

1.5.3. Closure and recultivation

The facilities are planned for a 20-25 year period of operation. The design of the closure and recultivation of the two sites should be made while they are in operation. About 100 persons are expected to work during this phase, who will dismount the main facilities and equipment. What is still fit could be reused and the depreciate equipment, sent for recycling. The site should be recultivated technically and biologically according to a design worked up in advance.

The design should contain the after-care activities the Operator will carry out for a period of 30 years after the landfill closure. The landfill closure plan includes activities of disassembling the durable facilities that are not related to the environment protection and the future functional designation of the terrain, where the plan contains the dismounting schedule, the dismounting methods and the qualification required from the specialists and workers engaged in the dismounting operations; surface landfill capping done in accordance with the design for building the top insulation landfill liner, including the technical and biological recultivation and the ant-erosion and anti-land slide measures planned.

1.6. Production structure

1.6.1. Main activities, facilities and equipment

It is planned to build a mechanical and biological treatment facility for municipal solid waste collected in a mixed way and a non-hazardous waste landfill on the ***Yana-Sadinata site***. The layout of facilities is shown in ***Fig. 1.4.2.***

THE MECHANICAL AND BIOLOGICAL TREATMENT FACILITY consists of the following technological units presented with block schemes and described in their succession:

- **Receiving premises for municipal waste collected as mixed waste (building 1)** – It is designed for storing of municipal waste in a receiving bunker, dividing, separation (hazardous waste, metal), shredding of municipal solid waste collected as mixed waste prior to its mechanical treatment.
- **Mechanical treatment (building 2)** – The production hall is meant for mechanical treatment; metal separation and obtaining of high-calorific modified refuse-derived fuel.
- **Biological treatment (building 3)** – Consists of two premises for primary and secondary fermentation of the waste fraction <80 mm than a drum screen and <30mm than a ballistic separator.
- **Production of modified refuse-derived fuel (RDF2) (building 4)** – The production hall is intended for mechanical treatment and separation of high-calorific modified refuse-derived fuel (RDF2) after the latest metal separation.
- **Post-biological treatment (building 5)** – Used for production of non-standard compost from mechanical and biological treatment of MSW collected as mixed waste.
- **Refining of the compost produced from the mechanical and biological treatment (building 6)** – The premises are used for mechanical treatment, the corresponding metal separation and production of non-standard compost. The room is completely closed and is equipped with a sanitary-ventilation system.

On the basis of the detailed block scheme of the mechanical and biological treatment facility for municipal solid waste collected as mixed waste, a general material balance is presented in ***Fig.1.6.1.7.***

The proposed MBT scheme of municipal solid waste collected as mixed waste corresponds to the scheme shown in ***Fig. 1.2.1*** and is a typical process of mixed municipal waste treatment.

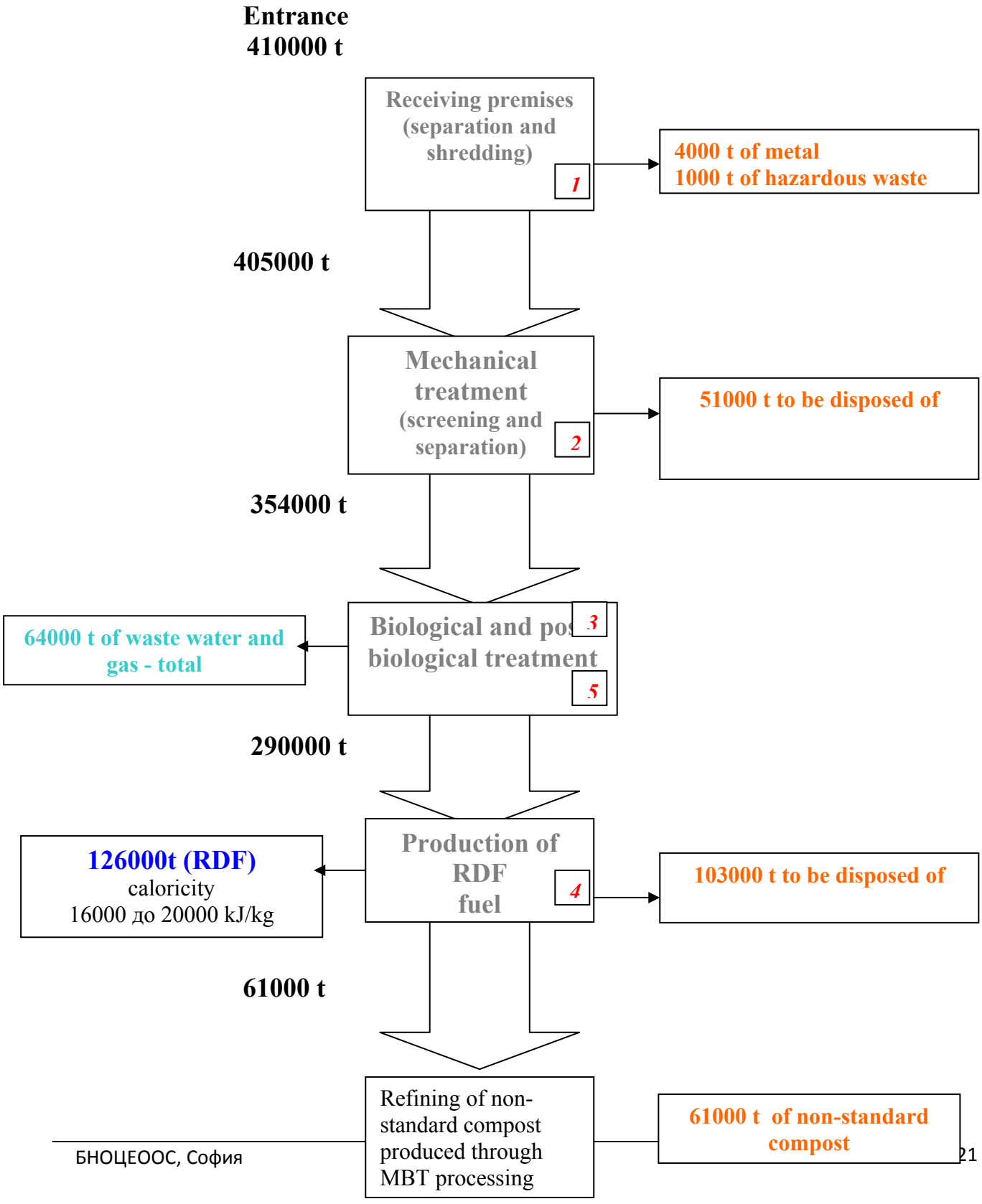


Fig. 1.6.1.7- General material balance of a mechanical and biological treatment facility of Sofia Municipality municipal waste collected as mixed waste

THE NON-HAZARDOUS WASTE LANDFILL SITE is intended for waste from the mechanical and biological treatment, to the amount of 210 000 t/a in case the resulting non-standard compost is to be disposed of. If it is to be sold on the market, the amount of waste to be disposed of is 157 000 t/a. These quantities include also the waste for disposal from the two composting facilities. The waste that is to be disposed of is treated and stabilized in advance, thus meeting the requirements for pre-treatment of waste before disposal.

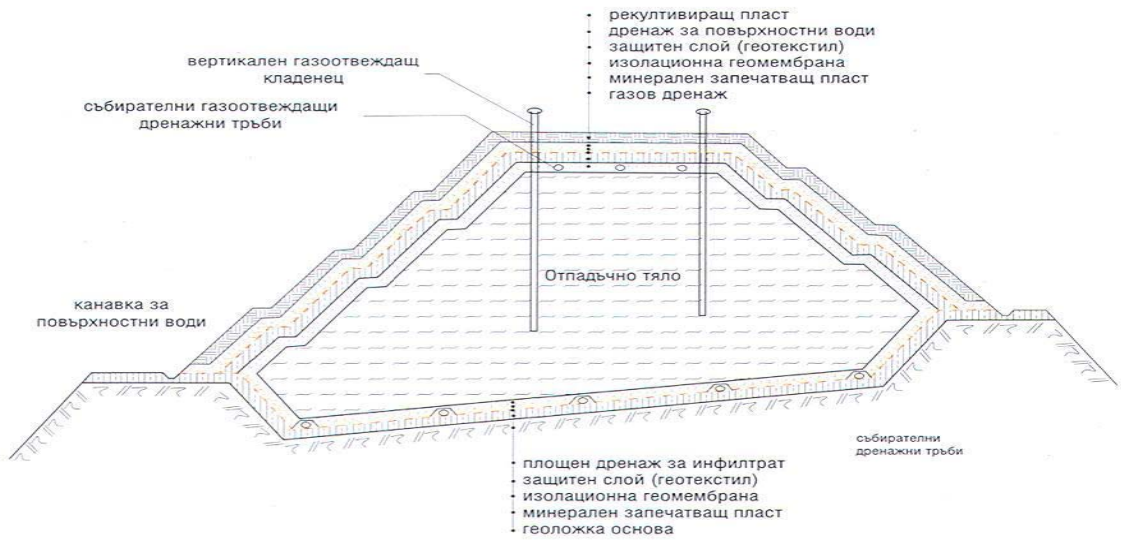


Fig.1.6.1.8. – Principal scheme of a modern landfill site.

Vertical gas off-take
System
Collecting gas off-take drainage pipes

Recultivation layer
Surface water drainage
Protective layer (geotextile)
Insulation geomembrane
Mineral sealing layer
Gas drainage

Surface drain ditch
Solid waste body

Collecting drainage pipes

Drainage layer for leachate
Protective layer (geotextile)
Insulation geomembrane
Mineral sealing layer
Geological bedrock

The principal scheme of building every landfill cell is shown on ***Fig. 1.6.1.8.*** The landfill will be designed and implemented according to the Bulgarian and the European standards of building such kind of facilities, which most generally find expression in the following:

- appropriate choice and correct designation of the site;
- bottom insulation liner – for protection of the soil and ground water;
- collection and treatment of the leachate in the waste water treatment plant (WWTP) – for protection of ground water from contamination;
- biogas management – to avoid uncontrolled emissions into the atmosphere;
- placing the waste in cells – to exercise operative control and reduce the penetration of rainwater run-off;
- consolidation of waste – to limit the access of pests, reduce the risk of fire and strengthen the landfill body stability;
- day-to-day and intermediate cover;
- final capping after exhausting the capacity.

After the 10^{th} year of operation of the non-hazardous waste landfill site the release of biogas is expected as a result of stabilized waste decomposition processes (including non-standard compost), resulting from atmospheric impacts (rain, melting of snow etc.). The biogas released is to be collected by the drainage system and managed in an environment-friendly manner. The biogas capture system is described in the auxiliary facilities and equipment section. The waste water (leachate) from the non-hazardous waste landfill site will be captured by a drainage system and treated in the WWTP described in the auxiliary facilities and equipment section.

Building of two composting facilities (biological treatment) for biodegradable waste is envisaged for the ***Han Bogrov site***. Their situation is shown in ***Fig. 1.4.4***. Composting is an exothermal process where organic substrates are subjected to aerobic biodegradation by a mixed microbial population in conditions of higher temperature and humidity. In the biodegradation process the limited substrate undergoes a physical and chemical conversion with the formation of stable mummified end product (compost). As organic manure, this product is valuable for agriculture and as a means of improving the soil. In the process of composting, under the influence of O_2 the organic substances develop into a more stable form, CO_2 and H_2O are released and the temperature goes up. In natural conditions biodegradation runs slowly, on the surface of the earth, at the temperature of surrounding environment, and mostly anaerobic ally. The natural decomposition of organic waste may be accelerated if the substrate is gathered in piles (figures) or in appropriate vessels, which allows of preserving a part of the heat released in the fermentation processes.

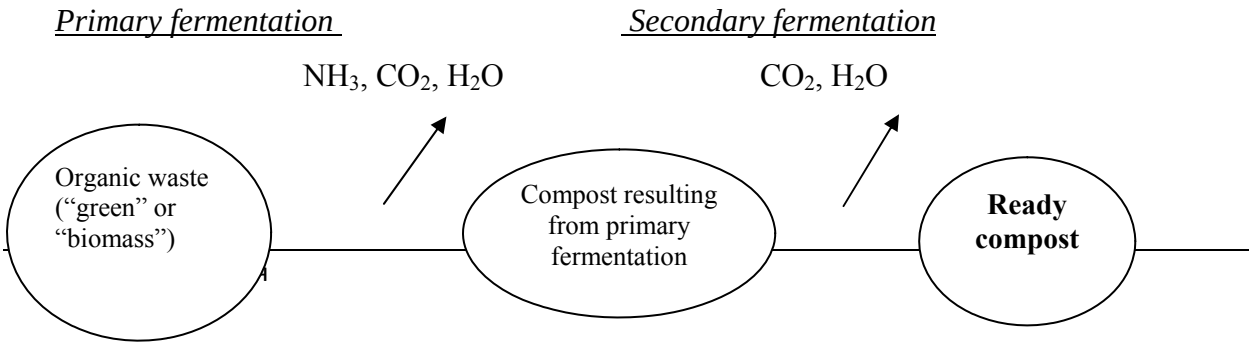


Fig.1.6.1.10 – Biochemical reactions in the aerobic composting process.

The biochemical reactions in composting are shown in ***Fig.1.6.1.10.*** The fermentation process runs in two phases – biological treatment I and II phase. During the *biological treatment period – I phase (primary fermentation)*; a group of aerobic bacteria decompose the organic matter into CO_2, H_2O and NH_3. The biochemical reactions generate a big amount of energy which causes a sharp rise in the primary compost temperature up to 60-70^{0}C. The heat is favourable to the evaporation of the water contained and at the same time facilitates the elimination of different pathogenic factors.

During the *biological treatment period – II phase (secondary fermentation),* another group of aerobic bacteria classified as nitrifying bacteria oxidize NH_3 to NO_2 or NO_3, which remain in the compost in the form of different compounds. These biochemical reactions generate a smaller amount of energy and for this reason the temperature of maturing compost is below 40 ^{0}C.

THE GARDEN WASTE ("GREEN WATE") COMPOSTING FACILITY consists of the following technological units:

- **Receiving area (storehouse) for garden waste**;
- **Mechanical treatment (sorting, shredding) of the initial green waste** – this is a part of the biological treatment premises I (primary fermentation), but it is separated from it by a wall.
- **Biological treatment – I phase (primary fermentation).** The premises are in a completely close ventilated building. The polluted air treatment is performed in a biofilter.
- **Biological treatment – II phase (secondary fermentation).** The premises floor is covered with asphalt or cemented which is easy to maintain clean by washing. The waste water is collected in reservoirs and then goes for treatment.
- **Refining (screening) –** The compost obtained after the secondary fermentation is treated (refined) through screening.
- **Ready compost storage** – The premises are closed from three sides with movable partitions. "Green waste" compost is only stored here. The refined compost is offered to users in bulk or in bags.

THE FACILITY FOR COMPOSTING OF FOOD WASTE FROM COMMERCIAL OUTLETS („biomass") consists of the following technological units:

- **Mechanical treatment (sorting, shredding) of the initial food mass (biomass)** – The premises are a part of the biological treatment I premises (primary fermentation), but is fully separated from it by walls.
- **Biological treatment – I phase (primary fermentation).** The premises are completely closed and ventilated. The exhaust air from aeration is purified in biofilters.
- **Biological treatment – II phase (secondary fermentation).** The premises are completely closed and ventilated. The exhaust air from aeration is purified in biofilters.

- **Maturing process –** The premises are completely closed and ventilated. The exhaust air from aeration is purified in biofilters.
- **Refining (screening)** – the compost produced is treated (refined) through screening. The premises are a part of a storehouse for ready compost, but are separated from it by a wall where the front part is open.
- **Ready compost storage** – The premises are closed from three sides by movable wall partitions. It is only used for storage of compost from "biomass". The refined compost is stored and offered to users in bulk or in bags.

As a result of the composting processes a market product is obtained, called compost, which is a humic substance-based product with valuable qualities as a soil improver. The total production of compost expected from the composting facilities and intended for sale is 23000 t/a. The Ministry of Agriculture and Food, based on data of the type and composition of the waste to be used for production of compost, expresses the opinion that the compost may freely be used as a soil improver. The structures of the Ministry of Agriculture and Food undertake to support the use of compost by providing consultancy services, popularizing its use in agriculture, as well as by determining of areas where its application will bring about very good results. This support for the end product of composting facilities complies with the National Regional Development Strategy of the Republic of Bulgaria for the Period 2005-2015 *for protection of the agricultural land, which will contribute to applying the integrated pollution prevention and control permit (IPPC) in sector agriculture, as well as to the building of capacities for production of compost and biohumus by processing manure.* Support has also been declared by the National Agricultural Advisory Service with a Letter with an outgoing ЦУ-02-100/13.03.2008 concerning the utilization of waste for compost production (***Application 7.)***

The composition of compost varies widely (in dry mass %): organic substances 25-80; carbon 8-50; nitrogen 0,4-3,5; phosphorus 0,1-1,6; potassium 0,4-1,6; calcium (CaO) 0,7-1,5. According to the Bulgarian legislation, the composition of the compost produced is not standardized but what is most important is that it should not contain heavy metals or other elements that may cause pollution of the soil.

Table 1.6.1

Maximum admissible concentration values for pollutants in compost, so that it is suitable for use as a soil improver

Element	Measure	Compost composition by German standard	Maximum admissible concentration values for heavy metals in the soil *	
Pb	mg/kg	150	80	100
Cu	mg/kg	100	100	140
Zn	mg/kg	400	250	300
Cr	mg/kg	100	200	200
Ni	mg/kg	50	60	75
Cd	mg/kg	1,5	2,0	3,0
Hg	mg/kg	1,5	1	1

As	mg/kg		25	25
pH			6-7,4	>7,4

* ORDINANCE on the order and the way of recovery of sludge from waste water treatment through its use in the agriculture *adopted with CM Decree 339 of 14.12.2004, promulgated in SG No112 of 23.12.2204*

Table 1.6.1 presents the maximum admissible concentration values for pollutants in compost, so that it can be suitable for use as a soil improver. From the data shown in the above table it can be seen that the compost offered on the market has to meet maximum admissible concentration of heavy metals in the soil, which will guarantee its environmental friendliness. The compost finds application in improvement of the soil structure and adsorption properties, as well as in recovery of contaminated soil and improvement of poor-quality soil arability. It protects the soil from erosion and washing away. Compost is organic-mineral fertilizer with a slow effect determined by the fact that the nutrient elements nitrogen (N), phosphorus (P) and potassium (K) are bonded to the organic compounds in it. This is an important advantage from the point of view of ensuring continuous and constant feeding up of agricultural crops and maintenance of controllable admissible nitrate levels in the soil.

1.6.2. Auxiliary facilities and equipment

To achieve good technological work and operation of the main facilities and to meet the requirements of protecting the environment components it is envisaged to use some auxiliary equipment.

Yana – Sadinata site

The location of the main and the auxiliary facilities is shown in ***Fig. 1.4.2.*** The waste water from the MBT facility and from the non-hazardous waste landfill site, as well as the waste water for the ***Han Bogrov site*** will be treated in the waste water treatment plant (WWTP).

WWTP – Includes two stages of waste water treatment – mechanical and biological. Within its territory there are several reservoirs for incoming polluted waste water and outgoing treated waste water, reactor bells, filtering facilities, air-supply station, as well as a chemical substance dosing station (equipment), electric power supply, a process control and management system. The total area of the facility building will be about 1200 m², with a maximum height of the building of 10 m. The incoming waste water reservoirs will be located next to the facility building, on an area of 250 m².

Biofilters – Their location is shown in ***Fig.1.4.2.*** Two biofilters are planned, either of them occupying an area of 0.2 hectares of land. They consist of "wooden rods" with organic biodegradable substance as filling among them. Polluted waste gas is fed to the lower part of the filter and spreads within it. The biofilter dimensions will be as follows:

- Biofilter 1 – 150000 m^3/h

- Biofilter 2 - 120000 m^3/h

As a result of the treatment, the dust content and smell in them are reduced. The expected value is <300 units/m^3, with a standard of 500 units/m^3 and/or 50 mg of total organic carbon (TOC). It is planned to change the biofilter filling once in every e years, where the used filling will be ultimately disposed of at the composting facility.

Gas take-off system of the non-hazardous waste landfill site – During the first years of the waste degradation in the landfill the process is anaerobic and a considerable amount of carbon dioxide is released. After the free oxygen in the waste layer has been used up, the anaerobic degradation begins where methane and carbon dioxide are formed. The gas take-off system may be made up of a network of perforated pipes located in the last cover layer or of drilling wells of perforated pipes, which is to be decided during the design phase. The gas take-off drilling well is going to be constructed at the same time with the operation of the landfill site. Bearing in mind the quantities and composition of the waste to be disposed of, intensive release of biogas is expected after the tenth year of the landfill operation, which is to continue for about 20 years. Dominant factors with regard to the amount of biogas formed are the external factors temperature, air access, humidity, pH, presence of nutrients, etc. The expected maximum gas flow rate is 1000 Nm^3/h, with concentration of 30-50 %CH_4. This gas composition and flow rate makes it unsuitable for subsequent use; that is why it is envisaged to burn the gas in a "torch".

Han Bogrov site

Biofilter – its location can be seen in ***Fig. 1.4.4.*** The facility occupies an area of 1200 m^2. Its construction and operation are analogous to those of the biofilters on the ***Yana – Sadinata site.*** Waste gas polluted with dust and smell from the two composting facilities situated on the site will be treated in it.

Waste water reservoirs – their location is shown in ***Fig. 1.4.4.*** The facility occupies an area of 200 m^2. It collects the waste water pumped at regular intervals into tanks and transported to the WWTP on the Yana ***– Sadinata site.***

At both sites facilities for washing the waste transport trucks are envisaged in the conceptual designs.

1.6.3. Other

Yana – Sadinata site

On the site (***Fig. 1.4.2***) there will be a car park for arriving articulated trucks and lorries hauling non-standard compost and refuse-derived fuel (RDF). Automatic weightier will be placed to measure the quantity of incoming waste and the output ready for dispatch. There will also be an

administrative building for the managing and the maintenance staff, bathrooms and toilets, a chemical analysis laboratory, storage premises and other.

Han Bogrov site

On the site (***Fig. 1.4.4***) there will be an administrative building (on an area of 140m^2) and an engine room (on an area of 350m^2). In the administrative building there will be a laboratory for analysis of the compost produced and the waste water. The engine building will house a garage for the articulated trucks and premises for servicing the facilities and the trucks.

The total area of the planned internal and road infrastructure is 23325m^2. A car park for 15 cars is envisaged.

1.7. Basic raw materials – quantity and quality assessment

1.7.1 During construction

The construction of the sites and the two facilities, regardless of the choice, is going to be new construction which will use typical building materials. It is expected that natural raw materials like ballast, sand, stone, wood and water will be used in the construction works, and their quantities will be determined by the working design. The materials will be purchased from trading companies. Technical and economic analysis has been made within the framework of the feasibility study of the nearest quarries from where building materials could be taken. A map of their location is given in ***Fig***. 3.8.1 and the qualities of the natural raw materials are dealt with in item 3.8. The necessary quality and quantity requirements to the materials to be used in the construction works will be specified in the design phase. Materials for hydro-insulation of the buildings, polymer adhesives, paints and varnish, asphalt for the road infrastructure, asphalt or cement covering for the premises floor. It is of extreme importance not to admit the use of asbestos material insulation.

Other building materials such as timber for formwork operations; iron fittings as per billet made in advance; bricks; insulation materials; metal constructions and ceramic products do not pose a risk to the human health and the environment. Their quantities will be specified in the Quantity Account Form of the working design and will be bought from trading companies which have the right to produce or distribute them. The excess quantities of the above materials or quantities that could not be used are considered as waste in item 1.12.1.

In the construction of the non-hazardous landfill site the materials used for building of the *bottom and top mineral layers, the drainage layer and the recultivation layer* have to meet the requirements described in Application 2 to Art. 23 of Regulation No 8 of the conditions and requirements (*promulgated 2004*); Regulation No 3 on the admissible content of harmful substances in soils (*promulgated 1979, last amended 2002)*; Ordinance on the order and the way of recovery of sludge from waste water through its use in the agriculture (*promulgated 2004)* and Ordinance No 26 on

recultivation of degraded land areas, improvement of low-productivity land and utilization of the humus layer (*promulgated 1996).*

The quantities of the raw materials used during the time of construction will be given in detail in the Quantity and Value Accounts of the project documentation, according to the Territory Structure Act and its bylaws.

1.7.2. During operation

The main factors on the basis of which the expected quantities of municipal waste are determined are: the projected number of population of a given area, including the temporarily residing persons whose number has shown a tendency toward increase over the recent years, as well as the waste accumulation rate. The expected volume of the waste is determined according to the maximum variant of the demographic development forecast of the Master Plan of the city of Sofia, where the following number of population of Sofia is envisaged:

- in 2010 – 1 299 827;
- in 2015 – 1 388 519;
- in 2020 – 1 474 832;

According to an expert estimation, the average daily contingent of temporarily residing people within the territory of Sofia Municipality is determined to be about 100 000 to 120 000 people.

In view of the considerable methodological differences regarding the waste accumulation rate per inhabitant per day or year, it is assumed, on the basis of the existing rate of 1, 15 – 1, 25 kg per inhabitant per day, that the MSW accumulation rate for Sofia Municipality will be 1, 09 kg per inhabitant per day for 2010 and 1, 17 kg per inhabitant per day for 2020.

Under these conditions the expected quantities of municipal solid waste in 2010 will be 515000 t and in 2020, about 630000 t, where the daily amounts are estimated to be 1410 t and 1726 t, respectively.

On the other hand, according to FICHTNER Consortium data presented in a Feasibility Study of Sofia Municipality Household Waste Management, assigned by Sofia Municipality, in 2007 a total of 372352 tons of waste were packed in bales. This quantity does not include large-dimension waste, vegetable waste from households and the capital city's green system, separately collected waste at collection points, separately collected waste in open markets and other large commercial outlets, the waste collected separately by the citizens in separate collection containers, by the organizations of package waste utilizing.

The Investment Proposal of "Development of an Integrated System of Facilities for Treatment of the Municipal Solid Waste of Sofia Municipality" involves treatment (separation, disposal, recovery and landfilling) of:

- 410000 t/a (1200 t/d or 50 t/h) MSW collected as mixed waste from Sofia Municipality, which is to be treated in the mechanical and biological treatment facility with subsequent landfilling of the waste from the facility at the non-hazardous landfill site;
- 20000 t/a (60 t/d or 2,5 t/h) separately collected garden waste („green waste"), generated within the territory of Sofia Municipality, which is to be composted in a separate facility;
- 20000 t/a (60t/d or 2,5 t/h) separately collected food waste from commercial outlets („biomass" or „bio waste") within Sofia Municipality, which is to be composted in a separate facility.

In the course of the feasibility studies of the investment proposal, a forecast was drawn up of the household waste generated within Sofia Municipality for a thirty-year period, on the basis of which the capacities of the facilities and equipment proposed in the investment proposal were determined. The expected morphological composition of the waste is presented in Table 1.7.3

Table 1.7.3

Morphological composition of waste, %

	2005	***2007****	***2010***	***2020***
Paper and cardboard	25.4	22.4	26.4	27.4
Polymers	12.5	14.3	12.4	12.2
Glass	9.5	8.4	9.1	8.8
Metal	1.5	1.9	1.5	1.4
Textiles	2.8	5.9	2.6	2.6
Wood	1.2	3.5	1.2	1.2
Leather, rubber	1.1	1.4	1.1	1.0
Food and kitchen waste	25.7	24.1	26.0	26.2
Green waste	8.4	1.8	8.4	8.3
Inert waste	11.3	13.7	10.8	10.5
Non-identified	4.5	2.6	4.3	3.7

* The above data, provided by Alara 2000, refers to the household waste composition

Bearing in mind that in the beginning of 2007 the practice of separate collection of paper, plastic and glass waste started, it should be expected that after being separately collected and separated, the waste sent to the MBT facilities will be with considerably changed composition.

The waste treatment processes envisaged in the investment proposal are mechanical and biological, and they require:

- electric energy;
- air (which supplies the oxygen necessary for the biological treatment processes);
- water.

Natural raw materials will be used in the operation of the mom-hazardous waste landfill. For the *daily covering with soil* of the deposited waste under the conditions of operation, the landfill will need masses of earth (substrates) with definite qualities and in definite quantities. The requirements to the materials to be used for *daily covering with soil of the deposited waste* boil down to the following main parameters:

- To be free from heavy metals, toxic elements and other substances dangerous to health and to the environment;
- To be close to the site and in sufficient quantities so that the needs of the landfill are met;
- When possible to be obtained while developing other deposits;

For covering the waste with soil it is possible to use:

- Soil materials and soil substrates selectively kept in storage during the construction of the MSW landfill site;
- Soil materials and subsoil substrates kept in storage at an inert waste landfill in Sofia Municipality;
- Substrates from the development of mines, quarries and ballast pits in proximity to the site;
- Clay sand from the operation of ballast pits located along the Lesnovska and Iskar rivers;
- Inert and non-hazardous waste from industry – slime, tailings, cinder, slag, etc.;
- Geological materials in a natural state.

The location of the sites these materials can be supplied from is given in ***Fig.3.8.1.*** The feasibility studies made by the Fichtner consortium contain data of distances and costs related to the delivery of materials.

For transportation of the waste between the different premises, vehicles and machines operating on diesel fuel will be used. For maintenance of pumps, conveyor belts, mobile and fixed machinery, different kinds of oil and grease will be used. In the halls where the main machinery and equipment is to be located, it will be necessary to use disinfection products for maintaining of the sanitary and hygiene standards required. Chemical substances and different chemicals are going to be used in the WWTP.

1.7.3. During decommissioning and closing down

The composting and MBT facilities closure involves disassembling the facilities and equipment and their sorting by suitability and possibility for reuse.

During the operation phase it a plan should be worked out for closure, technical and biological recultivation of the sites where the facilities are located. No use of natural raw materials is planned for this phase.

With regard to the landfill site, pursuant to Regulation No 8, its closing down is carried out in accordance with a plan worked out in advance, which includes activities of demounting the

durable facilities built, which are not related to protection of the environment and the future functional designation of the terrain. The landfill surface insulation is carried in accordance with a design solution of building the top insulation liner and includes technical and biological recultivation.

1.8. Power resources used – type and quantity; characteristics of fuels; power use efficiency

- **Electric energy**

At this stage the ***Han Bogrov*** and ***Yana-Sadinata*** sites are not supplied with electric power and there is no infrastructure that allows of their being connected directly. It will probably be necessary to build local substations.

On the ***Yana-Sadinata site*** after supplying the necessary equipment, it will be possible to use the now non-equipped aerial power line 20 κV, whose route passes within the framework of the site.

In the area of the ***Han Bogrov site*****,** within the territory of the village of Gorni Bogrov, in proximity to the site (237m) there is a power line passing toward the east. It runs parallel to the Musachevo station – Yana station railway line. Supplying the landfill site with electricity is possible by building kiosk switchgear with tap from the national power-distribution network. The following amounts of electric power are required for the composting facilities:

- Garden waste composting facility (green waste) – 0.4GWh/a;
- Composting facility for waste paper from large commercial outlets – 2.8GWh/a;

Among the proposed alternative sites by location, the WWTP Kubratovo site and Construction Control Zone (CCZ) Kremikovtsi are supplied with electricity.

- **Heat Power**

No installation of a centralized heating system is envisaged for either of the sites. There is no infrastructure developed and no possibility for head and power supply from a centralized heat power source. A considerable amount of heat will be released in the composting technologies, which will be used in the processes of drying of intermediate products and the product, the compost, for maintenance of optimum technological parameters. In the process of developing the working design precise heat balance sheets should be drawn up and it should be established if there will be excess heat that could be used for heating the buildings or for other purposes.

