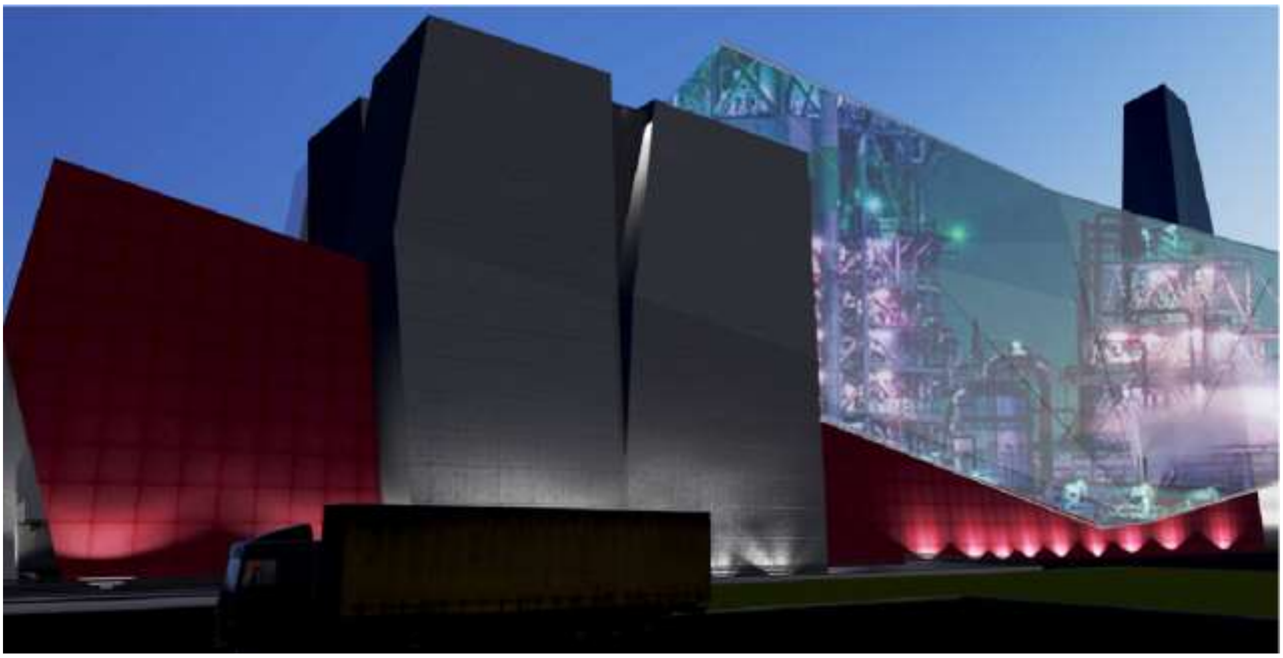
EIA REPORT

FOR

EIAR OF IP FOR CONSTRUCTION OF A COGENERATION PLANT UTILIZING RDF IN SOFIA



CLIENT:
TOPLOFIKATSIA SOFIA EAD

Sofia
August 2014

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LIST OF ACRONYMS

AMS	Automatic monitoring station
CBA	Cost-Benefit Analysis
SHW	Safety and Health at Work
BI	Biological indicators
DRBD	Danube River Basin Directorate
DRBWMD	Danube River Basin Water Management Directorate
BDS	Bulgarian State Standard
BOD	Biological oxygen demand
CB	Condensing boiler of cogeneration plant utilizing RDF in Sofia
WHSFS	Workplace health and safety and fire safety
WPI	Water pre-treatment installation
CSS	City sewerage system
FL	Fuels and lubricants
CWWTP	City's Waste Water Treatment Plant
SG	State Gazette
ICE	Internal combustion engines
EIAR	Environmental Impact Assessment Report
CAR	Compatibility Assessment Report
EU	European Union
ERDF	European Regional Development Fund
EMF	Electromagnetic field
BDA	Biological Diversity Act
WA	Water Act
PZ	Protected zone
PAA	Protected Areas Act
PS	Protected site
EPA	Environmental Protection Act
PA	Protected area (special area of conservation)
WMA	Waste Management Act
SDA	Spatial Development Act
ExEA	Executive Environment Agency
BAR	Bottom ash removal
IELV	Individual emission limit values
IP	Investment Proposal
SDS	Safety data sheet
IEDII	Ion-exchange de-ionization installation

S	Stack
AAQ	Ambient air quality
LWWTP	Local waste water treatment plant
MBT	Mechanical-biological treatment of waste
MH	Ministry of Health
MAF	Ministry of Agriculture and Food
MEE	Ministry of Economy and Energy
MV	Motor vehicles
MRD	Ministry of Regional Development
MoEW	Ministry of Environment and Water
	Condensing boiler of cogeneration plant utilizing RDF in Sofia
CM	Council of Ministers
OCPPEIA	Ordinance on the conditions and procedures for performance of environmental impact assessment
CA Ordinance	Ordinance on the conditions and procedures for carrying out assessment of the compatibility of plans, programmes, projects and investment proposals with the conservation objectives of the protected areas
ELV	Emission limit values
NEK	National Electric Company
NEN	National Ecological Network
BAT	Best Available Techniques
NSI	National Statistical Institute
NHIC	National Health Information Centre
OW	Oil water
EIA	Environmental Impact Assessment
	Acute infections of the upper respiratory tract
CA	Compatibility Assessment
	Detailed site development plan
SWB	Surface water body
GWB	Groundwater body
TLV	Threshold limit value
WWTP	Waste water treatment plant
DSDP	Detailed site development plan
DSDP-LUP	Detailed site development plan – Land use plan
RBMP	River Basin Management Plan
WFD	Water Framework Directive
RHI	Regional Health Care Inspectorate

RIEW	Regional Inspectorate of Environment and Water
UNFCCC	United Nations Framework Convention on Climate Change
SCWWTP	Sofia City Waste Water Treatment Plant
ALV24	Average emission limit values for 24 hours
WHO	World Health Organization
SM	Sofia Municipality
SZ	Safeguard zone
CMS	Control and Monitoring System
OHS	Occupational health service
HA	Heat accumulator
TG	Turbogenerator
TPP	Thermal Power Plant
TW	Tube well
TS	Toplofikatsia Sofia EAD
TSI	Technical Specification for Interoperability
FY	Fiscal year
ФХ	Физикохимични показатели
ХЗВ	Water with chemical pollutants
ХМ	Хидроморфологични показатели
PM_{10}	Particulate matter up to 10 micrometers
DW	Drill well
COD	Chemical oxygen demand
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLP	Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures
EWC	European Waste Catalogue
IUCN	International Union for Conservation of Nature
REACH	Regulation (EC) No. 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals, Directive 67/548/2008
RDF	Refuse-derived fuel - modified solid fuel derived from refuse
SNCR	Selective Non Catalytic Reduction
PCBs	Polychlorinated biphenyls, polychlorinated terphenyls, monomethyl-tetrachlorodiphenyl methane, mono-methyl-dichloro-diphenyl methane, monomethyl-dibromo-diphenyl methane and any mixture containing any of those substances in a total of more than 0,005 % by weight

INTRODUCTION

The Environmental Impact Assessment Report (EIAR) of the Investment Proposal (IP) for Construction of a Cogeneration Plant Utilizing RDF in Sofia is prepared in conformity with art. 95, paragraph 2 of the Environmental Protection Act (EPA) (SG No. 91/2002, as last amended and supplemented SG No. 22/11.03.2014) and art. 9, paragraphs 1 and 4, art. 10, paragraphs 1 and 3 of Ordinance on the Conditions and Order for Performance of Environmental Impact Assessment (SG No.. 25/2003, as last amended and supplemented SG No. 94/30.11.2012) and on the grounds of Decision on assessing the need for performance of environmental impact assessment - Letter of outgoing ref. No. 26-00-8305/09.10.2013 of RIEW - Sofia. The investment proposal falls within the scope of section 2.1 of Appendix No. 1 of EPA and is subject to mandatory environmental impact assessment (EIA). According to art.94, paragraph 2 of EPA the authority competent to deliver a decision is the Director of RIEW - Sofia.

Terms of reference for the scope and content of the EIA report have been prepared in 2013 in accordance with art.95, paragraph 2 and paragraph 3 of EPA and with art.10, paragraph 1 of the Ordinance on the Conditions and Order for Performance of Environmental Impact Assessment According to RIEW letter of outgoing Ref. No.26-00-8305/09.10.2013 г. the presented scope of the EIA report includes the information, specified under art. 10, paragraph 3 of OCOPEIA. The suggested EIAR structure meets the requirements stipulated under article 96, paragraph 1 of EPA and art. 10, paragraph 3, item 5 of OCOPEIA, and this EIAR has been prepared following that structure.

The EIAR provides a description and analysis of the environment, cultural heritage and human health components and factors, which will be significantly affected by the investment proposal as well of the interaction between those components and factors. In this EIAR the likely significant effects on the population and on the environment, resulting from the investment proposal implementation, the use of natural resources, emission of pollutants, waste generation and creation of nuisances in the course of construction, normal operation and in emergency situations, have been specified, described and assessed.

All adopted requirements and all recommendations made in the stands of different institutions have been fulfilled in EIAR.

The Guidelines for EIA of investment proposals, Sofia, 2002, the guidelines and methods for the application of Directive 2001/42/EC for environmental impact assessment as well as other literature, described under **section 6** of this report, have been used as the methodological basis for the preparation of the EIAR.

Legal framework

The investment proposal will be implemented in conformity with the regulatory and legislation basis currently in force in Bulgaria.

When preparing the EIA report the requirements of the laws, ordinances, regulations and standards of the Republic of Bulgaria and the main EU directives, connected with environmental protection and relevant to the project, have been observed.

The EIA procedure has been conducted in conformity with Chapter 6 of the Environmental Protection Act (EPA) and the Ordinance on the Conditions and Order for Performance of Environmental Impact Assessment (published in SG No. 25 of 18.03.2003, as last amended and supplemented SG No. 94 of 30.11.2012).

The above documents have been transposed from the EIA Directive of EU (85/337/EEC, amended and supplemented by Directive 97/11/EC, amended and supplemented by Directive 2003/35/EC).

The investment proposal of Toplofikatsia Sofia EAD falls within the scope of Annex 4 of EPA (is subject to issuance of an integrated permit - item 5.2,"Disposal or utilization of waste in incineration installations", item "a" - non-hazardous waste, installations of capacity exceeding 3 tonnes per hour.) The Client has declared his wish for admitting the exception under art.118, paragraph 2 of EPA and in accordance with art. 99 of EPA regarding provision of the information to the assignment for determining the EIA scope and content as a separate **Appendix 12.2**, which includes also an Evaluation for the use of best available techniques (BAT) in the Investment Proposal (Appendix 2, item 2, Letter of Toplofikatsia Sofia EAD, ref. No. П-5449/16.12.13).

The EIA procedure observes also the other requirement of Bulgarian legislation related to environmental protection.

1 GENERAL INFORMATION REGARDING THE INVESTMENT PROPOSAL AND ACTIVITIES

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1.1 INVESTMENT PROPOSAL NECESSITY AND PURPOSE

The investment proposal refers to a new development: „**Construction of a cogeneration plant utilizing RDF in Sofia**”.

Toplofikatsia Sofia (TS) intends to use modified solid fuel, derived from refuse (RDF), with the purpose of changing the fuel base for energy production by substituting natural gas, switching to new renewable fuel sources and improving the thermal energy production efficiency.

By building a **Cogeneration plant utilizing RDF** at one of the existing heat production sites a portion of the basic fuel - natural gas - currently used by Toplofikatsia Sofia EAD will be replaced by RDF (refuse derived fuel) – modified solid fuel derived from refuse, and that will make thermal energy production at TPP Sofia less dependent on imported gas.

The new plant, utilizing RDF for energy purposes, is an important component of the strategy of Toplofikatsia Sofia for development and stabilization of the production capacity for thermal energy generation in Sofia. The thermal power station utilizing RDF will replace part of the outdated thermal energy producing installations in Toplofikatsia Sofia (some of which are over 50 years old) by new and modern installations, complying to the European directives for highly efficient and environmentally friendly energy production.

On the other hand the construction of the cogeneration plant utilizing RDF is a components of the investment project of Sofia Municipality for Development of an Integrated System of Municipal Waste Treatment Facilities and is the third and final phase of that project, after building of composting and mechanical-biological waste treatment installations, while at the same time *corresponds to the main objective of the National Waste Management Programme for sustainable development through the establishment of an integrated waste management framework*. The integrated approach for solving the household waste issue, adopted by Sofia Municipality, is also in conformity with the Operational Programme Environment 2007 - 2013. The quantity of Sofia municipality household waste, intended for disposal in non-hazardous waste landfills, will be reduced by around 80 %.

Therefore the construction of the plant is a priority both for Sofia Municipality and for Toplofikatsia Sofia EAD. It will result in applying a modern waste management solution in Sofia municipality and at the same time achieving the necessary high-efficiency and environmental protection indices by the district heating company in thermal energy production. Implementing this project will reduce the dependence of Toplofikatsia Sofia on imported gas - i.e. the basic fuel will be partly diversified. The RDF utilization plant will reduce CH_4 and CO_2 emissions from municipal solid waste while the combustible component available in waste will be utilized for cogeneration of energy.

High-efficiency cogeneration is one of the main priorities of Directive 2001/27/EU on energy efficiency and has significant potential for saving primary energy. That type of technology results in improving energy efficiency as well as reducing the harmful impact on the environment. In addition the suggested investment proposal envisages utilization of waste and generation of energy; reduction of waste will be achieved and that will result in sustainable waste management in Sofia municipality. .

1.2 INVESTMENT PROPOSAL LOCATION - PHYSICAL CHARACTERISTICS, BOUNDARIES, DISTANCES FROM PROTECTED SITES AND OTHER NEN COMPONENTS

Two sites have been suggested for the plant location.

- **TPP Sofia** with site „**B**” as a main site; and
- **TPP Sofia-East** with site „**B**” as an alternative site.

TPP Sofia site - located in the northern part of Sofia, in "Zadgarov Rayon" industrial area. That is within the territory of plot No.68134.511.4, plan 22, quadrant 22, plot 1 of Sofia city plan, district Serdika, 6 Istoria Slavyanobalgarskaya Str.

The total area of TPP Sofia ground is 334,945 m^2, on which 50 existing buildings are located with total built-up area 45,987.31 m^2. Site „**B**" (the main site envisaged for the plant location) is in the western section of the ground and has an area of around 15 daa, and the structure discharging emissions into the ambient air is located at 400 m distance from the outlines of **TPP Sofia.**

According to the master plan of Sofia the **TPP Sofia** ground is located in a mixed-type area (part of "Zadgarov Rayon" industrial area), intended for industrial development, a cemetery and commercial sites. Site „**B**" is located within the territory of **TPP Sofia** and no land use change procedure is necessary.

The residential areas closest to the boundary of **TPP Sofia** are as follows: - to the north-east - residential buildings of Orlandovtsi district (beyond the outlines, at 15 m distance from them and at over 400 m distance from the chimney stacks); - to the north - Suhodolska river and a single residential building (beyond the outlines, at 50 m distance from them and at around 500 m distance from the chimney stacks); - to the north-east and east - cemetery park and Parva Balgarska Armia Blvd., to the south - Istoria Slavyanobalgarskaya St. and four departmental residential buildings (beyond the outlines, at 15 m distance from them and at over 400 m distance from the chimney stacks).

TPP Sofia-East site – the alternative site selected for the purposes of EIA. It is located in the eastern part of Sofia and provides thermal energy for Sofia East district heating region. TPP Sofia-East ground falls within Iskar District industrial area, plot No.68134.1506.143, plan 143, quadrant 1 of Sofia city cadastre, 6 Dimitar Peshev St., and has a total area of 319,692 m^2. Site „B" (the alternative site envisaged for the plant location) is located near the railway line, has an area of around 20 daa, and the structure discharging emissions into the ambient air is located at 400 m distance from the outlines of TPP Sofia-East.

The ground of TPP Sofia-East, used for thermal energy generation, borders industrial construction areas, planting areas and mixed-purpose areas. Adjacent to TPP Sofia-East are industrial enterprises and plots as follows: - to the north-east - the large industrial enterprise Sofia Med; to the west - the border is Dimitar Peshev St. and to the west of that street there are industrial plots partially used by small enterprises; - to the south - garages; - to the south-east - crushed-stone pit, Iskar river, agricultural land. The area around the site within a 800 m radius from it is an industrial area. The residential areas closest to the boundaries of TPP Sofia-East ground are as follows: - to the north-east - beyond the river - D. Milenkov quarter (beyond the ground outlines, at 450 m distance); to the south-east - a residential building (beyond the ground outlines, at 350 m distance); and to the south - a part of Druzhba quarter (beyond the ground outlines, at 450 m distance).

Site „B" is located within the territory of TPP Sofia-East and no land use change procedure is necessary.