- **Fuel (black oil, diesel, petrol, natural gas);**

It is possible to ensure gas supply on the ***Han Bogrov site*** in view of the close proximity of an existing gas-main of Ø700mm, which belongs to Bulgargaz. The investment proposal does not foresee use of natural gas as a raw material in the technological processes or for heating.

During the operation of facilities on the two sites it is planned to use diesel for the different kinds of machinery (front loaders, tip-lorries, articulated lorries, etc.), which will carry out the transportation of the initial waste, the intermediate and end products within the territory of the sites:

- Composting facilities –11 pieces of machinery – ***15000m^3/a*** diesel;
- MBT facility – 20 pieces of machinery – ***2000m^3/a*** diesel.

1.9. Water supply sources. Water amounts. Water and water basin use permits. Water balance.

1.9.1. Water supply and water balance

There is no developed water supply infrastructure on either of the sites that could allow direct connection of the future user to the water-supply system serviced by Sofiiska Voda. ***On the Han Bogrov site*** it is possible to supply water with drinkable quality by making a deviation from the existing water main which provides water to the buildings servicing the tailings pond ***Application 7*** – Letter from the Danube Region Basin Directorate (outgoing No 2055/26.05.2008) concerning different water catchment equipment in proximity to the site. For production purposes it is possible to build an own water source. ***On the Yana-Sadinata site*** an own water source may be built or it is possible to use the Sofiiska Voda AD services (***Application 7-*** Letter, incoming No 2600-1172/22.02.2008) and for drinking water needs, mineral water.

According to the feasibility studies, for the investment proposal implementation the needs for water will be as follows:

- for the green waste and biomass composting facilities – only for the sanitary and hygiene needs of the premises;
- for the MBT facility for municipal waste collected in a mixed way:
    - for sanitary and hygiene needs of the premises;
    - for production needs – 400m^3/a or 0, 05 m^3/h. In the technical module for waste biological treatment (***Fig.1.6.1.3***) it is planned to use condensation waste water in the technological process that is produced from the vapour released from the waste biological treatment, which minimizes the amount of "fresh" water necessary for the water turnover cycle.
- for sanitary and hygiene needs of the staff:
    - for the Yana-Sadinata site – 6 m^3/d;
    - for the Han Bogrov site – 1,2 m^3/d;

The industrial waste water from the two sites is to be treated in their own WWTP which is planned to be located on the ***Yana-Sadinata site.***

1.9.2. Site water management

a) Construction

During the construction phase water is necessary both for construction and for the staff needs, and will be provided as follows:

- for sanitary and hygiene needs – the number of workers fully depends on the organization of construction approved;
- water for construction purposes will be supplied from temporary or permanent water boreholes or with water carrying tank lorries in quantities that are typical of the given kind of construction works.

One hundred and fifty people are expected to work on the two sites and the water necessary to meet the drinking water needs and the sanitary and hygiene purposes is 10 m^3 a day. In the construction phase, the impact on the surface water quality is reflected in the increased content of mechanical impurities. It is recommendable that drainage ditches be made round the building site so that the surface water pollution is minimized.

b) Operation

The investment proposal envisages minimum use of "fresh" water for industrial needs because the waste that is to be treated is wet and creation of an internal condensation water turnover cycle in the biological treatment process is planned. The "fresh" water is necessary to maintain the sanitary and hygiene conditions on the premises. The outlet water from some technological modules is planned to be used as industrial water in the waste biological treatment (***Fig. 1.6.1.1 – 1.6.1.6***).

The industrial and sanitary waste water from the Han Bogrov site will be collected in reservoirs (***Fig. 1.4.3***) from where it will be regularly carried to the Yana-Sadinata WWTP for treatment. A sewer system should be built for the sanitary water from the two sites. Table 1.9.2.1 shows the amounts of waste water that is to be treated in the Yana-Sadinata WWTP. The water treated at the WWYP is to be discharged in the nearby canal as a surface water intake and from there it will join the water catchment area of the Lesnovska and Iskar rivers.

Table 1.9.2.1

Waste water amounts to be treated in the WWTP

Parameter	Time period	Unit	Min	Max	Design value
Leachate from the Yana-Sadinata landfill site	$Q_{d,landf.}$	m^3/d	0.0	36.0	36
	$Q_{h,landf.}$	m^3/h	0.0	2.7	1.5
Waste water from the Yana-Sadinata MBT process	$Q_{d, MBT}$	m^3/d	0.0	36.0	36
	$Q_{h, MBT}$	m^3/h	0.0	1.5	1.5

Waste water from composting Han Bogrov	$Q_{d, comp.}$	m³/d	72.0	120.0	120
	$Q_{h, comp}$	m³/h	3.0	5.0	5.0
Total		m³/d	72.0	192.0	***192***
		m³/h	3.0	9.2	***8.0***

c) Closure and recultivation

The water-supply and sewage systems that are under the infrastructure and the green areas will probably not be disassembled. The fate of these systems depends on the further site land use. The systems within the buildings to be demolished are subject to disassembly, if purpose for their use after 25 years is not found.

1.10. Waste gas generated – quantity and quality assessment

1.10.1. During construction

During the phase of developing the investment proposal project *"Integrated System of Facilities and Equipment for Treatment of the Municipal Solid Waste of Sofia Municipality"*, mostly unorganized harmful substance emissions into the atmospheric air are expected. The air pollution in the area during the construction phase will be due to:

- Burned gas from the internal combustion engines (ICE) of the machines used in the construction and transport operations. The main pollutants to be released in the air are CO, nitrogen oxides (NOx), SO_2, hydrocarbons and dust. These emissions will depend on the number and type of machinery and equipment used in construction, and on the operation mode.
- Airborne particulate matter (dust) – dust will be emitted mainly during the construction and assembly works, the humus layer removal and during the terrain restoration, where its concentration will depend on the season when the construction works are carried out, the climatic and meteorological factors and the measures undertaken to reduce the dust load.

Building machines and means of motor transport such as excavators, bulldozers, front loaders, automatic dump trucks etc. are going to be used during the construction period. About 300 tons of diesel fuel is expected to be used. According to the methodology of fast inventory **(Methodology of determining the emissions of harmful substances by balance-sheet methods, MOEW, 2005 (CORINAIR),** with these amounts of used fuel, the following emissions will be released to the atmosphere for the whole period: a total of 1719 kg of soot, 1200 kg of sulphur oxides, 14640 kg of nitrogen oxides, 4740 kg of carbon oxide, volatile organic compounds and other (Table 1.10.1.1.). The above figures for the harmful substances to be released to the atmosphere are tentative and will be further specified after determining the type and number of building machines and equipment, the technology and the organization of construction works.

1.10.2. During operation

During the period of operation of the investment proposal *"Integrated system of facilities and equipment for treatment of the municipal solid waste of Sofia Municipality"* emissions are expected from:

1. The internal combustion engines of:
   - the vehicles for the collection and transportation of waste to the mechanical and biological treatment (MBT) facility;
   - the vehicles for the transportation of garden waste ("green waste") and the food waste from large commercial outlets (biomass) to the composting facilities;
   - the vehicles for the transportation of waste to be recycled, hazardous waste, compost and modified refuse-derived fuel (RDF)
2. The machinery and equipment that will be used as internal transportation of intermediate and end products, a compacting machine (compactor) for the waste densification in the landfill;
3. Waste mechanical and biological treatment (MBT) facility;
4. Non-hazardous waste landfill site;
5. "Green waste" and "biomass" composting facilities.

Emissions from the waste transportation

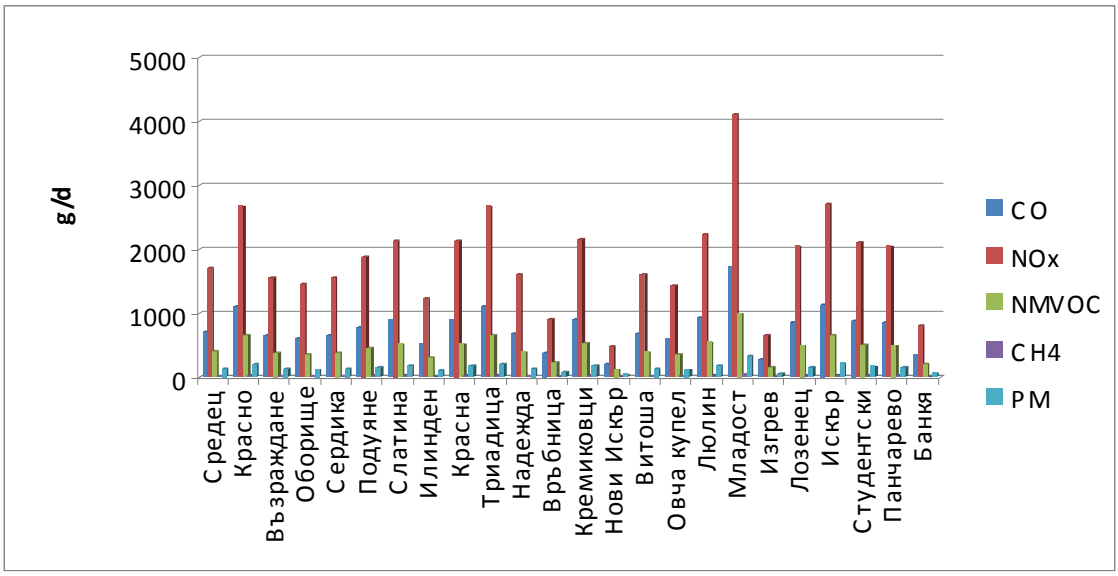
The main source of atmospheric pollution is the *traffic* of waste transportation vehicles and the heavy trucks for the transportation the metal and inert recycled waste. The assessment has been made on the recommendation of the RIEW-Sofia (outgoing No 08-00-2073/10.07.2008)

For evaluation of the amounts of air pollutants emitted from the engines of waste transportation vehicles data has been used from the "Financial Analysis and Financial Evaluation of the Sites for Treatment of the Municipal Waste of Sofia Municipality" made by I.D.S. Investment Design Studio, with Sofia Municipality as assignor. This report contains detailed routes for the transportation of waste to the sites of WWTP Kubratovo, Gara Yana and CCZ Kremikovtsi. The routes from the Gara Yana variant refer to a great extent to the Han Bogrov site as well because they fully coincide for a large part of the territory of Sofia; the difference in the road deviations leading to the villages of Yana and Han Bogrov after the ring-road has been taken into account for each of the routes. The amounts of pollutant emissions have been determined according to the "Methodology of determining harmful substance emissions to the air" (EMEP/CORINAIR Inventory Guidebook 1997 and 2000, third edition, 09 2004), on the basis of the average diesel fuel consumption determined in the same methodology for the motor vehicle category of heavy trucks and the corresponding emission factors (EF) for pollutants.

Table 1.10.2.3

Amounts of CO, NOx, NMVOC, CH_4, PM and CO_2 emitted from the engines of community service vehicles per day by municipality

Municipality	Average number of journeys per day	Transport distance, Han Bogrov	CO	NOx	NMVOC	CH_4	PM	CO_2
	Number	*km*	*G*					*Kg*
Sredets	10	22	711.57	1705.51	412.26	16.94	135.54	208.95
Krasno Selo	15	23	1115.87	2674.56	646.50	26.57	212.55	327.68
Vazrazhdane	10	20	646.88	1550.47	374.78	15.40	123.22	189.96
Oborishte	9	21	611.31	1465.19	354.17	14.55	116.44	179.51
Serdika	10	20	646.88	1550.47	374.78	15.40	123.22	189.96
Poduyane	11	22	782.73	1876.07	453.49	18.64	149.09	229.85
Slatina	12	23	892.70	2139.65	517.20	21.25	170.04	262.14
Ilinden	8	20	517.51	1240.37	299.83	12.32	98.57	151.97
Krasna Polyana	12	23	892.70	2139.65	517.20	21.25	170.04	262.14
Triaditsa	15	23	1115.87	2674.56	646.50	26.57	212.55	327.68
Nadezhda	13	16	672.76	1612.49	389.77	16.02	128.14	197.56
Vrabnitsa	9	13	378.43	907.02	219.25	9.01	72.08	111.13
Kremikovtsi	9	31	902.40	2162.90	522.82	21.49	171.89	264.99
Novi Iskar	7	9	203.77	488.40	118.06	4.85	38.81	59.84
Vitosha	8	26	672.76	1612.49	389.77	16.02	128.14	197.56
Ovcha Kupel	8	23	595.13	1426.43	344.80	14.17	113.36	174.76
Lyulin	16	18	931.51	2232.67	539.69	22.18	177.43	273.54
Mladost	14	38	1720.71	4124.24	996.92	40.97	327.75	505.29
Izgrev	7	12	271.69	651.20	157.41	6.47	51.75	79.78
Lozenets	8	33	853.89	2046.62	494.71	20.33	162.65	250.74
Iskar	10	35	1132.05	2713.32	655.87	26.95	215.63	332.43
Studentski	8	34	879.76	2108.64	509.70	20.95	167.57	258.34
Pancharevo	6	44	853.89	2046.62	494.71	20.33	162.65	250.74
Bankya	5	21	339.61	814.00	196.76	8.09	64.69	99.73
Amount	***240***		***18342.40***	***43963.52***	***10626.94***	***436.72***	***3493.79***	***5386.26***
Average			***764.27***	***1831.81***	***442.79***	***18.20***	***145.57***	***224.43***



Фиг. 1.10.2.1. Contribution of the community service vehicles by municipalities (routes) per day to the air pollution of the city of Sofia

Data of Table 10.1.2.3 is used to visualize the current status through ***Fig. 1.10.2.1.*** From what is shown it is clear that lorries servicing the municipality of Mladost are the greatest contributor, which is due to the length of this route, as well as to the number of necessary journeys per day.

Fig.1.10.2.2. Percentage distribution of the amounts of nitrogen oxides from sources of the Kremikovtsi metallurgy and metalworking plant, from transport and Toplofikatsia (the district heating company), and other industrial enterprises within the territory of Sofia Municipality

Road transport is the main source of nitrogen oxides, carbon oxide (93.1%) and volatile organic compounds (VOC) (86.9 %) within the territory of Sofia Municipality. Of the totally emitted 12935.48 t/y of NO_x 7412.032 t/y are due to transport (***Fig. 1.10.2.2***).

The contribution of all waste transportation vehicles (journeys) is equivalent to 0.124% of the total amount and for this reason it is not necessary to stimulate the spread of pollutants emitted from the engines of waste transportation vehicles for the whole territory of Sofia Municipality.

The amount of gas and particulate matter emissions from transport operations will depend on the number of vehicles used, the number of journeys, the distances, the condition and maintenances of motor fleet and the road surface. Table 1.10.2.4 shows tentative data of the harmful substance emissions in the RDF transport to the end users in Bulgaria.

Modified refuse-derived fuel (RDF) with caloricity of 16000 to 20000 kJ/kg may be sold to production enterprises in Bulgaria or in other countries, which have Integrated Pollution Prevention and Control Permits (IPPCP) or Waste Management Permits where it is indicated that they are eligible to work with such kind of fuel. Sofia Municipality has studied the market of this fuel; at a national level an interest in it is taken by the cement plants in Zlatna Panega – 16000t/a, Beli Izvor – 40000t/a; Devnya – from ~50000 to ~85000t/a. (***Application 7.)***

Emissions from the internal combustion engines of the vehicles servicing the MBT facility and the non-hazardous waste landfill site

Item 1.6.1 describes the transport vehicles and machinery for each of the technological units located in the buildings within the territory of the ***Yana-Sadinata site***. A heavy compacting machine with chain and vibration force (compactor) will be used for waste compaction in the landfill. The emissions will depend on the type and power of the machines used, on their technical state and operation mode.

Emissions from the mechanical and biological treatment facility

There will be emissions of harmful substances from the mechanical and biological treatment facility for household refuse collected as mixed waste as a result of the biological process of waste decomposition running there. The selected method, which corresponds to the best available techniques for municipal waste treatment, involves in the first place crushing, separation and biological treatment, where the heat generated is utilized in the process with the purpose of reducing the moisture content of the mixture treated. As a result of this, what is released in the first place in the gas phase is carbon dioxide, ammonia (primary fermentation) and water vapour from the biological degradation and the initial moisture content of the waste. With regard to the carbon dioxide and the water vapour generated from the main treatment process, no regulatory limits are applied. This shows absence of significant negative impacts of these emissions on the environment and human health, and because of this modelling of their spread and reporting of an eventual cumulative effect on the background loading is not necessary.

The abovementioned products of biological degradation are transmitted mostly through the air necessary for the processes (bearer of oxygen). Air is fed also for ventilation of the halls and for maintenance of the sanitary and hygiene requirements for fork environment.

During the unloading, separation, shredding (crushing), drying and storage of waste there will emissions of particulates, of substances with unpleasant smell and of water vapour. Their quantity will vary and will depend on the type of waste, moisture and the meteorological conditions (temperature, moisture content). For non-admission of unorganized particulate emissions from

MBT and unpleasant smell, the storage houses are covered and all facilities are airtight and with remote control.

The principles of the ventilation system of the waste mechanical and biological treatment facility boil down to the following:

- the waste gas from buildings 1, 2, 4 and 6 is used partially for aeration in the biological treatment process (composting) in buildings 3 and 5, thus minimizing the end quantities of waste gas for scrubbing through the biofilters;
- the air in buildings 1, 2, 4 and 6 is rich in unpleasant smell. Depending on the composition and moisture of waste, the smell may reach 5000 units as a result of the biological degradation processes, while the odour standard is 500 units.
- the waste gas from building 3 (biological treatment) is fed for scrubbing to biofilter 1, and that from building 5 (post-biological treatment), to biofilter 2. The two biofilters are designed in such a way that the odour at the exit does not exceed 500 units and/or 50 mg of total organic carbon (TOC).
- The other main pollutant in the waste gas is dust which should also meet the standards for work environment in each of the buildings.

Emissions from the non-hazardous waste landfill site

Waste gas will be emitted from a gas well where the waste gas collected from the drainage system will be led. In view of the fact that stabilized waste will be fed to the landfill, which will start degrading under the influence of external factors such as temperature, rainfall and snow melting, a more intensive gas release is expected to begin in the tenth year after the initial disposal and continue for a long time after the landfill closure. The amount of gas emissions is calculated on the basis of data of the quantities disposed of, using the Methodology of calculating by balance-sheet methods of the emissions of harmful substances released to the atmosphere – CHEB code-94/ 0904/. Because of the low flow rate and insufficient concentration of methane, the resulting biogas is not going to be used and will be burned in a “torch”.

Table 1.10.2.7.

Annual emissions from the internal combustion engines (ICE) of the machines operating on the site where the composting facilities are located

Substance	Emission (кg/t)	Annual emissions(kg/a)
Non-methane volatile organic compound (NMVOC)	7,3	92527,5
NO_x	30,2	382785
CO	12,6	159705
CO_2	3700	46897500
N_2O	0,12	1521
CH_4	0,3	3802,5
NH_3	0,01	126,75
PM	2,4	30420
Emission (g/t)		
Cd	0,01	126,75
Cu	1,7	21547,5
Zn	1,0	12675
Ni	0,7	8872,5

Emissions from ICE of the machinery servicing the composting facilities

Item 1.6.1 contains a description of the transport vehicles and machinery for the two composting facilities located on the ***Han Bogrov site***. Emissions will depend on the type and power of the machines, their technical state and mode of operation. The amounts of harmful substances emitted, calculated according to the Methodology of calculating by balance-sheet methods of the emissions of harmful substances released to the atmosphere, MOEW 2006, per ton of fuel and the expected annual emissions are shown in Table 1.10.2.7.

Emissions from the composting facilities

Processes of primary and secondary fermentation occur in the composting of garden waste ("green waste") and food waste ("biomass"). As has been mentioned above, the kinds of gas released from the MBY facility are water vapour, carbon dioxide and ammonia. Their amount will depend on the quantity of organic waste and the composting technology.

Here it is envisaged again to use the ventilation gas from the premises in the composting process and, after its being enriched in odour, pass it for scrubbing through a biofilter, before it is emitted into the atmosphere.

The emissions of ammonia calculated according to the Methodology of calculating by balance-sheet methods of the emissions of harmful substances released to the atmosphere in the production of compost from waste, in the process of waste gas scrubbing through a biofilter with a performance coefficient of 90%:

- Ammonia emissions (NH3) - 24 g/ t of organic waste, or annual release of 480 kg/a of NH_3 from each facility.

According to the requirements of the *Reference document on the best available techniques for waste treatment industries* 2006, the use of the biofilters chosen should lead to reduction of emissions from the mechanical and biological treatment occurring in the composting facilities and the MBT facility to the following levels (through the techniques of reducing emissions in the biological treatment processes listed in ***Section 4.2.12*** and described in detail in ***Section 4.6*** of the *Reference document on the best available techniques for waste treatment industries*, 2006).

Table 1.10.2.8.

Characteristics of the treated gas after going through the biofilters

Parameter	**Treated gas**
Odour (ouE/m^3)	< 500 – 6000
NH_3 (mg/Nm^3)	< 1 – 20
For volatile organic compounds (VOC) and particulate matter – for VOC: 7÷20 mg/Nm^3 (in some cases the upper limit may reach 50 mg/Nm^3); for particulate matter 5÷20 mg/Nm^3). The experts from the technical work group on the *Reference document on the best available techniques for waste treatment industries*, 2006 think that N_2O (***Section 4.6.10***) Hg will have to be included in this table, too, although there is not enough data to validate values of these parameters.	

1.10.3. During closure and recultivation

The air pollution will be a result of unorganized emissions of particulate matter and gas from the operation of the servicing machinery and equipment during the disassembly of facilities, pulling down of the buildings, transport, earthwork and other operations.

1.11. Waste water generated – quantity and quality assessment.

1.11.1. During construction

No other waste water generation is expected, except for the overland flow of water from the sites and the sanitary wastewater.

Surface rainwater run-off – the total projected quantity for the construction period (12 months) will amount to 22272 m^3 (1, 72 l/sec). This quantity is forecasted on the basis of the annual rainfall for the corresponding altitude (693 mm/m^2 annually). The distribution of rainfall is uneven over the year. The greatest amount of rainfall, about 230mm, is during the May – June period and the lowest amount of rainfall, about 105mm, is in winter, from January to March.

Sewage and sanitary wastewater – with presumably 150 people as an average number, working on the two sites, distributed in two shifts, waste water to the amount of about 9, 37 m^3/day will be generated (0, 21 l/s). The total quantity of sewage and sanitary wastewater for the whole period of implementation of the project (12 months) will amount to about 3185, 8 m^3. During the construction phase, until a WWTP is built, it is recommendable that mobile toilets are used and a contract for their maintenance be signed with an external company.

During the construction phase, the influence on the quality of surface water is expressed in the increased quantity of mechanical impurities. It is recommendable that drain ditches be made round the building site to minimize the pollution of surface water.

1.11.2. During operation

Yana-Sadinata site – Waste water from the MBT facility and from the non-hazardous waste disposal site, as well as waste water from the Han Bogrov site is to be treated in a waste water treatment plant (WWTP). Its capacity, as well as the amount of water entering for treatment is shown in Table 1.9.2.1 and Table 1.11.2.1 presents the design parameters of the WWTP, according to the quantity and quality of the waste water to be treated. The sewage and sanitary wastewater from the two sites (5 m^3/d) will go for final treatment to the same WWTP because its design capacity is big enough to accept these amounts of water. The leachate will be collected from the landfill body through a drainage system built in accordance with Regulation No 8/ 2004 on the conditions and requirements for building and operation of landfills, from where, again pursuant to Regulation No 8/ 2004, it will be fed to the WWTP for treatment. This technological solution complies with the best available techniques (BAT) which have been included as regulatory requirements in Regulation No 8/ 2004 on the building and operation of landfills.

Table 1.11.2.1

WWTP design parameters

Parameter	**Unit**	**Design value**					
Amounts of waste water							
Q_d	m^3/d	192					
Q_h	m^3/h	8.0					
Parameter	**Concentrations**					**Quantities**	
	Unit	**At the entrance**	**At the exit**	**According to Ordinance 6/ 2000**	**Best available techniques**	**Design value**	**Unit**
Biological oxygen demand (BOD_5)	mg/l	3200	15	25	2÷20	614	kg/d
Chemical oxygen demand (COD)	mg/l	12700	70	125	20÷120	2440	kg/d
Heavy metals (Cr, Cu, Ni, Pb, Zn)	mg/l				0.1÷1		
As	mg/l				< 0.1		
Hg	mg/l				0.01÷0.05		
Cd	mg/l				< 0.1÷0.2		
Cr (VI)	mg/l				< 0.1÷0.4		
P	mg/l			2			
NH_4-N	mg/l	1800	2.0	15.0		346	kg/d

Adsorbable organically bound halogens (AOX)	mg/l	5.0				1.0	kg/d
Total content of undissolved substances	mg/l		50	60			
pH		8.0	8.0	-			
Temperature	°C	10	Not more than 3°C of the average temperature for the season	-			

Han Bogrov site – Industrial waste water from the composting facilities and the sewage and sanitary wastewater will be collected in closed reservoirs whose location is given in ***Fig. 1.4.4.*** They will be periodically transported to the WWTP at Yana-Sadinata for treatment.

1.11.3. During closure and recultivation

Analogous to the construction phase, in this phase waste water will be generated from the surface water run-off and the sewage and sanitary wastewater. The sewage and sanitary wastewater will be led to the WWTP through the corresponding sewer system. The plan for closure and decommissioning of facilities should envisage retaining of the WWTP in the beginning of this phase, because leachate will continue to be generated during the landfill post-operation period.

The overland flow that may be generated will be caught and treated, if necessary in the WWTP.

1.12. Municipal solid waste generated – quantity and quality assessment

1.12.1. During construction

The present investment proposal envisages building of an integrated system of facilities and equipment for treatment of the municipal solid waste (MSW) of Sofia Municipality. Construction will be carried out together with building of the internal infrastructure (roads, water supply and sewer systems) and the main facilities on the premises – the landfill "body", the waste water treatment plant (WWTP), the biofilters and other. The sequence of construction works should be described in the work design.

The terrain of the two sites where the waste treatment facilities will be constructed is not built up. The waste generated at this stage is mostly construction waste from the building materials used (iron fittings; pieces of concrete, wood from the formwork of the reinforced concrete constructions; metal, glass, plastics, rubber, timber, lubricants), classified in accordance with Ordinance No 3/ 2004 on waste classification (*SG No 44 of 25.05.2004).*

The hazardous waste from group 13 will be separated while maintaining the building equipment. It is recommendable that until the construction and commissioning of the machine unit maintenance of the transport vehicles and machinery be carried out by an external firm on the basis

of a contract. Hazardous waste collection sites are formed where waste is to be collected in tanks in accordance with the fire-precaution requirements. The sites for temporary storage of waste should meet the regulatory requirements. The operator has to sign a contract with an external firm holding a permit under Art. 37 of the Waste Management Act or an integral permit for transportation and disposal of this waste.

Package waste will be separated during the facilities assembly operations. On each site there must be a place for storing the packaging from the machinery and equipment delivered. Their sorting by type (wooden, plastic, metal, paper and cardboard) as well as their sale for recycling should be organized.

There will be minimum quantities of construction waste (code 17 01 и 17 02). It will be collected in replaceable containers for each of the sites and disposed of at landfill sites for construction and demolition debris, after a permit has been received from the municipality Mayor. Metal waste (code 1704) is transferred for recycling to a firm holding a permit under t. 54 of the Waste Management Act.

Soil and stone waste, and waste from earthworks (codes 170504 and 170506) will be generated while laying the foundations of the buildings and forming the landfill body. The presumed quantities will be indicated in the project documentation. The excavated earth and rock masses will be used for forming the landfill dikes, levelling up the terrain and other. In case of established excess, a site is formed for storing this waste until the landfill operation phase.

From the feasibility studies it has been established that the lands within the territory of the ***Han Bogrov*** site are dangerously (category B III) and hazardously (category C) contaminated with radionuclides. It is necessary to remove considerable cubic content of polluted soil (170503* and 170505*) (approximately 53572 m^3), according to Art. 14. (1) of the law on dangerous contaminations, because of the fact that the site is situated in a part of the so called “Frequently Flooded Area of Yana” (Razliv Yana). It is not only necessary to foresee costs for its scooping up, transportation and disposal in the Buhovo tailings pond, but also for working out a radiation programme for the activities during construction and for control after its completion.

During the time of developing the Integrated System of Facilities and Equipment for Treatment of the Municipal Solid Waste of Sofia Municipality about 150 people will be employed and their vital functions will be the main source of municipal waste generation. The quantity of municipal waste for the two sites will be about 150 kg/day. This refuse will be collected in bags and/or containers and will be periodically hauled and disposed of. The operator has to sign a contract with a company holding a permit under Art.37 of the Waste Management Act for regular

haulage of waste from the site. Disposal takes place after receiving a permit from the Mayor of the corresponding municipality.

The construction works will continue for about 12 months. The duration of this phase depends on the organization of the technological process of the construction and assembly firm, as well as on the meteorological conditions. This is also the period of waste construction generation. The organisation of the ultimate disposal of generated waste is based on a contract with a firm

1.12.2. During operation

The Investment Proposal is related to the development of an integrated system of facilities and equipment for treatment of the municipal solid waste of Sofia Municipality. In its essence it conforms to ***Section 5.2*** of the *Reference document on the best available techniques for waste treatment industries, 2006,* and envisages the following processes:

- Biological treatment – in the facilities for composting garden waste or "green waste", food waste from large commercial outlets, or "biomass", the biodegradable components of waste collected as mixed waste;
- Physical treatment – in the composting facilities and in the MBT facility;
- Extraction of valuable components from waste – advance separation of incoming waste on the two sites;
- Production of fuel from waste – at the MBT facility;

The material balances of the production processes are described in ***Fig.1.6.1.1– 1.6.1.7.*** The mass balance and the change in the waste morphological structure in the process of treatment are presented by technological units in ***Application 4***. Generation of the following industrial waste is expected from the production processes by sites, classified in accordance with Ordinance No 3/ 2004 on the classification of waste.

Yana-Sadinata site

Table 1.12.2.1.

Description of the waste from the MBT facility

Code under Regulation No 3/ 2004	**Name**	**Quantity, t/a**	**Point of generation**	**Mode of treatment**
At the facility entrance				
20 03 01	Mixed municipal waste	410000	Sofia Municipality	Collected and delivered by the companies holding concession for the cleaning and waste removal
At the facility exit				
16 04 02*	Pyrotechnic waste – irregularly fallen among the mixed municipal waste	1000	Technological unit (building) 1	Transferring for treatment to a firm holding a permit under Art. 37 of the Waste

				Management Act (WMA)
	Irregularly dumped radioactive waste			Transferring for treatment to a specialized firm holding the required permits
20 01 34	Lead-acid batteries – irregularly fallen among the mixed municipal waste			Transferring for treatment to a firm holding a permit under Art. 37 of the WMA
19 05	**Waste from aerobic degradation of solid waste**			
19 05 03	Non-standard compost	61000	Technological unit (building) 6	Sale of damaged terrains for recultivation Disposal
1912	**Waste from mechanical treatment of refuse (for example, sorting, shredding, screening, separation) that is not recorded elsewhere**			
19 12 02	ferrous metals	4000	Metal separation from all technological units	Sale for recycling to a firm holding a permit under Art. 37 of the WMA
19 12 10	combustible waste (RDF –modified refuse-derived fuel)	126000	From technological unit 4	Sale for utilization to external firms holding a permit for use of RDF fuel or an Integrated Permit
19 12 12	other waste (including mixtures of materials) from mechanical treatment of waste non containing harmful substances	154000	From technological units (buildings) 1,2,4,6	Disposal

Non-standard compost (190503) is suitable for use in recultivation of damaged terrains, including from mining and extractive operations. Sofia Municipality has received a letter from the Bulgarian Chamber of Mining and Geology (BCMG) with a description of the potential clients for this waste (***Application 7***). Bearing in mind the existence of numerous waste (spoil) banks, tailings ponds and other damaged terrains in the area of the investment proposal implementation, it is necessary to have specific talks with the owners of such terrains about the use of this waste, which will facilitate the recovery processes with regard to the environment. This will contribute to the improvement of the aesthetic appearance of the area as a whole.