The construction of the plant does not necessitate changing the site development category or the site development parameters of the area within which the selected site of TPP Sofia or of TPP Sofia-East falls; neither does it necessitate changing the land use or any basic or additional functions of the area.

TPP Sofia site was selected to be the main site (Site Selection Report, approved by Toplofikatsia Sofia EAD (TS) on 26.07.2013).

1.3 NECESSARY AREA; OWNERSHIP

The site of the **Cogeneration Plant Utilizing RDF in Sofia** will comprise: the main production and administration building, a bottom ash storage depot, tanks for diesel generator fuel and for ammonia solution, a heat accumulator, electronic scales and a transport area.

The built-up area of the main production and administration building is 5,345 m^2. It is envisaged that the entire ground outside the building, of area around 10,370 m^2, will be covered with concrete pavement.

The installations and equipment of TPP Sofia and TPP Sofia-East are property of Toplofikatsia Sofia; they have been built on plots which are municipal property, and no land use change procedure is necessary for the land of either of the sites. All construction operations and temporary sites will be located within the allotted terrain, within the existing thermal power stations.

1.4 CONNECTION WITH OTHER EXISTING FACILITIES, APPROVED THROUGH SITE DEVELOPMENT PLANS, AND WITH OTHER ACTIVITIES

The investment proposal is in accordance with:

- the National Strategy on the Environment
- the National Action Plan
- the National Waste Management Programme
- the Operational Programme Environment 2007 - 2013

The Operational Programme Environment 2007 - 2013 specifies the following under Priority Axis 2:

"... Priority axis 2: Improvement and development of waste treatment infrastructure - This priority aims compliance with several directives, the requirements of which have been transposed into the national legislation. The priority is focused mainly on achieving compliance with Directive 75/442/EEC on waste and Directive 1999/31/EC on the landfill of waste. The waste management hierarchy, formulated in the 1996 Community Strategy for Waste Management, describes the preferred sequence of waste management operations and activities as follows:

(1). Prevention of waste by reducing the generation of waste and/or the presence of hazardous substances in generated waste.

(2). Re-use / recycling / recovery through:

- re-use - repeated use of products or articles for the same purpose or for other purposes;
- recycling - processing of waste and using it as raw materials for the production of the same or other products;
- recovery - by applying the methods of composting, energy recovery or other technologies.

The purpose of the hierarchy is to illustrate a model of an integrated waste management approach, and applying that hierarchy in the specified sequence will contribute to the creations of a sustainable waste management policy.

In Bulgaria the WMA stipulates a waste management hierarchy, which specifies as:

- priority 1 - prevention of waste formation;
- priority 2 - waste utilization through recycling, reuse and/or extraction of secondary raw materials and energy recovery;
- priority 3 - e final disposal *or incineration* of waste should the prevention, reduction and/or recovery thereof be impossible.

„.......... Despite the potential risks the usage of waste as an alternative fuel and/or its incineration with energy recovery could be a feasible possibility with actual benefits for the environment and the national economy. In cogeneration of energy, utilizing RDF, the incineration of waste shall be performed only in installations that are in compliance with the requirements of the legislation and thus the highest level of environmental protection shall be guaranteed. The emitted heat shall be recovered to the greatest possible extent. Waste with high energy content that is not suitable for recycling shall be orientated towards incineration with energy recovery."

RDF will be supplied by Sofia Municipality (SM) from the MBT installation in the territory of Yana village, Sadinata site.

In this regard RIEW - Sofia, by its Decision No. 14-8/2008 related to the investment project for Development of an Integrated System of Municipal Waste Treatment Facilities, approved the construction of an MBT installation (respectively RDF production) and some of the stated reasons for the decision are as follows:

... "The investment project of SM for Development of an Integrated System of Municipal Waste Treatment Facilities corresponds to the primary objective of the National Waste Management Programme for sustainable development through the establishment of an integrated waste management framework. The integrated approach adopted by SM for solving the household waste problem is in accordance with the Operational Programme Environment 2007 - 2013."

... "The IP (Integrated System of Municipal Waste Treatment Facilities, a MBT installation in particular) is included in the Action Plan to the draft of the National Waste Management Programme for the period 2009 - 2013."

... "The IP (Integrated System of Municipal Waste Treatment Facilities, a MBT installation in particular) of SM is connected with the strategies, programme and plans for the municipality development, approved by the Municipal Council, and corresponds to the set goals for expanding of separate collection, waste recycling *and utilisation of the energy potential of household waste as energy source*, by which to achieve environmentally sound management of household waste”

... "By the suggested solutions for mechanical-biological treatment (MBT) of household waste before its disposal, the IP for construction of an Integrated System of Municipal Waste Treatment Facilities takes into consideration the requirements of art.4 of WMA regarding waste management hierarchy, which gives priority to prevention of waste generation, waste reuse, recycling and other forms of waste utilization, while waste disposal is the last option."

Taking into consideration the fact that the MBT installation will produce RDF to be used as fuel, by building a cogeneration plant utilizing RDF Toplofikatsia Sofia will contribute to attaining the waste management goals set by Sofia Municipality.

The following goal has been set in the municipal strategy for waste management:

- Utilization of the energy potential of household waste as a renewable energy source.

The investment proposal corresponds to the results envisaged in Operational Programme Environment 2014-2020 through priority axis 2: Waste, under which Specific goal 1 is set**:** Sustainable waste management for resource-effective and green economy:

- Installations and measures in accordance with the hierarchy of wastes management, for improvement of municipal waste management and for meeting regulatory requirements:
- Building of other installations for household waste utilization and/or disposal.

The investment proposal corresponds to the annexes to the National Strategic Plan for reduction of the biodegradable component of waste intended for disposal and is not a separate waste disposal technology. The waste will be pre-treated beyond the IP territory, in an MBT installation. Through the mechanical-biological treatment of waste different fractions of the waste will be separated and waste will be prepared for further utilization or disposal.

SM will produce RDF in the new installation for mechanical-biological waste treatment (MBT). The construction of an Integrated System of Municipal Waste Treatment Facilities is also in compliance with the requirements of the Programme for implementation of Directive 1999/31/EC according to which pre-treatment of waste before its disposal is a mandatory requirement.

The selected technology - an independent RDF installation with a steam turbine of its own - corresponds completely to the framework of Directive 2004/8/EC of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market, currently in force, and meets the requirements of Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency

Investment planning, construction permit issuance, construction and commissioning of waste incineration and co-incineration installations shall be performed in accordance with SDA after an EIA procedure in accordance with Chapter 6 of EPA. Ordinance No. 8 of 14.06.2001 on the scope and content of site development schemes and plans, SG No. 66/2008, specifies the requirements regarding the scope and contents of site development schemes and plans created within the territory of the Republic of Bulgaria.

(2) The following shall be determined by the plans specified under paragraph 1: ... "the general structure of the territory which is the object of the plan: residential areas, areas for production and storage facilities, areas intended for planting and specially planted areas, sports and entertainment areas, public service areas, areas with cultural and historical heritage sites, areas for resorts, tourism and for summer houses construction, areas for networks and equipment of the technical infrastructure, agricultural areas, forest areas, areas under environmental protection, damaged areas subject to recovery, special purpose areas, other purpose or mixed purpose areas; the general site development regime for each of the areas specified under item 1 through site development zones, areas under site development regime and separate real estate units under site development regime with respective rules and regulations;

According to SDA (in force as of 31.03.2001, promulgated in SG No.1/2001 and its latests amendments), art. 8, The specific intended purpose of lots shall be determined by the relevant detailed plan and may be one of the following: ... "1. (amended SG No. 65/2003, amended and supplemented SG No. 65/2004) within urbanized areas or in detached lots outside the boundaries of such areas: for residential, public services, **manufacturing**, storage, resort, country-house, sporting or recreational functions, for green spaces and landscaped links between green spaces and nature-conservation areas, for decorative water systems (cascades, navigable canals etc.), for public access and transport, including bicycle paths and movement of persons with disabilities, for technical infrastructure, for special-purpose installations etc.;

According to SDA, art.12, (1) Within the meaning given by this Act, "building development" shall be the arrangement and construction of buildings, structures, networks and facilities in lots. ... " (3) (amended SG No. 65/2003). Building development of works whereof the functions are compatible with the intended purpose of the lots shall be permissible in any lots referred to in items 2, 3 and 4 of article 8 herein without alteration of the intended purpose, in compliance with the effective statutory framework and on the basis of a detailed plan or a design permit issued by the Chief Architect of the municipality."

According to the master plan of Sofia it has been recommended to Sofia Municipality to give priority to new closed-cycle and water-saving technologies. The implementation of the investment proposal will be in conformity with the urban development master plan of Sofa concerning the respective city area, observing the zoning and the parameters for each zone. Implementing the project will not contravene any of the set parameters.

1.4.1 TPP SOFIA SITE

According to the master plan of Sofia **TPP Sofia** ground is located in a mixed-type industrial area (part of "Zadgarov Rayon" industrial area), intended for industrial development, a cemetery and commercial sites. The sites in view are located within the territory of **TPP Sofia** and no land use change procedure is necessary. The site borders the following: - to the north-east - Orlandovtsi district; - to the north - Suhodolska river; to the north-east and east - the cemetery and Parva Balgarska Armia Blvd., to the south - 202 Str. and four departmental residential buildings.

TPP Sofia site is characterised by the following requirements regarding construction: Category - 20: Mixed-type industrial area; -Maximum building density - 55 %; -Minimum planting area - 30 %; -Function: for construction of industrial, storage, administration, service and commercial buildings and facilities.

1.4.2 TPP SOFIA-EAST SITE

TPP Sofia-East is within Gara Iskar industrial area and is intended for thermal energy and electricity production. The ground of TPP Sofia-East, used for thermal energy generation, borders industrial construction areas, planting areas and mixed-purpose areas. Adjacent to TPP Sofia-East are industrial enterprises and plots as follows: - to the north-east - the large industrial enterprise Sofia Med; to the west - the border is Dimitar Peshev St. and to the west of that street there are industrial plots partially used by small enterprises; - to the south - garages; - to the south-east - a crushed-stone pit, Iskar river, agricultural land.

TPP Sofia-East site is characterised by the following requirements regarding construction: Category - 30: An industrial area for industrial construction, supply of petroleum products, thermal power stations and petrol stations. Function: For industrial construction, supply of petroleum products, thermal power stations and petrol stations.

The stand of the Ministry of Economy and Energy, stated under item 408 of letter ref. No. 26 of 12.11.2013, is that by implementing this IP a considerable potential is achieved for saving primary energy, which is one of the priorities set by Directive 2001/27/EU for improving energy efficiency and high-efficiency cogeneration of energy (in this case - production by the installation).

The stand of Environmental Association "Za Zemyata" (in English: "For the Earth"), on using waste products as a resource for electricity and heat generation, expressed in their letter Ref. No. 298/15.11.2013, has been analysed and taken into consideration.

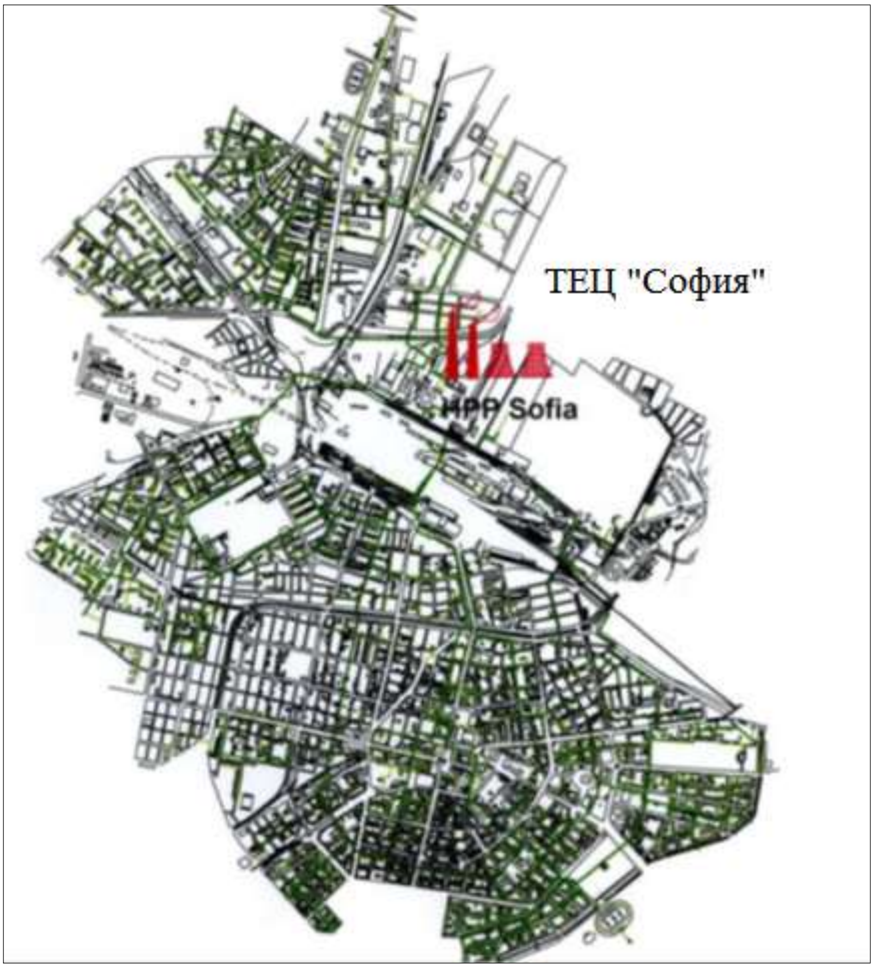


FIGURE 1.4-1 DISTRICT HEATING AREAS WITHIN THE SCOPE OF TPP SOFIA

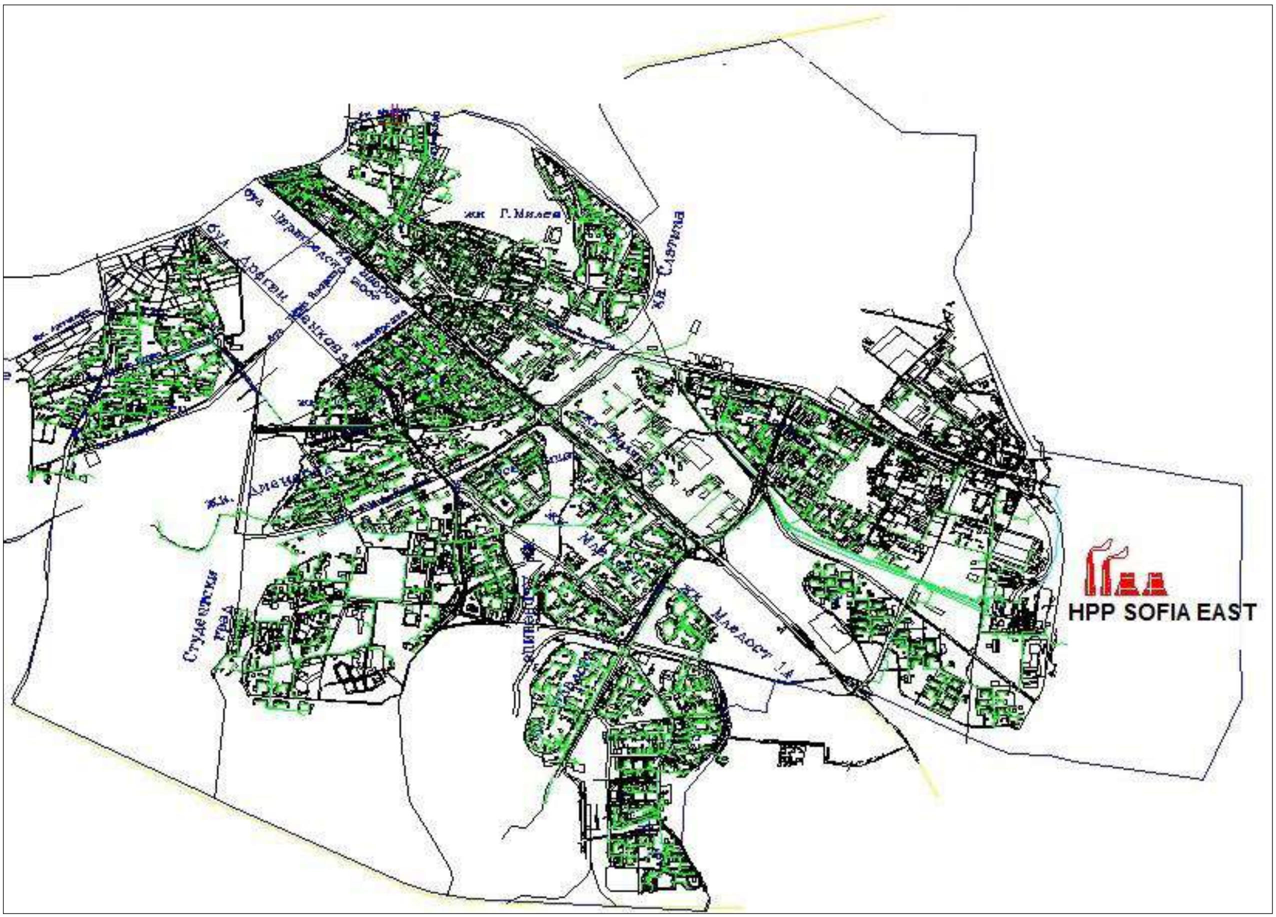


FIGURE 1.4-2 DISTRICT HEATING AREAS WITHIN THE SCOPE OF TPP SOFIA-EAST

1.5 PHYSICAL AND JURIDICAL PERSONS AFFECTED BY THE INVESTMENT PROPOSAL

The IP for **Construction of a cogeneration plant utilizing RDF in Sofia** has a number of local and international stakeholders.