The use of modified refuse-derived fuel as an alternative fuel provides a chance to preserve non-renewable natural resources (coal, petroleum, natural gas). In the practice of some EU member-countries and in Bulgaria the solid fuel obtained is directed to the production of cement and lime or to electric power stations operating on coal. With the continuous increase in traditional fuel prices, the market of modified solid fuel (RDF) keeps expanding. The biomass contained in it (60% on average) is growing in importance as a result of industry's desire not to sustain losses from the EU Emission Trading Scheme (ETS).

According to the *Reference document on the best available techniques for waste treatment industries,2006,* it is the Operator's obligation to keep in touch with the fuel user with the aim to control the composition of the fuel produced (***described in Section 4.5.1 of the Reference Document on the Best Available Techniques)*** and maintain a quality assurance system which guarantees the characteristics of the refuse-derived fuel (***described in Section 4.5.1 of the Reference Document on the BAT***), which ensures maintenance of the normal technological modus in the use of these kinds of fuel and observance of the emission standards for refuse-derived fuel. At this stage, Sofia Municipality has been address because of declared interest in using this fuel in cement plants (***Application 7)*** in Bulgaria.

Table 1.12.2.2.

Description of waste from the non-hazardous waste disposal site

Code under Regulation No 3/ 2004	**Name**	**Quantity**	**Point of generation**	**Mode of treatment**
At the facility entrance				
19 12 12	other waste (including mixtures of materials) from mechanical treatment of waste not containing harmful substances	157000 **t/a**	The MBT facility and the composting facilities	Collected for disposal from the technological units of the two sites
19 05 03	Non-standard compost	max 61000 **t/a**	The MBT facility	The rest of the non-standard compost unsold on the market is disposed of.
At the facility exit				
19 07	**Leachate from landfill sites**			
19 07 03	leachate from landfill sites not containing harmful substances	36m^3/d or 1,5m^3/h	The non-hazardous waste disposal site	Sending to WWTP (conforms to the Reference document on the BAT – Regulation No 8/ 2004)

Characteristics of the leachate sent for treatment to the WWTP from the non-hazardous waste landfill site are given in Table 1.11.2.3.

Table 1.12.2.3

Description of waste from the Waste Water Treatment Plant (WWTP)

Code under Regulation No 3/2004	**Name**	**Quantity**	**Point of generation**	**Mode of treatment**
19 08	**Waste from waste water treatment plants, not recorded elsewhere**			
19 08 01	waste from bars and screens		Mechanical stage (aeration) of WWTP	Disposal
19 08 02	waste from grit catchers		Mechanical stage (aeration) of WWTP	Disposal
19 08 12	sludge from biological treatment of waste water not containing harmful substances	314 kg/d	Biological stage (aeration) of WWTP	MBT or disposal

19 08 99	waste not recorded elsewhere – spent activated carbon		Biological stage (aeration) of WWTP	Disposal or composting

In accordance with the *Reference document on the best available techniques for waste treatment industries 2006*, the aerobic decomposition of sludge is included in the ***Section of mechanical and biological treatment*** of the document, where a good practice is the reduction of the organic part of waste through MBT.

Han Bogrov site **–** The composting facilities are expected to generate the waste mentioned below, classified according to Regulation No 3/ 2004 on waste classification. Their characteristics are shown Table 1.12.2.4

Table 1.12.2.4

Description of waste from the facilities for composting of garden waste or "green waste"

Code under Regulation No 3/2004	**Name**	**Quantity, t/a**	**Point of generation**	**Mode of treatment**
At the facility entrance				
20 02 01	biodegradable garden waste (green waste)	20000	The green areas within the territory if Sofia Municipality	Separate collection through the planting and landscaping firms
At the facility exit				
19 05	**Waste from aerobic degradation of solid waste**			
19 05 02	non-composted fractions of green waste	5079	fraction>30-40mm	Disposal Repeated composting
1912	**Waste from mechanical treatment of waste (for example, sorting), not recorded elsewhere**			
19 12 02	ferrous metals	98	Metal separation	Sale for recycling to a firm holding a permit under Art. 37 of the WMA
19 12 12	other waste (including mixtures of materials) from mechanical treatment of waste not containing harmful substances	200	from sorting prior to biological treatment	Disposal

The expected quantities of food waste from "biomass" for the period of operation of the facilities by source of generation are shown in Table 1.12.2.6, and Table 1.12.2.7 gives a characteristic of the waste from the "biomass" facility

Table 1.12.2.7

Description of waste from the facilities for composting food waste from large commercial outlets such as restaurants, markets etc. (biomass)

Code under Regulation No 3/2004	**Name**	**Quantity, t/a**	**Point of generation**	**Mode of treatment**
At the facility entrance				
20 01 08	biodegradable waste from kitchens and catering establishments	20000	catering establishments	Separate collected
20 03 02	waste from markets		markets	Separate collected

At the facility exit				
19 05	**Waste from aerobic decomposition of solid waste**			
19 05 02	non-composted fractions of green waste	5869	fraction>30-40mm	Disposal Repeated composting
1912	**Waste from mechanical treatment of waste (for example, sorting, crushing, screening), not recorded elsewhere**			
19 12 02	ferrous metals	98	Metal separation	Sale for recycling to a firm holding a permit under Art. 37 of the WMA
19 12 05	glass	1890	Screening	Disposal
19 12 09	minerals (for example, sand, stones)			
19 12 12	other waste (including mixtures of materials) from mechanical treatment of waste not containing harmful substances	500	from sorting prior to biological treatment	Disposal

Apart from the industrial waste described by facility, generation of waste is also expected in the process of operation of the facilities, from the transport vehicles and machinery and the workers' vital functions on the two sites, this expected waste is shown in Table 1.12.2.8.

Table 1.12.2.8

From maintenance of the MBT facilities, the composting facilities and the workers' vital functions

Code under Regulation No 3/2004	**Name**	**Point of generation**	**Mode of treatment**
130113*	Waste hydraulic oils	Maintenance of lines, machinery and equipment	Collection in tanks and temporary storage until transportation by a firm holding a permit under Art. 37 of the WMA, on the basis of a written contract
130308*	Spent motor oil and gear drive oils	Maintenance of lines, machinery and equipment	Collection in tanks and temporary storage until transportation by a firm holding a permit under Art. 37 of the WMA, on the basis of a written contract
15 01 01	Paper and cardboard packages	Administrative activities	Separate collection, packaging and sale for recycling to firms holding a permit under Art. 37 of the WMA, on the basis of a written contract
15 01 02	Plastic packages	From mineral water	
150110*	Packages containing remains of harmful substances or contaminated with harmful substances	Maintenance of lines, machinery and equipment	Separate collection, packaging and sale for recycling to firms holding a permit under Art. 37 of the WMA, on the basis of a written contract
19 05 99	Waste not recorded elsewhere	Biofilter backfilling	Treatment at the composting facilities

20 03 01	Mixed municipal waste	From the personnel's vital functions	Treatment at the MBT facility

For maintenance of the facility and the specialized transport machinery (front loader and automatic dump truck) it is recommended to select motor oils and lubricants free from polychlorinated biphenyls (PCBs), thus minimizing or eliminating the possibility for the generation of hazardous waste containing PCBs. The only generation of hazardous waste during the operation, maintenance and repair is as follows:

- Hydraulic oils (130113*);
- Spent motor oils, lubricants and gear oils (130308*);

The annual quantity and frequency of the generation of waste from grease and liquids depends on the way in which the regular and preventive maintenance of equipment should be carried out. Spent oils and grease should be collected in packages containing remains of harmful substances or contaminated with harmful substances (150110*) and transferred to the company supplying the oils and grease. The latter should be included in the contract for delivery. It is recommendable that the system of exchanging an "empty" package for a "full" one be applied. The procedure of changing the oils and grease should be described in the Instruction for the facility and transport machinery maintenance. The workers (tool fitters, drivers) should be instructed about the way of collecting waste before starting work. When necessary, temporary storehouse premises should be established (a site for temporary storage of this waste) in the administrative building, which should comply with the fire-precaution requirements and should be designated according to the regulatory requirements.

To satisfy their needs for drinking water, the workers are going to use mineral water. It is recommended that the mineral water packages (150102) should be collected separately and delivered to the supplier on the basis of a contract. Paper packaging, as well as paper and cardboard waste (150101) should be collected separately and delivered for utilization.

The contracting authority envisages 70 people working at the two facilities, so the expected quantity of municipal waste (200301) is 70 kg/d (3 kg/h). These quantities should be collected and transported to the MBT facility, for which a procedure is to be worked out (Work instruction).

It is recommended that on signing contracts with external firms for whatever waste-related activity, the contracting authority should insist on receiving a copy of the firm's Permit for handling waste.

The Operator has to develop a company ***Waste Management Programme*** for the territory of the two sites. The waste management should be documented in accordance with the regulatory requirements and a person should be determined to take charge of this activity.

1.12.3. During closure and recultivation

Generation of solid waste is expected, whose type will depend on the materials used during construction. The facilities and the equipment fit for use will be disassembled and offered for reuse. All the remaining waste will be separated, waste to be recycled will be provided to companies holding a permit under Art. 37 of the WMA for recycling. The municipal waste management is analogous to that during construction and is indicated in item 1.12.1.

In accordance with the requirements of Regulation No 8 on the conditions and requirements for building and operation of landfills and other facilities and installations for waste recovery and disposal (*SG No. 83 of 24.09.2004, amended No 8730.10.2007*), the non-hazardous waste disposal site will be closed with a top insulation layer and recultivated according to a closure and recultivation project developed in advance. The detailed design of the top insulation layer is a part of the Working Project of the non-hazardous landfill site. The emissions from the WWTP and the gas well are subject to after care following the non-hazardous landfill closure.

1.13. Energy pollutants generated – quantity and quality assessment

During the construction period, mostly noise from the auto-assembly machinery movement and the earthwork activities will be generated. The expected noise load values of the working environment on the sites will be below the maximum admissible levels.

1.14. Accident hazard

For each of the sites where facilities, i.e. parts of the Integrated System of Facilities and Equipment for Treatment of the Municipal Waste of Sofia Municipality, are located it is necessary to develop an **Emergency Response Plan in the Event of Accidents and Disasters.** The aim of the plan is to create optimum organization for duly forecasting the character and effects of earthquakes, floods and other common disasters, big production accidents and fires, and successful implementation of local protective, safety and disaster liquidation measures in the emerging centres of damage (contamination). The plan has to be in concert with “Fire Precaution’ and “Civil Defence” in the city of Sofia.

1.15. Accident prevention and emergency response measures

For general guidelines, coordination and control of the activity on the organization and management of rescue and emergency response activities in the event of disasters, accidents and calamities, as well as for preventive work, non-admittance or reduction of their negative effects, an ***Emergency Plan*** has to be developed. This plan should specify the measures for non-admittance,

prevention or liquidation of the effects of disasters or accidents (the most probable ones are described in item 1.14), depending on their nature, as well as the services and organizations to be sought for interaction in case of occurrence of a disaster or accident within the territory of the two sites where the equipment and facilities for composting, mechanical and biological treatment and disposal of waste, the procedure and ways of notification of incidents, accidents and disasters, the order of introducing the action plane in the event of accidents, etc. It should reflect the obligations of officials taking an active part in the liquidation of the aftermath of accidents and the order of their activities, as well as the terms for submitting the information to the higher-ranking instances.

1.16. Monitoring

During the nvestment proposal implementation, monitoring at the various stages (construction, operation, closuse, recultivation) is envisaged, the frequency, place and method of which are shown in **Tables 1.16.1., 1.16.2. and 1.16.3.**

Table 1.16.1

System of monitoring of the investment proposal during construction

SOURCE	Method*	Point	Frequency
Traffic during the construction works	КВМ	Network of points of monitoring of dust emissions	Daily (visual) Weekly
Surface run-off from the site	КВМ	Discharge poins;	Daily (visual) Weekly
Emissions from automobiles and trucks, and other transport vehicles	КВ	Vehicle service station	Daily (visual) At the time of servicing the vehicle
* Method- К = quantity, based on analyses; В = visual evaluation; М = numerous monitoring points			

In compliance with Ordinance No.8 of 24 August 2004 on the conditions and requirements for building and operation of landfills and other facilities and instalations for waste recovery and disposal, monitoring should be carried out when laying the bottom insulation layer of the non-hazardous waste landfill.

Table 1.16.2.

System of monitoring the investment proposal during operation

SOURCE	Method*	Point	Frequency
Operation phase			
Surface run-off from the site	КВМ	Discharge points;	Monthly
Composting facilities	К	Monitoring of the waste water from the reservoir of the site	Automatic continuous control
MBT facilities	К	Waste water monitoring	Automatic continuous control
Non-hazardous waste landfill	К,В,М	Leachate monitoring	Automatic continuous control

SOURCE	Method*	Point	Frequency
WWTP	К	Monitoring of in-coming waste water to be treated	Automatic continuous control
Waste water discharge after treatment in a WWTP	КВМ	Monitoring of waste water at the point of discharge	Monthly
Waste gas treatment	О, К	Biofilters	Monthly
Non-hazardous waste landfill	К,В,М	Gas well	Automatic continuous control
Ventilation systems feeding air to the facility halls on both sites	К,В,М	At the entrance of each hall	Automatic continuous control
All sources of dust emissions	КВМ	Network of soil testing points on the work sites	Once a year
Floods and leakages from the transport machinery	КВМ	Water and soil monitoring	Monthly
* Method- К = quantity, based on analyses; В = visual evaluation; М = numerous points of monitoring О = organoleptic			

The quality of ambient air has to be an object of continuous monitoring and control on the territory of the site, as well as at typical points along the route of auto transport machinery.

Ambient air- Sampling points are envisaged, which could be of use for the facility to observe the parameters of the ventilation system and biofilter operation. No violation of emission standards is expected if the biofilters are properly maintained (replacing the filtering filling every 2 years) and if the performance parameters are kept within the set limits.

Surface and ground water - It is envisaged to carry out monitoring of the surface waste water from the facilities, as well as of the ground water within and around the territory of the two sites. It is necessary to specify the sampling points, the sampling frequency and the components which need to be determined. Reliable measures should be provided for control of the technical condition of industrial sewerage, so that urgent and adequate measures can be taken in case of emergency. A system of control of the basic parameters of processed water discharged into the industrial sewerage should be ensured, concurrently with the treatment station operation, in order to guarantee control of the necessary indicators.

Monitoring for preservation of ground water by drilling at the appropriate places.

Waste- with regard to performance of own waste monitoring, a company 'Waste Management Programme' preparation is envisaged. It should contain a monitoring plan for the introduction of strict control on generated waste, its storage in appropriate warehouses, location of the sites for temporary storage of waste, according to the legislation requirements, and its

forwarding to licensed companies for further treatment. Monitoring (quality and quantity) is to be conducted by introduction of reporting books for the waste in compliance with Ordinance 9/2004.

Table 1.16.3

A system for monitoring of the investment proposal at closure and recultivation

SOURCE	Method*	Point	Frequency
Closing stage			
Building demolition activities	КВМ	A network of points for monitoring of dust emissions	Daily (visual) Weekly during work
Surface run-off	КВМ	Monitoring points	Weekly
* Method- К = quantity, based on analyses; В = visual evaluation; М = numerous spots of monitoring			

The investment proposal envisages monitoring of environmental components in accordance with the existing BAT (*Reference document on the best available techniques for waste treatment industries, 2006*). The exact number and location of the points will be determined at a next stage, observing the methods, location of the points and frequency of sampling shown in **Table 1.16.4.**

Table 1.16.4

System for monitoringwith regard to the environment components

Components	Methods	Location of the points	Frequency of sampling
Surface run-off	Manual sampling and analysis	The discharge point into the surface water intake	Monthly
Ground water	Manual sampling and analysis	Network of piezometers	Monthly
Quality of ambient air (dust)	Emission measurement	Monitoring of dust emissions	Monthly
Quality of the ambient air	Gas sensors	Monitoring of waste gas emissions	Permanently
Soils	Mechanical sampling	In a network, with a distance of 500 m between the measurement points, which spreads beyond the boundaries of the site	Before the release of emission, twice during the emission
Flora and fauna	Monitoring of habitats	Making investigations to find out the existing situation before the start of the investment proposal	For three years after commencing the activity.
Archaeology	Maintaining contacts with the competent institutions in case of uncovering archaeological finds, with the purpose of documenting and preserving them.	Areas of direct influence	Permanently
Noise and vibrations	Noise and vibration monitoring	Selected points between the sources and the objects of impact	Depending on the particular activities

In accordance with Application 3 to Art.3, Para.2, p.3, Art.12, Para. 1, Art.13, Art.16, p.3, Art.22, Art.4, Art.40, Para.1, p.1 of Ordinance No.8 of 24 August 2004 on the conditions and requirements for building and operation of landfills, it is required that in the course of operation and after closing of the landfill, monitoring of the landfills of waste should be carried out. According to Art. 44 of Ordinance No. 8, it is required to exercise control and observe the parameters for a period of 30 years after the landfill closure. The intercompany control finds expression in input control,

and control of the disposal technology, the insulation, the drainage system and the overall landfill stability. Input control is exercised at the entrance of the landfills and it includes visual evaluation of the waste, and the date and time of the waste entering, and the number of runs.

The determination of the volume of leachate, its quality composition and statutory methods of analysis, as well as the sampling frequency depending on the landfill condition are shown in table 1.16.5. The sampling and determination of the leachate volume and composition have to be carried out according to the ISO Standard 5667-2 (1991), Water quality – Sampling – Guidance on sampling techniques. The leachate and ground water sampling and analysis is carried out according to the indicator parameters of anticipated pollution, which are necessary for early determination of the changes in ground water quality.

Table 1.16.5

Monitoring of leachate, ground water and gas emissions

No.	Indicators	During the landfill operation	After the landfill closure
10.	Volume of leachate	monthly	Every 6 months
11.	Composition of leachate	quarterly	Every 6 months
12.	Level of ground water	Every 6 months	Every 6 months
13.	Composition of ground water	Every 6 months	Every 6 months
14.	Potential gas emissions and atmospheric pressure (CH4, CO2,O2, H2S, H2 etc.)	monthly	Every 6 months

According to Art. 4.1 of the abovementioned Application 3 on monitoring of ground water, measurements should be made at least at three points – one above the landfill and two behind it in direction of the natural flow of ground water.

The Concentrations of separate components in ground water are to be evaluated by criteria in accordance with the legal requirements (Application No.1 to Art.10, Para. 2 of Ordinance No.1/10.10.2007 on ground water survey, use and preservation).

The ground water monitoring after the WWTP is to be in compliance with the requirements of Application 3 of ORDINANCE No. 6 of 9.11.2000 on the limit values for admissible content of dangerous and harmful substances in the waste water discharges in the water bodies (*prom. SG , No 97 of 28.11.2000, suppl. and amend. No 24 of 23.03.2004, in force from 23.03.2004)*

2. Studied alternatives for location and alternatives by technology and motive for the choice made for the study, bearing in mind the environmental impact, including a "zero alternative”

2.1. Zero alternative

The “zero alternative” in the case of the Sofia Municipality’s waste treatment is not acceptable. The accumulation of baled or disposed municipal waste without separation dooms not

only the present-day but also the future generations from the adjoining areas to continuous exposure of generated pollutants in the atmospheric air, the most significant of them being greenhouse gas from methane and carbon dioxide. On the other hand, today's practice is unacceptable because the municipal waste potential as a raw-material and energy resource is not made use of. This practice fully contradicts the principles of sustainable development and does not comply with the regulatory requirements of the National Strategy for Gradual Reduction of the Quantity of Biodegradable Waste Destined for Landfilling and the plan for its implementation.

2.2. Alternatives for implementation of the investment proposal in compliance with the best available techniques (BAT)

With regard to the best available techniques for solid waste treatment, there are two reference documents of the European Commission:

- Integrated Pollution Prevention and Control, Reference Document on the Best Available Techniques for Waste Incineration, August 2006*;*
- Integrated Pollution Prevention and Control, Reference Document on Best Available Techniques for the Waste Treatment Industries, August 2006.

The general scheme of the systems for mixed municipal waste treatment, in accordance with BAT, is shown in ***Fig. 2.2.1.*** Waste separation (from 2 to 12) is related to prioritizing the possibility for waste recycling and reuse, which is in conformity with the European waste management hierarchy.

a) Technologies set out in the investment proposal

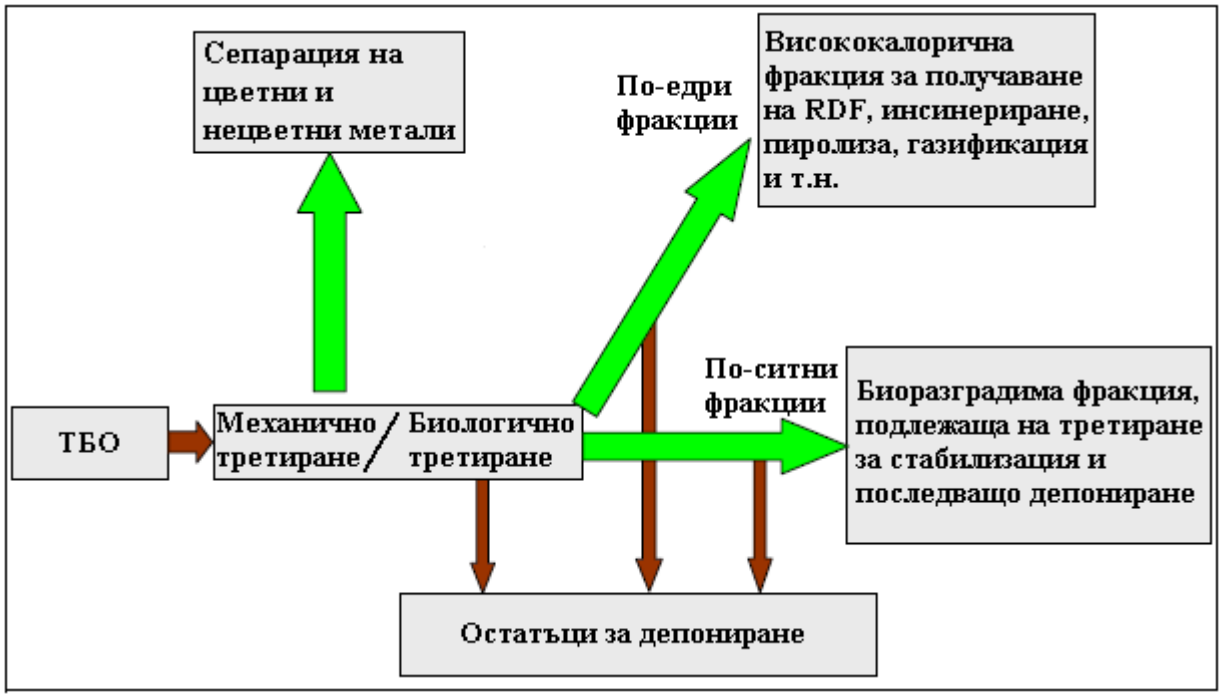
The investment proposal falls completely within the scope of Reference Document on Best Available Techniques for the Waste Treatments Industries, August 2006, and covers the processes of mechanical and biological treatment, composting and disposal.

Fig.2.2.1 – General scheme of municipal solid waste treatment, according to BAT

1 SMW - tipping floor
2 SMW explosive
3 SMW inflammable
4 SMW radioactive
5 SMW household appliances
6 SMW hazardous
7 SMW plastics
8 SMW paper and cardboard
9 SMW metals

10 SMW		glass
11 SMW		fabrics, rubber, leather
12 SMW		construction, sand, soil, inorganic
	Organic (combustible and biodegradable)	Inorganic (incombustible and non-biodegradable)
Use and disposal through thermo chemical processes	Recovery and disposal through biochemical processes	
RDF	Composting	Disposal
Incineration and energy generation	Household gas production	Cement industry
Pyrolysis		Construction
Gasification		
Plasma processes		

According to the BAT (*Reference Document on Best Available Techniques for the Waste Treatments Industries, August 2006)* for waste treatment, the ***MECHANICAL AND BIOLOGICAL TREATMENT*** installations separate metal and inert materials; organic fractions (for stabilization through composting) are released and a high-calorific fraction for RDF fuel is produced together with the compost. Modified waste (RDF fuel) can also be produced in the "dry stabilization" process where residual waste (after the separation of metal and inert waste) is dried in a process of composting, which results in a residual mass of high-calorific value. The process is shown in Fig. 2.2.2.



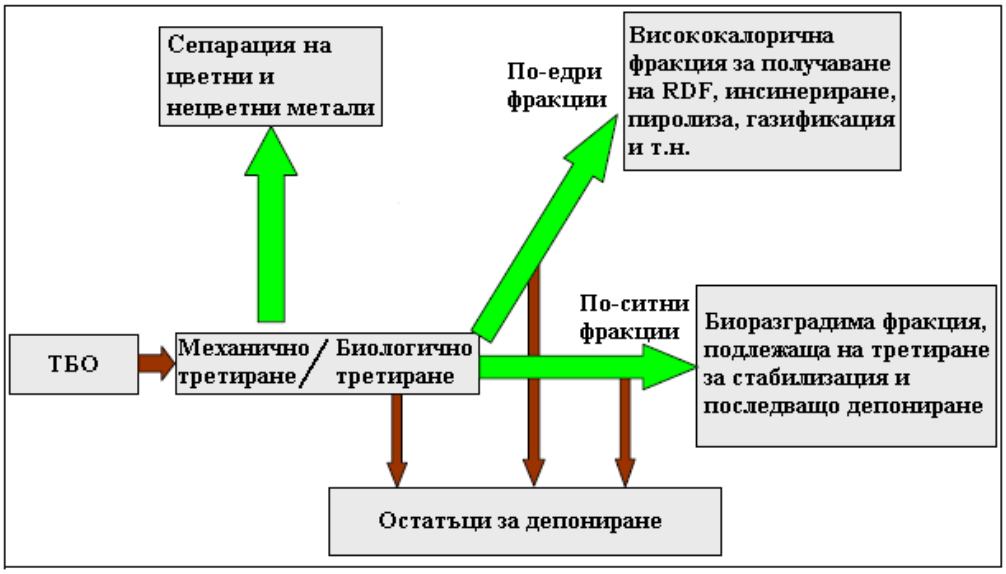


Fig. 2.2.2 Diagram of the incoming and outgoing streams in mechanical and biological treatment (*the brown arrows show the path of residual materials and the green ones, the path of treated outgoing streams).*

Mechanical treatment can be applied before or after the biological treatment **[Eunomia Research & Consulting, 2002], [TWG, 2004]**

Separation of non-ferrous and ferrous metals

MSW Mechanical treatment / Biological treatment

Larger fractions fraction for production of RDF, incineration, pyrolisis, gasification, etc.

Smaller fractions Biodegradable fraction subject to treatment for stabilization and subsequent disposal

Residues to be disposed of

The production of refuse-derived fuels (RDF) is the most widely applied practice in the EU member-states which have achieved a high level of MSW separation while at the source of their generation and recycling. Non-recyclable high-calorific waste, suitable for RDF production, is generated in the process of recycling. The best examples in this respect are Austria, Germany and Holland. The total RDF amount derived from municipal solid waste (MSW) in the EU in 2003 is about 3 million tons. The capacity for RDF production is growing more and more with the building of new MSW installations, some of the latest ones being built in Austria, Belgium, Finland, Italy and Holland.

In Great Britain, modified fuel derived from waste (RDF) is combusted in incinerators with fluidized medium in order to generate energy. Modified fuels derived from refuse (RDF) are combusted together with other fuels in heating plants, paper plants in Finland and in some cement furnaces in Austria, Belgium, Denmark, Italy and Holland. Direct combustion of RDF is not always

possible and it is necessary to store it. The total RDF quantity combusted as concomitant fuel accounts for 70% of the one produced. The quantity of combusted RDF is expected to increase in Belgium, Italy and Great Britain. There are also installations using RDF in incombustible processes such as gasification and pyrolisis.

Some organic waste which is polluted and cannot be recycled is subject to mechanical and biological treatment to the point of obtaining modified fuels derived from refuse (RDF). Such kinds of waste are plastic and cardboard/paper from commercial and industrial activities (from packaging or from production itself), waste rubber, biomass waste (straw, non-treated wood waste, dried sludge), waste textile materials, organic waste (oils, industrial sludge, impregnated wood shavings and used solvents).

The modified refuse-derived fuels (RDF) include a wide variety of prior treated waste materials for the purpose of complying with the requirements of achieving a high-calorific value. RDF could include residues from MSW recycling, industrial waste, sludge, hazardous industrial waste and biomass waste, etc.

In English-speaking countries the term RDF is translated as high-calorific fraction released in the separation of MSW. One of the least expensive and already well-known technologies for obtaining of RDF from MSW is the prior mechanical and biological treatment. RDF can be obtained from MSW through a number of different processes which most generally consist of separation at the source of generation, sorting or mechanical separation, reducing the size (shredding, crushing, etc.), separation and screening, mixing, drying and pelletization, packaging and storage.

Waste is usually separated for obtaining the recyclable fraction (for example, metals), the inert fraction (glass) and for the separation of the fine wet particles of the biodegradable fraction (food and garden residues) with high moisture and dust particulate content. Wet organic materials are separated for composting or anaerobic digestion and the product derived can be used as soil improving agent in recultivation of damaged terrains (including landfill sites) or may be disposed of. In some cases the biodegradable fraction is stored at a place for drying by means of biological treatment (the so-called “dry stabilization” process). The coarse fraction is separated for disposal or goes back into the stream for pulverization. The intermediate fraction containing paper, cardboard, wood, plastics and fabrics can be directly incinerated as coarse fuel (coarse RDF) or dried and pelletized as high-density RDF.

Two technologies have been developed for production of refuse-derived fuel (RDF) from the MSW high-calorific fraction: Mechanical and biological treatment and; dry stabilization process.

The quantity of refuse-derived fuels (RDF) produced from a ton of MSW varies depending on the type of prior waste collection and the quality requirements. It has been established from studies that RDF produced from MSW varies between 23 and 50% of the weight of the waste recycled, depending on the treatment process chosen and the country concerned (Table 2.2.1). In other studies this percent varies between 55 and 85%.

Table 2.2.1.

Level of obtaining of RDF from MSW, depending on the process of treatment and the country where it is performed

Country	**Type of treatment**	**% RDF obtained**
Austria	MBT	23
Belgium	MBT	40-50
Finland	MT	Varies
Holland	MT	35
United Kingdom	MT	22-50

Note: MBT – mechanical and biological treatment; MT – mechanical treatment

One of the advantages of co-firing of RDF with other fuels in industrial processes is the reduction in the quantity of non-renewable natural resources through their replacement with modified refuse-derived fuel (RDF).

There is a tendency towards a big-capacity of mechanical and biological treatment installations because they treat huge volumes of mixed waste. A capacity of 50 – 100,000 t/a is considered normal, but it can also reach 700,000 t/a, which is the capacity of the plant in Milan, Italy, and at the same time the installation capacity may only be 7,000 t/a. So far, there have been at least four mechanical and biological treatment installations in Europe with complete utilization of MSW in the form of waste recycling and energy generation. This technology is applied also in some cities in Canada, whose number of population is similar to this of Sofia.