1.5.1 BULGARIAN STAKEHOLDERS

The investment proposal is for construction within the territory of Sofia municipality, Sofia District. The project will affect juridical and physical persons who are within the area intended for the IP implementation, in the area of its impact.

- Sofia municipality- The project for a heat generation plant utilizing low-quality fuel (RDF) has been initiated by Sofia municipality administration as an integral part of the project for Sofia municipality waste management. Sofia Municipality (or possibly TS) intend to apply for funding from EU for the project for a heat generation plant utilizing low-quality fuel (RDF).
- Toplofikatsia Sofia EAD (TS)
- Government institutions concerned by the implementation of the project: Ministry of Energy, Ministry of Environment and Water, Ministry of Regional Development, Ministry of Culture, Ministry of Health, Executive Environment Agency, Road Infrastructure Agency, Sofia RHI, Sofia Municipality, SM - Serdika District and Iskar District, etc.

- Companies concerned by the implementation of the project: - Sofiyska Voda (English: Sofia Water) AD; NEK EAD; CEZ Distribution Bulgaria AD; Bulgarian Telecommunication Company AD and BULGARTRANSGAZ AD.
- The investment proposal falls within the management areas of RIEW - Sofia and Basin Directorate for Water Management in Danube Region - Pleven
- Non-governmental organisations concerned with the areas of conservation under Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora and Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds are: Balkani Wildlife Society, World Wide Fund for Nature, and Bulgarian Society for Protection of Birds (BSPB).

The population of Sofia and Bulgaria will benefit from the project in time.

1.5.2 INTERNATIONAL STAKEHOLDERS

- European Commission (EC) - EC initiates and lays down new legislation in the area of environment, which shall be applied in each EU member state. It is the responsibility of EC to establish authorities for approval of large-scale projects and to apply financing strategies in the area of environmental protection in order to ensure efficient enforcement of European legislation.
- The European Investment Bank (EIB) - the financial institution of the European Union - provides long-term loans for capital investment aimed at encouraging a balanced economic development and integration. Sofia Municipality and TS have already contacted EIB for co-financing of MBT and the plant which will utilize low-quality fuel (RDF). Therefore EIB is potentially an important project stakeholder.
- The European Bank for Reconstruction and Development (EBRD) - can be a source alternative to EIB for bank financing of the project.
- Kozloduy International Fund (KIF) - could be an attractive source for the project financing.
- The World Bank provides funding for infrastructure in the area of environment protection, chiefly through IBRD and where possible - through IFC. IBRD is one of the five organisations in the World Bank group. IBRD can be an alternative source for the project financing.

1.6 A SCHEME OF A NEW TRANSPORT INFRASTRUCTURE OR ALTERATION OF THE EXISTING ONE

1.6.1 TRANSPORTATION OF RDF BY SOFIA MUNICIPALITY

It is envisaged that RDF will be transported chiefly from the MBT installation (in the territory of Yana village, Sadinata site) and potential quantities of low-calorie RDF will be added from other sources. RDF will be delivered by Sofia Municipality by semi-trailer trucks (16.5 m, rear dump) RDF will be transported in bulk and will be delivered on workdays and Saturdays except for public holidays.

1.6.2 ACCESS ROADS AND TEMPORARY WORKS

The main flows for supply of modified solid fuels derived from waste (RDF) and for transportation of the waste, generated in the plant operation, are the following:

- *Flow 1* – Transportation of modified solid fuels derived from waste (RDF) from the MBT installation to the RDF incineration installation (incoming flow);

- *Flow 2* – Transportation of bottom ash (non-hazardous waste) from the installation to the landfill for inert materials (outgoing flow);
- *Flow 3* – Transportation of fly ash and boiler ash and of residues resulting from flue gas cleaning (fine dust particles - hazardous waste) - all vehicles transporting the collected and packed hazardous waste for following treatment (outgoing flow);
- *Flow 4* – all vehicles necessary in the process of plant operation (construction and repair works, preventive repairs etc.) - (intra-company flow)

Access for transport to TPP Sofia is possible through the existing road network: - The main entrance from the south-west from Istoria Slavyanobalgarskaya St.; Freight entrance from the north-east from Nesho Bonchev St.; Railway entrance from the north, with three tracks, for supply of mazut (alternative reserve fuel) in Parva Balgarska Armia St. The railway line is the site's connection to the national railway network.

RDF will be transported from the MBT plant to TPP Sofia using peripheral roads with relatively light traffic of heavy-freight vehicles. The traffic is somewhat heavier in the area of Hadzhi Dimitar quarter (Rezbarska St.). The route goes across several quarters and the boulevard is relatively wide. There is an option to use the high-speed northern bypass and reach the plant from there, but some quarters - Benkovski and Orlandovtsi - would have to be crossed in that case also.

The distance between the MBT plant and TPP Sofia by road is around 23 km; that refers to the route through Botevgradsko Shose Blvd. and Gen. Danail Nikolaev Blvd.

When measuring the distance to TPP Sofia-East it has been envisaged that the ring-road, Tsarigradsko Shose Blvd. and Dimitar Peshev St. will be used for the transportation. It is not recommended to use the route through Busmantsi quarter. The distance between the MBT plant and TPP Sofia-East is 27.5 km.

The investment proposal does not involve, neither does it envisage, any changes in the existing road infrastructure, in the transport plan, or a change in the access roads to TPP Sofia or TPP Sofia-East sites. In either of the sites building only an internal road network will be necessary in order to enable access to the plant site.

1.6.3 TRANSPORT OPERATIONS FOR DRF SUPPLY AND TRANSPORTATION OF WASTE

- **Flow 1** - transportation of RDF from the MBT plant to the new plant - 180,000 t/year; - the distance to TPP Sofia is around 23 km, and to TPP Sofia-East – 27.5 km **- Figure 1.6-1.**

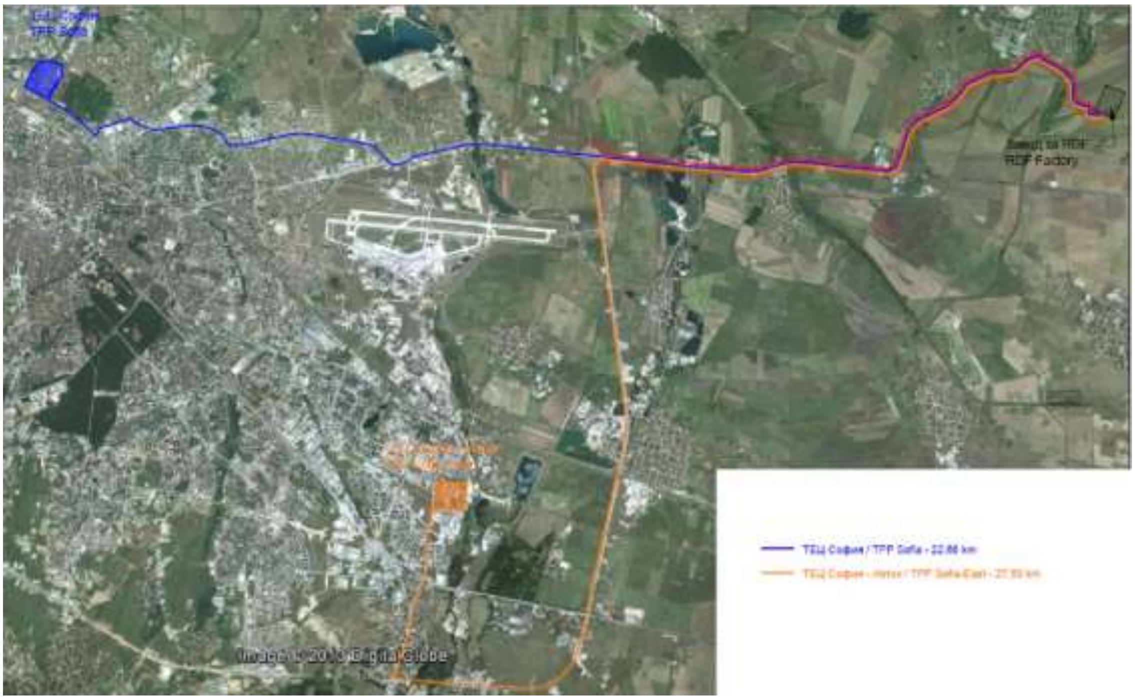


FIGURE 1.6-1 FLOW 1 - TRANSPORTATION OF RDF FROM THE MBT PLANT TO THE POTENTIAL SITES OF THE NEW PLANT

- **Flow 2** - transportation of bottom ash from the plant to Vrazhdebna landfill for construction waste - 36,000 t/year; 115 t/day. The distance to TPP Sofia is around 11.5 km, and to TPP Sofia-East – 16.8 km **- Figure 1.6-2.**

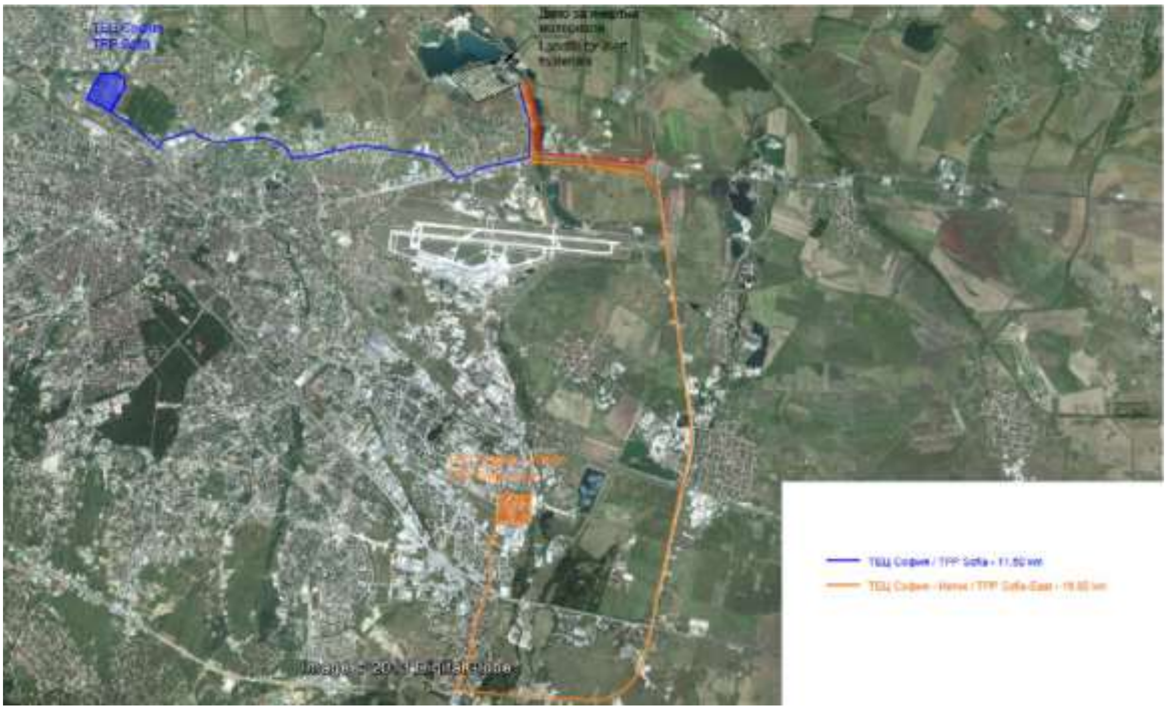


FIGURE 1.6-2 FLOW 2 - TRANSPORTATION OF BOTTOM ASH FROM THE PLANT TO VRAZHDEBNA LANDFILL FOR CONSTRUCTION WASTE

- **Flow 3** – transportation of fly ash (hazardous waste) from the plant to a depot for temporary storage (regional depot Sevlievo - 200 km or Ruse - 330 km) or to a mine in Germany (2,000 km) - maximum 35 t/day.

The road connection for delivery of RDF from the supplier to the new plant in **TPP Sofia** is 4.5 km (16%) shorter than that to **TPP Sofia-East**. For the transportation of slag (by-product from RDF incineration) to Vrazhdebna landfill for construction waste the road from **TPP Sofia** is 5.3 km (or 30%) shorter than that from **TPP Sofia-East**.

All considered potential sites for the IP construction have also railway connections. An ex-ante technical and economic evaluation has been performed and international experience has been studied. Using road transport is preferred at present.

In case transport by rail is used, it would be necessary to build a separate installation for loading and unloading operations at the site; besides the transportation costs for transport by rail are currently several times higher than the costs of road transport.

2 INVESTMENT PROPOSAL SUMMARY

2.1 PRODUCTION STRUCTURE (MAIN OPERATIONS, INSTALLATIONS AND EQUIPMENT; ACCESSORY INSTALLATIONS AND EQUIPMENT; OTHER), BASIC TECHNOLOGICAL CHARACTERISTICS AND LOCATION LAYOUT

2.1.1 TECHNOLOGIES APPLIED

The main stages in the utilization of waste in electricity cogeneration are the following - **Figure 2.1-1**:

- → RDF acceptance;
- → pre-treatment (outside the site of the installation);
- → feeding to the combustion chamber;
- → thermal treatment of the waste;
- → waste utilisation (e.g. a boiler) or disposal;
- → electricity and heat generation;
- → supply of the generated electricity to the electricity distribution system;
- → supply of the generated heat to the district heating system;
- → flue gas treatment (cleaning);
- → discharging (emitting) of gas into the air;
- → monitoring and control of emissions;
- → waste water control and treatment (use mainly in reclaimed water circulation);
- → bottom ash (from incineration) management and treatment;
- → disposal of the waste from operation.

FIGURE 2.1-1 SCHEMATIC DIAGRAM OF THE STAGES OF COGENERATION INSTALLATIONS UTILIZING WASTE

Thermal treatment of waste - the basic technologies for thermal treatment of waste in incineration installations are the following: - grate incineration, rotary furnace, boiling layer, pyrolysis and gasification. It has been noted that not all technologies are suitable for all types of waste.

TABLE 2.1-1 COMPARISON OF WASTE HEAT TREATMENT TECHNOLOGIES

Incineration technology	Non-treated MSW	Treated MSW and RDF	Hazardous waste	sludge from WWTP
Grate incineration - pushing grate	Commonly used	Commonly used	Not normally used	Not normally used
Grate incineration - chain grate	Used	Used	Rarely used	Not normally used
Grate incineration - rocking grate	Used	Used	Rarely used	Not normally used
Grate incineration - roller grate	Used	Commonly used	Rarely used	Not normally used
Grate incineration - water-cooled	Used	Used	Rarely used	Not normally used
A grate plus rotary tunnel furnace	Used	Not normally used	Rarely used	Not normally used
Rotary tunnel furnace	Not normally used	Used	Widely used	Used
Rotary tunnel furnace - water-cooled	Not normally used	Used	Used	Used
Incineration in a bubbling boiling layer	Rarely used	Used	Not normally used	Used
Incineration in a boiling layer - circulating	Rarely used	Used	Not normally used	Widely used
Incineration in a boiling layer - rotating	Used	Used	Not normally used	Used
Pyrolysis	Rarely used	Rarely used	Rarely used	Rarely used
Gasification	Rarely used	Rarely used	Rarely used	Rarely used

In the preliminary study the thermal treatment only the **grate incineration and boiling layer** options have been considered as those are considered to be *the most appropriate as regards treatment of modified fuel (RDF)* where municipal solid waste has been pre-treated. Gasification and other similar technologies are not considered to be developed to a sufficient degree or are still under development for large-scale application for RDF incineration.

Option No.1 Grate incineration – project technology in this investment proposal of Toplofikatsia Sofia EAD

Option No.2 Incineration in a boiling layer – considered as an alternative option of the incineration technology and described and rejected for further design phases due to the specified advantages of Option 1 and to a number of disadvantages connected with the increased amounts of hazardous waste.

2.1.2 TECHNOLOGICAL INFORMATION ON THE INCINERATION TECHNOLOGY SUGGESTED IN THE INVESTMENT PROPOSAL AND REASONS FOR THE SELECTION OF THE GRATE INCINERATION OPTION FOR APPLICATION

2.1.2.1 GRATE INCINERATION TECHNOLOGY

That technology is envisaged in the investment proposal of Toplofikatsia Sofia EAD.