The investment proposal sets out an alternative and envisages the corresponding facilities and equipment for production of modified refuse-derived fuels (RDF), which can be directed to application in the production processes existing in the country. This is an established practice in other EU countries as well, especially in the current market situation where fuel prices are rising. In this way a part of the household waste turns into an energy resource. As with composting, in this case, too, what is to be released mostly in the atmosphere is steam and carbon dioxide. It is natural that the best available techniques necessitate the use of suitable treatment facilities as has been envisaged in this investment proposal.

- ***COMPOSTING*** is an exothermic process in which organic substrates are subjected to aerobic biodegradation by a mixed microbial population in conditions of higher temperature and moisture (**Fig. 2.2.3**).

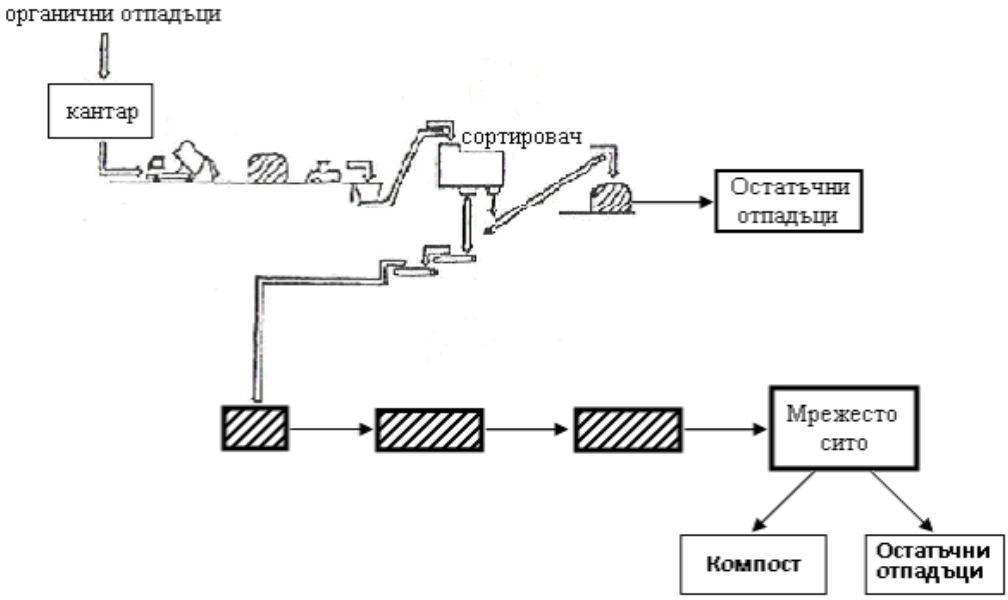


Fig. 2.2.3 Schematic diagram of the process of composting

Organic waste
Scales Sorter Residual waste
Mesh screen
Compost Residual waste

The parallel use of the two main composting techniques and MBT allow for a considerable reduction of the volume of municipal waste residues to be disposed of.

The best available techniques with regard to ***DISPOSAL*** boil down to complying with the requirements of Ordinance No. 8 for the conditions and requirements for building and operation of landfills and other facilities and installations for waste recovery and disposal (*promulgated State Gazette No 83 of 24.09.2004, supplemented SG No 87 of 30.10.2007, in force from 30.10.2007*).

b) Thermal waste treatment methods

Preliminary pre-project MSW thermal treatment methods. The alternative solution for waste thermal treatment, contained in the investment proposal, has diverged on the basis of considerations of economic nature (higher initial and operating costs, higher staff qualification, limitations with regard to the possible treatment sites, etc.), but the wide use of different techniques relative to the above requires that consideration be given to this alternative, too, as well as to some other technologies. The Integrated Solid Waste Management System of Sofia Municipality foresees extension of the separate collection and waste component recycling technique with the optimistic

forecast of a quantity increase to 160,000t/a in the coming years. The accomplishment of these quantities however requires a lot of other activities and, first of all, in the authors' opinion, economic incentives for the population. The thermal methods considered in the preliminary pre-project studies are analyzed and compared with the technologies referred to in the Reference Document on BAT for Waste Incineration, August 2006 (*Integrated Pollution Prevention and Control, Reference Document on the Best Available Techniques for Waste Incineration, August 2006).*

c) Considered alternatives

Four alternatives for building of an integrated system for treatment of the daily waste in Sofia are considered in the pre-project research and the accompanying documents for the project "Management of the municipal waste of Sofia Municipality" for financing from the EU funds. Final report on task 4 – The future system of waste management", prepared by Consortium Fihner.

What is common in the 4 alternatives is the construction of two facilities for composting of separately collected biodegradable waste. One is for composting of separately collected waste from the maintenance of parks and gardens by planting companies, and the other one is for composting of separately collected biodegradable food waste from big shopping centres (restaurants, hotels, bazaars, etc). The compost obtained from the two installations will not be polluted by heavy metals and can be successfully used as a soil improver on damaged or polluted terrains, which is a prerequisite for improvement of its properties. The common feature of the first 3 alternatives is that separation of recyclable materials found in the mixed collection is envisaged prior to the biothermal treatment of the waste. In alternative 4, which is related to the burning of mixed waste, such separation is not envisaged.

Alternative 1 is proposed as a cheap solution, which will only meet the requirements of Council Directive 1999/31/EC on the landfill of waste. Waste is subjected to a minimum prior treatment and generates biogas and leachate, analogical to the mixed solid waste disposal. Recycling is not a key element in this alternative, which does not comply with the hierarchy of waste management. The main disadvantage is the need for a landfill for 30 years, while a possibility to ensure land for a 15-20 year period exists.

Alternative 2 – its main advantage is the possibility to be has a basic advantage to be implemented until 2011. Even though it is more expensive than alternative 1, it conforms to the European and Bulgarian strategies for use of the the biodegradable part of waste and to the waste management hierarchy.

The disadvantages of Alternative 2 are connected with the realization of the products from waste recycling – refuse-derived fuels (RDF) and compost. Bearing in mind that due to economic reasons, in our country there are industrial plants working on refuse-derived fuel, and that currently they import this fuel, the lower transporation costs will probably make this product attractive. The compost is used as a soil improver and it also shows a good effect when purified from various polluters and can be used for re-cultivation of damaged terrains.

Alternative 3 – its main disadvantage is the long period of implementation, which, on the background of the "zero alternative" for Sofia Municipality, makes its unacceptable. The construction of a thermal power plant working on RDF or the reconstruction of some of the existing power plants for work with refuse-derived fuel is a process requiring both time and finances. Waste from the purification of smoke gase, classified as hazardous waste, is an additional problem, and within the territory of Sofia Municipality there is no suitable terrain for construction of a hazardous waste landfill, because of the requirements of Ordinance No 7/1992 concerning the sanitation requirements for the health protection of community environment or the sanitation and hygienic zones.

The idea to convert all organic components into refuse-derived fuel is excellent because this will reduce the flow of waste to be disposed of and prolong the landfill life. The flexibility of the alternative related to usage for personal needs or sale as an alternative source of fuel should not be overlooked.

Alternative 4 has the highest rating based on the advantages related to the small necessary landfill area, independence from the market, energy production and low operation costs. The joint costs are low, too. The alternative is optimized with regard to the utilization of energy but it should be further developed in terms of recyclable waste before its being fed into the incinerator.

The main disadvantage is the hazardous waste from the purification of smoke gas, classified as hazardous, which is related to the same problem of hazardous waste landfill as in Alternative 3.

The above alternatives were considered by the Steering Committee of Sofia Municipality's waste management, set up by order of the Mayor of Sofia Municipality, who approved the implementation of the investment proposal for **Alternative 2** - Mechanical and biological treatment of mixed waste and composting of waste from parks and gardens (green waste) and separately collected biodegradable waste from big shopping centres (food waste). That is why this alternative is formulated as an investment proposal for Development of an Integrated System of Facilities and Equipment for Treatment of Sofia Municipality Solid Waste.

2.3. Alternative places of the elements of the investment proposal

For the purpose of building the Integrated System of facilities for Treatment of the Municipal Solid Waste of Sofia Municipality, terrains situated at different places were surveyed (evaluated and analyzed) (more than 80 in number). On the basis of the pre-investment studies, these sites were reduced in number and the following sites for building of equipment and/or facilities for municipal waste remedy and disposal were considered: Kubratovo WWTP, Steel Structure Plan (ZSK) Kremikovtsi AD , the Sadinata area, village of Yana, the Pasishteto area, village of Yana, Han Bogrov in the village of Gorni Bogrov, shown in ***Fig. 1.3.1***

WWTP Kubratovo site – According to the Master Plan, the site falls within the following planning and development zones:

- Tsm - terrains for landfills and waste treatment facilities;
- Tvk - terrains for Water Supply and Sewage sites/reservoirs, waste water treatment plants/;
- Tti - terrains for transport infrastructure - streets and roads.

The main part of the transport infrastructure and its characteristic features have already been built. According to the ecological assessment of the Detailed Site Development Plan accepted by the competent authorities, recommendations were given for its expansion in accordance with the new requirements of the sites which are to be constructed. As the notification for the present investment proposal envisages eventual construction of a composting facility only, the larger areas and infrastructure foreseen will be reduced.

ZSK Kremikovtsi site – According to the Master Plan, the site falls within the Tsm zone, i.e. terrains for landfills and waste treatment facilities. The site of the investment proposal is connected with the infrastructure of the closely situated built-up areas through the adjoining thoroughfares in the north and north-west directions and railway tracks, which provide access to the national road and railway networks and airports – the Sofia ring road, the Sofia –Vidin road, the Sofia – Varna road, the Sofia –Ruse road, the Sofia – Kulata road; the railway lines of Belgrade – Sofia – Istanbul, Sofia – Vidin, Sofia –Varna; Sofia – Ruse etc.; the Razpredelitelna railway station in Sofia; the airports of Sofia, Musachevo and Bozhurishte.

The site for the investment proposal implementation has the following advantages:

- all communications are already provided – gasification, existing sewerage system for household and industrial sewage effluents, and stormwater channels; water supply for industrial and potable needs, including from own water sources;
- existing asphalted and concrete paved roads in good condition;
- developed railway infrastructure with connection to the national railway network.

Regarding the change in the existing infrastructure, for the purposes of the investment proposal it is necessary to shift the existing railway tracks which are part of the internal railway system of the former Kremikovtsi AD site. The tracks wll be shifted to the periphery of the site in view of their subsequent use.

Yana-Sadinata site is located in the Sadinata area, belonging to the territory of Yana, region of Kremikovtsi. It is situated about 350 – 400 m south of Hemus Highway. The by-pass railway line to Kremikovtsi and Svetovrachane passes through its southern part. Transportation service can be provided through reconstruction of an existing dirt road with the length of 1 500 m., which will connect the site with Hemus Highway. The design and construction of a road connection from Hemus Highway to the site has been assigned. The terrain under review lacks engineering security, i.e. water supply, sewerage, electricity supply, gasification and heating. It is 13 200 m from Sofia Airport, thus complying with the necessary requirements of Ordinance No. 14 of 2000.

Yana-Pasishteto site – According to the Master Plan of the city of Sofia, the site falls into the Tcm development zone, i.e. areas to be used for landfills and waste treatment facilities. The terrain has no engineering security, i.e. water supply, sewerage, electricity supply, gasification and heating.

Han Bogrov site - According to the Master Plan of Sofia, it falls within the Tcm development zone, i.e. areas to be used for landfills and waste treatment facilities. The site is located in the Malo Livade area, in the territory of the village of Gorni Bogrov, region of Kremikovtsi. There is no infrastructure built on the site – water supply, swerage, electricity supply, gasification or heating. The transportation service is secured by an existing road leaing to the town of Elin Pelin, which is a turn off of the Sofia – Burgas main road. In a straight line from the site to the nearest built-up areas are: the village of Dolni Bogrov – 2,7 km, the village of Gorni Bogrov – 2 km, the village of Musachevo – 1,5 km, the Han Bogrov area – 1,7 km and, the village of Ravno Pole – 2,7 km. Radioactive contamination of the soil has been established as a result of deposition of industrial waste from uranium ore processing. A positive opinion concerning the site has been expressed on environmental assessment No CO-01-01 of 2008 by the Regional Inspectorate of Environment and Water (RIEW) – Sofia about coordination of the Zoning and Development Plan for assigning a place for municipal waste treatment.

Table 2.3.1.

Facilities and equipment envisaged to be built on alternative sites according to the investment proposal

№	Name of the site	Area (decares)	Facilities/equipment

1.	Kubratovo	58.118	Waste treatment facility – MBT or composting
2.	Han Bogrov	70.240	Waste treatment facility – MBT or composting
3.	ZSK Kremikovtsi	149.355	Waste treatment facility – MBT, composting and/or thermal treatment
4.	Yana-Sadinata	332.835	Waste treatment facility and non-hazardous waste landfill – composting and/or disposal
5.	Yana-Pasishteto	203.842	Solid non-hazardous waste landfill – deposition

3. Description and analysis of the environmental components and factors under Art. 4 and Art. 5 of the material and cultural heritage, which will be largely affected by the investment proposal, as well as their interaction

It is envisaged that the implementation of the investment proposal 'Integrated System of Facilities for Municipal Waste Treatment' will take place on two sites: Yana – Sadinata and Han Bogrov. In compliance with the requirements of the Environmental Protection Act and the Ordinance on the terms and procedure for making environmental impact assessment (EIA) of investment project proposals (*SG No.3/2006*) and the Guidelines for Making of EIA of Investment Project Proposals (*prepared within the framework of the project "Practical application of environmental assessment of plans and programs in Bulgaria", MATO/BG/9/1, Sofia 2002)* the contracting authority has proposed alternative site options - Yana-Pasishteto, Kubratovo and ZSK Kremikovtsi, respectively.

The EIA Report considers all alternative sites with equal attention and analyzes them with respect to the impact of the installations located and the pollutant emissions on the environmental components.

3.1. Atmosphere

According to the climatic zoning of the country, the investment proposal sites fall within the Sofia field as part of the European continental climatic region.

The average annual sum of precipitation for the Sofia area is between 591 and 693mm. The highest precipitation rate is about 230 mm in the period May - June and the lowest one, about 105 mm, in winter (January - March). Rainfalls predominate.

The snow cover days are 30 - 40 on average. The first snow cover forms towards the end of November and the last one in the middle of March. Stable snow cover is characteristic of 40% of the winter.

The average annual temperature is 10.2ºC. The lowest temperature value is in January, the absolute minimum temperature reaching (-27.5ºC). The warmest months are July and August with absolute maximum temperature of 37.4ºC recorded in August.

During half of the days in the year near-ground temperature inversions can be observed. The inversions result in an increase in the concentration of pollutants in the near-ground air layer, especially during the cold half-year. The average annual relative air humidity is 72%.

Fog is a typical phenomenon for the Sofia valley. The number of foggy days is about 30 per year on average, in some years being 5-10.

The valley relief and thermal inversions determine the prevailing calm weather in Sofia. The wind frequency rose shows that western winds prevail in the area. Eastern winds with their cold air masses cause cold spells in winter. The average annual wind velocity at the stations varies between 0.7m/s and 2.6m/s.

In summer and in the transitional seasons the so-called 'mountain-valley winds' blow along the Vitosha slopes. In daytime they blow from the valley bottom to the mountain and in the evening from the mountain to the city. The refreshing and air-purifying effect of these winds can be felt best in the southern quarters of the city.

3.2. Atmospheric air

The main emission sources in Sofa are industry and auto transport. The basic industry emissions are generated by metallurgy, the power and chemical industries.

Kremikovtsi AD is among the greatest emitters of harmful substances in the Sofia Municipality area. The main emissions are fine dust particles/FDP (94.1%), sulfur dioxide (74.5%), lead (61.8%0, nitrogen oxides (24.8%).

The power industry is a source of nitrogen oxide emissions (15.8% of the total amount), carbon dioxide (30.8%), sulfur dioxide (13.7%), soot and dust.

The chemical industry emits pharmaceutical dust, organic solvent vapors (Sopharma), sulfur dioxide, hydrogen sulfide, sulfur alcohols, dust (Rulon-Iskar), soot, hydrocarbons (ZAG), vapors of solvents and thinners (Lakprom).

Over the last years the automobile transport in the municipality has been another serious source of air pollution by carbon dioxide, carbon oxide (93.1%), hydrocarbons (86.9%), nitrogen oxides (57.3%), polyaromatic hydrocarbons (67.8%), soot and dust.

Data from modeling the distribution of harmful substances in the near-ground layer (Ambient Air Quality Program-Sofia 2005) within the territory of Sofia Municipality show that:

- Nitrogen oxide concentrations which exceed the lower allowable limit value for the protection of human health cover the areas of heaviest auto traffic in the municipality – the downtown area.

- Sulfur dioxide concentrations which exceed the lower assessment threshold for the protection of human health are established in the area of Kremikovtsi.
- Carbon oxide concentrations – the highest for Sofia City due to the heavy auto traffic.
- Concentrations of fine dust particles (FDP) above the lower allowable limit value are established the Kremikovtsi EAD area. The average share of automobile transport in the FDP pollution in the area of Sofia City is 38%.
- Benzene concentrations – the highest for Sofia City downtown area due to the heavy auto traffic.

The air quality assessment for the area in which the investment project will be implemented is made on the basis of the data gathered from the air monitoring system for the most frequently encountered pollutants: sulfur dioxide, nitrogen oxides, dust, FDP10 (fine dust particles), hydrogen sulfide, etc. measured at the stations closest to the investment proposal sites.

From the data presented the following comments can be made:

- At the monitoring stations which are closest to the investment project, Gara Yana and Druzhba Quarter, dust and FDP10 (fine dust particles) air pollution is generally established, the concentrations reaching 17 times ALV (allowed values) for FDP10 (fine dust particles) in the area of Gara Yana and up to 8.8 times ALV for the Druzhba area.
- More frequent exceedances of the measured hourly concentrations of nitrogen oxide were established in the city (Orlov Most and Druzhba Quarter stations), and the maximum measured value reaching 2.13 times above MAC (maximum acceptable concentrations) (Druzhba Quarter). Average annual concentrations of 1.2 to 1.45 times higher than the ALV (allowed values) were established for the area of Orlov Most (2006-2007). The reason for this is probably the heavy traffic.
- The sulfur dioxide poses no problem for the ambient air at the stations located closest to the sites - Gara Yana and Druzhba Quarter.
- During the period 2005 - 2007 no air pollution by lead aerosols, cadmium, nickel and arsenic was established. No benzene and carbon oxide concentrations above the allowed values was observed.
- Fine dust particles (FDP10) and hydrogen sulfide pollution was established in the Kremikovtsi area in 2007. The daily FDP10 concentrations exceed the allowed values 6.6 times and the hydrogen sulfide concentrations up to 4 times. High single occurrences of hydrogen sulfide pollution, exceeding the ALV 18 times were observed. Incidental ozone pollutions, on some days exceeding up to 1.2 times the human health protection threshold were established in the area. No

higher sulfur dioxide, nitrogen oxides, carbon oxide and ammonia concentrations were established during the measurement period.

3.3. Waters

The area where the investment project will be implemented is part of the Sofia valley which is a kind of catchment area where surface and ground water is formed. The valley kettle is drained by the River Iskar and its tributaries located in fanlike manner. The River Iskar runs through the Sofia field and has developed a complicated river network which receives a lot of tributaries such as the rivers of Lesnovska, Vladayska, Blato, Novoselska, etc. The field is surrounded by the Balkan Mountain, Lyulin Mountain, Vitosha Mountain and the Ihtiman Sredna Gora Mountain. The rivers running through the area have a moderate continental water regime which is characterized by winter-spring or spring high water (February or March and March - June) resulting from snow melt and rainfall and continuous summer-autumn low water (July - November). Structurally the valley is a young Pliocene-Quaternary graben. The Sofia kettle geological bedrock is composed of Upper-Cretaceous andesites, tuffs and tuffites, sandstones, marls and marly limestones, Upper Jurassic limestones, sandy shales and quartzites, etc. The Pliocene spreads all over the kettle. It has developed into sandy facies. Its thickness varies within wide limits – from 27 m at the Sofiyski Hali (the Central Sofia Market Hall) to 1180 m at the town of Elin Pelin. The average prevailing thickness is 300 – 500 m. It is represented by three horizons: lower, middle and upper. The lower and upper horizons are hydrogeological aquifers unlike the middle one.

The Lesnovska River is a II project category and the Iskar River (at Kurilo) is a III project category, according to the requirements of Ordinance 7/1986. The water quality in the Lesnovska River area meet the requirements of category I and category II according to all indices: pH, dissolved oxygen, BOD_5, permanganate oxidation, undissolved substances, chlorides, sulfates, iron and manganese with the exception of the nitrite nitrogen content index whose values meet the requirements for a category III water basin.

The water quality in the Iskar River area meet the requirements of the category concerned with the exception of the indices for nitrite nitrogen and phosphate contents, the exceedance for the nitrite nitrogen being about 3 times and for the phosphates 35% above the regulatory requirements. The average annual values for contents of dissolved substances, ammonia, nitrites and nitrates in the groundwater are below the limit values of the ecological threshold and the same is true for the sulfate contents in the village of Yana, region of Sofia and chloride and sulfate contents in the town of Elin Pelin. The average annual values for chlorides and sulfates in the groundwater are below the limit value for pollution threshold. The average annual values for iron and manganese content in the

groundwater at the villages of Yana and Lakorsko are above the regulatory requirements for pollution threshold for iron - 0.2 mg/l and for manganese - 0.05 mg/l.

The waste water formed from the investment proposal, during the construction, operation and closure, will be treated in a local wastewater treatment plant and discharged in a nearby water basin in accordance with the requirements of Ordinance 10/2002 or transferred to WWTP - Kubratovo so that they do not affect adversely the surface and ground water in the area of the investment proposal location.

3.4. Soils

The investment proposal includes several alternative site locations: Yana – Sadinata, Han Bogrov, Pasishteto and Kubratovo. The soils on the territory of the Yana – Sadinata and Han Bogrov sites are chromic cambisols, alluvial and vertisols. The investment project proposes to locate a mechanical and biological treatment facility for mixed municipal solid waste treatment and a non-hazardous waste landfill. The two waste composting facilities are to be located in Han Bogrov. The soils of the two sites and the areas around them are highly resistant to different toxic substances that might penetrate them. They are assessed as suitable for the purposes of the investment proposal.

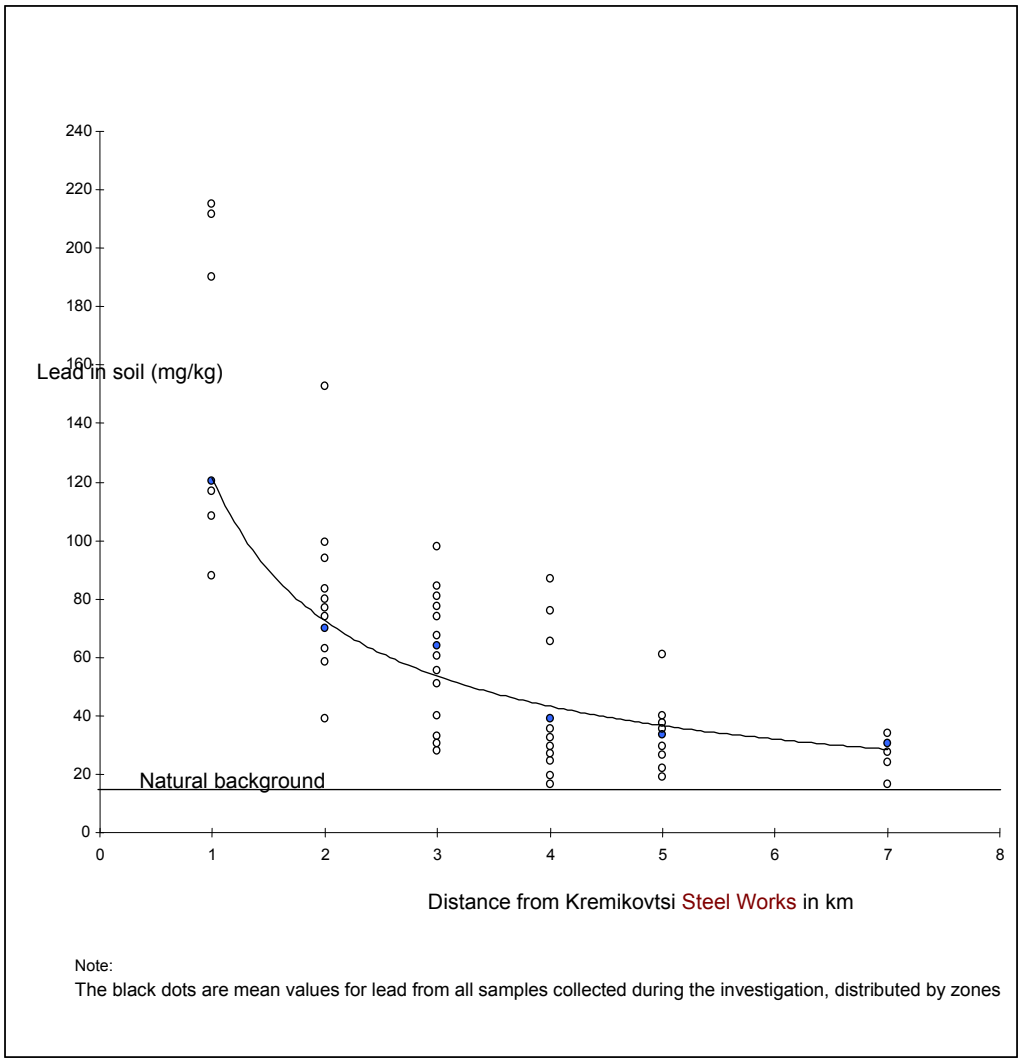


Fig. 3.4.2.1 - Lead content in soils from Kremikovtsi Municipality according to the zonal sampling at different distances from Kremikovtsi Steel Works (after Borisov, Chuldzhyan 1991)

Soils from the lands of Pasishteto and Kubratovo sites have some flaws that make them less suitable for implementation of the investment proposal. A disadvantage is the existing high-moist areas where the conditions for decomposition of organic substances are unfavorable. In addition, the Kubratovo site requires extension and adding of other lands for the purposes of the investment proposal.

The lands selected for the location of the Yana-Sadinata and Han Bogrov sites are suitable for the investment proposal implementation because the soils of the areas that will be used are polluted. The main soil pollutants are manganese, lead, arsenic, copper, zinc, cadmium, etc. The pollution level is medium to high and shows that the chemical content of soils is changed, which has affected the soil fertility. At present the lands are used for agricultural purposes. Because of the soil pollution a selective system of agriculture needs to be be applied, which imposes restrictions on the growing of a number of crops. The investment proposal will change the purpose of the land use

– from agricultural to industrial. A number of studies show that the most highly polluted lands are in the area of the villages of Yana, Dolni Bogrov and Gorni Bogrov, which have been proposed for the investment proposal implementation. The reason for the high degree of pollution is the proximity of the sources of pollution. For example, fig. 3.4.2.1 shows that the greater the distance from the Kremikovtsi Steel Works, the lower the lead content in the soils is. This is also true for other pollutants and means that the investment proposal will not use fertile farm lands.

In view of the level of soil pollution in the areas proposed for the building of the Integrated System of Facilities for Municipal Waste Treatment and the change in the use of agricultural lands, the investment proposal implementation is sustainable, provided the recommendations for protection of the soils in the adjoining lands, set out in point 6 of the Environment Impact Assessment (EIA) Report, are met.

3.5. Geological bedrock and subsoil

The Yana – Sadinata and Han-Bogrov sites are suitable for implementation of the investment proposal provided that the design of the buildings, facilities and the landfill meet the requirements of Ordinance 7/2004 on the requirements for sites determined for placing of waste treatment facilities and Ordinance 8/2004 on the conditions and requirements for the operation of landfills. The engineering-geological varieties seen in the area have high physico-mechanical properties for foundation works. During the geological and hydrogeological surveys of Yana-Sadinata, a ***Filtration coefficient $\kappa \leq 1{,}6.10^{-7}$ m/s*** has been established. The landfill-building project has to envisage measures for: sealing the bottom and slopes, groundwater drainage, mineral sealing layer, insulation geomembrane, protection geotextile layer of the geomembrane, leachate drainage system.

The investment proposal can also be implemented on the ***Yana-Pasishteto, ZSK-Kremikovtsi and Kubratovo*** sites with respect to the geological bedrock condition but it is necessary to analyze other regulatory requirements to the sites on which waste treatment facilities are to be located.

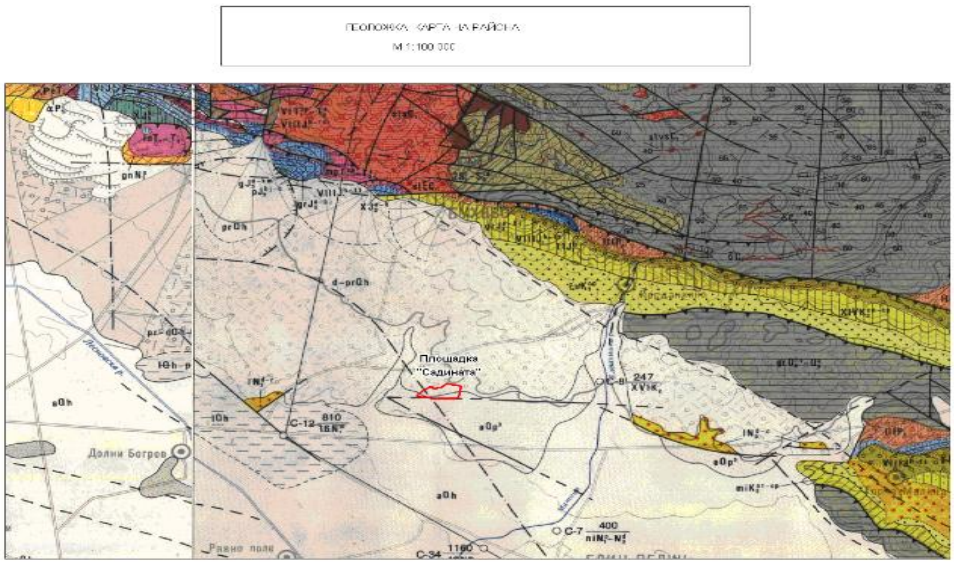


Fig. 3.5.2 – Geological map of the area

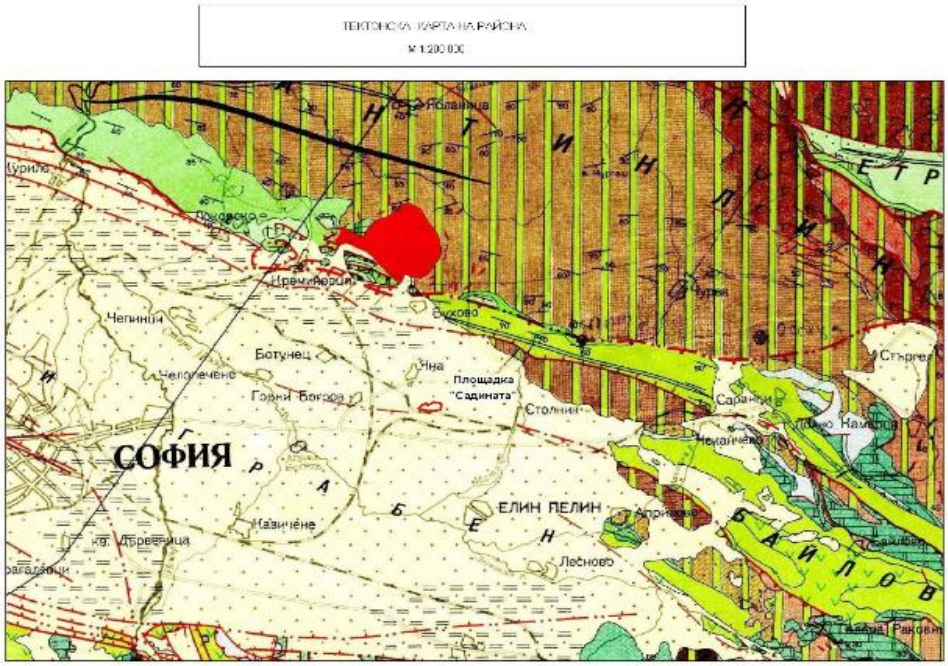
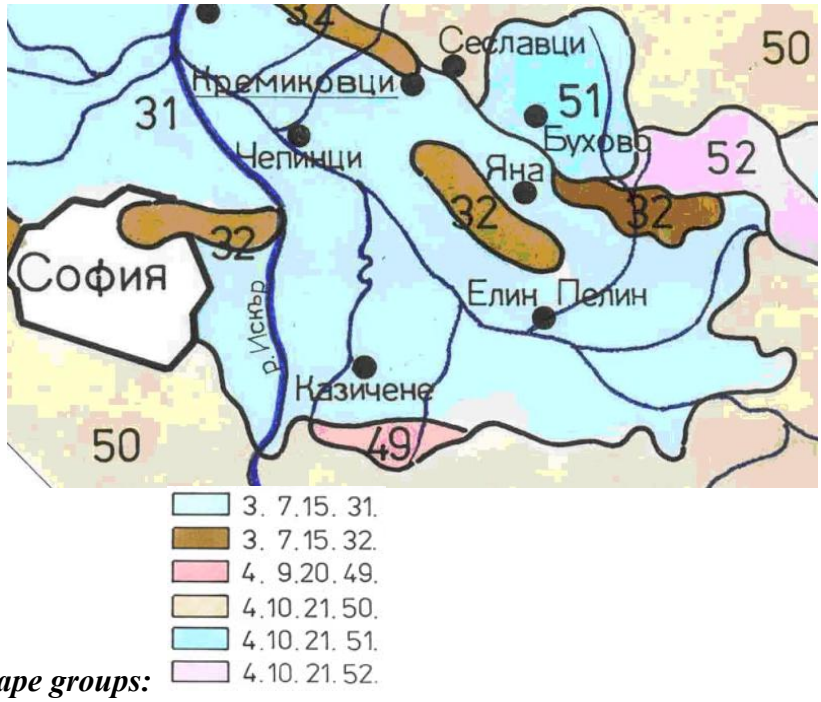


Fig. 3.5.3 – Tectonic map of the area

3.6. Landscape

From the point of view of the **impact on the landscape**, each site (the proposed Yana-Sadinata and Han Bogrov sites, as well as their alternatives in terms of location), on which the waste treatment facilities will be located, are **point sites.**



Legend of landscape groups:

Fig. 3.6.1 –Typology of landscape in the area of the sites, Sc 1: 300000

According to the **regional landscape zoning** of Bulgaria they fall in:

B. Central Balkan mountain valley landscape region

IX. Vitosha-Ihtiman landscape subregion

58. Sofia landscape area

The site as a territory falls within the northern part of the Sofia landscape area.

According to the **typological landscape zoning** of the country, the sites fall in the following landscape structures:

3. Class. Valley landscapes

3. 7. Type. Landscapes of moderate continental meadow-steppe and forest meadow-steppe beds of intermountain valleys

3. 7. 15. Subtype. Landscapes of the meadow-steppe mainly flat beds of the southern intermountain valleys

3. 7. 15. 31. Group Landscapes of meadow-steppe beds of intermountain valleys with friable quaternary sediments with a high degree of agricultural use

As regards the ***Yana-Sadinata, Yana-Pasishteto and Han Bogrov sites,*** with the investment proposal implemention the existing landscape agrarian crop-rotation structure will be thoroughly changed into anthropogenic-technogenic.

With regard to Kubratovo ***and ZSK-Kremikovtsi***, as a result of the implementation of the investment project proposal there will be no change in the invariant structure of the area of the site itself. There will be no change in the socio-economic functions of the landscape. No particular vulnerability of the landscape loading beyond the territorial scope of the site will be observed, especially after the embankment of the Iskar River. It should be born in mind that with the project implementation, processes like anthropogenic-technical impact, degradation, alteration, transformation and loading will be reduced in terms of the landscape. Municipal solid waste treatment plants can be constructed on each of the sites.

3.7. Natural objects

3.7.1.Protected nature territories

Relatively closest to the sites where implementation of the investment proposal for Development of an Integrated System of Facilities for Treatment of the Municipal Solid Waste of Sofia Municipality is envisaged, the protected area ***3M Blatata, village of Dolni Bogrov,*** is located, which is within the boundaries of a protected area according to Birds Directive – ***Dolni Bogrov-Kazichene (code BG0002004)***. The Protected area was declared by Order of the Ministry of Environment and Water (MOEW), No. 1065 of 24.11.1993 and occupies an area of 14.80 ha. It was established with the aim to protect the natural habitat of protected and rare kinds of birds – great crested grebe *(Podiceps cristatus)* and little grebe *(Podiceps ruficollis)*, night heron, *(Nycticorax nycticorax)*, squacco heron, *(Ardeola ralloides)*, little egret *(Egretta garzetta)* etc.

The area is an important habitat for a large group of birds of European environmental significance (*BirdLife International, 2004*). According to the Order for declaring the protected area, activities related to killing, catching and disturbing nesting birds within its boundaries is forbidden, as is construction, opening of quarries, felling, pasture, hunting and fishing during the breeding season; the water and area pollution with waste.

3M Blatata-Dolni Bogrov is located at a distance of about 3-4 km from the Han Bogrov site and at about 7-8 km from the site near the village of Yana, in the Sadinata area.

With regard to the impacts on ***3M Blatata*** and taking into account that none of the offered ***sites of Kubratovo, ZSK - Kremikovtzi,Yana-Pasishteto, Yana-Sadinata and Han Bogrov*** affects the territorial integrity or contradicts the regimes underlying the order of declaring the protected

area, it can be accepted that regardless of the choice there will not be negative impacts in the investment proposal implementation. Relatively closest to the protected area is the site near Han Bogrov but the distance of 3-4 km is enough to avoid indirect impacts.

The only thing is that when transport vehicles pass near the protected area during the construction and operation of the sites located near Han Bogrov and Yana, the level of the noise and air pollution might increase in comparison with the current condition, but these impacts are expected to be insignificant.

3.7.2. Protected areas according to the Birds Directive

Two zones have been declared according to the Birds Directive within the territory of the investment study – **Dolni Bogrov-Kazichene with code BG0002004** (OIP code BG004), falling under NATURA 2000, with an area 2251.16 ha and **Ribarnitsi-Chelopechene with code BG0002114** with an area of 65,19 ha (***Fig. 3.7.1 and Fig. 3.7.2***). The protected zones were established to preserve the natural habitats of protected and rare kinds of birds listed in Application 2 of the Biodiversity Act. This zone includes the Blatata protected area near the village of Dolni Bogrov. In 1993 it was declared an area for preservation of rare and endangered species, mainly waterbirds. In 1997, BirdLife International declared it an Ornithological important place (OIP).

Regular inhabitants of the area are small mammals: Rodentia – different kinds of mice *Apodemus* spp. and *Mus* spp., *Rattus* spp., *Microtus* spp. and Insectivora – *Erinaceus concolor*, *Talpa europaea*, *Sorex* spp., *Crocidura* spp., *Neomys* spp. They have the most important significance in the accumulation and transfer of harmful substancess as they take an intermediate position in the food chains in the transfer of substances from the producers (vegetation) to the consumers (animals).

In the **Ribarnitsi Chelopechene** site protected under Natura 2000**, NATURA 2000 code BG0002114**, which is threatened to disappear because of a sand quarry, internationally endangered bird species such as phalacrocorax pygmeus and aythya nyroca can be found, the latter of which was regularly nesting there. Chelopechene is one of the most important places for nesting and migratory waterbirds in the Sofia field. Thirty two endangered bird species included in Annex 1 to Council Directive 79/409/EEC on the conservation of wild birds and 39 species protected under the same Directive as migratort species can be found here. This is an important resting place for migratory birds and it provided food basis for all these species.

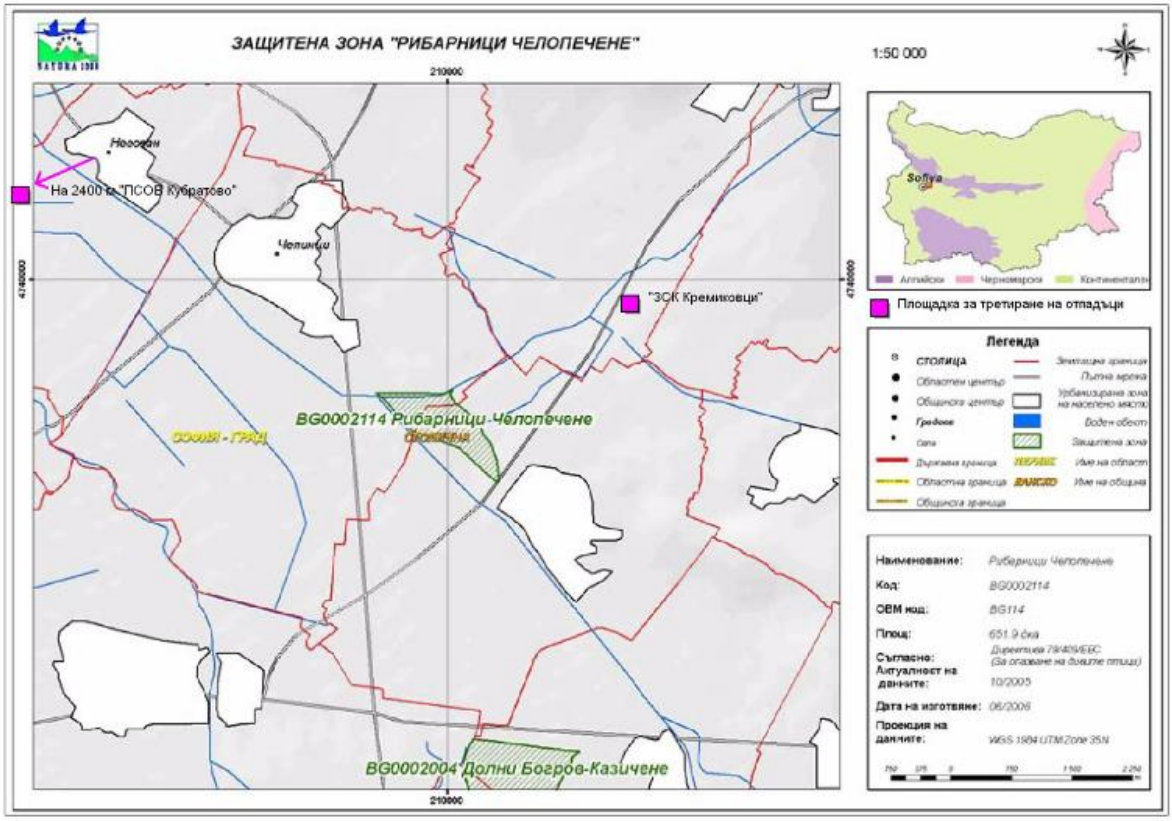


Fig. 3.7.1 – Location of the Dolni Bogrov – Kazichene and the sites of the investment proposal (including alternatives by location)

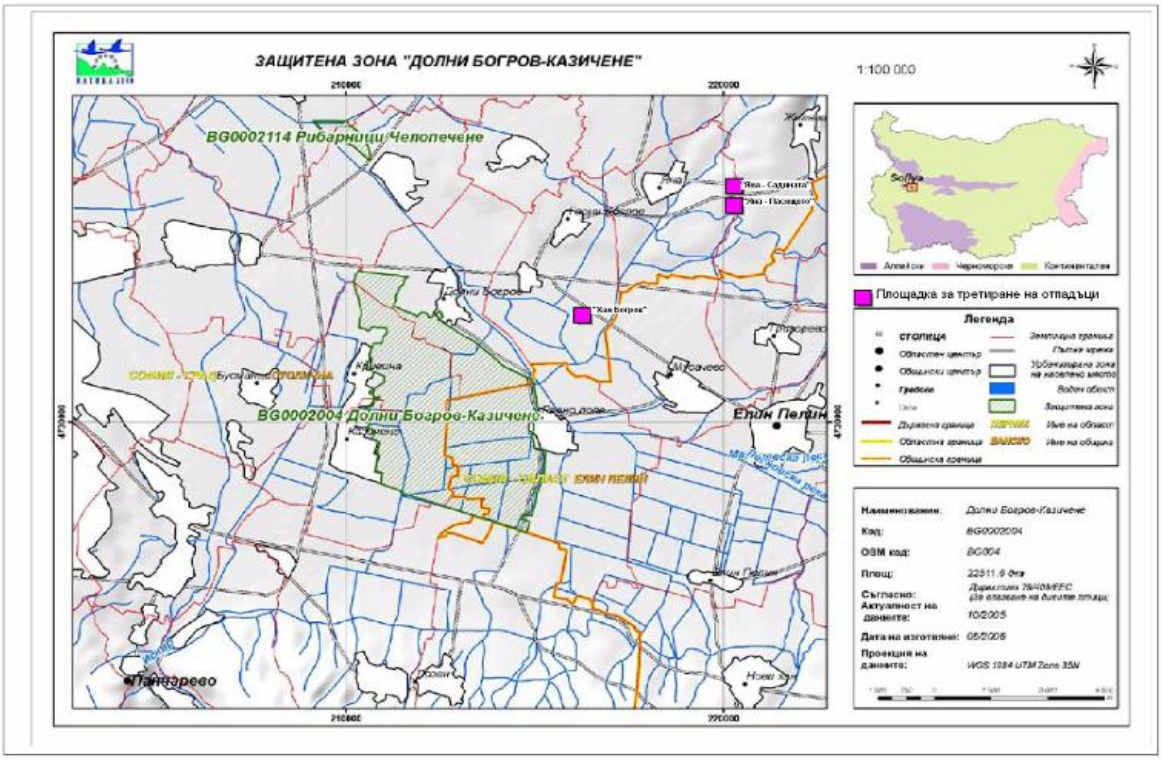


Fig. 3.7.2 – Location of the Ribarnitsi – Chelopechene Protected Area and the sites of the investment proposal (including alternatives by location)

Regarding the impacts on ***3M Blatata*** and taking into account that none of the offered ***sites of Kubratovo, ZSK-Kremikovtsi, Yana-Pasishteto, Yana-Sadinata and Han Bogrov*** affects the territorial integrity or contradicts the regimes underlying the order of declaring the protected area, it can be accepted that regardless of the choice there will be no negative impacts during the investment proposal implementation. Relatively closest to the protected area is the ***Han Bogrov*** site, but the distance of 3-4 km is enough to avoid even indirect impacts. The ***Yana-Sadinata*** site is at a distance of 7-8 km from ***3M Blatata***, and therefore direct impact and integrity violation are not possible.

3.8. Mineral diversity

Extraction of minerals does not take place within the territory of the proposed Yana–Sadinata and Han Bogrov sites, and on the three considered alternative sites, nor are mineral resources found there. In the area of the villages of Chepintsi, Negovan, Pet Mogili and Novi Silozi sand and gravel extraction takes place.

The gravel and sand quarries in the Iskar and Lesnovska river valleys (**Table 3.8.1** and ***Fig. 3.8.1***) are based on alluvial Quaternary sediments from the river beds and flood terraces of the two rivers and the uppermost part of the Neogen – Lozentska svita.

Condition of quarry reserves as of 01.01.1997

Quarry	**Condition of reserves (in thous. m^3)**
1. Stari silozi	119
2. Koriyata	263
3. Novi silozi	549
4. Pet mogili	3622
5. Negovan	2557
6. Chepintsi	26535

The Chelopechene gravel pit is located to the northwest of the village of Dolni Bogrov and to the southwest of the village of Chelopechene, on the left coast of the Lesnovska river near the Dolni Bogrov landfill site - 1. According to estimates their quantity is about 200,000 m^3.

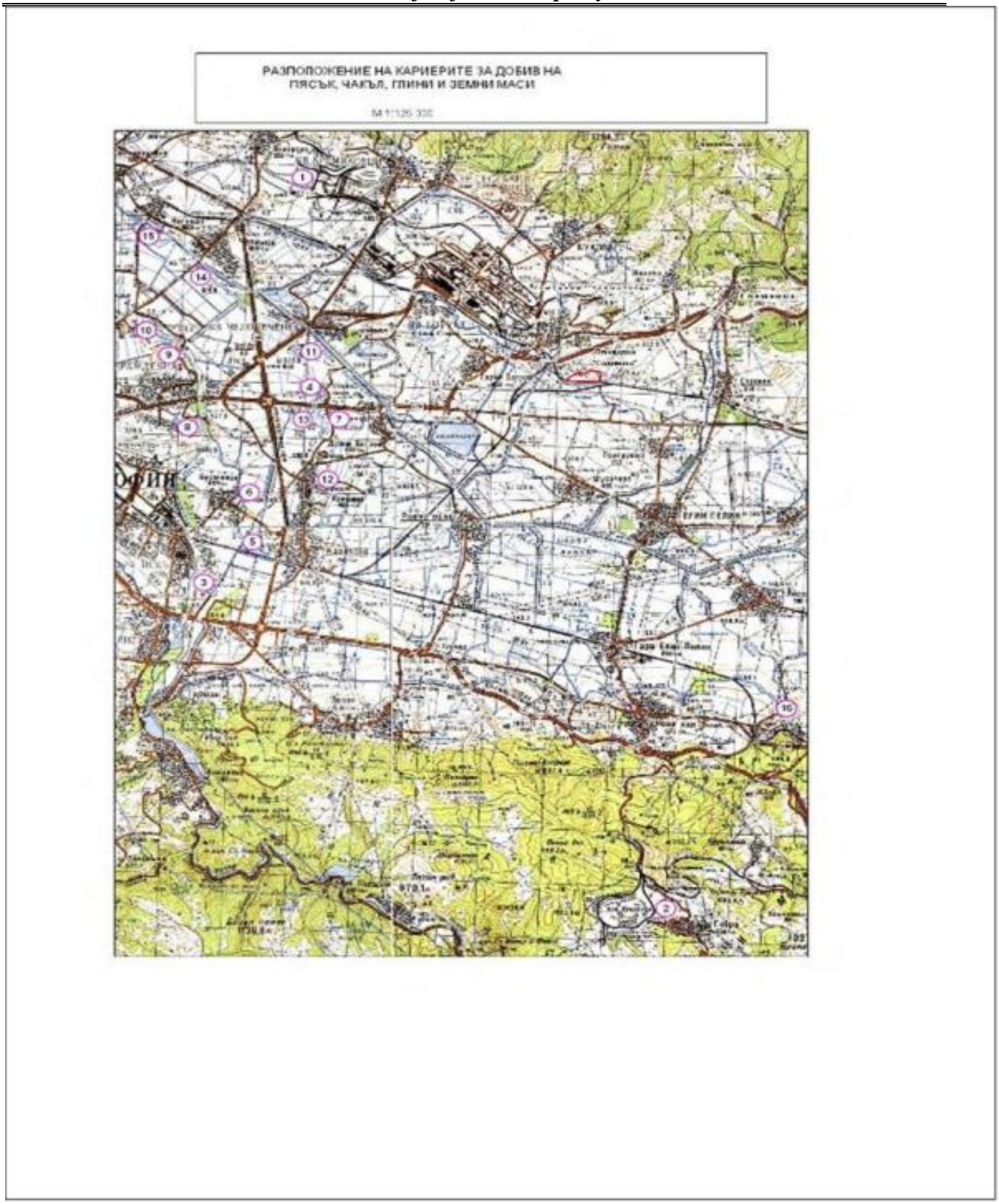


Fig. 3.8.1

The Vrajdebna gravel pit is situated on the left bank of the Iskar river between the hollow of the inert material quarry and the river itself. According to estimates, their quantity is about 500 000 m^3. The researches of the Research Geological Laboratory GEOLAB – EAD show that waste from

the sand and clay mining at theVrajdebna quarry have the following indicators: damp or very damp; average to solid fictile, dense.

Clay quarries near uranium tailing ponds – town of Buhovo (***Fig. 3.8.1.***) are situated in the freeboard??? of the two tailings ponds – 'old' and 'new'. They were opened with the aim of building the walls and partially covering the 'old' one. The lithologic structure is: sandy-clay depositions with fine-grained angular gravel, gravel-sand clay and sand clay, all of them with characterizing red-brown colour. The genetic type is deluvial and proluvial, which determines the horizontal and vertical heterogeneity of the section. The age is defined as Pleistocene. The total thickness of deluvial-proluvial Quaternary reaches 75 m in the interfluvial massives and to 35m in the river-bed parts. They are formed from wind blowing and resedimentation of syenites, palaeozoic shales and Upper Cretaceous lime and sand materials. Road connections are asphalted and ground roads are not more than 5 km long. The proven reserves, graded as B category (1969) are 1462000 m^3. The Pobit Kamak - Boyata clay deposit is located between the villages of Pobit Kamak and Bogdanlia, Elin Pelin municipality. It started operating in 1980, but over the recent 5 years it has not been used (concession to be received from the Bulgarian Ceramics Company AD, Sofia). There is no operation and recultivation projec. Existing communications – motor vehicle road of about 500 m to the Pobit Kamak railway rtation.

Concerning the mineral diversity established on the basis of preliminary pre-project, engineering and geological researches, literary data etc., it was found out that on the territory of the proposed sites, as well as the alternative by location sites no minerals are extracted and no mineral resources are found.

Near the sites there are gravel and clay deposits which are granted on concession and can be used for obtaining of building material for construction of the facilities and the lower insulation layer of the non-hazardous waste landfill site.

3.9. Biodiversity

3.9.1. Flora and vegetation

The vegetation cover of the site envisaged for construction of 2 composting facilities within the Han Bogrov area is composed of agro-phytoceonosis and derivative grassland communities. A number of weed and ruderal species participate in different quantitative proportions in the wheat agro-phytocoenoses with joined surface and in the agro-phytocoenosis of sunflower. Near the arable land derivative grassland communities with predomination of wheat grass have been formed, at the over damped sites where small groups of common reed (*Phragmites australis (Cav.*) *Trin ex Steudel*) grow, and along the road there are ligneous and frutescent microgroups.

The vegetation cover of the site in the Sadinata area, village of Yana, which is envisaged for a waste mechanical and biological treatment facility and for a non-hazardous waste landfill consists of derivative pasture-type grassland communities and weed communities in different agricultural crops cultivated.

The thorough analysis of the floristic composition of vegetation of the properties included in the site and its adjoining properties shows predomination of secondary and dynamic plant species and plant communities. On the examined territories there are no rare or protected plant species and vegetation communities, which are object of protection, included in the Biodiversity Law (prom. SG, Issue 77 of 09.08.2002).

With the construction of the 2 composting facilities on the proposed site in the area of Han Bogrov and the construction of the mechanical and biological waste treatment facility and the non-hazardous waste landfill in the Sadinata area in the region of the village of Yana, the widely spread secondary weed ruderal and derivative herbaceous vegetation will be destroyed mostly, while rare and protected plant species and plant communities will not be affected. On the basis of the findings on the current status a conclusion can be drawn that the implementation of the investment proposal will not have a significant negative impact on the vegetation in the areas adjoining the sites.

3.9.2. Fauna and the animal world

The significant anthropogenisation of the region and the continuous regular pollution have affected dramatically the fauna and the formation of the contemporary complex. The fauna in the region can be subdivided into three categories in terms of its resistance to to the level of anthropogenic loading: synanthropic, eusynanthropic and ecologically plastic species. The specifics of the animal world is determined by the interaction of two factors: on the one hand, the strongly anthropogenized zone in the region of the project implementation, related to a constant and strong anthropogenic pressure and all the implications arising therefrom (human presence, soil pollution with heavy metals, change of natural habitats etc.), and on the other hand the relative proximity of **two protected zones** to the sites of the investment proposal of Sofia Municipality for Development of an Integrated System of Facilities for Treatment of the Municipal Waste of Sofia Municipality – **Dolni Bogrov-Kazichene with code BG0002004** (OIP code BG004) according to NATURE 2000 with an area of 2251.16 ha and **Ribarnitsi-Chelopechene with code BG0002114,** with an area of 65.19 ha.

3.9.3. Ecosystems and ecosystem diversity

The habitats of the investigated territory of the Han Bogrov site are evaluated as derivative and secondary degraded. Different types of agro-ecosystems are periodically formed in them. The root type of vegetation on the studied territory are mezophyte and mezoxerophyte deciduous forests

in the moderate and subboreal regions of Europe, which are related to climax or long-term derivative forest ecosystems. Therefore the contemporary habitats can be considered as derivative and secondary, and the herbaceous ecosystems formed in them as temporary and transient.

Derivative xerotherm plant formations with predomination of Dichantieta ischaemi, Chrysopogoneta grylli and Ephemereta predominate on the territory of the site in the Sadinata area. They are formed on territories of root forest habitats, after different forms of degradation and successive modifications of mixed oak forests with predominating Quercus cerris L. and Quercus frainetto Ten. The herbaceous ecosystems related to the pasture-type vegetation are evaluated as relatively stable.

On considerable parts of the provided site the habitats are secondary transformed and agricultural crops are cultivated on them, which, following the floristic approach, refer to the group of annual plant and weed communities in earthed-up crops. The herbaceous ecosystems formed on them are transient and unstable.

The complex evaluation of the potential and actual contemporary habitats and ecosystems shows that they do not belong to the habitats for priority conservation in Bulgaria, included in Application № 1 to article 6, paragraph 1, item 1 (Prom. SG, No 88 of 2005) to the Biodiversity Act (Prom. SG, No 77 of 09.08.2002).

In the construction of the 2 composting facilities on the proposed Han Bogrov site mainly secondary habitats of derivative agro-ecosystems will be destroyed, to be transformed into anthropogenic systems, while rare and protected types of habitats will not be affected.

With the construction of the mechanical and biological waste treatment facility and the non-hazardous waste landfill on the Sadinata site, mainly derivative habitats of relatively stable herbaceous ecosystems related to pasture vegetation will be destroyed and transformed into secondary anthropogenic ecosystems.

Based on the above findings, a conclusion can be drawn that in the current condition of the ecosystems the implementation of the investment proposal will not have a significant impact on the types of habitats and ecosystems.

3.10. Cultural, architectural, historical and archaeological heritage

The investment proposal implementation is projected to have an impact on the archeological monuments of culture and in their security zone, which requires strict control on construction works (particularly with respect to construction works organization – excavations and earth disposal, passing of construction and transportation equipment, supply and input of materials and other activities). For the purpose of studying the availability and the current status of monuments of

culture, dossiers of the National Institute of Monuments of Culture (NIMC) have been used, of archaeological and historical monuments of culture within the territory of the sites where the project will be implemented, i.e. the Han Bogrov and the Yana-Sadinata areas. According to Order No1711 of the Council of Ministers of 22.10.1962, the settlement mounds and tumuli in Bulgaria are declared monuments of culture of national significance, i.e. they are presumed to have the status of monuments of culture of national significance. On the territory of the proposed sites for the investment proposal implementation there are not any data of available monuments of culture. Eight archaeological monuments of culture – prehistoric and Roman settlements and tumuli (State Gazette issue 35/1996, Order of the Council of Ministers No.1711/1962) – have been registered so far in the lands belonging to the villages of Yana and Gorni Bogrov. One of the monuments, a Roman settlement and bath in the Banishte area, 1.5 km to the south of Gorni Bogrov, is located near the potential Han Bogrov site (***Application 7*** – letter of the National Institute of Monuments of Culture – ref.no. 2467/21.07.2008).

Based on the fact that according to scientific data only 20 - 25% (1/5 to 1/4) of all supposed monuments of culture have been revealed in the Republic of Bulgaria, it is stipulated by law that on discovering archaeological monuments during construction and other works it is compulsory to inform the nearest archaeological museum and the National Institute of Monuments of Culture (Art. 18 of the Monuments of Culture and Museums Act, promulgated State Gazette issue 29 of 1969 with the repeated subsequent amendments and supplements).

3.11. Health status of the population

The population of the neighbouring municipalities (Yana, Seslavtsi, Kremikovtsi, Zhelyava, Gorni Bogrov, Dolni Bogrov, Vrazhdebna, Botunets) numbers about 22,000 – 25,000 residents. They are mainly exposed to negative impact of the polluting emissions caused by Kremikovtsi AD and the automobile transport:

- *Irritating dust and gas* – sulphur and nitrogen oxides, whose average daily, monthly and yearly ambient concentrations during the recent years have significantly varied and often exceeded the limit values. They have an irritating effect on the respiratory organs and the lungs. Their concentrations in the ambient air may cause allergic bronchitis and bronchial asthma.
- *Metal aerosols*- mainly lead aerosols. Concentrations of lead fumes caused by extraction of iron depends on the lead content of the ore which is processed. Lead is xenobiotic, but its wide spread in the ambient air and the working environment makes it a substance present in the human body. In the second place are the manganese aerosols which just like the lead ones are released in the production of cast-iron and steel. The manganese aerosols and its compounds cause changes in the central nervous system. At more significant concentrations, which are found in the working environment, they can cause 'manganese-induced parkinsonism'.

• *Other chemical pollutants of ambient air,* but relatively less significant for the population health are ammonia, carbon oxide, hydrocarbons – oil or aromatic, aldehydes, etc.

The negative impact of the above-mentioned pollutants can have the following consequences:

- The general health status and increase of the common sick rate as a result of declining overall strength of the organism;
- The specific effect of irritating gas and dust on the respiratory organs causes an increase in lung affections, an increase of the frequency of infections of the upper air passages;
- Possible increase in the lead content in blood.

A series of surveys of the population health status in the area carried out for the last decade show that there are not any data indicating a higher sick rate. The most frequent diseases of the adult population are: diseases of the respiratory system, in particular acute upper respiratory tract infections, diseases of the endocrine system, diseases of the nervous system, diseases of the cardiovascular system. The structure of these diseases found out on the basis of numbers of addressing physicians does not differ from that for the whole country. The most frequent diseases with children are again the acute upper respiratory tract infections, intestinal infections and infectious diseases. It should be noted that the mobility of the population in the area is high and a great part of the employed are out of the area most of the time.

The standardized indicators of the mortality structure according to the International Classification of Diseases in the capital city of Sofia and in Sofia Region differ from these for the other regions of the country. It should be noted, that malignant neoplasms as a cause for mortality, in particular those of the respiratory organs and the digestive system, are with a higher rate for the population in Sofia Region in comparison to the capital city of Sofia. The same holds true in respect of the diseases of the circulatory system.

In principle the death rate of the population over 60 - 65 years of age has increased. The causes for over 90% of the deaths in Sofia Municipality and Sofia Region are the following 4 groups of diseases: in the first place are the diseases of the circulatory system (hypertony, chronic ischaemic heart disease, acute myocardial infarction and brain vascular diseases); in the second place are the malignant neoplasms (mainly of the digestive and the respiratory system); in the third place are the diseases of the respiratory system and in fourth place are the diseases of the digestive system. The standardized indicators show that the life style – unhealthy nutrition, overweight, harmful habits (alcohol, smoking), lack of appropriate sports occupation, sedentary life and stress account for the diseases causing mortality among the population.