The grate incineration technology has been used for incineration of waste since the beginning of last century. The grate incineration technology has undergone intensive development and at present it is a high-technology process with an improved control system; it is applicable for RDF utilization and is the widest spread waste incineration technology globally. Over 300 waste incineration facilities applying grate incineration technology are currently in operation only in Europe. Minimum the same number of such facilities are in operation in Asia and over 80 facilities are in operation in North America.

That technology is highly developed and has proven qualities for utilizing RDF. Incineration equipment based on the grate incineration technology is offered for capacity ranging from below 10 t/h to around 40 t/h.

2.1.2.1.1 DESCRIPTION OF THE GRATE INCINERATION PROCESS

The incineration grate fulfils two main technological functions (**Figure 2.1-2**), namely:

- Advancing, rocking, shaking, mixing, distributing and levelling the fuel on the grate;
- Distribution of primary air within the fuel layer so as to ensure uniform and controlled incineration.

A model diagram of a grate incineration installation utilizing the heat is shown in the figure below.

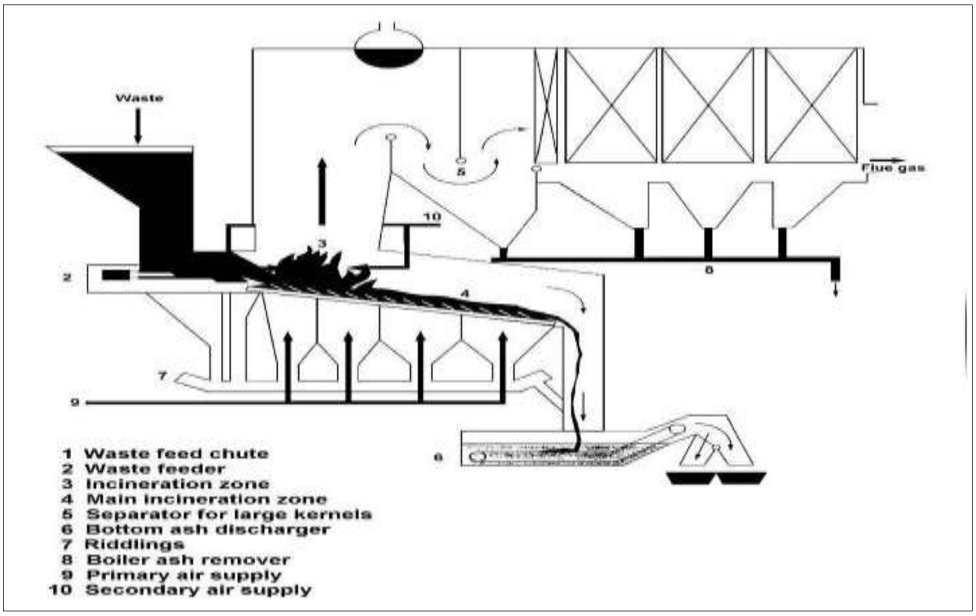


FIGURE 2.1-2 MODEL DIAGRAM OF GRATE INCINERATION, COMBUSTION CHAMBER WITH UTILIZATION OF THE HEAT FROM A WASTE-UTILIZATION COGENERATION INSTALLATION [1, UBA, 2001]

The grate incineration technology is offered by a number of qualified suppliers, who have quite a number of references regarding similar projects and extensive knowledge. The major manufacturers in Europe for grate incineration technology are: Babcock & Wilcox Vølund (Denmark); Fisia Babcock Environment GmbH (Germany); Hitachi Zosen Inova (Switzerland); Martin GmbH (Germany). The plant for energy generation from RDF will be based on grate incineration technology and an incorporated horizontal boiler. The technology block diagram of the installation envisaged in the investment proposal for cogeneration of heat and electricity utilizing modified fuel (RDF) is shown in **Figure 2.1-3**.

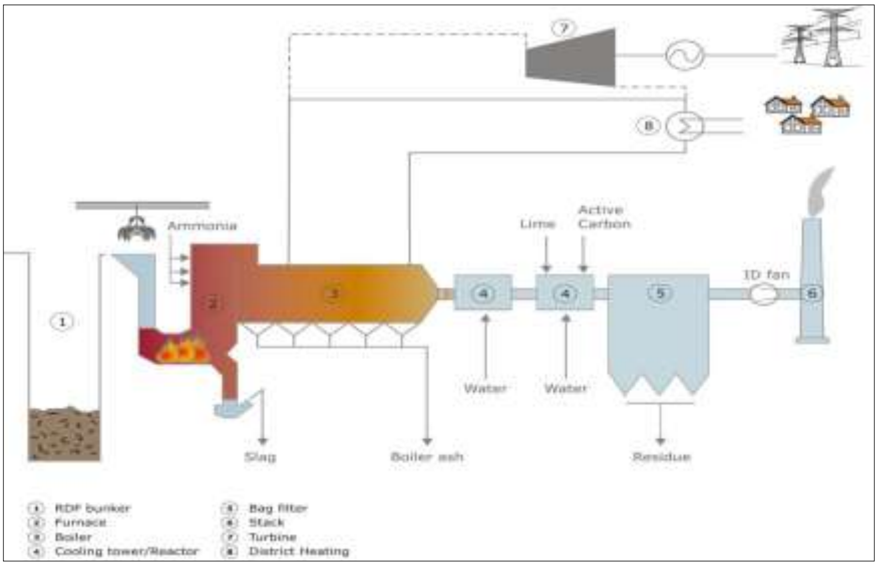


FIGURE 2.1-3 TECHNOLOGY BLOCK DIAGRAM OF THE COGENERATION INSTALLATION UTILIZING RDF[1]

The fuel (RDF) will be fed into the combustion chamber from a feed shaft and onto a pushing grate where drying and incineration processes take place. The heat of the flue gas will be used for steam generation in an integrated horizontal boiler, comprising a vertical evaporation radiation section and a horizontal convection steam reheating and economizer section.

The grate is divided into a number of individually adjustable longitudinal sections and one or more guide tracks. The number of tracks depends on the capacity (for waste) and the number of grate sections depends on the fuel composition, partial load, maximum load, calorific value etc.

The first 65-70 % of the grate are used as a drying and incineration zone, and the remaining section of the grate has to ensure complete and final incineration of bottom ash. The grate bars and the other grate components exposed to thermal, chemical or mechanical impacts have to be made of chrome-nickel steel alloy in accordance with the manufacturer's standards.

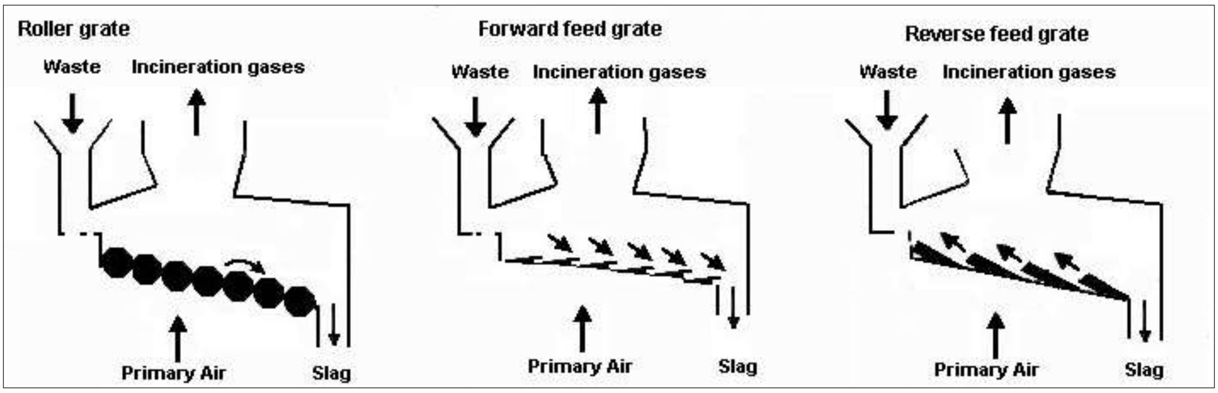


FIGURE 2.1-4 DIFFERENT TYPES OF INCINERATION GRATES [1, UBA, 2001]

The widely used grate type - forward pushing grate - has been chosen in this investment proposal. The forward pushing grate technology has been preferred because of its stability and proven capacity for treating a wide range of fuels, including RDF, low-grade RDF, sludge and low-grade biomass. The production lines designed to apply grate-type combustion processes show low technological sensitivity to most of the variations, usually observed in RDF, e.g. physical

[1] Technical note from the investment proposal

parameters and chemical composition. Yet the output of such a line is determined within a typical heat range and is thus less sensitive to variations in the calorific value and humidity content of the fuel. When the delivered RDF has calorific value lower than that designed for the plant, a larger quantity of RDF can be processed, and when the RDF has higher calorific value, smaller quantities of RDF can be processed.

The plant will be able to process also dehydrated sludge from waste water treatment plants. The sludge will be fed to the incineration grate by means of the RDF feeder. No temporary storage of sludge at the site is envisaged.

The cooling of the grate bars can be dome using air or water. In both cases primary air passing through the grate cools the grate bars. Further cooling by water is performed by water circulation in the grate bars. Water cooling of the grate bars is applied to reduce the grate wearing out when fuel of high calorific value is processed.

The waste retention time - from the moment waste enters the grate to the moment of receiving in the bottom ash extractor - is usually 1 hour, depending on the characteristics of the input fuel. It is important that the grate is completely covered by a layer of fuel so as to protect the grate bars. If the grate is not covered by a layer of RDF, the temperature will rise and there will be a risk of damage to the grate.

2.1.2.1.2 ENERGY GENERATION, COMBUSTION TEMPERATURE AND RETENTION TIME

The energy generated in the incineration process is transferred to a water-steam cycle and the resulting steam drives the steam turbine. Most grate incineration installations in Europe operate at steam parameters around 400-425°C and 40-50 bar.

Due to the high price of electricity, more attention has been given recently to increasing the electricity production. In 15 of the most recent energy producing installations is that the parameters of the steam are up to 440°C / 60 bar.

2.1.2.1.3 PROCESS WASTE (WASTE FROM THE TECHNOLOGY OPERATION)

The incineration of RDF in grate installations generates process waste (waste from the operation of the installation) in the form of bottom ash, boiler dust and fly ash. Usually bottom ash is 16-20 % of RDF depending on the content of ash/inert materials in the input RDF. Ferrous and non-ferrous metals can be extracted from the bottom ash and reused, and bottom ash can be used in construction. The non-incinerated material content in bottom ash is usually below 1 %.

Boiler dust and fly ash together are usually around 4.5 - 5.5 % of RDF. That fraction is classified as hazardous waste and has to be disposed in landfills for hazardous waste.

2.1.2.1.4 PRE-TREATMENT OF FUEL

The incineration section with grate can receive RDF which has not been pre-treated in any other way except mixing. RDF is unloaded directly into the bunker from where it is fed into a hopper.

2.1.2.1.5 FLEXIBILITY

Grate-type incineration installations are adaptable and enable operation with fuel of a wide range of characteristics and a wide range of calorific values and moisture content. The calorific value of mixed fuel usually varies within 8-18 GJ/t, which is not a problem for the incineration process and all guarantees for protection of the environment can be ensured.

As a general rule it can be said that the technology involving a grate is suitable for incineration of waste of calorific value <16 GJ/t and inert materials content above 10 %. Above data is considered average value, and peak loads exceeding those values are admissible.

2.1.2.1.6 TECHNICAL RISKS

The technical risks in the construction of an incineration installation using grate incineration technology are considered very low. The technology is well developed and has proven advantages also for RDF. The available grate incineration installations have around 91 - 95 % operational availability.

2.1.2.2 INCINERATION IN A BOILING LAYER TECHNOLOGY

This technology has been considered as an alternative technology for RDF incineration.

The incineration in a boiling layer technology has been developed in the 1920-ies for coal incineration and later developed further also for other fuels like wood chips and sludge from WWTP. Incineration of RDF applying boiling layer technology started in 1980, mainly in smaller installations in Germany and Sweden. At present around 15 incineration in a boiling layer installations of capacity over 10 t/h are operating in Europe.

In Europe incineration in a boiling layer installations are supplied chiefly by: Metso (Finland); Foster Wheeler (USA/Switzerland); Lentjes (Germany). As mentioned above, there are a limited number of reference installations in Europe, and the picture is similar around the world. Different types of such installations are functioning in Sweden, Germany and Belgium.

2.1.2.2.1 PROCESS DESCRIPTION

RDF incineration takes place in a sand bed instead on incineration grates. Hot air is blown vertically from bottom to top and keeps the individual sand particles floating; the sand bed behaves like a boiling liquid. The sand facilitates uniform penetration of air, which ensures good incineration provided the fuel is also uniformly distributed. Different materials (silica sand, basaltic sand etc.) are used depending of the type of fuel, and the bed particles are usually of size 0.8 - 3 mm.

Different types of boiling layer technologies exist. The two most common types of incineration in a boiling layer are: stationary (bubbling) boiling layer and circulating boiling layer (**Figure 2.1-5**).

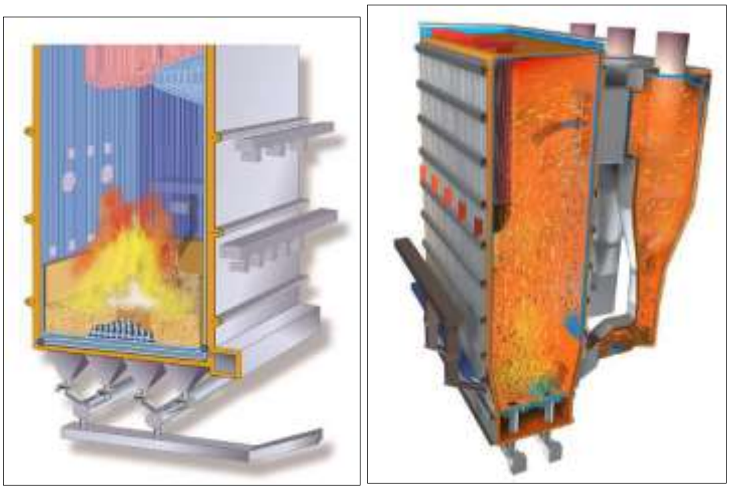


FIGURE 2.1-5 TYPES OF INCINERATION IN A BOILING LAYER: A) BUBBLING BOILING LAYER, AND B) CIRCULATING BOILING LAYER

In general the stationary (bubbling) boiling layer is preferred if the content of volatile substances is high. The advantage of the bubbling boiling layer is that the gas velocity is lower than that in circulating boiling layer. Yet bubbling boiling layer requires homogeneous fuel as it is more difficult to regulate the combustion process when the fuel characteristics vary. Using that technology with RDF is usually problematic.

Experience with boiling layer installations in Belgium shows that the heavy metals content in the residue is **higher** than that with grate technology installations.

2.1.2.2.2 TECHNICAL RISKS

The technical risks in the construction of an RDF incineration installation using boiling layer technology are considered relatively high. Unlike the grate installation technology, this technology has been proven in only a limited number of installations.

2.1.2.3 THE TECHNOLOGY SELECTED IN THE IP - GRATE INCINERATION

Based on the analysis made, grate incineration technology has been chosen in the investment proposal for the following reasons:

- When using boiling layer greater part of the ash content goes to the fly ash. That results in a higher fraction of hazardous waste, which has to be disposed in special landfills.
- The boiling layer method involves a higher risk of faults / corrosion of the boiler due to the higher amount of fly ash. That higher amount is due to the high content of alkali metals and heavy metals in RDF.
- The boiling layer technology is less frequently used for RDF compared to the grate incineration technology.
- The boiling layer technology is not so flexible for RDF of less pre-treatment and that makes such an installation less suitable in case of fuel content changes in future.
- Because of the very short time of fuel retention in the combustion chamber the boiling layer technology is less flexible as regards sudden changes in the fuel. The boiling layer reacts much faster to changes in the calorific values and moisture content. That technology is very sensitive to such changes and sets high requirements regarding good RDF mixing and homogeneous fuel. Larger size particles disrupt the boiling process and can destroy the sand bed.
- Broader range of pre-treatment of fuel is required for the boiling layer boiler. That includes the following: Breaking the material so that the size of particles is around 5-15 cm; creation of average calorific value; elimination, to the greatest possible extent, of metals like aluminium, which impedes the boiling of the layer as it melts; elimination, to the greatest possible extent, of elements which cause slag formation - like potassium, sodium and phosphorus. That process usually takes place in the RDF production installation.

Example: One of the reference installations - Indaver in Belgium - attempted, in the course of commissioning, to process a mixture of sludge from WWTPs and non-treated MSW but found that that disrupted the process, so they have built a pre-treatment installation, which is to be a component of the overall process.

The environmental reasons for rejection of the option for incineration in a boiling layer are:

- Larger amount of generated hazardous waste;
- Impossibility to use the installation for incineration of sludge from WWTPs and other waste in future; Practice shows that that option requires building a waste pre-treatment installation in addition;
- The technical risks for the equipment are higher and that hampers operation;
- Treating the waste water polluted in the course of operation is required.

2.1.3 DESCRIPTION OF THE BASIC CHARACTERISTICS OF THE PRODUCTION PROCESS

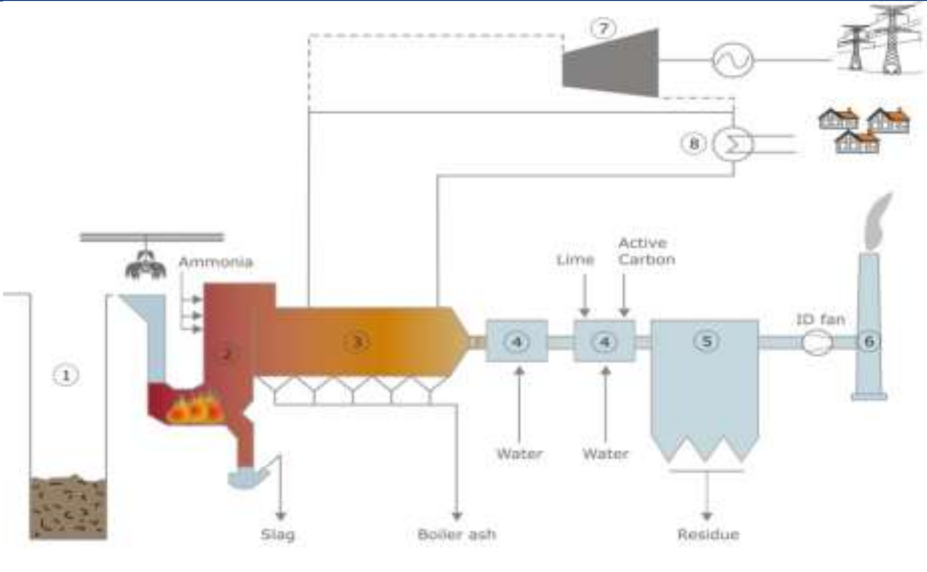
2.1.3.1 DESCRIPTION OF THE BASIC PROCESSES (ACCORDING TO PROSPECTUS DATA) OF THE GRATE INCINERATION TECHNOLOGY

The main process in an installation utilizing modified solid fuels derived from waste (RDF) is cogeneration of heat and electricity, as shown in the figure below. The plant for energy generation from RDF will be based on grate incineration technology and an incorporated horizontal boiler. The expected calorific value of RDF (13 GJ/t) is in a range appropriate for the application of grate installations, as with them the limit value is approximately 16 GJ/t. The expected ash contents (15-20 %) is in an appropriate range, above the critical level for grate installations - which is around 10 %.

Modified solid fuels derived from waste (RDF) will be delivered by rear dump semi-trailer trucks (16.5 m). The hall for unloading is 30.00 m wide and that ensures easy access for all types of trucks. The tucks will be loaded indoors. The bunker for reception and storage of delivered RDF has dimensions 24.00 m x 36.25 m and its bottom is at level -11.00 m relative to level ±0.00 of the building. The control room provides unobstructed view to the RDF bunker through a window at the control room floor.

A gripper crane is installed above the bunker to feed fuel into the feeding shaft; the crane can move also over the administration section. The fuel (RDF) will be fed into the combustion chamber from a feed shaft and onto a forward pushing grate where drying and incineration processes will take place.

The technology block diagram of the installation envisaged in the investment proposal for cogeneration of heat and electricity utilizing modified fuel (RDF) is shown in **Figure 2.1-6**.



1 - RDF bunker
2 - combustion chamber
3 - boiler
4 - cooling tower /reactor
5 - sleeve filter
6 - stack
7 - turbine
8 - district heating

FIGURE 2.1-6 TECHNOLOGY BLOCK DIAGRAM OF THE COGENERATION INSTALLATION UTILIZING RDF

A furnace, a boiler and a flue gas cleaning installation will be arranged in the production hall in the appropriate order. The steam generator (a boiler) in horizontal configuration will be located in a boiler room. The boiler will be mounted on a boiler support structure with substructures integrated in the foundation structure of the building. The following will also be located in the hall: a turbine room under the horizontal section of the boiler – 478 m^2; a room for boiler condensers 478 m^2; a room for the pumps 596 m^2; flue gas cleaning hall 998 m^2 with a crane over the hall and silos for consumables, silos for waste products (residues), flue gas condensation.

The grate incineration technology is well developed and suitable for RDF incineration; incineration equipment is offered for a capacity from below 10 t/h to approximately 40 t/h.

The forward pushing grate technology has been preferred because of its stability in performing the incineration process and proven capacity for treating a wide range of fuels, including: RDF, low-grade RDF, sludge and low-grade biomass. The production lines designed to apply grate-type combustion processes show low technological sensitivity to most of the fuel variations, usually observed in RDF, for example: physical dimensions, humidity content and chemical composition. Yet the output of such a line is determined within a heat range typical for this case and it is thus less sensitive to variations in the calorific value and humidity content of the fuel. When the delivered RDF has calorific value lower than that designed for the installation, a larger quantity of RDF can be processed, and when the RDF has higher calorific value, smaller quantities of RDF can be processed. The waste retention time - from the moment waste enters the grate to the moment of receiving in the bottom ash extractor - is usually 1 hour, depending on the characteristics of the input fuel.

The incineration section with grate can utilize RDF which has not been pre-treated in any other way except mixing. RDF is unloaded directly into the bunker from where it is fed into a hopper. If delivered fuel contains components of size over 1 m, they have to be broken into smaller pieces in order to prevent chocking in the chute or in the bottom ash extractor. That is usually done by means of a shredder, installed directly in the bunker for waste. Based on the available data about the RDF composition no shredding (breaking) of the fuel will be necessary.

The plant will be able to process also dehydrated sludge from waste water treatment plants. sludge will be fed to the combustion chamber by means of the RDF feeding mechanism, and no temporary storage of sludge at the site is envisaged.

The heat and electricity cogeneration installation utilizing RDF comprises the following main systems:

- A horizontal boiler including: combustion chamber with a radiation and a semi-radiation heat exchange section as well a convection heat exchange section;
- A turbine/generator - condensers/water steam cycle;
- Accessory equipment;
- Electric systems;
- Building structures;
- A heat accumulator;
- Monitoring and control system.

The combustion chamber and the boiler convection section have to be of such size as to fulfil the requirement for complete burning out of flue gas in the combustion chamber, at minimum temperature 850°C (up to 1,100°C for some hazardous waste) and 2 seconds minimum retention time of fuel particles at that temperature (Directive 2000/76/EC) so that to prevent dioxins resulting from the combustion process.

The boiler is horizontal and consists of three vertical radiating gas ducts followed by a horizontal convection section, where following the :flue gas the respective processes take place: evaporation, steam reheating and economizing heating. The boiler configuration in the vertical radiating section has such dimensions as to provide flue gas speed in the range of 3.5 - 5.5. m/s, and in the horizontal convection steam reheating and economizing section - 8.5 - 9.5 m/s flue gas speed.

The horizontal boiler (**Figure 2.1-7**) requires more space than the vertical solution. It is possible to position the turbine/generator unit below the horizontal convection section, and in many cases the space under the turbine/generator unit is used as a room for electric equipment and accessory equipment. In that way the space in the building is used more efficiently. The height of the boiler area depends on the boiler configuration, while in both solutions (horizontal and vertical boiler) it is important to have a high furnace chamber to ensure the necessary incineration time for the fuel particles and reduction of the flue gas temperature before the gas goes into the second duct. For this installation the height of the furnace chamber needs to be minimum 25 m above the grate.

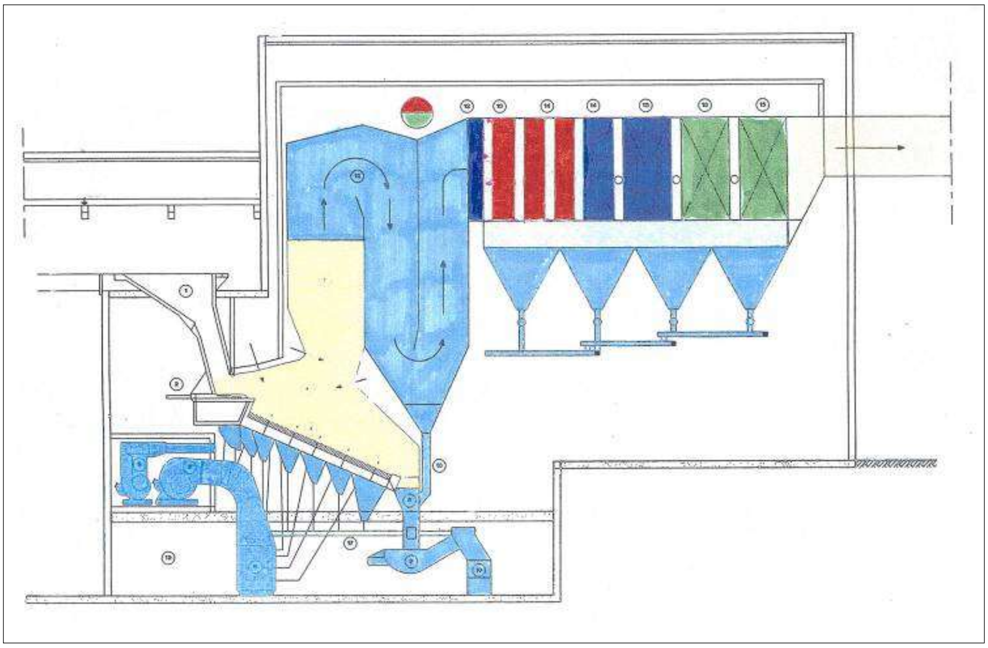


FIGURE 2.1-7 HORIZONTAL CONFIGURATION OF THE BOILER OF THE COGENERATION INSTALLATION UTILIZING RDF

The horizontal convection gas duct is equipped with a mechanic percussion device, which knocks on the pipes in the convection gas duct at a pre-set frequency (usually 4 to 6 series of 2-5 minutes per day) and knocks loose the dust and ash which have stuck to the surfaces. The dust/ fly ash is collected in hoppers (silos). Knocking can be performed by a mechanical or a pneumatic device.

The convection section consists of steam reheating and economizer sections. To regulate the temperature of the reheated output steam, feedwater or condensate is injected between the stages of the steam heater.

The temperature in the cross section at the convection section entrance is an important factor and must not exceed 625°C at any given moment of the envisaged 8,000 service hours per year. That should be achieved first and foremost by means of designing the boiler carefully. Most manufacturers include a device for injecting water into the third vertical gas duct - as an additional preventive measure for cleaning the radiating heating surfaces. The cleaning of water blowing-through unit is performed by means of momentary evaporation of cold water; that causes the ash particles stuck to the surface to crack because of the thermal shock and fall off. A water-injection cleaning system will be built only in the vertical radiating section.

The maintenance and operation conditions make the choice of a horizontal convection arrangement advantageous for the following reasons: Lower degree of contamination due to more effective cleaning; the elimination of soot and ash will not result in contamination of the other pipe sections; long intervals of operation can be achieved between the times when the boiler is cleaned externally by hand; 8,000 hours of continuous operation is usually guaranteed for a horizontal boiler compared to 4,500 hours for a vertical boiler.

A system for reducing NOx content in the products of incineration will be installed at the end of the combustion chamber. The system will apply selective non-catalytic reduction (SNCR).

The energy generated in the incineration process is transferred to the water-steam unit where the resulting steam drives a steam turbine. Most grate incineration installations in Europe operate at parameters of the heated steam around 400-425°C and 40-50 bar, but due to the greater focus on electricity production recently there is a certain tendency that the steam parameters are: temperature up to 440°C and pressure up to 60 bar.

2.1.3.2 STEAM PARAMETERS AND CORROSION

In the investment proposal the parameters of the heated steam are determined to be: temperature 425ºC and pressure 60 bar, as that enables higher energy efficiency while keeping the corrosion risk at an acceptable level. The installation will incinerate RDF in the combustion chamber of a horizontal steam boiler, and the generated steam will be fed into and utilized in a back-pressure turbine (the pressure of steam after the turbine is higher than the air pressure) with a condensing boiler.

From the boiler the steam of 60 bar pressure and temperature 425ºC is fed to the steam turbine, generating electricity for the national electricity transmission grid. The expected nominal electricity generating capacity of the turbine is 20 MW_e. The net electrical power capacity (envisaged for connection to the electricity transmission grid) is estimated to be approximately 19.5 MW_e.

The exhaust steam from the turbine is led to the incorporated condensing boiler where the steam condenses and generates thermal energy to be supplied to the district heating system of Sofia. The net heating capacity of the condensing boiler is estimated to be approximately 50 MW_t, to which additional 5 ÷ 8 MW_t heating capacity shall be added from the flue gas utilization.

According to the preconditions for the project, stated by Toplofikatsia Sofia, the installation should be able to provide the necessary steam to the existing steam collector 12 bar for the plant's own needs.

Combustion air excess - The combustion air systems will provide such quantity of air as exactly necessary for the combustion process, in order to ensure high efficiency of combustion while avoiding the influence of the high-temperature corrosive environment. Although the project can be based on operation with low excess air quantities (consequently smaller ventilators, smaller boilers and smaller flue gas treatment systems) it is recommended to include a requirement that the air/ flue gas system is designed in such a way as to enable operation at constant air excess (λ) of 1.8 (dry O_2 content of ~8.0 %) in order to ensure sufficient flexibility in case of variations of the content of used fuel.

Primary input air - Maintaining negative pressure of air in the fuel unloading areas is important in order to avoid problems with possible odour emissions from the RDF bunker. That is why the primary air necessary for the combustion process in the boiler will be supplied (sucked in) from the fuel storage bunker.

The secondary input air will be supplied (sucked in) from the top section of the boiler room and will be injected into the radiation section through 3 to 5 rows of nozzles. Additional air will be supplied also through the ventilation openings in the façade.

Water supply pumps - The installation will be equipped with 2 x 100 % electric pumps feeding water to the boiler as well as one emergency pump. The water supply pumps will be connected to the emergency power supply system for safe shut-down of the installation.

The water supply system will provide deionised water, and a reserve of such water must be provided for supply to the boiler for 24 hours. The capacity of the make-up water tank shall cover the full volume of the boiler. The existing feedwater installations of the respective TPP can be used as an additional option.

Bottom ash removal (BAR) management **-** Bottom ash will be removed from the grate area with about 15 % water content.. The overall solution of the installation will enable also bottom ash storage in a system of storage containers at the site or in bulk.

Connection to the district heating system **-** The main components of the connection to the district heating system will be located in the plant building; those are: a heating pumping installation; a heating metering installation; heating stop valves; indoor pipelines in the pump/condenser room including a main stop valve; installation for power supply to the mentioned equipment; control and monitoring units.

A heat accumulator **-** In order to balance the thermal energy supply (varying in different hours of the day and night) to the district heating system in summer, the RDF incineration installation continuously operating at nominal load, a heat accumulator will be included in the internal circuit. It expected that the heat accumulator will have such parameters as to accumulate 230 MWh thermal energy and will act as a unit storing heat in night hours and respectively supporting the covering of peak loads.

To avoid the need for building a large-size accumulator, in the summertime hot water will be stored at temperature up to 90^{O}C. That is somewhat higher than the envisaged supply temperature, and the necessary temperature level in the feeding line will be controlled by mixing with cold water from the return line.

Turbine/condensers/water steam cycle **-** Based on the option approved for implementation, with an industrial steam turbine with back pressure and two heat condensers, and set parameters of the steam 60 bar/ 425°C at the turbine inlet, the installation will have a built unit of electric power (gross) 20 MW_e and calorific power (gross) 58 MW_t, at nominal operating conditions with utilization of 22.5 t/h RDF with calorific value13 GJ/t.

The expected electricity for own use of the installation is of around 2 MW_e power. The turbogenerator will be able to operate also in island mode thus generating electricity to meet only the own needs of the entire power plant.

The total heat and electricity output depend on the RDF and on the grate construction, and that is shown in the combustion diagram - **Figure 2.1-8**. When the installation is under full load the boiler will generate around 100 t/h steam, and the possibility for obtaining maximum calorific and electric power will depend on the temperature in the district heating network as well as on the possibility to use the temperature potential of the flue gas condensate - **Figure 2.1-9**.