The registered diseases caused by malignant neoplasms, infectious diseases and the mentally diseased under observation in psychiatric hospitals per 100 000 persons of the population

in 2006 are systematized in Zdraveopazvane 2007 (Health Care 2007) (National Statistical Institute (NSI) and National Centre of Health Information (NCHI) 2008, Sofia).

Concrete data of the registered morbidity of the population in Sofia Region do not differ substantially from these for a significant number of the other regions in the country. The standardized indicators for morbidity of malignant neoplasms of the mammary gland and blood-forming system for the capital Sofia are higher. It can be explained by the easier access to qualified medical help and less failures in diagnosing the specific disease in the capital. The same holds true for diseases as scarlatina and active tuberculosis. The problems of sewerage, unregulated landfills and Romany ghettos in Sofia Region are the probable reasons for the relative high share of the cases of acute viral hepatitis. This disease is typical of the towns and villages with poor hygiene.

By 31.12.2006, according to statistical data, the capital of Sofia had 50 medical institutions for medical treatment with 8,544 beds, of which 12 were multi-profile hospitals. Besides there Furthermore it disposes of 285 medical institutions for outpatient care. In Sofia Region there are 15 medical institutions for medical treatment with 1,655 beds, of which 8 are multi-profile hospitals, as well as 52 medical institutions for outpatient care. The capital has 113 nurseries with 4,201 places. In Sofia Region there are 32 nurseries with 682 places. The medical services for the population are well organised. The population is secured with medical staff, qualified physicians emergency health care.

In 2006, the *Primary disabled* persons under 16 years of age in the capital of Sofia were 487, in Sofia Region they were 114. In 2006, the disabled persons over 16 years of age in the capital of Sofia ran to 16,075, and in Sofia Region to 4,738. The relative share of people with an over 70% loss of working ability prevails.

The data about *employment and unemployment* (Table 3.11.5) originate from an edition of the National Statistical Institute ("Employment and Unemployment Basic Data" NISI/2007, Sofia, 2008). The labour force consists of persons between 15 and 64 years of age. In 2007 the number of the employed persons in Sofia-capital was 544,800, and the number of the employed persons in Sofia-region was 103,600.

It should be emphasized that the lands of the village of Yana, the residential area of the village itself and of the villages located on the territory adjacent to "Kremikovtsi" AD are considered as causing problems for the health of the population in connection with the proven dangerous contamination of the environment according to the "National Environmental Strategy and National Action Plan for 2005-2014" (CM) and National Action Plan for the Environment and Public Health 2004-2019 (MH and MEOW). Numerous studies of investment proposals related to

procedures for assessment of the effects of certain public and private projects on the environment, planned studies carried out for assessment of the health risk for the population and the children and the living environment made by scientific institutes (NZHMEH and later NZOOS - Sofia), as well as by Sofia RIOKOZ and RIEW – Sofia have constantly found out dangerous over-contamination of the ambient air, of the soil and the nutrition chain with heavy metals and organic substances from the metallurgical plant in conjunction with the production traffic. The residential area in the neighbourhood of Yana-Sadinata is considered as a "hot spot" as regards the dangers for the population health caused by the activities at "Kremikovtsi"AD.

The realizing of the investment proposal has a *significant favourable impact* as regards the problem of safe waste management of Sofia Municipality. The landfill in the quarter of Suchodol will be closed and remediated. Tension and fears of Sofia's population for accidental contaminations will be relieved. It will be possible to remove constantly emerging unregulated landfills in some boroughs of the capital.

Based on aforesaid considerations we have a reason to regard the overall health status of the population in the area adjacent to the construction site as not different from the national average.

The number of the registered diseases and the morbidity, generally for Sofia, as well as per respective age groups and classes of diseases has declined. The tendency from last two years for higher overall morbidity of persons over 18 years of age remains unchanged.

The proportion of neoplasms has increased by 0.7%. The frequency of cases of malignant neoplasms among children has slightly increased, whereas among adults it has decreased.

The acute infections of the upper air passages along with acute bronchitis and bronchiolitis account for around 2/3 of the diseases in this class in infancy and around ½ among adults. The frequency of asthma cases among children has increased and is more than three times higher than that among adults, which is specific for this age.

Dermatitis and eczema are diseases taking up around 1/3 of all diseases in this class. It can be noted that there is a decrease in their frequency which is greater among adults.

In the structure of overall morbidity leading in the considered groups of diseases are the diseases of the respiratory system, followed by diseases of the skin and subcutaneous tissue, neoplasms and blood diseases, which is a tendency from the last two years.

Leading diseases among children from 0 to 17 years of age are diseases of the respiratory system, followed by diseases of the skin and subcutaneous tissue and of the blood, blood-forming organs and some disorders of the immune mechanism. Among persons over 18 years of age in first place related to the frequency are diseases of the respiratory system, followed by diseases of the

skin and subcutaneous tissue and neoplasms. These data are consistent with the proportions of the stated classes of diseases during the last two years.

For the first time after 2003 at four points the average yearly dust and fine dust particles concentrations have been above the admissible limits. The tendency of recording the highest values of dust and fine dust particles during the cold months of the year, when the heating installations of solid, liquid and gas fuel are in operation, is retained. The remaining indicators have small deviations during these years.

In 2007 the number of the registered diseases and their frequency per 1,000 have declined in comparison to 2006. The tendency of the last two years for higher frequency of diseases among persons over 18 years of age compared with that among children remains unchanged.

There are not any categorical data for impact of ambient air pollution on the population health in Sofia-city.

3.12. Risky energy sources and harmful physical factors

The industrial extraction of uranium in the Bouhovo ore field dates back to 1947. The first mill for processing of uranium ore built then was "Metallurgist". It was a multi-tonnage mill, as it processed large quantities of ore with high to average percentage of uranium. The processing of uranium ore by mill "Metallurgist" at the beginning of the 1950's caused radioactive contamination of terrains in the area called "Razliv Yana" ("Flood Yana"). It was formed in the period 1947-1958, when the mill for processing of uranium ore did not have tailing ponds. At that time the waste resulting from the uranium enrichment was directly dumped in the floodplain Manastirsko Dere above the village of Yana. Heavier fraction (sand) of the waste gradually filled the lower parts of the relief and in the course of time consolidated into alluviums. The liquid fraction was poured out into the ravine and downstream of the river Bouhovo entered the river Yaneshnitsa, which is a tributary of the river Lesnovska. Under the influence of the stream and water erosion some parts of the solid fraction were deposited along the banks of the Bouhovska river and further at the flood terraces of the rivers Bouhovska, which passes through the village of Yana, Yaneshnitsa and Lesnovska till the river Iskar. The total area of the contaminated surface is estimated to over 1,183 decares. They form a stripe on both sides of the ravines and the rivers with a width of five and several ten meters.

As shown in the figure, the highest intensities of the power of gamma-radiation dose are in the northern part of the proposed ***Site Han Bogrov***. More than a half of the area of the site features values of power distribution of gamma-radiation dose over 300 nGy/h (measured at 1 m height from the earth surface). According to Ordinance No. 1 of 01.05.1999 about the norms for purposes of

radiation protection and safety by removing the sequences of the uranium industry in Republic of Bulgaria and Enclosure No. 2 to the same Ordinance, the norm for radiation protection and safety for the indicator power of gamma-radiation dose in the ambient air for using terrains for all kinds of purposes without limitation and construction of new buildings is 300 nGy/h. Background values of the power of gamma-radiation dose are also fixed to 300 nGy/h. The area within the site foreseen for treatment with an ensured servitude of 15m around with values of the power of gamma-radiation dose over 300 nGy/h measured at height 1m above the earth surface amounts to 38,000m^2.

The registered radioactive contamination in depth 0.8 m with values over 100ips (over 200 Bq/kg) is observed along the north-west border of the site and its size is approx. 9,000m^2. At 1m depth within the site there are not registered increased contents of radionuclides. By a Decree No.302 of 12 December 2007 for amendment and supplement of Decree No.74 of the Council of Ministers from 1998 for removing the sequences from the extraction and processing of uranium raw material (SG, issue39 of 1998), promulgated SG, issue 108 of 19 December 2007, "Razliv Yana" ("Flood Yana") is included in the list of Enclosure No.1 to the decree as an affected area by the extraction and processing of uranium raw material. The organisation and control of activities on technical removal, technical and biological recultivation and execution of related activities is assigned to "ECOENGINEERING-RM" EOOD, Sofia. After execution of the activities on removing the sequences in the objects, included in Enclosure 1 and accepting them in the corresponding order "ECOENGINEERING-RM" EOOD hands over the object with an acceptance protocol to the owner and continues to monitor the waters. Highest intensities of the power of gamma-radiation dose are observed in the north part of ***Site Han Bogrov.*** The contaminations in "Razliv Yana" ("Flood Yana") distinguish themselves by space inhomogeneity.

The registered radioactive contamination in depth 0.8 m with values over 100ips (over 200 Bq/kg) is observed along the north-west border of the ***Site Han Bogrov*** and has a size of approx. 9,000m^2. In depth 1m within the site there are not registered increased contents of radionuclides. On the territory of the other proposed site ***Yana-Sadinata***, as well as on the alternative sites there are not any data for increased radioactivity and impact of risky physical factors.

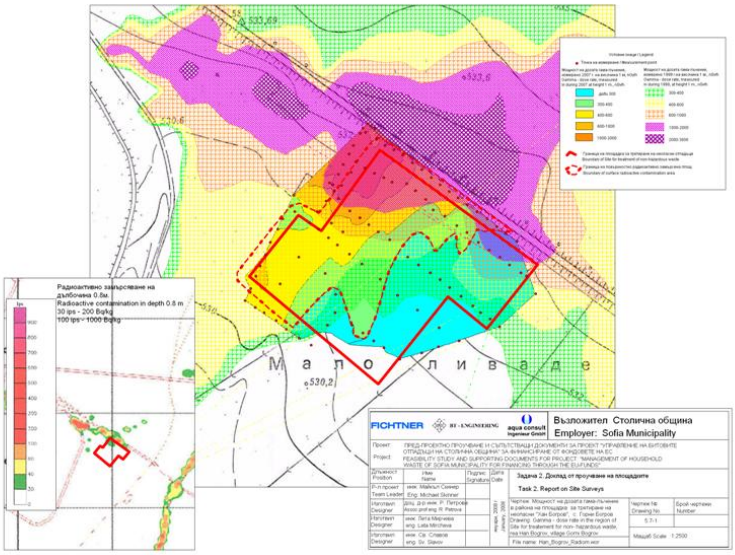


Fig. 3.12.2 – Radioactive contamination in depth 0.8 m and power of gamma-radiation dose in the area of the site Han Bogrov

3.13. Waste and dangerous substances

On the territory of the proposed ***Sites "Yana Sadinata" and "Han Bogrov"*** there are not any running anthropogenic processes as a result of unregulated landfills and waste pollution. The terrains represent agricultural lands which in the Master Plan of Sofia are designed as terrains on which will be built installations for waste treatment.

The territories of the alternative as location ***Sites Kubratovo*** and ***"Kremikovtsi"*** are antropogenised as a result of industrial activities carried out on these sites. ***The Site Kubratovo*** belongs to the terrain of the Sofia municipal station for cleaning of waste waters Kubratovo (within the meaning of Art.2, P.3, letter "b" – industrial enterprise, unit of technical infrastructure). According to the Master Plan of Sofia-city and Sofia-region it belongs to the zones Tsm, Tvk, Tti. The site for the installations for treatment of municipal solid waste is situated in the northeast part of the terrain of the Cleaning station, where the drying concrete fields from the solid sediments of PSOV are located.

Site "Kremikovtsi"", despite the fact that it is located in antropogenised terrain, does not meet the requirements of Ordnance 7/1992 for hygiene norms of health protection of the living environment (SG 46/1992, 46/1994, 89,101/1996, 101/1997, 20/1999). Having in view "the heavy" procedure for decreasing the sanitary-hygiene zone, as well as the negative reactions of the affected population, the difficulties which the Contracting Authority faces would compromise the efforts for solving the problem of processing the waste, including the financing of the installations and the Landfill for non-hazardous waste.

4. Description, analysis and assessment of supposed significant impacts on the population and the environment as a result of the investment proposal implementation, the use of natural resources and the harmful emissions at normal operation and at emergencies, waste generation, and creation of discomfort.

4.1. Atmosphere

a) Construction

The envisaged activities during the construction stage of the MBT installations, the Landfill for non-hazardous municipal waste, and the Composting Installations described in detail in p. 1.5.1., will probably result in minimal changes in the base layer surface, related to the installations construction and the landfill shaping, the access roads, the compaction of the landfill bottom with heavy building machines, the levelling and firming of swaths, etc. As a whole, these changes would be insignificant for the atmosphere.

b) Exploitation

Considering the essence of the investment proposal during the operation of the MBT installations, the non-hazardous waste landfill for and the composting installations, no negative impacts are expected on the "Atmosphere" component. The caused impacts in the specifics of the base layer surface will be preserved without any considerable deviations during the operation stage. No pollutants influencing the atmosphere will be discharged during the installations operation. The changes in the base layer surface related to backfilling of the vault cells with non-hazardous waste will not affect the microclimate in the territory of the platform for waste treatment because of the latter's very small surface, regardless of the choice of platform.

c) Closure and recultivation

During the stage of closing the installation and carrying out recultivation practices, a recovery of the concerned terrain is expected to happen with minimal effects on the local climatic conditions. The effets will most probably have a positive character because the transportation of waste to the site will stop and the biological recultivation will start.

4.2. Atmospheric air

a) Construction

Regardless of the choice of platform, there will be no sources of organized emissions during the construction stage of the investment proposal. During the construction the site will be a source

of unorganized emissions only. In this period various type activities will be executed on preparing the platforms for composting installations and for MBT and the landfill for non-hazardous municipal waste – excavation and backfilling works for shaping the platform, construction of exploitation roads, construction of production halls and buildings, transport activities.

The air pollution in the region of the chosen platforms during the investment proposal construction will be due to exhaust gases from the internal-combustion engines (ICE) of the machines executing the construction and transport works on the construction site. The basic air pollutants to be emitted in the air are CO, NOx, SO2, CHx and dust. These emissions are unorganized and they depend on the number, the type and the working regime of the machines used in the construction.

- Dust particles when executing the above mentioned works – they are restricted in time and quantity, within the limits of the working day and the entire construction work.

b) Exploitation

According to prognostic quantitative data, the additional atmospheric air pollution caused by the traffic of waste transportation trucks will be insignificant and it will represent only 0.124 % of the total air pollution in Sofia Municipality related to the traffic of motor vehicles on diesel fuel.

The air from the Receiving Tank in the Receiving Depository, as well as in the production halls, will be caught at the sources of its generation by a sanitary aspiration ventilation system and purification facilities equipped with biofilters. So as not to let out any unorganized emissions of foul odours and biogas, subpressure is secured in the covered halls in both receiving sites. The installations are hermetical, automated and remote-controlled.

No serious atmospheric air pollution is expected by dust (FDP) of metal waste and recyclable materials, since these will be temporarily stored in containers and after that reloaded for recycling under contracts with external companies. The size of the chopped urban waste is not supposed to generate a high relative share of fine dust particles.

RDF-fuel is an insignificant source of production dust, since it will be stored in a covered warehouse. After being loaded directly in containers, it will be destined for realization as an energy source.

It should be emphasized that at the mathematical modeling of pollution with dust and volatile organic compounds in the EIA for Kremikovtzi SA (at minimum EIA procedures), the measurements made by the Regional Inspectorate of Environment and Waters (RIEW) – Sofia, as well as the monitoring results of atmospheric contamination, showed that the metallurgy plant is the

leading risk air pollutant. In almost all cases the fine dust particles in the region of Yana village are with values above the hygiene standards.

Computer simulation has determined that the activities related to mechanical and biological urban waste treatment at the waste treatment platforms at relative windlessness will be a source of volatile organic compounds in the region of Yana village of the order of 0.02 – 0.03 μg/m^3.

The prognostic concentrations of nitric oxides from the waste transportation trucks in the near to the earth atmospheric layer are determined as 0.01 – 2.0 μg/m^3. The maximum value of contamination with nitric oxides is expected on both sides of the route for municipal waste transportation in Sofia Municipality.

Computer simulation has determined the concentrations of carbon oxide to be 0.001 – 9.0 μg/m^3, for the mercuric compounds - from 0.00350 μg/m^3 to 0.00371 μg/m^3 on mercury basis. The calculated maximum values of mercuric compounds are vey low and they are determined within a radius up to 1000 m from the source of organized emissions.

Foul odours are expected in the region of the Receiving Tank at unloading the municipal waste from the waste transportation trucks. After that the waste passes into the rough mincing installation which is covered. In the hall of the Receiving Depository, as well as in all the other halls of both platforms, a sanitary aspiration ventilation facility with subpressure is provided. The investor shall secure foul odour levels below 300 U/m^3 at admissible threshold limit of 500 U/m^3 according to the investor's legislation. A gas collection system shall be constructed, as well as gas wells for catching the biogas from the deposited stablized waste in the cells. The amount of biogas will be considerably smaller than the biogas emitted from an ordinary sanitary landfill for untreated municipal waste. The biogas shall be torch-combusted.

The high wall and the afforestation belt will help lessen the spreading of atmospheric contaminants and foul odours which are going to be below the admissible threshold limits.

When elaborating the EIA of Sofia General Urbanization Plan (GUP), an assessment of the health hazard was made in the period 2002 – 2003 for the 24 city districts by monitoring the morbidity rate of children at the age of 0 – 14 years in terms of sought medical aid for diseases of the respiratory system, allergies, skin diseases, congenital abnormalities. The results comparison according to districts, their location with regard to the risk industrial areas, including Kremikovtzi SA, and the average values for Sofia Municipality and for the country, showed a statistically reliable increase in morbidity rate in terms of sought medical aid in children from the northeast zone of Sofia city (Bainova, 2003). There is a statistically reliable increase in the frequency of respiratory, allergic and skin diseases (GUP of Sofia and Metropolitan Municipality, 2003). This

supports the numerous published investigations of science workers from the National Center of Hygiene, Medical Ecology and Nutrition (NCHMEN)/the National Center of Public Health Protection (NCPHP) for the past 20 years proving the adverse effects of Kremikovtzi SA on the health of the population in this area.

As per data of the Municipal RIPHPC heightened lead concentrations have been measured in the streets and the zones with specific sanitary protection status in Yana village (Bainova, 2003). Detailed data for heavy metals contamination of the soil, the agricultural land, the forests, the grain and fodder crops, the fruits and the vegetables in the lands of the villages near the plant area (the villages of Yana, Kremikovtzi, Botunetz quarter, the town of Buhovo, Dolni Bogrov village, Seslavtzi village) have been presented in the "Final EIA Report on Kremikovtzi SA" (BSECEEP, Sofia, 1998).

It was determined that the maximum average 24-hour dust concentration during the 4th quarter of 2004 at the spot Sofia – Yana station was 0.75 mg/m^3 at $TLV_{av.24\text{-}hr..}$ of 0.25 mg/m^3. The increase of contamination above the threshold limits is threefold (see Section "Atmospheric air" of EIA Report). The maximum average 24-hour concentration of FDP_{10} during the 4th quarter of 2004 was 571 μg/m^3 at $TLV_{av.24\text{-}hr..}$ of 70 μg /m^3. The increase of contamination above the threshold limits is 8.1 times. The introduced requirement for determining the FDP concentrations is grounded by the fact that the larger dust particles are deposited in the upper respiratory tract (the nasal mucosa, the tracheal mucosa and the large bronchi) and do not represent any serious health hazard. FDP with sizes 10 μm, 5 μm, 2.5μm are spread over great distance, they pollute the dwelling environment and get into the indoor air through closed doors and windows of the houses. FDP reach the small bronchi, the bronchioles and the lung alveoli. Epidemiological investigations have been carried out on risk population groups in large cities and settlement areas close to industrial zones (Antova et al., 2001, Bainova, 2002). Often the measured total dust concentration in the air is found to be below the hygiene standard, while the FDP concentrations are found to be above the admissible threshold limits guaranteeing good health to the population.

The analysis of the morbidity rate of the adult population from the residence places in the region of Kremikovtzi SA has shown that the diseases of the respiratory system and the upper respiratory tract, of the endocrine and the nervous systems, and the cardiovascular diseases are prevalent. As compared to the morbidity rate structure in terms of sought medical aid in the country, the higher relative share of endocrine disorders is unusual. It is known that a considerable part of the persistent organic pollutants (POP''), including the polycyclic aromatic hydrocarbons related to

metallurgic processes emissions (chemical coke production, blast furnace) are endocrine modulators (Egeback & Bertilsson, 1983, Ritter et al., 1996).

Hereunder we have briefly cited some new investigations on the effects of excessive (above the standard) FDP concentrations on the health of the population (Bainova, 2002). *Children* in residence places with above the standard FDP concentrations have a higher morbidity rate predominantly of spastic bronchitis and chronic inflammation of the upper respiratory tract. They are at higher risk of congenital abnormalities, since FDP are loaded with persistent organic pollutants and heavy metals. The adults suffer more from acute and chronic bronchitis, pneumonia, cardiovascular and cancer diseases. Motor vehicles, particularly those on diesel fuel, are sources of 25 – 30 % of direct $FDP_{2.5}$ emissions in the air of settlement environment. Upon absence of considerable total dust increase, the measured concentrations of FDP_{10} and $FDP_{2.5}$ are with statistically reliable higher levels. It is proved that they are significant for the higher rate of bronchitis, bronchial asthma and pneumonia among the risk groups (children, adults and persons with respiratory and cardiovascular diseases) of the population (Buckeridge et al., Environmental Health Perspectives, 2002, v. 110, No 3, 293-300).

The monitoring of the frequency of daily admittance of patients with respiratory diseases to the clinics of residence places with worsened atmospheric air quality has shown that upon heightened concentrations of FDP_{10}, nitirc oxides, sulfuric dioxide and ozone in combination with reduced relative air humidity, there is a statistically reliable increase of short-term morbidity rate in terms of sought medical aid mostly of respiratory and skin diseases. The daily frequency of cardiovascular diseases increases upon heightened concentrations of FDP_{10} in combination with nitirc oxides, sulfuric dioxide and lowered average daily temperatures mostly during cold days (Chit Ming et al., Environmental Health Perspectives, 2002, v. 110, No 1, 67 -77).

The comparative assessment of data from multiple epidemiological studies among the population in risk residence places (Janssen et al., Environmental Health Perspectives, 2002, v. 110, No 1, 43-49) has found that an increase of $FDP_{2.5}$ by 10 $\mu g/m^3$ from motor vehicles related emissions at heavy traffic has a connection with increased average daily mortality rate mostly from infarction and other cardiovascular diseases.

In conclusion, we can assume that the dust and FDP spread through the activities of Kremikovtzi SA, including the disposal areas for waste slag from blast furnaces near Yana village, are a leading risk factor for the health of the population. As compared to it, the investment proposal for covered mechanical and biological treatment of municipal waste at the platform in “Sadinata” locality will play by far a lesser role for the air pollution in the settlement environment.

"Hemus" highway comes second in significance as a source of atmospheric air pollution in the region with dust, FDP, nitirc oxides, carbon and sulfuric oxides, volatile organic compounds and polycyclic aromatic hydrocarbons.

The results from the investigation of the atmospheric air quality at the spot Sofia – Yana station are made available to the affected population. This must become a stimulus for taking efficient measures by RIEW Sofia, the Municipal RIPHPC and Kremikovtzi SA for ensuring healthier conditions in the settlement environment.

c) Closure and recultivation

During the closure and recultivation stage of the investment proposal no presence of organic emission sources is expected.

The air pollution will be a result of unorganized dust and gas emissions from the activities and the used equipment at installation dismantling operations, demolishing of buildings, excavation/backfilling works and other activities.

The expected emissions will be similar to those at the construction stage and they will depend on the duration of the closure and recultivation activities.

It is necessary to work out a preliminary project for the terrain closure and recultivation including definite measures for restriction of dust emissions in the air.

d) Conclusions

The assessment of the investment proposal impact on environment is based on the following motives:

- During the construction and the closing of the investment proposal site there will be unorganized gas and dust emissions. They will be restricted in time. The impact will be local and will not affect the population of the near villages.
- The basic emissions at the investment proposal operation will be of dust, carbon dioxide, water vapours, ammonia, substances with foul odour.
- So as not to admit unorganized emissions of dust and municipal solid waste and foul odours, the depositories are envisaged to be covered and all installations to be hermetic, automated and remote controlled. Mounting of biofilters is envisaged.
- The location of the investment project platforms in proximity to the industrial zone with basic plant Kremikovtzi SA, as well as the proximity of the circular motorway and "Hemus" highway, supposes a cumulative effect with respect to dust, FDP, ammonia, etc.
- The cumulative effect of emissions from the municipal waste treatment installations will be insignificantly small.
- In view of the existing air condition in the region, the harmful substances – nitric oxides and ammonia – emitted at the investment proposal operation, will not present a problem to the region. The problematic for region phenol is not emitted by any of the installations. The

dust, FDP, and probably hydrogen sulphide, are minute and they will not affect significantly the the air quality.

- The impact of emissions on the air quality in the region when realizing the investment proposal will be insignificant if the emission concentration standards are complied with as indicated in the investment proposal.

4.3. Waters

Surface water

a) Construction

The generated waste water – i.e. the surface run-off from the working platforms and the household/fecal water – is not expected to affect negatively the surface water in the region. The generated household/fecal water whose quantity for both platforms is about 1,5-2 m^3/day is to be treated by chemical toilets.

b) Operation

There are no water supply and drainage systems at the platforms. Water supply for ***Yana-Sadinata*** is envisaged from their own drill well after coordination with the competent ecology and health authorities. Drinking water should meet the requirements of Ordinance No.9 on the quality of water intended for drinking and household purposes (Official Gazette, issue 30/2001). It is under the supervision of the Municipal RIPHPC. Han Bogrov can be fed by the water supply systems of the buildings servicing the tailings pond of Kremikovtzi Metallurgic Plant.

The technological process does not require special use of technological water. Water from own drill well water source will be used for production needs and for maintaining the cleanness of the installations and the equipment, the production and the administrative and office premises, the warehouses, the loading/unloading platforms, the internal roads and hydrants.

The groundwater in the territory of "Yana-Sadinata" occurs at average depth of 7 m. In the lands of Yana village there are local wells and yard wells for irrigation of the gardens and the agricultural crops.

There are no designated sanitary guarded areas of water sources and facilities for water supply with drinking and household purposes water or mineral water sources for use by the population near ***Yana-Sadinata platform*** (Ordinance No.3 on the terms and conditions of research, designing, approbation and exploitation of sanitary guarded areas around water sources and facilities for water supply with drinking and household purposes water and around mineral water sources used for healing, prophylactic, drinking and hygiene needs – Official Gazette, issue 88/2000).

The rivers Yaninski Valog and Lesnovska run through the region of the investment proposal. There are two small dam lakes in the region, as well. No additional contamination of the surface water is expected, since there will be catching systems for production water (leachate from the drainage systems in the cells for deposited stabilized waste, water from the installations and from washing the working premises, sanitary/household waste water, water from washing the dump trucks). Rain water within the site limits will also be collected and purified. The cells for storage of stabilized municipal waste will be isolated by protection screens for eliminating the risk of groundwater contamination in the region. The quantity of leachated water from the deposited stabilized waste and from the production waste water run-off is expected to be of the order of $36m^3$/d. Upon preliminary municipal waste separation and mechanical treatment of organic waste for RDF-fuel no separation of waste water is expected. Even at this stage of the investment proposal development an internal (pure) reversible cycle is envisaged – a condensate from cooling the generated gases of MBT.

The investment proposal envisages construction of its own Waste Water Treatment Plant (WWTP) and a system for monitoring the contamination of the production water and the rain water flows from both platforms. The WWTP will purify $36m^3$/d waste water from the MBT installation, $36m^3$/d leachate from the landfill, $120m^3$/d from the composting installations of ***Han Bogrov,*** as well as the household/fecal water from both platforms.

The technological process does not envisage construction of an open field for composting the biologically decomposable mixed municipal waste. The composting will be performed in closed tanks within a short period and by catching the waste gases and waste water.

c) Closure and recultivation

The formed quantity of household/fecal waste water and the leachate from the Landfill for non-hazardous waste will be diposed to the respective sewage system near the WWPT and will not have a negative impact on the surface water.

Groundwater

a) Construction

The waste water formed from the surface run-off during the construction at the platforms will not have a negative impact on groundwater, since the insignificant quantity of household/fecal water will be treated in chemical toilets.

b) Operation

The built sewer network for conveying the waste water is hermetic and it does not allow passing of waste water into the groundwater-bearing strata.

c) Closure and recultivation

During the closing stage there will be no negative impact on groundwater in the region of the investment proposal.

4.4. Soils

a) Construction

"Yana – Sadinata" platform - the soils on the whole platform will be physically damaged by the excavation/backfilling works. The agricultural land overgrown with weeds, cereals, trees and bush groups has a deep soil profile whose humus horizon has to be preserved for the future recultivation of the terrain and greenbelt setting around the newly constructed buildings. (Fig. 4.4.1.). Despite the fact that for a long time the region was exposed to the emissions from Kremikovtzi SA, a part of the humus horizon can be used for recultivation of other damaged terrains, since the soils in this region consist of deeper cinnamon and forest and alluvial soils, and the contamination is superficial. A small part of the powerful humus layer can be utilized on the spot – only on the areas free of construction and compact coverage.

Fig. 4.4.1.- View of ***"Yana – Sadinata"*** **platform**

"Khan Bogrov" **platform** – During the investment proposal construction the soils will be physically damaged by the excavation/backfilling works. Now there is a partially preserved humus horizon at the places of agricultural land overgrown with weeds and trees/bush groups, which has to be conserved for future recultivation of the terrain and for greenbelt setting around the newly constructed buildings.

b) Operation

"Yana – Sadinata" **platform –** The investment site will occupy an area of approx. 240 dka on which buildings and facilities will be situated, as well as a landfill for non-hazardous waste, green areas, purification facilities, roads, maneuver landings and warehouse areas (covered with

compact pavement so as to prevent flowing of contaminated water to adjacent terrains). The proposed technology for the investment site operation is of a kind which will not allow spreading of considerable emissions beyond its own terrain. The basic gas and dust emissions which may be discharged into the atmosphere and from there to be deposited on the soils, are CO_2, N_2, methane, the products of organic matter fermentation and decomposition, as well as water vapour released from the treatment of organic materials until their turning into non-conventional compost. That is why no contamination of the ambient soils through air emissions during the normal operation of the investment site is expected.

The contamination of the ambient lands caused by the transport could be greater. A negative impact on the soils of green areas on the very platform is possible due to the trucks movement – compacting, dusting and spreading of light waste objects at strong winds, contamination of the wall itself, which would aggravate the landscape more than the ambient soils. The contamination will be permanent and cumulative but insignificant on the background of the total pollution by Kremikovtzi SA.

In order to reduce this contamination and to prevent the spreading of dust/gas emissions on the ambient lands, it is necessary to make a green belt around the platform's wall which would screen the production and would create a more agreeable landscape around the investment site. No contamination on the arable land and soil through contaminated water is expected at normal operation of the investment project, since the surface water and the landfill leachate will be collected and discharged for purification, and the compact pavement of the free areas will not allow their infiltration toward groundwater or adjacent areas.

***Han Bogrov* platform** – The investment site will occupy an area of 7,024 ha on which buildings and facilities will be situated, as well as green areas, roads, maneuver landings and open warehouse areas (covered with compact pavement so as to prevent flowing of contaminated water to adjacent terrains). An impact on the grean areas soils on the very platform is possible due to the trucks movement – compacting, dusting and spreading of light waste objects at strong winds, contamination of the wall itself, which would aggravate the landscape more than the ambient soils. The contamination will be permanent and cumulative but insignificant on the background of the total pollution by Kremikovtzi SA. In order to reduce this contamination and to prevent the spreading of dust/gas emissions on the ambient lands, it is necessary to make a green belt around the platform's wall which would screen the production and would create a more agreeable landscape around the investment site.

No contamination of the arable land and the soil through contaminated water is expected at normal operation of the investment project, since the surface water will be collected by the compact pavement of the free areas.

c***) Closure and recultivation***

During the closure and recultivation stage the facilities of both platforms will be dismantled, the terrain will be levelled and subjected to technical and biological recultivation in compliance with the regulatory requirements, which will have a positive effect on soils as a component of the environment.

4.5. Geological bedrock and subsoil

a) Construction

During the construction no activities having direct impact on the geological bedrock are envisaged. The only envisaged operation is raking away the surface recultivation soil layer. No indirect damage of the geological bedrock by the used heavy construction machinery or in any other way is expected as well. There will be no impact on the subsoil. The construction of the envisaged facilities on Yana village – Sadinata Platform, if complied with the detailed geological studies, would not affect negatively the foundation stability.

b) Operaion

The results obtained from the trial/filtration water drawing and water inflow define the filtration coefficient for the permeable layers to be between $1{,}59.10^{-5}$ – $1{,}67.10^{-7}$ m/s. The groundwater levels are found at depth from 0, 70 – 1.03m to 8.78m. At such circumstances the natural geological bedrock does not ensure enough retention capacity for preventing the risk of soil and water contamination by contaminants infiltration. If the envisaged technical solutions and recommendations made in the present Report are observed, the probability of damage/contamination of the geological bedrock and the subsoil during the landfill operation is completely excluded. During the operation no significant impact is expected in view of the lithological section. The basic lithological type founding the platform are clays which do not behave as good fluid stopper which is necessary for similar facilities.

c) Closure and recultivation

No damage or contamination of the geological bedrock and the subsoil is expected during the landfill closure and recultivation stage.

4.6. Landscape

a) Construction

The change of the landscape during the construction of ***Platforms "Yana – Sadinata", "Yana – Pasishteto", "Khan Borgov"*** will be direct in the platforms' territory and indirect in the adjacent landscapes. The changes for the grounds of the platform will be irreversible and regressive

in character. The change of the platform landscape will be purposeful, while for the adjacent landscapes it will be extraneous, and the borders between them will be clearly distinguishable. As a result of the irreversible changes at the platform facility for mechanical and biological treatment of municipal solid waste and the landfill a degradation will occur in the landscape's structure, characterized by a marked modification of the present condition (***Fig .4.4.1***). There will be no change in the social and the economic functions of the landscape for ***Platforms Kubratovo and "ZSK Kremikovtzi"***. In terms of landscape it should be taken into account that in the course of construction the processes of anthropogenic/technical impact, degradation, modification, transformation and loading will decrease, and upon realization of a suitable internal (for the platforms' terrain) greenbelt setting, the aesthetical appearance could be improved.

b) Operation

No migration of landscape pollutants will be observed on the site and beyond it. With the project implementation the social and the economic functions of the landscape in the platform territory will change – its resources production and environment formation functions will be restricted. Tendencies toward anthropogenic modification of the landscape will be created. The transformation processes are naturally irreversible and there will be no possibility for self-purification and self-recovery of the landscapes. No threshold loading of the landscapes could be determined for the site. The main impact on the landscapes is visual – of aesthetical nature, particularly as viewed from "Hemus" highway. By suitable greenbelt setting and recultivation the obtained anthopogenic landscape may acquire an agreeable appearance and an ecological landscape structure.

c) Closure and recultivation

The recultivation should be engineering/technical and biological and will result in recovery of the existing landscape structure.

4.7. Natural sites – Protected areas

a) Construction

The investment proposal implementation will not affect the territorial integrity of the ***Protected Area "Blatata"***. The regimens stipulated in the ordinance for its acknowledgement will not be infringed as well. All construction activities on the platforms will be executed beyond the borders of the protected area – at a distance of about 3-4 km. The possible negative impacts are connected with the transport equipment which will pass on the roads in proximity to the protected area. As a result of this an increase of the noise level and of the air pollution could be expected as compared to the present condition. The impacts will be restricted in time.

b) Operation

During the operation period of the investment proposal the territorial integrity of the ***Protected Area "Blatata"*** will not be damaged. The regimens stipulated in the ordinance for its acknowledgement will not be infringed as well. During this stage too the possible negative impacts are connected with the transport equipment which will pass on the roads in proximity to the protected area. During the operation phase the impact will be permanent throughout the whole period of the platforms' functioning. The municipal waste transportation will result in additional loading of the existing road infrastructure, including the roads near the protected area. In spite of this, in view of reducing the air pollution and decreasing the noise levels at peak hours, it is recommendable to carry out the waste transportation beyond those hours.

c) Closure and recultivation

No negative impacts are expected during the closure and recultivation stage, since all the activities will be executed beyond the protected area at a distance of about 3-4 km from Han Bogrov Platform and 7-8 km from "Yana – Sadinata" Platform.

4.8. Mineral diversity

a) Construction

No mineral resources have been found in the investment project territory and no negative impacts on the mineral diversity are anticipated. During this stage the necessary building materials will be supplied from neighbouring districts and the mineral diversity will not be affected.

b) Operation

The investment proposal is not engaged in quarrying mineral resources. During the operation stages no negative impact on the mineral diversity is expected. The necessary gas-sealing lithological types will be supplied from other regions and the mineral diversity will not be affected.

c) Closure and recultivation

During the closure and recultivation stages and no negative impact on the mineral diversity is anticipated.

4.9. Biodiversity

a) Construction

Flora – The implementation of the investment proposal in ***Han Bogrov and Yana-Sadinata Platforms*** will destroy mostly the widely distributed secondary weed-ruderal vegetation and the derivative grass plants, and the rare and protected plant species and coexistent plant groups will not be affected. In view of its contemporary condition, we can assume that the investment proposal implementation will not affect it in a way altering significantly the nature of the vegetation cover of coexistent plant groups ambient to the platforms. Based on the findings made as to the contemporary condition, we can draw a conclusion that the investment proposal implementation

will not have a significant negative impact on the vegetation cover of coexistent plant groups ambient to the platforms' territories.

Again, only secondary vegetation will be destroyed upon using the alternative platforms ***("Yana-Pasishteto", "ZSK Kremikovtzi" and Kubratovo)***. A partial negative impact on the nearby riverside vegetation is possible at ***Kubratovo Platform***.

Fauna – With respect to the wild fauna species, the soil surface removal will have a significant impact because of destroying the useful entomofauna, including soil microorganisms which participate in the humus formation and are an important factor of soil fertlity, rain worms and others playing an exceptionally important role in ecological balance.

With respect to mammals, there will be a direct negative impact on the species living on the ground and underground and which are closely connected with this habitat. Basically these are small rodents, field mice and their reproduction colonies, as well as the insect-eating mammals as moles and hedgehogs.

There will be no impact on the typical natural habitats because they are absent from the investment project terrain.

Ecosystems and ecosytemic diversity – During the construction of both composting installations at ***Han Bogrov Platform***, some of the secondary habitats of derivative agro-ecosystems will be destroyed and transformed into anthropogenic ones, whereat no rare or protected habitat types will be affected.

During the construction of the Installation for mechanical and biological waste treatment and the Landfill for non-hazardous waste at ***"Yana-Sadinata" Platform***, mainly derivative habitats of relatively stable grass ecosystems related to pasture-type vegetation will be destroyed and transformed into secondary anthopogenic systems. Based on the made findings, we can assume that in view of the contemporary condition of the ecosystems the investment proposal implementation will not affect significantly the habitat types and ecosystems.

b) Operation

Flora - It is possible that at the provision of modern technologies for municipal solid waste treatment at the installations at Khan Bogrov and Sadinata Platforms, whereat the discharged contaminants comply with the standards as provided by the applicable legistation in our country and the EU, the flora in the adjacent territories would sustain additional loading with harmful substances. Analogous conclusions can be made as to the operation of the Landfill for non-hazardous waste at the platform in Sadinata locality. The impact from the functioning adjacent industrial plants is dominating as against the insignificant emissions within TLV from the installations for waste treatment situated in ***Yana-Sadinata*** and ***Han Bogrov***.

The greenbelt setting project should be implemented at this stage (both in the territory of ***Yana-Sadinata*** production platform and as a forest-protective belt).

Fauna – No direct impact on the fauna is expected during the operation.

Ecosystems and ecosystemic diversity – The creation of the forest-protective belt at the initial phase of operation or as early as the end of the construction period at ***"Yana-Sadinata" Platform*** will facilitate the minimizing of the harmful factors and their impact on the environment components. A suitable internal greenbelt setting should be envisaged for ***Han BogrovPlatform*** as well.

c) Closure and recultivation

Flora - Insignificant impacts on the flora of the adjacent territories are possible upon closure and recultivation of the investment project platforms, which can be prevented by timely mitigatory measures. A Project for technical and biological recultivation of both platforms should be applied during this period.

Fauna – During closing it is necessary to effect the necessary recultivation aimed at restoring the soil fauna.

Ecosystems and ecosystemic diversity – When closing the installations for municipal solid waste treatment and the Landfill for non-hazardous waste it is possible to have impacts on the habitats and the ecosystems adjacent to the platforms' territories. It is possible to create conditions for restoration of the habitats and to form stable tree and grass ecosystems when realizing the technical and biological recultivation.

4.10. Cultural, architectural, historic and archeological heritage

a) Construction

The possibilities of preserving the archeological and historical heritage potentially located in the region of the platform for construction of an "Integrated System of Facilities for Municipal solid waste Treatment of waste in Sofia Municipality" and the measures for prevention, reduction or compensation of the negative impacts on the cultural and historic heritage include:

- Preservation of the cultural monuments and the zone around them during construction of the technical infrastructure, especially during excavation/backfilling works and trucking away of land masses – as activities involving risk of damage and destruction of already discovered and displayed or still undiscovered archeological cultural monuments.
- Effecting investigations in the region aimed at discovering new archeological findings and subsequent inclusion of the sites as an element of the overall landscape structure of the territory with scientific and cognitive value (as provided by Art.15, Paragr.1 of the Cultural Monuments and Museums Act and the Regulation for carrying out terrain archeological investigations in the Republic of Bulgaria, *promulg. In Official Gazette, issue 12 of 1997).*

- Upon eventual discovery of archeological monuments in the concerned territory, the relevant authorities and institutions should be informed immediately and actions should be undertaken in compliance with the normative acts and legislative provisions in the R. of Bulgaria.
- For any other actions concerning archeological cultural monuments administrative or penal responsibility shall be borne as provided by the applicable legislation of the country.

b) Operation

The facilities for municipal solid waste treatment comply with the best available techniques and they will not emit pollutants (contaminants) over the TLV and therefore no direct impacts on the archeological sites and cultural monuments are expected during the site operation, provided that all recommendations based on the analyses and the assessment have been observed.

c) Closure and recultivation

No direct impacts on the archeological sites and cultural monuments are expected during the site closure and recultivation, provided that all recommendations based on the analyses and the assessment during the construction have been observed.

4.11. Health hazard

Favourable impacts. The construction of an "Integrated System of Facilities for Municipal solid waste Treatment of waste in Sofia Municipality" will solve a considerable number of the problems of municipal waste management. The number of non-regulated dumping-grounds in some districts of Sofia will decrease. The treatment of municipal waste without combustion and discharge of hazardous emissions has an essential hygienic importance. Based on the data indicated in ***Figures 1.1.6.1 – 1.1.6.7*** and the summary for the material flows distribution (%) of the MBT installation for mixed collected municipal solid waste, it was established that the waste-based modified fuel (RDF) is 30.73%, which will be an appropriate energy source and an alternative of the non-recoverable natural fuels; the non-conventional compost – 14.88% - will be obtained in covered systems (tanks) for rapid decomposition and it may be used for recultivation of damaged terrains, including those near the two platforms; the metals – 0.97% will be submitted for recycling (now they are deposited together with the household waste). The hazardous waste is only 0.24% and it can be separated and treated in an ecological way. The non-hazardous waste to be deposited is 40% and it will be treated in a landfill meeting upgraded ecological requirements. The waste water – 9.82% will be treated in WWTP until achieving TLV for inflowing. The waste gases – 3.36% will be treated in biofilters. The economic significance for the whole population of Sofia Municipality is that the refuse collection fee will not be increased at the expense of trucking away the waste packs over long distances. No unnecessary tension will be created among the people and the non-government ecological organizations. The facility construction will create as much as 70 new jobs with suitable remuneration and far more agreeable labour conditions for the personnel.

- *Unfavourable impacts*. They may occur upon non-observance of the requirements of the Act on Healthy and Safe Labour Conditions (*Official Gazette*, *issue. 124/ 1997, amended, .issue 86/1999, issue 64 and 92/ 2000, issue 25 and 111/ 2001, amend. and supplement. issue. 18 and 114/ 2003, issue 70/ 2004, issue 76/2005)*, and the related ordinances and orders. Additional diseases of the respiratory system, the eyes and the skin of the personnel, mostly of allergic nature, may be expected in the Receiving Depositories of both platforms. Upon work without silencers at conditions of production noise levels above the standard and absence of suitable breaks in noise-isolated premises, some of the workers may get damage of their hearing and neurological complaints. Fires and accidents are possible related to the installations for drying of chopped waste, during the production and temporary storage of the briquets, at the biological treatment of organic waste. The facilities operator of both platforms must have a contract with a relevant Occupational Medical Service *(Ordinance No.3 on the terms and conditions of effecting the activity of occupational medical services, Official Gazette, issue 14/2008*), in order to organize a regular monitoring of the working environment factors, a control on the workers in risk working places, preliminary and current prophylactic medical examinations and a real health hazard assessment with measures for hazard reduction.

Upon omissions in the sanitary ventilation systems for catching the air from the working environment and in the purification equipment in the facilities, an impact of foul odours and dust (FDP) is possible.

No additional infavourable impacts of fould odours, production dust, gas and noise emissions from the traffic of the dump trucks from the realization of the recyclable treated waste is expected for the population from the villages of Gorni Borgov, Grigorevo, Stolnik and Musachevo. They are located at a distance of more than 2000 m from the MBT and the Composting Platforms.

The residence places near Kremikovtzi SA are risk ones. The region is acknowledged as a “hot spot” at the hazard assessment for the environment according to the “National environmental strategy and the National action plan for 2005-2014” (Council of Ministers) and the “National plan of actions for the environment and public health 2004 – 2010” (CM and Ministry of Environment and Waters). The population in the villages around the platform in Yana village and Sadinata locality is justly concerned about data on the health hazard from the contamination of the dwelling environment. The population is not correctly informed about the expected health hazards, the sourced of contamination and the measures for reduction of the health hazards related to the activities in Kremikovtzi SA. The unfavourable factors for the dwelling environment of the population in Yana village caused by Kremikovtzi SA are well known, as is the fact that for decades

now the administrative management of the metallurgy plant does not observe the prescriptions of RIEW Sofia and the Municipal RIPHPC. The health hazard is significant due to the unknown and unregulated activities of disposal areas for blast furnace slag, which are situated on the opposite side of the highway near the houses and not far from the school.

The investment proposal for municipal waste treatment of Sofia Municipality has technologies conformed with the best available practices (BAP), and the supplied information on the exposure along the pathway of amospheric air, water and food chain give us grounds to accept that the additional unfavourable impact will be small and considerably below the admissible human health standards and the European ecological and health legislation.

4.12. Risk energy sources and hazardous physical factors

a) Construction

The noise and other physical factors loadings for the said platformes are determined most of all by the adjacency of "Hemus" highway and the railroad track. Their impact changes over time and it is mostly connected with automobile traffic. Because of the significant distance from these highways, no permanent loading above the standard can be expected. It occurs episodically upon passing of train sets. During the construction it is basically the noise that will be generated from the movement of the transport and mounting equipment and from the excavation/backfilling works. The expected noise background values for the working environment at the platform will be below the threshold limit values.

It was established from the feasibility studies that the lands in the territory of ***Han Bogrov Platform*** are dangerously (category "B IIG") and riskily (category "C") contaminated with radionuclides. It is necessary to take away considerable cubic volumes of contaminated soils (approx. 53572 m^3), as provided by Art.14 (1) of the Health Protection Act, due to the fact that the platform falls within a portion of the so-called " Yana flood area".

b) Operation

The construction and the operation of the facilities and the installations for municipal waste treatment by Sofia Municipality are connected with generation of production noise and vibrations. The noise penetration into the environment depends on a number of factors: acoustic characteristics of the noise sources (strength, spectral composition), dimensions and acoustic qualities of the premises, noise isolation possibilities of the buildings, the production halls and the installations, suitable foundations for the heavy machines and the chopping, separation, drying and briqueting installations, the location of the sources of unfavourable factors and of the risk population groups. The significant *noise and vibration* sources can be systematize as follows:

- Heavy construction machinery and construction activities at the platform, traffic of dump trucks for delivery of building materials and special equipment, for trucking away building waste.

- An average of 10 dump trucks/day, about 120 - 140 courses/day.
- Receiving Tank and Receiving Depository: unloading of mixed municipal waste in the Receiving Tank (410000 t annually or 50 t/hour), initial manual or automated separation, rough chopping, separation and loading/unloading works at temporary storage and realization of the separated metal waste. The acoustic loading is restricted to the closed space.
- Biological treatment: drying, repeated chopping, and multiple-degree separation of waste materials with low relative humidity, loading/unloading works for depositing treated stabilized inert waste in isolated cells. The acoustic loading is restricted to the closed space.
- Mechanical production of modified fuel from the organic components of finally chopped and dried waste in automated covered facilities. Temporary storage and loading/unloading works. Trucking by clients' trucks.
- Depositing of a part of the non-hazardous waste in the cells, levelling and landfilling (excavator, bulldozer, compactor).
- Compressors, ventilators, ventilation systems, equipped with biological filters for purification of the air from the production halls, systems for waste drying and air flow control from the production halls.
- Water pumps for water collection and utilization – a condensate from the gases purification after waste drying. Pumps for drainage water from the leachate in cells for composting and depositing. System for collection of waste water flows from the site hygienation, purification in local WWTP. Hydrants for spraying, irrigation of the green areas and for fire emergencies.

There will be no other sources of production noise at the waste treatment platforms (gas station, diesel generators). Facilities are envisaged for washing and disinfecting the dump trucks and the containers. As per data of the feasibility studies, the equivalent noise levels in the production halls where all installations for chopping, separation, drying, repeated chopping and separation are located, will be below 80 dB(A). The maximum production noise levels where no operators are supposed to be present (e.g. at chopping large-size waste, separation, treatment of inert materials) will not exceed 95 dB(A). Outside the production buildings the noise will not exceed 40 dB(A).

There will be no workers close to the installations for separation, chopping, sorting and treatment of municipal waste. The processes envisaged will be automated and remote controlled. Upon personal checking of the equipment, helmets complete with silencers will be used. The same is true for the persons engaged in the repair and technical maintenance.

At work in the open unfavourable impacts are expected from the *microclimate* during the cold and hot seasons of the year. This refers to the personnel engaged in depositing the inert waste at each consecutive cell, the maintenance of the equipment, the internal roads, the platform and the in-plant transport. Depending on the season, the workers will be provided with suitable working garments, hats, helmets, boots or special shoes and gloves.

There will be an increased *pressure* in the compressor premises, upon the use of ventilators and the induced sanitary ventilation, during the waste drying processes, during the cyclon-wise separation of chopped waste, during briquets production. Impacts of *high temperatures and pressure* are possible only in emergencies and accidents related to passing of air heated to 60^0C for drying of the roughly separated waste, when purifying the water vapour and gases mixture in the biological treatment production halls. These risk processes are automated and remote controlled.

The deposition of large quantities of mixed municipal waste in the Receiving facility for more than 24 hrs., the improper storage of the briquets with generation of high concentrations of organic dust in the covered premises, any omissions in collecting and treatment of the biogas from the cells, will create explosion and fire hazards. In the course of the technological processes signalling (alarm) and blocking systems are envisaged for preventing any such types of accidents. The hydrants will be used as the first measure for fire extinguishing.

Through the platform intended for construction of municipal waste MBT facility in "Sadinata" locality passes one air power line of 110 kV and two power lines of 220 kV . The investment proposal has envisaged them to be removed from there, whereby the potential non-ionizing radiation sources will be eliminated. No impacts related to heightened levels of infrared radiation and ionizing radiation is expected.

The administrative building, the production halls, the warehouse platforms and ramps, the internal roads, will have artificial *lighting*. The electrical installations will be safeguarded. The kiosk switchgear will be situated at a safe place envisaged for the purpose.

b) Closure and recultivation

The sources of hazardous physical factors from the buildings demolition and the equipment dismantling are analogous to those during the facilities construction.

4.13. Waste materials and hazardous substances

In order to minimize the negative impact of waste on the environment, the accepted hierarchy in the waste management methods should be applied as described in detail in the National Programme for Waste Management of the Ministry of Environment and Waters, 2003-2007. These principles should underlie the Corporative Programme of Waste Activities Management (including signing of contracts with users of the compost from the "green waste" and the "biowaste" and the obtained waste from RDF-fuel and non-convenient compost), by observing the following priorities: prevention of waste generation or their minimization at the very the source of generation; waste utilization by repeated use and submission for recycling; final waste treatment by deposition.

The investment proposal of Sofia Municipality is in compliance with these priorities. Their implementation should be transferred on corporate level at the waste management by the waste treatment facilities.

a) Construction

Table 4.13.2 presents the possible sources of hazardous substances, mixtures and powders at the construction and the operation of the "Integrated system of facilities for treatment of the waste of Sofia Municipality".

Table 4.13.2

Sources of hazardous chemical substances and mixtures at the construction and operation of the facilities for municipal solid waste treatmen

Name Chemical composition	Source	Hazard to the health and the environment
Diesel fuel Motor and machine lubricants, hydraulic oils (PAH*, PCB*)	Excavators, bulldozers, cranes, frontal loader, dump trucks, dumpers for realization of separated metals and RDF-fuel.	Hazardous. Combustible. Irritants. Allergens. Cancerogens – Category 3. Hazardour to environment.
Carbob oxides, nitric oxides, sulfuric oxides, VOC, PAH*	Exhaust gases emissions from construction machinery, loading and dump trucks	Irritants. Hazardous. Alllergens. Mitagens. Hazardour to environment.
Carbon dioxide, nitrogen, dust, VOC, mercury	Air flow from municipal waste drying	Contaminants are below the admissibke health standards
Cement, concrete, building waste, hydroisolation, glues, dyes, solvents	Dyring the plant infrastructure construction, including the production halls, warehouses, roads.	Irritation and allergic diseases of upper respiratory tract (URT), the eyes and the skin.
Soil dust (FDP) with free crystalline silicium dioxide below 2 %	Powder at construction, excavation and loading/unloading works. Contaminated internal roads, platforms and ramps.	Irritation of upper respiratory tract (URT), the eyes and the skin.
Dust (FDP) from municipal solid waste	Contaminated Receiving Tank and absence of sanitary-ventilation system with purification at the Receiving Tank	Allergic diseases of URT and skin. Secured aspiration ventilation.
Dust (FDP) contaminated with heavy metals, components of batteries (cadmium, Nickel)	Incorrect and long-term storage of separated waste obtained from the Receiving Depositories – in the open air at dry and windy weather.	Hazardous. Irritant. Allergen. Hazard of chronic diseases of the nervous, blood generating systems, the liver, the kidneys, remote effects.
Dust (FDP) from inert non-combustible materials	Incorrect and long-term storage of of waste obtained from Receiving Depository in the open air.	Irritation of URT, the eyes and the skin.
Dust (FDP) from municipal waste briquets	Loading/unloading works in the open air at windy weather.	Irritation and allergic diseases of URT, the eyes and the skin.
Fould odours – mercaptans, organic amines, amonia, nitric oxides, hydrogen sulphide, hydrogen cyanide	Inefficient aspiration with purification and isolation in the production halls	Hazardous. Psycho-sensory stress. Irritation of URT, the eyes and the skin.

PAH* - Polycyclic aromatic hydrocarbons
PCB* - Polychlorated biphenyls

The enumerated expected hazardous substances, mixtures and powders have a significance for the health of the workers engaged in the construction and the operation of the site. The *construction* is expected to last from 2008 till 2011. Companies licensed in specific construction activities will be hired. A significant role for the risk restriction will be played by organizations with proved experience, the use of well maintained construction machinery and heavy loading trucks, the provision of quality fuels for their refuelling, and replacement of lubricants outside the platform of the site, the efficient instructions, the use of personal protection means and suitable and clean working garments, provision of personal hygiene conditions.

b) Operation

The operation of the facility will last about 30 years. The Employer is acquainted with the best available practices for mixed municipal waste treatment in other countries of the European Union, Germany in particular. The use of production halls with sanitary ventilation systems, of covered automated installations with remote control, of purification facilities for catching and treatment of gas mixtures, polluted air and biogas at the very sources, will guarantee minimum

spreading of organized and unorganized emissions in the environment and the working environment components.

Alarm and blocking emergency systems, enough water and hydrants, are envisaged in events of fire and explosion. No additional unfavourable impacts as foul odours and hazardous substances are expected to affect the residents of Yana, Gorni Bogrov, Grigorevo, Stolnik and Musachevo villages which are located at a distance over 1000 m from the platform envisaged for the investment proposal implementation.

There will be no car-park, gas filling station, pertoleum fuels and oils warehouse and service station at the site, since they are related with the risks of fire, explosion and spilling of petroleum products. Biogas is expected to be emitted from the Landfill for non-hazardous waste after the tenth year. It has the potential of causing harm to human health through suffocation or explosion (at proportion 1:15 – biogas:air). Methane is not a toxic gas but it can worsen the air composition, and at insufficient concentration of oxygen for breathing methane's action may become toxic. If not managed, biogas (methane) may damage the environment, as it may randomly escape the Landfill. It usually causes withering of agricultural crops due to penetration in the soil. The investment proposal has taken in consideration the harmful impact of this gas, as it has envisaged construction of a gas-collection system, leading the gas into gas-wells and gas torch-combustion.

b) Closure and recultivation

At this stage the impact of waste and hazardous substances is reduced to the impact of construction waste and household waste from the bodily functions of the workers. The activities at this stage and the persons in charge should be described in detail in the plan for the installations' platforms closure and recultivation.

It is obligatory to describe the after-care of the Landfill for non-hazardous waste (monitoring, leachate and biogas management).

4.14. Hygiene guarded areas

As per Ordinance of the Council of Ministers No.7 of 25.05.1992 on the hygiene requirements for health protection of the settlement environment (*Official Gazette, issue 46/1992, amend. and supplement – OG, issue 46/1994,OG, issue 89 ,101/1999 ,OG, issue. 101/1997, OG, issue 20 & 41/1999,OG, issue 40/2002*), Appendix No.1 to Art.4 and Art.6:

- **p. 340.** (Amend. – OG, issue 20/1999) Non-hazardous waste deposition by daily landfilling -1000 m
- **p. 343a. "**Recycling as an independent activity and/or preliminary treatment (separation, chopping, baling, briqueting, packing, reloading, etc.) of municipal solid waste at platforms with capacity above 10 t a day", the hygiene protected zone is 1000 m. The investment

proposal has envisaged productivity of installations as follows: MBT – 1200t/d; "green waste" composting – 60 t/d; "biowaste" composting – 60 t/d.

- **p. 381c.** "Treatment of non-hazardous waste by physical, chemical and biological methods in closed spaces without warehouse facilities for waste collection and for additional treatment of the residue", the hygiene protected zone is 100 m. The composting of the biologically decomposable waste will be effected in covered premises (tanks) at conditions ensuring compost obtaining within much shorter time as compared to treatment of open composting fields. The investment proposal has included preliminary treatment of municipal waste by physical and biological methods in covered premises by disactivating the emissions of hazardous substances into the atmospheric air and the water by means of upgraded installations and facilities (biofilters).

By juxtaposing the indicated requirements for hygiene guarded areas and the location of both platforms with the waste treatment facilities envisaged on them, we can see that the residence places in the region are situated at a distance of over 1000 m from the investment proposal borders, i.e. the hygiene protected zonez are complied with.

4.15. Discomfort

- **BIOLOGICAL FACTORS –** Microorganisms, mostly the moulds, are proved sensitizers. They can cause allergic diseases of the type of rhinitis, pharingitis, spastic bronchitis, allergic conjunctivitis, bronchial asthma, and in some grave cases – pulmonary fibrosis, chronic eczema or contact urticaria. The received dump trucks will immediately be directed to the Receiving Tank. It is situated in a covered space, thus preventing the contamination with microorganisms of the open spaces at the site. The municipal waste will be transported by belt conveyors toward the separate treatment stages. The premises in the production halls will be so distributed that the production flows, which are largely automated, will not intercross. The only expected manual processes at the initial separation are those on sorting some fire-hazard and hazardous waste. Any immediate contact with municipal waste creates a health hazard for the personnel.

- **PSYCHO-SENSORY FACTORS –** The maintenace and the repair of the installations, the ventilation systems and the purification facilities are related to psycho-sensory stress. We can add to this the above standard production noise levels, if no silencers are used and if there are no periodic breaks organized for the personnal at suitable premises. The MBT waste facilities will operate on uninterrupted production schedule. In this connection reserve premises and production lines are envisaged for prevention of hazards at emergencies.

It is known that the personnel working with municipal waste can adapt to the foul odours impact, but this would mean additional phycho-sensory stress. In view of this, it is important to catch the odours by sanitary aspiration ventilation in the production hall and to have polluted air purified by biological filters. After being stabilized, the non-hazardous waste will not emit foul

odour. The investment proposal guarantees foul odour levels below 300 units/m^3, at hygiene standard of 500 units/m^3.

4.16. Summarized data on the investment proposal potential impact on environment components

Based on the technologies offered in the „Integrated system of facilities for municipal waste treatment", the material balance of the processes, the morphological composition of the municipal waste, as well as the type and quantities of generated waste gases, waste water, solid waste and energy pollutants as a result of the investment proposal operation, assessment and analysis has been made of the impacts on: the environment components and the health of the workers and of the population. With respect to the health/hygiene aspects of environment and the health hazard, the EIA Report has determined the potentially affected population by identifying and specifying the risk factors for the people's health and the exposed areas and assessing the possibilities of combined, complex, cumulative and remote impacts.

Table 4.5.

*Summarized data on the significance of impacts on the **environment** components, on the cultural heritage during construction*

Factors	Significant impact on environment components											
	Atmosphere	Atmospheric air	Water		Soils	Subsoil	Landscape	Protected areas	Biodiversity		Cultural heritage	Health hazard
			Superficial	Underground					Flora	Fauna		
Emissions in the air		P			P				P	P		P
Waste water			P		P				P	P		
Waste		P	P		P							
Risk energy sources					L							P
Discomfort									P	P		P

Table 4.10.

*Summarized data on the significance of impacts on the **environment** components, on the material and the cultural heritage during operation*

Factors	Significant impact on environment components											
	Atmosphere	Atmospheric air	Water		Soils	Subsoil	Landscape	sites - protect	Biodiversity		Cultural	Health hazard
			erfi	ergr	oun							

									Flora	Fauna		
Emissions in the air		P							P	P		P
Waste water			P									P
Waste					P				P	P		P
Risk energy sources										P		P
Discomfort									P	P		P

Summarized data are presented on the scope of the potential impacts (emissions in the air, waste water, waste) on the environment components, on the material and the cultural heritage, during the construction, the operation and the closure and recultivation stages – tables 4.5., 4.10. and 4.11. The potential impacts scope has been marked as: impact for the platform only – P; local impact up to 10 km – L; regional impact – R; nationwide impact - N

Table 4.11.