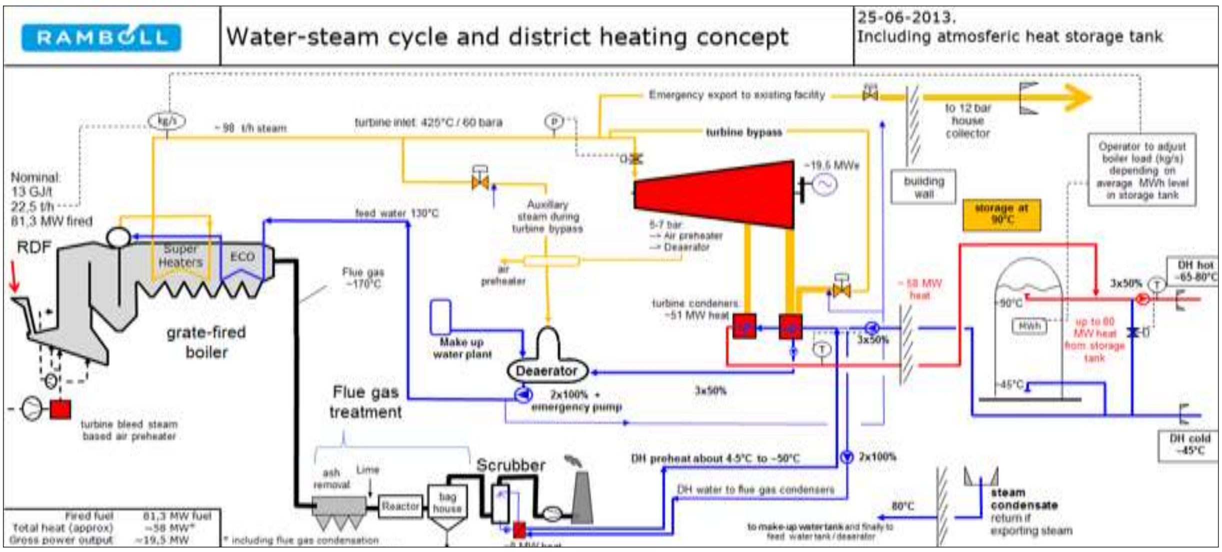


FIGURE 2.1-8 TECHNOLOGY BLOCK DIAGRAM OF THE WATER-STEAM CYCLE OF THE INSTALLATION AND THE HEATING SYSTEM (SIMPLIFIED)

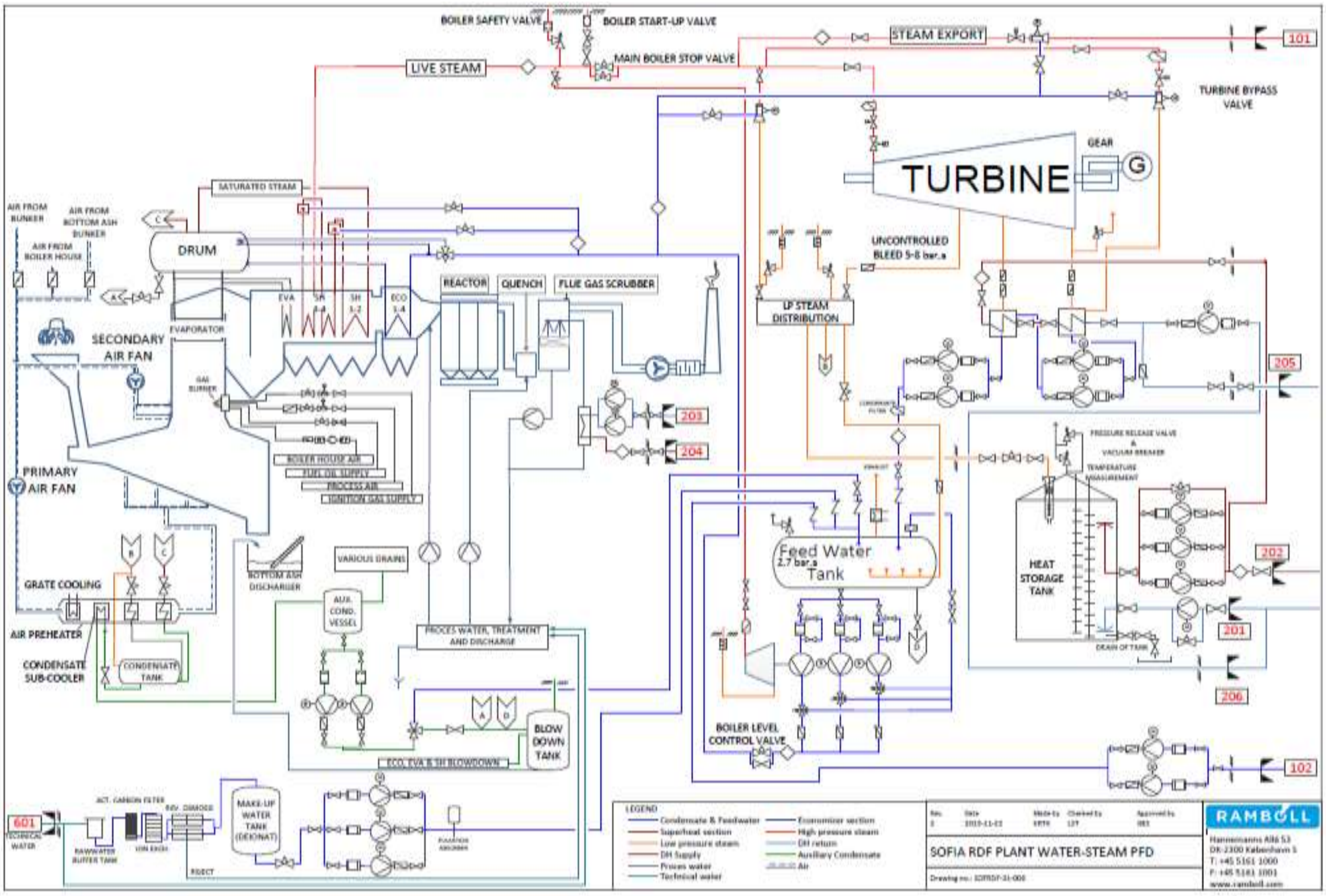


FIGURE 2.1-9 ELECTRICAL DIAGRAM OF THE WATER-STEAM CYCLE OF THE INSTALLATION

By flue gas condensation the calorific power of the installation is expected to increase by 5 - 8 MW_t and that is connected with the network's return temperatures.

If sufficient quantity of RDF or alternative fuel is provided, the energy result will not be sensitive to lower calorific value of RDF, until reaching the limit value 10.8 GJ/t.

It is required that the installation is able to operate in island mode, and in case heat can be stored in a heat accumulator (of 230 MWh capacity) then four hours independent operation will be possible.

2.1.3.3 ELECTRICITY GENERATION

With parameters for processing of 22.5 t/h RDF of 13 GJ/t calorific value, thermal power of around 81 MW will be generated in the installation from the fuel. The expected nominal result of the electric power of the steam turbine is 20 MW_e and the net electric power is expected to be 19.5 MW_e.

Around 50 MW_t calorific power is expected to be obtained as a result of utilization of exhaust steam in the condensing boiler, and from the flue gas condensation - additional 5÷8 MW, or around 58 MW_t total.

If we assume that the installation operates for 8,000 hours around the nominal design point, thus processing 180,000 tons of RDF, we can estimate that the annual electricity production will be approximately156 GWh per year (19.5 MW_e x 8,000 h). The installation needs additional power supply which is envisaged to be 95 kWh per ton of RDF, corresponding approximately to 17 GWh for 180,000 tons. Thus the maximum net electricity production is expected to be approximately 156 - 17 = 139 GWh per year.

Steam turbine - The turbine has to be designed with such dimensions as to receive 110 % of the maximum quantity of steam from the boiler at continuous production.. That will provide sufficient capacity of the turbine for slight excess and variations in the steam flow as well as a small reserve if the boiler functions better than expected. For the purpose of ensuring flexible control of the installation and for safety reasons when starting/stopping it is necessary to provide possibility that the installation operates without steam going through the turbine. That can be achieved by means of a turbine bypass system (steam diversion and cooling in the condensing boiler). The bypass connection should be able to divert steam quantity corresponding to 20-120 % of the boiler load.

In bypass mode slightly reheated steam will be produced, having such parameters which enable the condenser to operate correctly within the entire load range. Bypass can be used also when the heat producing system is given priority over the electricity production. A typical example of bypass can be: a steam turbine producing only load for own needs (~2 MW_e) or a non-operating steam turbine.

Heating condenser system - Two condensers are envisaged by which the heating network water will be heated. It has been chosen that the system has a configuration of heat pumps 3 x 50 %, which is two operating pumps in normal conditions and one reserve pump.

Connection to the district heating grid - The installation supplies electricity from a turbine/generator through a transformer to the grid. The transformer section transforms the voltage from the generator to the level necessary in the grid - 110 kV. The transformer section provides parasitic load to the equipment during generator operation. When the turbine is idle and the turbine/generator does not produce electricity, the available starting transformer can supply the necessary electricity from the grid. The power transformer will be connected to the local 110 kW network.

It is envisaged that the auxiliary and emergency power supply for the needs of the installation will be provided from the existing emergency power supply through switchgear 6 kV of the nearby new network pumping station (NNPS) by means of 6 kV cable connection. Protection of the buildings and of the outdoor equipment from direct lightning strikes is provided by the existing lightning protection installation.

2.1.3.4 *TREATMENT INSTALLATIONS*

When RDF is incinerated in conventional incineration systems with a grate, a level of NO_x of around 400 mg/Nm^3 is observed (11 % O_2, dry). The optimisation of processes by means of cascade air supply, flue gas recirculation and other activities influencing the primary incineration can reduce the amount of NO_X to some extent. It can not be expected that the limit value of 200 mg/Nm³ (dry flue gas at 11% O_2) as an average daily value can be observed without a specially designed, nitrogen oxides elimination process. That is why it is necessary to ensure extraction of NO_x from the incineration products, and that can be done using one of the basic methods: - Selective non-catalytic reduction of NO_X(SNCR); Selective catalytic reduction of NO_X (SCR).

2.1.3.5 *ADDITIONAL TREATMENT (REDUCTION OF THE CONCENTRATION OF NITROGEN OXIDES) APPLYING THE SELECTIVE NON-CATALYTIC REDUCTION (SNCR) METHOD*

Using of the selective non-catalytic reduction system (**Figure 2.1-10**), ammonia water (25 % water solution of ammonia) is injected into the radiation section of the boiler at 900°C flue gas temperature (the process is most effective at temperatures between 850 and 950°C). Here a chemical reaction takes place whereby ammonia reacts with NO and NO_2 to produce the non-hazardous N_2 and water.

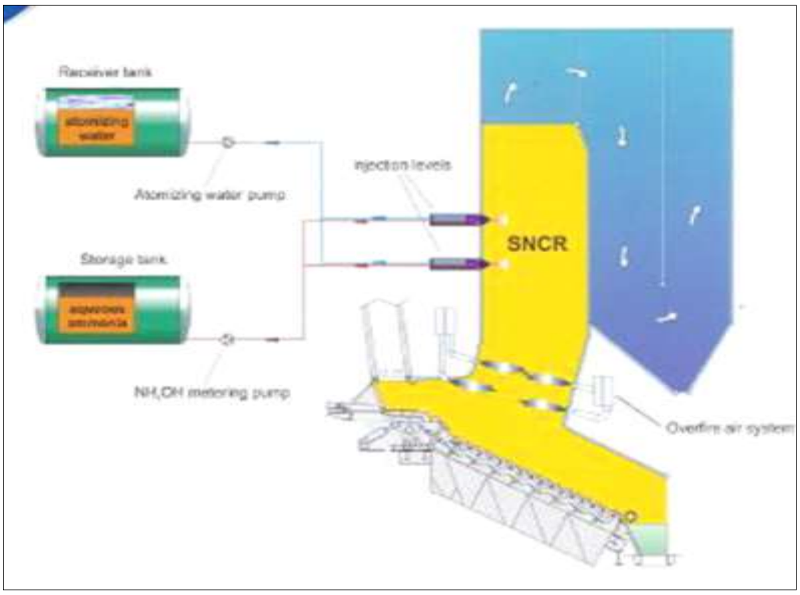


FIGURE 2.1-10 TECHNOLOGY DIAGRAM OF THE NITROGEN OXIDES REMOVAL SYSTEM IN THE COGENERATION INSTALLATION UTILIZING RDF

A certain excess amount of ammonia is necessary in order to ensure combining of the products of ammonia dissociation and NO/NO_2. When NO_x are reduced by 70 % it is necessary to increase stoichiometric consumption. For optimum results the process requires careful control of the ammonia injection points and discharge, together with incineration control.

Depending on the degree of optimization a certain amount of ammonia which has not reacted can leave the boiler with the flue gas. Emissions usually have to be maximum 10 mg/Nm³ (at 11% O_2 dry flue gas). In semi-dry flue gas cleaning systems a small quantity of discharged ammonia is trapped in the waste and the remaining ammonia is emitted into the ambient air with the flue gas. A typical requirement is that the ammonia concentration shall be below 10 mg/Nm³.

If the flue gas cleaning system includes also a wet gas scrubber, ammonia is absorbed by the treatment liquid, and due to that the generated waste water contains ammonia. Ammonia consumption can not be calculated precisely as part of the ammonia is thermally oxidized in the hot flue gas, but consumption of 5 -7 kg (25 % ammonia water) per ton of RDF is typical, through reduction to 150 mg/Nm³, or more than twice of the stoichiometric consumption.

The injection system requires 2-3 levels of injection nozzles in the furnace chamber of the boiler and a water- or air-based system for spraying of ammonia water into the boiler. With the SNCR system the requirement for 200 mg/Nm^3 can be met, and achieving lower levels is also possible - up to 100-150 mg/Nm^3 (by applying a more sophisticated system with more levels of injection and better control of temperature).

2.1.3.6 BASIC TREATMENT (SEPARATION OF DUST PARTICLES AND REMOVAL OF ACID GASES) BY MEANS OF A COMBINATION OF DRY AND WET CLEANING WITH BLOWING IN OF HYDRATED LIME AND ACTIVATED CARBON (SEMI-DRY) FOLLOWED BY WET SCRUBBER WITH CONDENSATION

When choosing a concept for basic treatment of flue gas (separation of dust particles and removal of acid gases) and for operation of installations for recovery of energy from waste, special attention should be paid to RDF fractions which have high sulphur and /or chlorine content as those are sources of SO_2 and HCl in untreated gas. And while almost all the chlorine is usually transformed in HCl, only a small portion of sulphur is transformed in SO_2 - around 30-70 %.

Experience shows that sulphur is actually present in all fractions of waste, including household waste (MSW), usually around 0.2 %. High sulphur content is observed in plaster (18 %) and in many of the types of tyres (around 1 %). Despite the efforts for separation, waste from demolition activities contains considerable amounts of sulphur, probably resulting from light gypsum board walls. The RDF specification shows sulphur "below 1 %". Typical content in RDF is chosen to be 0.25 %, which will result in up to around 300 mg/Nm³ SO_2 at 11%, O_2, dry base, and maximum 1,500 mg/Nm³ corresponding roughly to maximum 1 % of sulphur in RDF (depending on the origin of sulphur in RDF).

Chlorine in waste is found in small amounts (usually up to 0.1-0.3 %) when we view MSW, usually resulting from common salts in households. PVC is an important source with chlorine content around 50 %. Consequently any RDF fraction with PVC will add to the HCl levels in the untreated gas. Hence even small amounts of PVC in RDF will generate high levels of HCl in untreated gas.

The trend observed is that in countries where regulatory measures are in force for limiting the use of PVC and for separation of PVC from RDF, the Cl content in RDF is lower compared to countries in which no special attention is paid to PVC. For the common case 0.6 % average levels of HCl are assumed. Also as regards chlorine content careful consideration is required when choosing the concept for the treatment installation and calculating the parameters of untreated gas.

The technology block diagram showing the sequence of treatment equipment (combined dry-wet system with condensation) of the investment proposal installation utilizing modified fuel (RDF) for cogeneration of thermal energy and electricity is shown in the figure.

According to the investment proposal the installation will be equipped with a combined dry-wet (semi-wet) system for flue gas cleaning with sleeve filters after a reactor for injection of hydrated lime and activated carbon . The reason for choosing a dry-wet system for flue gas cleaning is to optimize the economic efficiency of the installation for its entire service life. Furthermore a dry-wet system enables avoiding problems with waste water as waste water treatment and/or discharge is not necessary. The combined dry-wet system for flue gas treatment is relatively simple but it requires installing a scrubber for additional cleaning with condensation of flue gas. Practice shows that a wet system for flue gas cleaning is considerably more complex as it necessitates providing an installation for treatment of the generated waste water.

2.1.3.6.1 A REACTOR FOR INJECTION OF ACTIVATED CARBON AND HYDRATED LIME AND FOLLOWING CLEANING IN SLEEVE FILTERS (SEMI-DRY CLEANING)

Flue gas (**Figure 2.1-11**) is led to a flue gas cleaning system, which is a combined dry-wet (semi-wet) system comprising a reactor, injection of activated carbon and hydrated lime, followed by sleeve filters.

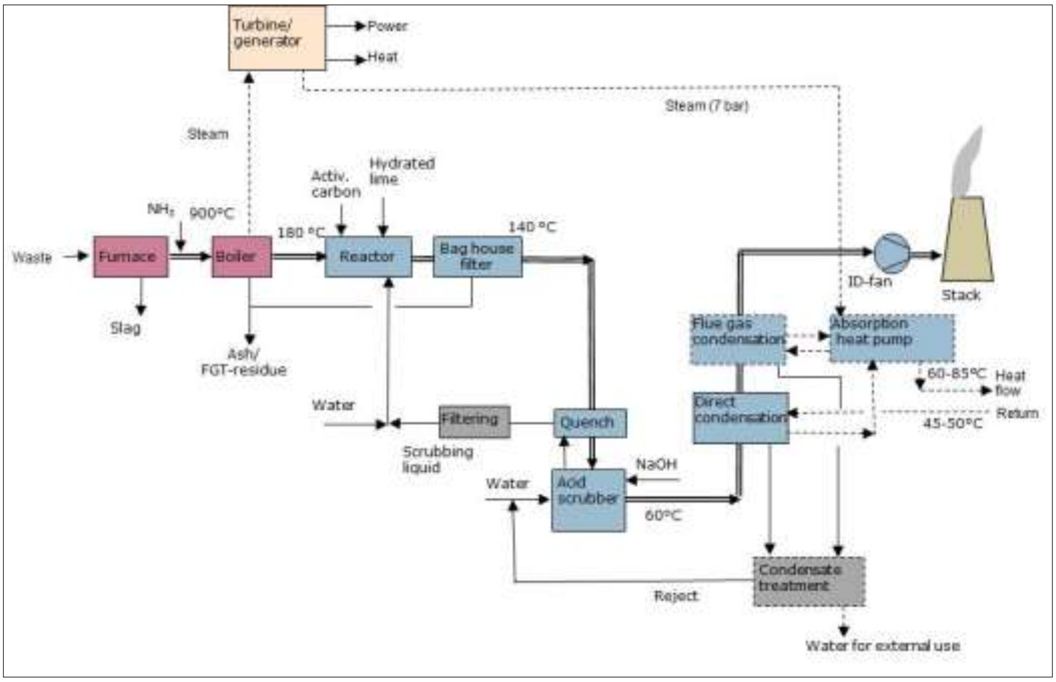


FIGURE 2.1-11 TECHNOLOGY BLOCK DIAGRAM OF CLEANING EQUIPMENT (COMBINED DRY-WET SYSTEM WITH CONDENSATION) TO THE RDF UTILIZATION INSTALLATION

The preliminary injection of dry hydrated lime into the direction of the filter leads to absorption of the acid components of flue gas (HCl, SO_2 and HF), which separate from the flue gas in the form of calcium salts, excess limestone and fly ash. activated carbon is also injected before the filter and it absorbs mercury, heavy metals and dioxins. Sleeve filters separate fine dust particles hydrated lime and activated carbon. The dry process with hydrated lime works at temperature around 150°C, which can be ensured by cooling in the economiser combined with feeding of cold air. Feeding of water into the reactor (semi-dry process) results in reducing the temperature to 140°C.

2.1.3.6.2 MASS BALANCE OF THE SYSTEM

The semi-wet system for flue gas cleaning produces dry residue, and special disposal of that residue is required, in certain landfills suitable for storage of waste of that type. The residual products (residue) from flue gas treatment are expected to be collected in bulk in large silos having storage capacity sufficient for minimum 8 days.

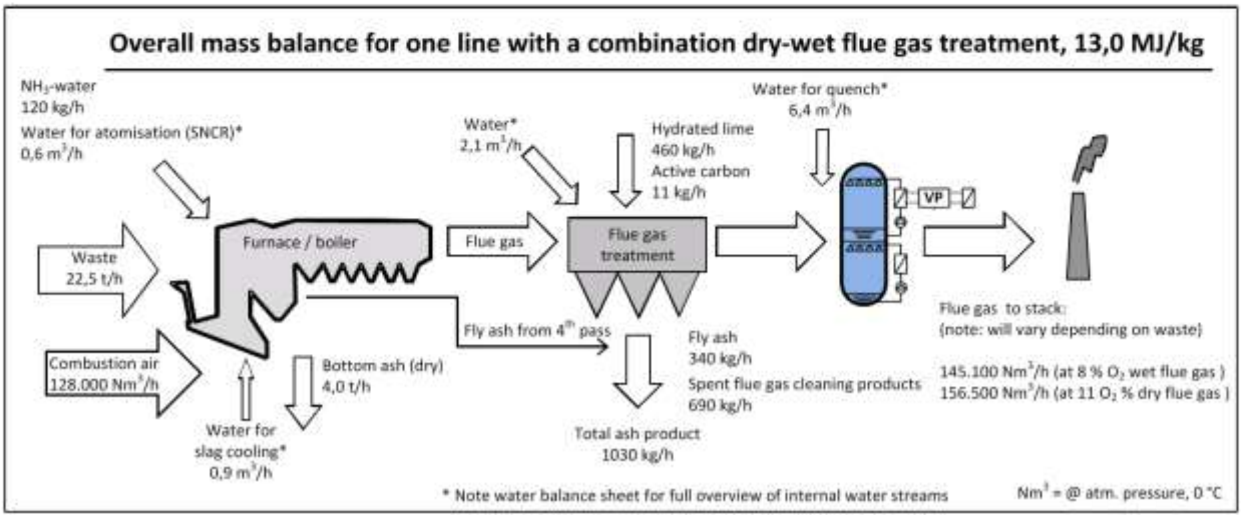


FIGURE 2.1-12 OVERALL MASS BALANCE OF THE COGENERATION INSTALLATION UTILIZING RDF

2.1.3.6.3 WET CLEANING BY MEANS OF SCRUBBER FOR ELIMINATION OF ACID GASES

The semi-wet system for flue gas cleaning is equipped also with a scrubber for additional (finish) cleaning, which removes most of the residual acid gases (HCl, HF and SO_2) remaining after absorption. Thus the consumption of hydrated lime in the reactor is limited and consequently the amount of dry residue is reduced. Also certain amount of fine dust particles, which have absorbed heavy metals and have not been eliminated by the filter, will be eliminated here due to the low pH value of the water solution in the scrubber.

At the scrubber entrance water is sprinkled in for cooling the flue gas, and the resulting liquid flowing off the scrubber is used in the semi-dry stage for moistening the hydrated lime or cooling the flue gas. In addition the scrubber makes it possible to utilize the condensation heat present in flue gas, which also further increases the total efficiency.

2.1.3.6.4 FLUE GAS CONDENSATION AFTER THE WET SCRUBBER

The purpose of flue gas condensation is to recover heat by transferring the heat from condensation of water vapour in flue gas to the heating system, increasing the energy efficiency of the entire installation. The condenser stage is installed in the end of the cleaning equipment line. That will most probably be the last part of the wet-cleaning phase, from which the circulating condensate liquid will pass through a heat exchanger to deliver heat to the heating water. Such direct condensation does not involve an additional source of energy, except for circulation pumps etc.

The chosen semi-wet system makes it possible to arrange treatment equipment in the installation without waste water generation, and no additional treatment or disposal of waste water is necessary.

The semi-wet system, based on hydrated lime and activated carbon, is relatively simple to install and operate. The scrubber ensures relatively low lime excess and consumption, stability in relation to the variation of the content of pollutants in untreated gas, and flexibility with respect to strict restrictions regarding emissions (in particular regarding HCl and SO_2). Combining this system with condensation is very easy when wet cleaning system is available.

Hydrated lime must be dosed with sufficiently large excess, regardless of the cleaning system, and due to that relatively large quantity of waste is generated, although the waste is less than that from dry or semi-dry systems. The operation of the scrubber results in additional consumption of energy and additional maintenance equipment.

Manufacturers often claim that the wet scrubber is an unnecessary stage, but it reduces the risk of polluting the environment as a result of variations in the parameters of incinerated RDF and future reduction of limit values of emissions.

2.1.3.6.5 AUXILIARY EQUIPMENT

Components cooling system - The cooling system will supply the necessary quantity of cooling water (water/propylene glycol mix), at a certain pressure and temperature level, to the cooling liquid consumer units integrated into the system, for example the turbine.

Emergency power supply/UPS - By means of emergency power supply the installation will be protected from failure and damages resulting from failures in the grid.

Cranes for waste – two identical cranes for waste will be installed to feed RDF to the bunker; each of the cranes operating alone will be sufficient for feeding the bunker. The cranes shall be able to function fully automatically, and shall be programmed to perform RDF homogenization and mixing when no feeding is required. The cranes shall be able to function fully automatically, to feed, mix and push RDF. The balance pans shall send data about the received RDF to the control system. For ensuring higher reliability an auxiliary grip shall be provided.

Cranes and auxiliary hoisting equipment - Two permanent cranes shall be installed in order to ensure efficient operation of the basic equipment: - A crane in the boiler room, load-carrying capacity 3.5 tons; - A crane in the turbine room, load carrying capacity 35 tons.

Control and Monitoring System - A Control and Monitoring System (CMS) is necessary for controlling and monitoring all processes and units and for maintaining automatic operation of the RDF incinerating installation.

Installing a display is also envisaged for real-time reporting of emissions (by means of a monitoring system). The display will be installed on the façade of the installation of that the data can be seen from a distance.

2.1.3.7 CAPACITY OF THE INSTALLATION

The installation has the following parameters:

Modified solid fuel (RDF) received:	180 000 t/y , 22.5 t/h
Electricity production:	20 MW_e
Thermal energy production:	58 MW_t (with flue gas condensation)
Operational availability of the installation:	8 000 h

In case of lack of modified solid fuel (RDF) of calorific value 13 GJ/T, produced as a result of municipal waste treatment, the installation **will be able** to utilize alternative fuels like for example: low-grade RDF - of low calorific value; low grade/fresh biomass of low calorific value; sludge (dehydrated, 10 % dry substance content, maximum 10 % of the total mass).

Such fuels have different calorific value, as follows:

→ RDF calorific value: Cv_{nom} (LHV) of 13 GJ/t, variations between 12 GJ/t and 14 GJ/t,
→ Low-grade RDF calorific value: Cv_{nom} (LHV) of 11 GJ/t, variations between 6 GJ/t and 12 GJ/t,
→ Sludge calorific value: Cv_{nom} (LHV) of 1 GJ/t, variations between ~0 GJ/t and 1.5 GJ/t,
→ Fresh biomass calorific value: Cv_{nom} (LHV) of 10 GJ/t, variations between 7 GJ/t and 13 GJ/t,

With parameters for processing of 22.5 t/h RDF of calorific value 13 GJ/t, thermal power of around 81 MW will be generated in the installation from the fuel. Based on the option approved for implementation, with an industrial steam turbine with back pressure and two heat condensers, and set parameters of the steam 60 bar/ 425°C at the turbine inlet, at nominal operating conditions (feeding of 22.5 t/h RDF with calorific value13 GJ/t) the installation will have installed electric capacity (gross) 20 MW_e and gross calorific power 58 MW_t.

Table 2.1-2 shows the expected composition of RDF (determined by SM in view of the planned construction of a MBT plant).

TABLE 2.1-2EXPECTED COMPOSITION OF RDF

Parameter	Unit of measure	Nominal value	Range
Expected quantity	tons per year	180,000	
Expected quantity	tons per week	3,000	
Net calorific value	MJ/kg	13	12-14
Volume density (at delivery)	kg/m³	250	
Dimensions	mm		30-200

Parameter	Unit of measure	Nominal value	Range
Humidity	% w/w	17	< 20
Ash	% w/w	18	15-20
S	% w/w	0.25	< 1.0
Cl	% w/w	0.6	< 0.75
Hg	ppm	0.2	< 0.6
Cd	ppm	-	< 4.0
Tl	ppm	-	< 1.0
Sb	ppm	-	< 25
As	ppm	-	< 5
Cr	ppm	-	< 40
Co	ppm	-	< 6
Cu	ppm	-	< 100
Pb	ppm	-	< 70
Mn	ppm	-	< 50
Ni	ppm	-	< 25
Sn	ppm	-	< 30
V	ppm	-	< 10
Zn	ppm	-	< 400
P_2O_5	% w/w	-	< 0.3
PCBs	ppm	-	< 50

From the boiler the steam at 60 bar pressure and temperature 425ºC is fed to the steam turbine, generating electricity for the national electricity transmission grid. The expected nominal result regarding the electric power of the steam turbine is 20 MW_ee. The net electric power is expected to be approximately 19.5 MW_e. The electricity for own needs is expected be of power around 2 MW_e. The turbogenerator will be able to operate in island mode thus generating electricity to meet only the own needs of the power plant. The power supplied to the electricity transmission grid is expected to be about 17.5 MW_t.

The exhaust steam from the turbine is led to the incorporated condensing boiler where the steam condenses and the generated thermal energy is supplied to the district heating system of Sofia. The installed heating capacity is estimated to be approximately 50 $MW_{t,}$ and it is possible to obtain additional 5 ÷ 8 MW_t from the flue gas utilization.

If we assume that the installation operates for 8,000 hours around the nominal design point, thus processing 180,000 t of RDF, we estimate that the annual electricity production will be approximately 160 GWh per year (20 x 8,000).

2.1.3.8 PERSONNEL

An installation for utilization of modified solid waste (RDF) of such capacity usually has a staff of around 30-35 employees working full time, for ensuring correct running of the process and general administration and management of the installation. As part of the employees will be working in shifts, the expected average daily number of employees working at the installation site is about 25 - 30 persons.

2.2 MAIN CHARACTERISTICS OF THE CONSTRUCTION WORKS

The main documents regulating the design and construction of the installation viewed in the investment proposal are the following:

- Ordinance No.4 of 21.05.2001 on the scope and content of investment projects (as last amended and supplemented SG No.96/04.12.2009)
- Ordinance No. 4 of 05.04.2013 on the conditions and the requirements for the construction and operation of installations for incineration and of installations for co-incineration of waste, SG No. 36/ 16.04.2013
- Ordinance No. 7 of 24.08.2007 on the requirements which must be met by the waste treatment facility sites
- Ordinance No. 6 of 27.08.2013 on the conditions and requirements for the construction and operation of waste landfills and other installation for recovery and disposal of waste, SG No.80/2013
- Ordinance No.RD-16-267 of 19.03.2008 on determining the amount of electricity generated in electricity and heat cogeneration, SG No.37/08.04.2008
- Ordinance No.14 of 15.06.2005 on the technical rules and standards for design, construction and use of sites and facilities for production, transformation, transmission and distribution of electricity

The construction phase can start in the end of 2014 and be completed within two years. Financing is expected to be provided under Operational Programme Environment 2014-2020

Before commencing the construction works the site will be cleaned up in order to prepare it for the implementation of the new installation project.

2.2.1 BUILDINGS, ZONES AND AUXILIARY INSTALLATIONS AT THE SITE

The estate area is 334,945 m^2. The built-up area of the main production and administration building is 5,345 m^2. The building is 2nd category according to SDA; it is located in the south part of the estate. Asphalt paved roads will be built to the plant, and in the area around it, in line with regulatory requirements.

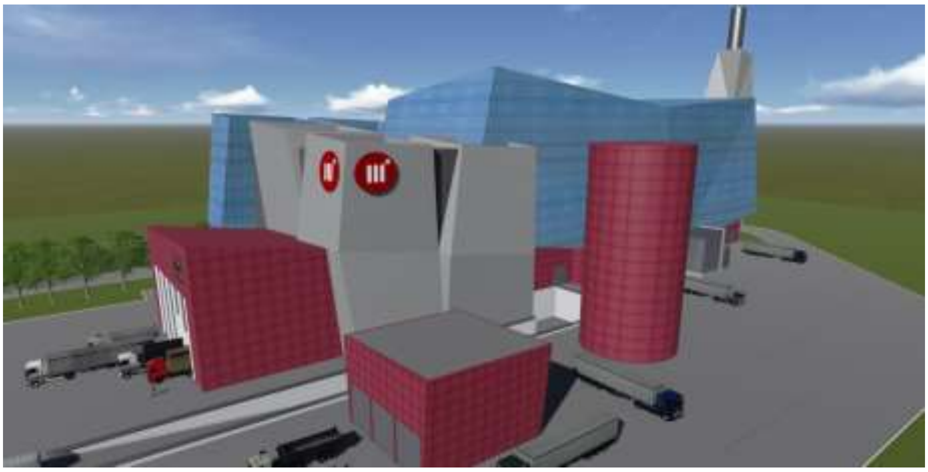


FIGURE 2.2-1 VISUAL REPRESENTATION OF THE SITE

2.2.1.1 TECHNOLOGICAL AREA

Entrance / Electronic scales - Located in the east part of the plot The work process starts with delivery of raw material, which will be delivered by rear dump semi-trailer trucks . After the trucks pass through the scales they are directed to a shed for unloading.