*Summarized data on the significance of impacts on the **environment** components, on the material and the cultural heritage during closure and recultivation*

Factors	Significant impact on environment components											
	Atmosphere	Atmospheroc air	Water		Soils	Subsoil	Landscape	Natural sites – protected areas	Biodiversity		Cultural heritage	Health hazard
			Superficial	Underground					Flora	Fauna		
Емисии във въздуха		P			P				P	P		P
Отпадъчни води									P	P		P
Отпадъци					P							P
Рискови енергийни източници										P		P
Дискомфорт										P		P

4.17. Transboundary impact

The IP is not expected to generate waste water and gases wich would result in contamination of the environment components. In view of the proposed platforms location, as well as their alternatives, there are no grounds to expect transboundary impact.

5. Methodologies used for environmental impact forecasts and assessment (legal acts, regulations, methodological prescriptions, instructions, directions, ordinances, rules, strategies, schedules).

- Environment Protection Act, promulg. OG, issue 91/25.09.2002, amend. OG, issue 98/18.10.2002, amend. OG, issue 86/30.09.2003, amend. OG, issue 70/10.08.2004, amend. OG, issue 74/13.09.2005, amend. OG, issue77/27.09.2005, amend. OG, issue 88/04.11.2005, amend. OG, issue 95/29.11.2005, amend. OG, issue 105/29.12.2005, amend. OG, issue 30/11.04.2006, amend. OG, issue 31/13.04.07
- Protection of Armospheric Air Purity Act (OG 45/1996, 49/1996, 85/1997, 27/2000, 102/2001, 91/2002, 112/2003)
- Waters Act (promulg. OG, issue 67/27.07.1999, in force as of 28.01.2000, amend. and supplemented – 81/6.10.2000, in force as of 6.10.2000, 34/6.04.2001, 41/24.04.2001, amend. 108/14.12.2001, 47/10.05.2002, in force as of 11.06.2002, 74/30.07.2002, 91/25.09.2002, in force as of 01.01.2003, amend. and supplemented – 42/9.05.2003, amend. 69/5.08.2003, 84/23.09.2003, suppl. 107/9.12.2003, 6/23.01.2004, amend. 70/10.08.2004, in force as of 01.01.2005, amend. and suppl. – 18/25.02.2005, in force as of 20.01.2005, amend. 77/29.07.2005, amend. and suppl. – 94/25.11.2005, in force as of 01.01.2006, amend. 29/7.04.2006, 30/11.04.2006, in force as of 12.07.2006, amend. and suppl. – 36/2.05.2006, in force as of 01.07.2006, 65/11.08.2006, in force as of 11.08.2006, amend. 66/15.08.2006, amend. 105/22.12.2006, in force as of 01.01.2007, 108/29.12.2006, in force as of 01.01.2007, 22/13.03.2007, in force as of 11.02.2007, 59/20.07.2007, in force as of 01.03.2008.
- Waste Management Act (promulg., OG 86/30.09.2003, amend. 70/10.08.2004, in force as of 01.01.2005, amend. and suppl. - 77/27.09.2005, amend. 87/1.11.2005, in force as of 1.05.2006, amend. and suppl. – 88/ 4.11.2005, amend. 95/29.11.2005, in force as of 1.03.2006, 105/29.12.2005, in force as of 1.01.2006, 30/11.04.2006, in force as of 12.07.2006, 34/25.04.2006, in force as of 1.01.2008 (*), 63/4.08.2006, in force as of 4.08.2006 (*), 80/3.10.2006, in force as of 3.10.2006, (*) 53/30.06.2007, in force as of 30.06.2007)
- Regulation No.7/25.05.1992 on hygiene requirements for health protection of settlement environment. OG, issue 46/1992.
- Regulation on the terms and conditions of issuing complex licences for new industrial installations and facilities construction and operation, and for exploitation of existing ones, adopted by Council of Ministers Ordinance No.62 of 12.03.2003, promulg. OG, issue 26/21.03.2003, amend. 29/31.03.2003, amend. and suppl. – 105/29.12.2005, amend. 4/13.01.2006.
- Regulation on the terms and conditions of working out Environment Impact Asessment (EIA) / adopted by Council of Ministers Ordinance No.59/7.03.2003, promulg. OG, issue 25/18.03.2003, amend. and suppl. – 3/10.01.2006 /
- Regulation No. 4/2001 on the investment projects scope and contents / OG 51/2001/.
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Arhus, Denmark, 1998), signed.
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, Finland, 1991), ratified and in force as of 10.09.1997
- Rules on the organization and the activities on prevention and elimination of the consequences from accidents, wreckages and disasters, adopted by Council of Ministers Ordinance No. 18/23.01.1998 promulg. OG, issue 13/3.02.1998, in force as of 3.02.1998, amend. 3/11.01.2000, in force as of 29.12.1999,

22/9.03.2001, in force as of 9.03.2001, amend. and suppl. – 15/14.02.2003, amend. 48/13.06.2006, in force as of 1.07.2006, repealed isue 40/18.05.2007, in force as of 18.05.2007.

- Regulation No.2 – Fire-fighting construction and technical standards /OG 58/1987, 33/1994г./.
- Regulation No.3/1997 on fire safety of sites in operation /OG 54/1997, 60/1997/.
- Regulation No. 4/1995 г. on the marks and signals of labour safety and fire protection.
- Regulation No.15 on fire safety in the performance of fire-involving works.
- Act on the Ratification of the Convention for the Participation of the Republic of Bulgaria in the European Environment Agency and the European Network for Ecological Information and Monitoring (OG, issue 105/2000).

6. Description of the measures envisaged to prevent, minimize or possibly stop significant harmful impacts on environment, and a plan for the measures implementation.

6.1. During the project development stage

	Measures	**Target**
1.	Preparing a Complex Licence Application for the Waste MBT Installation, the Composting Installation and the Non-hazardous Waste Landfill	Obtaining a construction visa
2.	Preparing a work project of the Waste MBT Installation, the Composting Installation and the Non-hazardous Waste Landfill	Protection of environment components
	Atmospheric air	
3.	To envisage a suitable purification system for catching the dust and treating the foul smelling gases	Protection of air purity
4.	The future landfill work project should involve a gas outlet system meeting the requirements of Regulation No.8 on the conditions and the requirements for construction and operation of landfills and other facilities for waste utilization and treatment – OG, issue 83/2004	Atmosphere protection
5.	Development of a monitoring plan. The frequency of measurements and studies should be conformed with the requirements of Regulation No.8 on the conditions and the requirements for construction and operation of landfills and other facilities for waste utilization and treatment – OG, issue 83/2004	Atmosphere protection
	Water	
6.	Elaboration of a technological mechanism allowing removal of hazardous and other substances from industrial and household/fecal waste waters by meeting the normative standards	Protection of surface and groundwater purity
7.	Development of WWTP work project based on data from the feasibility studies and the EIA Report recommendations	Protection of environment components
	Soils	
8.	Elaboration of recultivation project for the lands affected during the construction which do not fall under pavements and buildings	Preventive measures against ambient lands and groundwater contamination caused by the platforms contamination
9.	Designing of isolation greenbelts around the platforms with enough dense draugt-resistant and air pollution-resistant vegetation (best chosen from the site's natural areal)	Preventive measures against ambient lands contamination caused by the platforms contamination

10.	Designing of compact cement pavement and ditches around the facilities which may cause contamination of the ambient soils by waste materials or waste water and leachate, and hence – of the undrground water	Preventive measures against ambient lands contamination caused by the platforms contamination
11.	Elaboration of action plan in emergency situations	Protection of environment components
	Geological bedrock and subsoil, and mineral diversity	
12.	The effected preliminary engineering/geological and engineering/hydrogeological studies are sufficient and give a detailed picture of the terrain condition and they should be used in the project development stage	Protection of the geological bedrock
	Landscape	
13.	Elaboration of landscape layout project for the grounds and adjacent land	Improvement of the platforms aesthetical appearance
	Biodiversity	
14.	Elaboration of greenbelt setting project for the grounds and adjacent land with plant species resistant to anthropogenic impact	Ensuring fast and efficient greenbelt setting in the territory, aimed to reduce the harmful impacts on environment and to improve the landscape appearance
15.	Greenbelt designing and planting around the MBT installation grounds	Observance of Regulation No.8/2004 requirements; impacts restriction and improvement of environmental landscape appearance
	Cultural and historical heritage	
16.	Precise mapping of the location of monuments of culture on the cadastre	Not to affect any monuments of culture when developing sites and facilities projects
17.	Strict compliance with the parameters covered by the Project Development Visa and meeting those of the corresponding planning zones contained in the General and detailed planning project – Density of construction (DC), Intensity of construction (IC), Minimum planted area, etc.	Creation of optimum, ecologically fiendly conditions for the environment once the investment proposal has been implemented

6.2. During construction

	Measures	**Target**
	Atmospheric air	
18.	The routes of vehicles to be used should be so selected as to minimize the impact of their emissions	Protection from air pollution Protection of human health
19.	Fencing the construction site to restrict dust spreading in dry and windy weather.	Protection from air pollution
20.	Washing the tires of trucks entering the site in rainy or humid weather.	Protection from air pollution
21.	Construction of gas outlet system at the landfill complying with the requirements of Regulation No.8 on the conditions and requirements for construction and operation of landfills and other facilities for waste utilization and treatment – OG issue 83/2004	Protection from air pollution
22.	Using fuel meeting the requirements of Regulation No.17/1999 on the contents of lead, sulphur and other substances harmful to the environment - OG, 97/1999г.	Protection from air pollution Protection of human health
23.	***Water***	
24.	The materials, facilities and technologies used should ensure water density of drainage systems and installations in taking away waste waters.	Protection of surface and groundwater purity
	Soils	

25.	Removal of soil matter from the site intended for the new landfill and storing it at the specially provided landfills.	Efficient use of soil resources
26.	Creation of isolation greenbelts around the platforms	Protection of adjacent lands from pollution and landscape layout of the plant
27.	Recultivation of damaged lands in the territory of the grounds and in the adjacent land.	Restoration of the soil fertility of adjacent lands and the soils of the grounds.
28.	Greenbelt setting on soils free of compact pavement in the platforms grounds	Landscape layout of production areas and an aesthetical effect
	Waste	
29.	Not to dump construction materials outside the planned storage places.	Prevention of resourcess loss
30.	To organize a system for collection and submission for subsequent treatment of waste generated in the construction stage	Ecologically friendly waste management
	Natural sites	
31.	Where necessary sprinkling of roads for car traffic located close to the protected area	Dust pollution reduction in the protected area
	Geological bedrock, subsoil and mineral diversity	
32.	Construction and assembly works shall take account of the data obtained from geological engineering studies, field geophysical studies and lab analyses of physicoal and mechanical properties of selected construction-worthy soils.	Protection of environmental components and minimization of the impact of the investment proposal.
33.	Provide for an efficient control of the implementation of all types of work, in particular, before and during the implementation of insulation belts on the non-hazardous waste landfill.	Provision for an efficient and environmental-conscious operation of the non-hazardous waste landfill.
34.	Construction and assembly works shall be carried out as per the national regulatory and technological requirements applicable to the site.	Groundwater and geological bedrock protection
	Biodiversity	
35.	Along with the construction of the SUW installation and non-hazardous waste landfill, a step-by-step implementation of the greenbelt project should start	Formation of sustainable plant cohabitats
36.	Minimize the impact on the upper (humus) soils layer	Digging out the surface layer of soil destroys important entomologic fauna including soil microorganisms, a factor in the formation of humus and soil fertility.
	Cultural and historical heritage	
37.	It is recommended that the site Empoloyer signs a contract with experts (an architect and an archeologist) who should: ▪ Effect initial terrain surveys; ▪ Assess the need of excavations and prepare an action plan for investigation works and their control and evaluation; ▪ Instruct those who work in the site, particularly in immediate nearness to the historical and cultural monuments.	Protection of the existing cultural monuments and presumable discovery of new ones
	Health hazard	
38.	Workers should be supplied with all necessary personal protection aids and duly instructed to use the equipment at the corresponding places.	Minimization of negative impact on the people

39.	Work out and coordinate an emergency action plan as per the requirements of CM Ordinance No.18 to adopt Rules of organization and implementation of work related to prevention and elimination of disasters, emergencies and accidents (OG, 13/1998). The plan shall expressly set out access roads, water supply sources and communication resources in case of emergency.	Preventive measures for protection of people's health and environment components

6.3. During operation

	Measures	**Target**
	Atmospheric air	
40.	Maintain aspiration, aeration systems and purification equipment in good working order and provide for the necessary extent of dust and gas emissions removal.	Protection from air pollution.
41.	Monitoring the emissions and the quality of atmospheric air according to an approved plan	Protection from air pollution.
42.	Fuels used onsite at the plant should duly be certified for the estimated lead, sulfur and other environmentally harmful substance contents.	Protection of atmospheric air quality
	Water	
43.	Strict observance of technological requirements in the course of purification at the treatment of generated production and household/fecal water and carrying out the necessary facilities prophylaxis.	Protection of purity of surface and groundwater
44.	Ongoing qualitative and quantitative monitoring of all waste water types	Provision of efficiency of operation and environmental protection.
45.	Observations for the protection of groundwater through boring at certain points.	Protection of soils, surface and groundwater
	Soils	
46.	Maintaining hygiene on the platforms grounds	Prevention of ambient soils contamination
47.	Maintaining hygiene of motor vehicles	Prevention of ambient soils contamination
48.	Mauintaining the green areas at the platforms and the isolation greenbelt	Maintenance of the aesthetic outlook and status of production areas; Prevention of pollution of adjacent soils.
49.	Strict control on the transport and the production process	Prevention of ambient soils contamination
50.	Maintaining fire-safety facilities and equipment and regular instruction of workers for actions to be taken in emergencies	Prevention of emergencies and larger damages of adjacent land and agricultural production
51.	Working out a closure and recultivation project of the platforms in compliance with the regulatory requirements	Ecological management of environment components
52.	Upon emergencies with subsequent soil contamination in the region, meliorative measures should be carried out for soil recovery – liming, applying organic and mineral fertilizers, etc.	Prevention of soil contamination
	Landscape	
53.	Suitable park-architecture green setting in the grounds inside and around the platforms	Improving the aesthetic nature of the layout, achieving an agreeable landscape and ecological structure
54.	To work out a technical and biological stepwise recultivation project for damaged and contaminated lands, complied with the requirements of Regulation No.26 on "Recultivation of	Landscape recovery

	damaged terrains, imrovement of poor productivity lands, protection and utilization of the humus layer"	
	Natural sites	
55.	Waste trucking away should be carried out beyond peak hours (8 – 10 a.m. and 4 – 6 p.m.).	Minimization of noise levels and air pollution in the protected area
	Biodiversity	
56.	In addition to implementing the investment proposal, an adequate greenbelt setting project shall be developed for the territory of working installations and their vicinity.	Improvement of the condition of environmental components while minimizing negative impact of environmental impact factors on adjacent territories.
57.	Not to allow dissipation of any type of waste.	Suggesting the emergence of synanthropic and semisynanthropic species related to human activity
58.	Take regular actions to maintain the status of thus created green areas and systems in and around the grounds - subject of the investment proposal.	Formation of sustainable ecosystems able to minimize negative environmental impact.
	Cultural and historical heritage	
59.	It is recommended that the investor of the site signs contracts with qualified specialists (architect and archaeologist) to carry out a monitoring (coordinated with the National Institute of Culture Monuments) of the exploited territory and work related to the protection of cultural and historic heritage.	Protection of the existing culture monuments and presumable discovery of new ones
	Waste	
60.	Work out Worksheets to list and classify all types of waste entering or generated within the grounds.	Ecological waste management
61.	Work out a corporate waste management programme to apply within both grounds, to be coordinated with the Regional Inspectorate on Environment and Waters – Sofia	Ecological waste management
62.	Introduce necessary accounting papers in order to duly document waste-related activities as provided by Regulation No. 9/2004	Ecological waste management
63.	Work out corporate instructions on waste management in the specific work places.	Ecological waste management
64.	Provide temporary waste type-specific storage grounds to host waste until submittal to a company operating under a due waste management license.	Ecological waste management and protection of environment components
65.	Sign contracts with companies duly licensed to work under Art.37 and thus manage waste with reference to the hazardous waste, the sale of RDF-fuel and low-quality compost.	Ecological waste management and protection of environment components
66.	Sign a contract with a company duly licensed to work under Art. 54 and thus manage metal waste.	Ecological waste management
	Health hazard	
67.	The traffic of dump trucks and trucks for recyclable waste, inert materials and briquets should not pass near sites with specific sanitary and protection status	Protection of the population health
68.	No food, drinks and smoking will be allowed during work. These are allowed at the specific places intended in the office building during regulated breaks.	Minimizing health risk and protection of workers' health.
69.	Operators of installations should take a special training by experts familiar with a comparable plant in the EU already in operation.	Upgrading workers' qualifications and ensuring safety of work.
70.	Consider Regulation No.7 on the minimum requirements to	Protection of workers' health and reduction

	health and safety of work and at using working equipment (OG 88/1999, *amend. and suppl. no.48/2000, no.52/2001, amend. no.54/2001, amend, and suppl. no.43/2003, no.s 37 and 88/2004*).	of health hazard
71.	Preliminary and current instructions to be delivered, including on the safe handling of household waste. This is of particular importance to waste separation.	Protection of workers' health and reduction of health hazard
72.	The operator of installations shall sign a contarct with an Occupational Medicine Centre to ensure maintenance of safe and health working conditions according to Regulation no.3 on the terms and conditions of carrying out the activity of occupational medicine centres (OG no.14/2008).	Protection of workers' health and reduction of health hazard
73.	After starting regular operation, certain chemical agents in the working environment, dust in the air of the working environment, inhalable and respirable fractions should be measured according to Regulation No.13 on the protection of workers from risk due to exposure to chemical agents at work (OG no.8/2004, amend. and suppl. SG no.71/2006, SG no.67/20080.	Protection of workers' health and reduction of health hazard
74.	After starting regular operation, a measurement by a duly accredited lab of the noise at risk-prone workplaces will be done according to Regulation No.6 on the minimum requirements for health and safety protection of workers at risk of exposure to noise (*OG, 70/2005*)	Protection of workers' health and reduction of health hazard
75.	Provision of working garments, caps, gloves, dust resistant respiratory masks and silemcers to workers according to Regulation No.3 on special work garments and personal protection equipment (OG no.46/2001)	Protection of workers' health and reduction of health hazard
76.	Arrange for the cleaning and washing of work clothes and PPEs within the plant. These shall not be taken home by staff.	Protection of workers' health and reduction of health hazard
77.	Arrange for preliminary and regular medical examinations to staff while focusing especially on infectious and allergic conditions of the respiratory system, eyes and skin.	Protection of workers' health and reduction of health hazard
78.	Work out a Report on the risk assessment under Regulation No.5 on the terms and conditions and the frequency of risk assessments (OG no.47/1999), to be updated on an annual basis.	Protection of workers' health and reduction of health hazard

6.4. During closure and recultivation

	Measures	**Target**
	Atmospheric air	
79.	Post-operation monitoring of biogas emission from the landfill	Protection of atmospheric air purity
80.	Routes of the used transport motor vehicles should be so selected as to minimize their emissions impact.	Protection of air from pollution Protection of people's health
	Water	
81.	WWTP should be used at this stage, and its dimantling should be one of the last activities at the platform	Protection of surface and groundwater purity
82.	At the stage of preparing the facility for recultivation the entire drainage water from the landfill should be treated at WWTP	Restruction of pollutants dissemination
83.	Maintain drainage systems at the landfill according to the normal post-operation requirements.	Prevention of uncontrollable emissions.

84.	Current monitoring of surface and groundwater as per updated approved plan of the company managing the production platform	Осигуряване на данни за настъпващи изменения
85.	Annual reports containing data and analysis of the site's condition.	To serve as reference i further decision-making process.
	Soils	
86.	Dismantling or demolition of facilities; Cleaning the grounds; Levelling up the grounds.	Preparations for future use of the treated areas.
87.	Depending on the purpose of future use – laying of humus layer and recultivation of damaged lands – for agricultural purposes or other construction activities.	Modification of the type of use of the lands thus treated.
	Landscape	
88.	Appropriate recultivation and greenbelt setting of the resulting anthropogenic landscape.	Improving the aesthetic nature of the layout, achieving an agreeable landscape and ecological structure
89.	Carrying out technological and biological recultivation as per the applicable Bulgarian and EU legislation and the best practices.	Restoration of the landscape and achieving an aesthetic outlook.
90.	In the closing stage, during re-cultivation sustainable ecosystems should be formed according to soil and climate background conditions.	Recovery and creation of suitable ecosystems
	Biodiversity	
91.	Project development and implementation of a biological recultivation with a view to set up sustainable plant habitats.	Improvement of environment qualities
92.	Obligatory recultivation	Recovery of soil fauna
93.	Assessment of the habitats condition after the effected technical recultivation with a view to directing the biological recultivation toward recovery of the potential habitats and formation of sustainable ecosystems	formation of sustainable ecosystems corresponding to the potential habitats
94.	Monitoring the condition of the recultivated landfill by geodesic measurements, piezometers and analysis of chosen control points	Possibility to analyze changes at a later stage.
95.	Cultivation care and arrangement of created crops on re-cultivated terrains so as to guarantee the formation of sustainable ecosystems.	Achievement of sustainable ecosystem
	Cultural and historical heritage	
96.	It is recommended that the investor of the site signs contracts with experts (architect and archaeologist) to: - monitor and, if applicable, notify competent bodies (Ministry of Culture, National Institute of Culture Monuments, among others); - develop a project and carry out (in addition to soil recultivation) a recultivation of cultural landscape in order to improve the artistic and aesthetic features of the environment, particularly of the landscape.	Protection of the existing culture monuments and presumable discovery of new ones
	Health hazard	
97.	Workers should be supplied with all necessary personal protection means and duly instructed to use the equipment at the respective working places.	Minimization of the negative impact on humans.

7. Positions and opinions of affected public, competent EIA decision-making authorities and other specialized institutions

and concerned countries in a transboundary context, as a result of the consultations held.

According to Art. 9 (1) (amend. – OG, issue 3/2006) of the Regulation on the terms and conditions of performing environmental impact assessment (EIA) (amend. – OG, issue 3/2006) Sofia (Metropolitan) Municipality, in conformity with the investment proposal (IP) parameters, held consultations under Art.95, Paragr. 3 of the Environment Protection Act. The procedure of the consultations with regard to the Terms of reference for the scope and structure of the EIA Report, has been coordinated with the Regional Inspectorate on Environment and Waters, Sofia – ***Appendix 5***.

Tables 7.1, 7.2, 7.3 give detals on the administrative information pertaining to the implemented consultations procedure related to the Terms of reference for an EAI Report. ***Appendix 6*** contains copies of the consultation letters and announcements sent by Sofia Municipality.

Table 7.1

Administrative reference about the letters sent by Sofia Municipality regarding held consultations

№	**Consultations related to the EIA Report**	**Outgoing No. At Sofia Municipality**	**Date of receipt**
1	Ministry of Agriculture and Procurement	3200-3005(1)/27.06.2008	02.07.2008
2	Directorate of the National Environment Protection Agency at MEW	0403-3041/17.06.2008	
3	Regional Inspectorate on Environment and Waters (RIEW)– Sofia	3200-3015(3)/27.06.2008	**Ref. No. 08-00-2073/27.06.08**
4	Pool Directorate "Danube Region"	3200-3005(1)/27.06.2008	03.07.2008
5	Regional Inspectorate for Public Health Protection and Control (RIPCPH) - Sofia	3200-305(1)/27.06.2008	02.07.2008 **Ref. No. 3200-3005(5)/11.07.08**
6	Republican Road Infrastructure Fund	3200-3005(1)/27.06.2008	02.07.2008 **Ref. No. 200-3005(4)/11.07.08**
7	Mayor of Yana village Municipality	3200-3005(1)/27.06.2008	03.07.2008
8	Mayor of Gorni Bogrov village Municipality	3200-3005(1)/27.06.2008	03.07.2008
9	Mayor of Kremikivtzi District	3200-3005(1)/27.06.2008	04.07.2008
10	Sofoyska Voda AD	3200-3005(1)/27.06.2008	30.06.2008 **Ref. No. 320-3005(6)/11.07.08**
11	CEZ Razpredelenie Bulgaria AD	3200-3005(1)/27.06.2008	02.07.2008
12	District Governor, Sofia District	3200-3005(2)/09.07.2008	14.07.2008
13	RIPCPH Sofia district	3200-3005(2)/09.07.2008	14.07.2008 **Ref. No. 3200-3005(9)/21.07.08**

14	Mayor of Elin Pelin Municipality	3200-3005(2)/09.07.2008	14.07.2008
15	Sofia Citizen Society "Shtastlivetza"	3200-3005(1)/27.06.2008	07.07.2008
16	Environmental Society "Za zemyata"	3200-3005(1)/27.06.2008	03.07.2008 **By e-mail on 17.07.08**
17	Non-profit Association "Eco-mramor"	3200-3005(1)/27.06.2008	03.07.2008
18	Information and Educational Centre on Ecology	3200-3005(1)/27.06.2008	09.07.2008
19	National Instirute of Culture Monuments	18-00-307(5)/10.07.2008	**Ref. No. 2467/10.07.08**

Table 7.2

Administrative reference on sessions and consultation meetings held with Sofia Municipality Managing Board on discussing the EIA Report documents

	Session of the MB	**Date of session**	**Minutes**	**Statement/ Opinion No.**
1	Delivery of introductory report on the environmental impact assessment (EIA Report)	06.06.2008	09.06.2008	Ref. No.15.00-3293/13.06.08 of Sofia Municipality
2	Presentation of the Terms of reference for the scope and structure of the EIA Report pertaining to the investment proposal	07.07.2008	09.07.2008	Ref. No. 3200-3005(3)/10.07.08/ 13.06.08 of Eco-Mramor Inc. Ref. No.1500-3247/04.07.08/13.06. 08 of Ecoglasnost Inc.
3	Presentation of the procedure for consultations with competent bodies and the public on the Terms of reference for the scope, structure and form of the EIA Report.	07.07.2008	09.07.2008	
4	Presentation of the procedure for consultations in relation to working out an EIA report and the preparation of an ecological assessment of the Detailed Urbanization Plan for Yana village, Sadinata locality	07.07.2008	09.07.2008	RIEW Inc. No. 3200-3007(2)/10.07.08, coordinating the mechanism

Table 7.3

Administrative reference about consultations held via Sofia Municipality website and information panel announcements

	Information at SM's website (http://www.sofia.bg)	**Publication date**	**Deadline for coverage**	**Ref. No. of positions, opinions and points made**
1	Interim report on Task 5: "Organizational Framework"	12.06.08	10 working days as of publication date	
2	Final report "Effected analysis of the quantities and the contents of waste generated by typical settlement areas with differing development structure, including summary of collected data"	23.06.08	10 days as of publication	

3	Final report „Research of waste generators from the industry and services sectors including summary of collected data"	23.06.08	10 days as of publication	
4	Final report on Task: "Future waste management system"	04.06.08	30 days as of publication	Ecoglasnost Inc. No.1500-3246/04.07.08 Opinion Bremel International
5	Terms of reference for the scope and structure of EIA report on "Integrated system of facilities for municipal waste treatment in Sofia Municipality"	27.06.2008	14 days as of publication	
	Information board announcements at 33, Moskovska St.	**Date of publication**	**Deadline for coverage**	
	Terms of reference for the scope and structure of EIA report on "Integrated system of facilities for treatment of the municipal solid waste of Sofia Municipality"	27.06.2008	14 days as of publication	

8. Conclusion

8.1. Assumptions and findings

- Today's management of municipal solid waste generated in Sofia (Metropolitan) Municipality has by now reached all critical limits presenting a most significant threat to human health, environmental components, the cpital city's sustainable development and our country's prestige (image) to Europe and the world;
- The " Integrated system of facilities for treatment of the municipal solid waste of Sofia Municipality" subject to an environmental impact assessment provides for as follows:
  1. Recycling of recyclable components.
  2. Production of modified waste (RDF-fuel) to be utilized in industrial applications.
  3. Production of compost from plant and food wate to be urilized for soil amelioration purposes.
  4. Production of non-conventional compost to be utilized in the re-cultivation of damaged terrains.
  5. Deposition of non-hazardous waste (inert, incombustible waste).
- Appreciating the "Integrated system of household waste treatment facilities for the waste of Sofia Municipality" to be built shows it is the optimum, most applicable and most ecologically-conscious solution because of:
  1. No generated gaseous, fluid, solid and non-energetic pollutants threatening the environment and human health.
  2. The equipment (techniques and technologies) to be used completely meets the best available waste treatment techniques.
  3. The equipment (techniques and technologies) to be used completely meets Europe's and the world's best practices.
  4. MSW utilization is to be maximized, i.e. recyclation, fuel and industrial energy production, and compost production for contaminated and damaged lands as well as for agricultural purposes.
  5. Sofia Municipality's MSW, which is roughly 20% of national MSW is to be utilized as a resource for industry and agriculture for the first time in Bulgaria.

- The environment components subject to an environmental assessment regarding their status, available in the region where the "Integrated system of facilities for treatment of the municipal solid waste of Sofia Municipality" should be constructed, i.e. the Kremikovtzi region – the land of the villages of Yana and Gorni Bogrov, exhibit a high degree of anthropogenic impact, present pollution and damage (mainly due to Kremikovtzi SA's activity and the production and concentration of uranium at "Buhovo") and have been, are today and will remain a menace to all environmental components, people's health and the capital city's sustainable development;
- Attaining values of material (gasiform, fluid, solid) and energetic (irradiating, ionizing, heating, light, magnetic) pollutants related to the equipment (techniques and technologies) to be used, below the critical limits, will enable to implement the " Integrated system of facilities for treatment of the municipal solid waste of Sofia Municipality" in the region of concern;
- Of all 5 (five) grounds considered in this EIA Report, i.e. Yana-Sadinata, Khan Bogrov, Yana-Pasishteto, Kremikovtzi Metallurgy Plant, and Kubratovo, most appropriate are Yana-Sadinata and Khan Bogrov where the following is provided for:
  - regarding ***Yana-Sadinata*** – mechanobiological treatment and production of modified fuels, non-conventional compost and deposition of non-hazardous waste;
  - regarding ***Han Bogrov*** – composting plant origin waste and composting food waste

8.2. Major recommendations

The detailed economic analysis of techniques and technologies as well as social analyses in relation to the longterm management of Sofia Municipality's household waste and the preparation of this EIA Report provides sufficient grounds to make the following recommendations:

1. To build a plant as soon as possible - "Integrated system of facilities for treatment of the municipal solid waste of Sofia Municipality" as per the investment proposal

2. To develop and implement immediately a Programme aiming to remove observed "old damages" and put an end to the generation of "new damages" in the Sofia region of Kremikovtzi, primarily those related to the production activity of Kremikovtzi SA and the uranium production at "Buhovo".

8.3. Conclusion

1. **It is hereby suggested that the members of the Environmental Expert Council with the Regional Inspectorate on Environment and Water in Sofia approve Sofia Municipality's investment proposal to build an "Integrated system of facilities for treatment of the municipal solid waste of Sofia Municipality" with reference to the Yana-Sadinata and Han Bogrov sites in view of the afore-stated assumptions and findings.**
2. **Sofia Municipality should start the implementation of a Programme in order to remove observed "old damages" and put an end to the generation of "new damages" in the Sofia region of Kremikovtzi.**