Unloading hall - RDF will be delivered by rear dump semi-trailer trucks (16.5 m) The unloading hall is 30.00 m wide. It is located in the south-west section of the building. The tucks will be unloaded indoors. Five unloading places are envisaged in the design. From the raw material bunker waste will be fed to a receiving bunker by means of a bridge crane with loader grip, and from there it will be fed into the furnace for incineration.

Bunker for RDF - The bunker functions as a place for receiving and storing of delivered RDF. (Dimensions 24.00m./36.25m). It is located after the unloading shed From the raw material bunker waste will be fed to a receiving bunker by means of a bridge crane, and from there - into the furnace for incineration.

Production hall. That part of the building is a hall structure made of reinforced concrete and steel. It holds a slug removal room, a furnace, a boiler and a flue gas treatment installation arranged in the necessary sequence.

Boiler room - It accommodates the steam generator (boiler) in horizontal configuration. The released heat heats the incoming feed water until the necessary reheated steam is produced. This hall is separated from the RDF receiving bunker by a reinforced concrete wall, and from the turbine hall and the steam condensate separation hall - by vertical and horizontal reinforced concrete walls of fire resistance REI 120. Thus the two mentioned rooms are separated in a fire-protected section with area of 430 m^2 in accordance with regulatory requirements.

Turbine room, heat condensers, pumping station –area 478 m^2. Condensing boilers room 478 m^2, A room for the pumps 596 m^2. The turbine hall will be under the horizontal section of the boiler. The respective zones are accessible for the crane and there is sufficient space for the installing and maintenance of the turbine body, rotor etc. Here steam drives a turbine generator which produces electricity. Through a transformer the installation supplies electricity from the turbine/generator to the grid. The evacuation route for these rooms is through a naturally lit stair-well in the south-east façade.

Flue gas treatment hall, silos for consumables and waste products The area of the flue gas treatment hall is 998 m^2. Crane access to the hall has been provided. Silos for consumables, silos for waste products, and flue gas condensation installation are located here. The flue gas from incineration of the raw material shall be treated in this special hall and from there it will be led to a stack for discharging into the air. The hall area is separated from the diesel generator room and the transformer station room by vertical and horizontal reinforced concrete walls of fire resistance REI 120. The latter two rooms are also separated as fire-protected sections (of total area 140 m^2), in accordance with regulatory requirements. The total area of the boiler room and the flue gas treatment room (excluding the areas separated as fire-protected sections) is 1,734 m^2 in accordance with regulatory requirements. The technological installations and equipment will be delivered by the manufacturers in complex Metal shelves and stairs between them, fire resistance class A1, will be installed in the boiler room for servicing the water heating boiler, and in the flue gas treatment room for the sleeve filters and wet filters.

2.2.1.2 ADMINISTRATION AREA

Around 30-35 people is expected to be employed as full-time staff in order to ensure smooth operation of the installation, basic administration and management of the plant. As part of the employees will be working in shifts, the expected average daily number of employees working at the installation site is about 25 - 30 persons. Rooms providing good quality working environment will be provided for the staff. The levelling is as follows:

Level	Rooms
+0.00	Entrance hall, toilets, conference room and offices - total 518 m^2
+4.00	Dining area with a dining room for the staff, toilets, men's locker rooms, women's locker rooms - total 512 m^2
+8.00	Storage space /archives, low voltage room of crane, engine-room
+13.00	Control room, offices - total 501 m^2
+18.00	Crane floor – 506 m^2

A lift and staircase providing access to all floors of the installation - The entire administration area, in all floors, is separated from the saw material bunker and from the boiler room with walls REI 60 in conformity with the regulatory requirements. Two evacuation exits are provided at each floor, leading to two stair-wells in conformity with regulatory requirements. The floor halls are separated from the stair-wells by smoke-tight self-closing doors, which open to the direction of evacuation in conformity with the requirements. Emergency lighting for evacuation routes will be envisaged in the detailed design. The door of the archives room on the third floor is envisaged to be fire resistant - EI60 in conformity with the requirements. Concrete, fire-resistant gypsum board and tiles, all fire resistance class A, will be used for coating of ceilings, walls and floors.

Chimney stack and auxiliary equipment- The stack will be 80 m high in order to ensure good and effective discharge of gas emitted through the stack after flue gas treatment. The stack will be equipped with an internal stairway. The chimney stack will have an additional metal structure and will be lined with HPL (high-pressure laminate). Auxiliary installations and buildings necessary for normal work process flow will also be built at the site:

Bottom ash storehouse - The building is additional and is located in the east part of the site. The walls of the storehouse are made of reinforced concrete and lined with HPL panels "Fundermax" from the outside. Three columns divide the storehouse façade into sections, and three doors are envisaged there.

A heat accumulator - It is on a platform of reinforced concrete and is 35.00 m high.

Storehouse for fuel and ammonia water, diesel generator - the facility is intended to provide continuous operation process. The left section of the plant is closed with fixed panels and a single-slope roof. A door will be installed in one of the panel walls to provide access for the staff.

Cranes and auxiliary hoisting equipment - Two permanent cranes will be installed in order to ensure easy movement of basic equipment in the course of operation and for maintenance: - A crane in the boiler room, load-carrying capacity 3.5 tons, and a crane in the turbine room, load carrying capacity 35 tons. Cranes, passages, etc. shall be designed and provided in the plant so as to ensure fast and safe service and replacement of all components.

Space planning and materials - As regards space the building has three separate sections. The receiving hall is the lowest of the sections.

Bottom ash storehouse	A separate building
Heat accumulator	A separate area
Storage tank for diesel generator fuel	A separate area

2.3 NATURAL RESOURCES; TYPE AND QUANTITY OF NECESSARY RAW MATERIALS

The basic raw materials and resources, which will be used ***in the installation construction***, including for the construction of internal road connections and infrastructure components, are: land (a part of the unused ground of the TPP), water, electricity, minerals, aggregates, wood, fuels and oils for the machinery and equipment

The basic raw materials and resources, which will be used ***in the installation operation*** are: - modified solid fuels derived from waste (RDF), water, electricity, natural gas, diesel fuel and oils for the machinery and equipment, reagents and additive consumables for the treatment systems.

2.3.1 RESOURCES

According to the investment proposal the installation will use as main raw material modified solid fuels (RDF), derived from municipal waste by means of treatment, in quantity 180,000 tons per year or 22.5 t/h, at nominal calorific value 13 GJ/t (in the range of 12 GJ/t - 14 GJ/t).

The main raw materials, necessary for the operation of TPP Sofia and TPP Sofia-East are natural gas (basic fuel, imported from Russia) and untreated water, necessary to implement the power plant - user - power plant regime.

The **power supply** to the new installation will be provided within the internal power supply for own needs of the respective TPP (connected to the national grid). Both sites - TPP Sofia and TPP Sofia-East - have water supply and electricity supply and provide possibility for supply to the installation. Power consumption 66.7 kWhe/tRDF. – 12 000 MWh/y. In its operation, utilizing RDF, the new installation will produce the amount of electricity necessary for its own needs. Annual electricity production - 160 GWh/y and annual thermal energy production - 650 GWh/y

The new installation will use **natural gas** for starting and in case necessary to ensure stable operation conditions of the installation. In case of variable RDF parameters using natural gas is envisaged - 5 250 N m ^{3}/y . (it is used as a basic fuel in TPP Sofia and TPP Sofia-East). The necessary diesel fuel will be stored in a 50 m ^{3} tank.

Drinking water will be used in the new installation, supplied through tapping of the internal water supply system of the TPP, as well as **industrial water** supplied through tapping of the industrial water main. No new water-main construction is necessary, apart from water supply piping to the new installation site and building The new installation utilizing RDF itself will have an established water balance with waste water cycle (a cycle between the cooler before the wet scrubber and the condensing stage after it). External source water includes feed water for the heating network and initial starting of the water network of the new installation. Total amount of necessary water - 27,200 m ^{3}/y.

Auxiliary materials (reagents and additives) will be used chiefly in the flue gas treatment systems; such materials are:

- ammonia water (25 % solution of NH_3) - for the slective non-catalytic reduction system (SNCR) - 100-120 kg/h; average 113,5 kg/h; 900 t/y.
- hydrated lime ($Ca(OH)_2/CaO$) - for absorption of acid gas in the reactor followed by cleaning by means of sleeve filters - 460 kg/h; 3680 t/y.
- activated carbon - for absorption of mercury, heavy metals and dioxins in the reactor, followed by cleaning by means of sleeve filters - 11 kg/h; 88,2 t/y.
- sodium base (27 % solution of NaOH)- for final elimination of traces of acid gases in the wet scrubber - 20 kg/h; 160 t/y.

In future the installation can be set also in a technological mode for using alternative fuel or incineration of sludge from WWTP, after research and feasibility study.

2.3.2 ENERGY SOURCES TO BE USED - CHARACTERISTICS, TYPE, AMOUNT AND EFFICIENCY OF ENERGY SOURCES

The **power supply** to the new installation will be provided by a derivation of the internal power supply of the respective TPP (connected to the national grid). Both sites - TPP Sofia and TPP Sofia-East - have electricity supply and provide possibility for supply to the installation.

In its operation, utilizing RDF, the new installation will produce the amount of electricity necessary for its own needs. The expected nominal result regarding the electric power of the steam turbine is 20 MW_ee. The net electric power is expected to be approximately 19.5 MW_e. The electricity for own needs is expected to be of power 2 MW_e, and the electricity supplied to the electricity transmission grid - 17.5 MW_e.

Both sites - TPP Sofia and TPP Sofia-East - are connected to a gas hub of the gas main. By means of a diversion from an internal hub connection will be provided to the new installation, which will use **natural gas** for starting and in case necessary to ensure stable operation conditions of the installation. In case of variable RDF parameters using natural gas is envisaged .

The natural gas consumption is estimated for 2 burners (25 MW each) in the combustion chamber for starting the burning process and for stabilizing the temperature of incineration of low calorific value fuel (fresh biomass, dehydrated sludge etc.) The maximum natural gas consumption for starting the boiler is 5,250 Nm^3/h. Consumption of diesel fuel (50 m^3 tank) is has been estimated for emergency cases - in case a diesel generator of 1,250 kW is necessary.

2.3.3 WATER SUPPLY SOURCES - WATER QUANTITITES, USE PERMITS, WATER BALANCE

According to the investment proposal **drinking water** will be used in the installation, supplied through tapping of the internal water supply system of the TPP, as well as **industrial water** supplied through tapping of the industrial water main. For that water Toplofikatsia Sofia EAD has concluded a supply contract with Sofiyska Voda AD. No new water-main construction is necessary, apart from water supply piping to the new installation site and building The new installation utilizing RDF itself will have an established water balance with circulating water (a cycle between the cooler before the wet scrubber and the condensing stage after it).

Separate sewerage systems will be built at the site for blackwater/sewage and for rain water, and those systems will be connected to the existing ones.

External source water will include feed water for the heating network and for initial starting of the water network of the new installation. According to the IP the quantity of **added fresh water** necessary for the installation is 3.4 m^3/h, of which:

- → water for the nitrogen oxides removal system (NOx) – selective non-catalytic reduction (SNCR) – 0.6 m^3/h;
- → additional process water – 1.6 m^3/h;
- → feed water for the installation (water for the boiler) – 1.2 m^3/h.

According to IP **the quantity** of added fresh water for 8,000 hours operation of the installation in a year will be Q=0.151 m^3/t RDF or 27,200 m^3/y .

Water which will be provided by the condenser (6.7 m^3/h), residual water (feed water) after water treatment (0.2 m^3/h) will be used as:

- → - water for moistening of flue gas – 2.1 m^3/h;
- → - water for the cooling stage before the scrubber - 6.4 m^3/h.

The tank water quantities of lower quality, which will be derived from the installation (the boiler) will be used for moistening the bottom ash – 0.9 m^3/h.

Drinking water consumption (30 employees) will be around 1.35 m^3/day or 0.742 l/s. According to the regulations the necessary quantity of water for outdoor fire extinguishing is 25 l/s, and for indoor fire extinguishing - 5 l/s. That water will be supplied through a high-pressure water pipeline (a derivation of the existing pipeline for water for industrial purposes and fire extinguishing, of pressure 6 atm).

A ring of 6 dual-head fire hydrants (2x10 l/s), overground, is envisaged around the building for providing outdoor fire extinguishing. The indoor fire extinguishing installation will comprise: a ring of 4 indoor fire hydrants at level ±0.00; vertical branches in each stairwell, and indoor fire hydrants are envisaged at each storey level. The indoor fire extinguishing installation will be made of steel pipes Ø100.

2.4 WASTE GAS, WASTE WATER AND WASTE GENERATION - ESTIMATION OF QUANTITIES AND PARAMETERS

2.4.1 EMISSIONS OF WASTE GAS FROM THE OPERATION OF THE POTENTIAL SITES

2.4.1.1 EMISSIONS DURING CONSTRUCTION

During construction and installation of the cogeneration installation utilizing RDF there will be only incidental sources of emissions: gas from exhaust pipes of the construction equipment and vehicles, construction and installation works.

Two sites have been suggested for the installation location.

- TPP Sofia with site „B” as a main site; and
- TPP Sofia-East with site „B” as an alternative site.

According to the master plan of Sofia TPP Sofia plot is located in a mixed-type industrial area (part of "Zadgarov Rayon" industrial area), intended for industrial development, a cemetery and commercial sites. The total area of TPP Sofia ground is 334,945 m^2, on which 50 existing buildings are located with total built-up area 45,987.31 m^2. Site „B” (the main site envisaged for the plant location) is in the western section of the ground and has an area of around 15 daa, and the structure discharging emissions into the ambient air is located at 400 m distance from the outlines of TPP Sofia.

TPP Sofia-East site – the alternative site selected for the purposes of EIA - is located in the eastern part of Sofia and borders areas allocated for industrial construction, planting and mixed-purpose areas. The ground of TPP Sofia-East is within Iskar industrial area, at 6, Dimitar Peshev St., and has a total area of 319,692 m^2. Site „B” (the alternative site envisaged for the plant location) is located near the railway line, has an area of around 20 daa[2], and the structure discharging emissions into the ambient air is located at 400 m distance from the outlines of TPP Sofia East. Neighbouring TPP Sofia-East are industrial enterprises and plots, and the large industrial enterprise Sofia Med is to the north-east of the power plant. The area within a radius of 800 m of the site is industrial area.

2.4.1.1.1 DUST EMISSIONS

Dust emissions will be generated from the construction and excavation works at the site, including from transportation of construction waste, excavated earth etc.

The intensity of dust emissions depends to a large extent on the weather conditions at the time of construction works, on the season, on the meteorological factors (wind, air humidity, temperature, stability of the atmosphere), the characteristics of earth particles and many other factors.

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[2] The internationally accepted abbreviation for decare - deka (**da**) + ar (**a**) = **daa** – equal to 10 ares or 1,000 m^2.

2.4.1.1.2 GAS EMISSIONS

The estimation of emissions can be made according to **Tier 2** [3] of the methodology book **EMEP/EEA air pollutant emission inventory guidebook 2013** for non-road mobile sources and machinery (area sources), SNAP code **0808**, and for carbon dioxide - according to IPCC (**NFR**[4] code **1.A.5.b.iii**), in ICE exhaust gases.

Considerable reduction of pollutant emissions can be expected if construction machinery meeting minimum the standard requirements EURO IV is used during construction.

2.4.1.1.3 POLLUTANT EMISSIONS FROM PAYING OF ASPHALT PAVEMENT

According to the future technical projects for construction under this IP asphalt pavement is envisaged for the technological purpose areas as well as for the detour road and the access road. The level of emissions of non-methane volatile organic compounds (**NMVOC),** total suspended particulates (**TSP)** and fine dust particles - particulate matter up to 2.5 (**$PM_{2.5}$**) and up to 10 micrometers (**PM_{10})** during laying of asphalt mix can be calculated according to **Tier 1** of **EMEP/EEA air pollutant emission inventory guidebook-2013** (**NFR** code **2.D.3.b - Road paving with asphalt**), where emission factors are measured in gram per ton of laid bituminous mixture.

2.4.1.2 EMISSIONS DURING OPERATION

2.4.1.2.1 Emission limit values *(ELVS)*

TPP Sofia and TPP Sofia-East have been constructed as power plants generating electricity and thermal energy (steam and hot water) for heating and household needs of industrial areas and residential quarters.

IPPC permits have been issued for the operations at the sites of Toplofikatsia Sofia EAD: Integrated permit No. 43/2005 for TPP Sofia and No. 30/2005 for TPP Sofia-East, the latter updated by Decision No.30-HO-ИО-A1/2013 of the Executive Director of ExEA, and the emission limit values (ELVs) for nitrogen and sulphur oxides, carbon dioxide and particulate matter, emitted from stationary discharge structures (stacks) of power plants, are indicated in **Table 2.4-1**.

TABLE 2.4-1 EMISSION LIMIT VALUES

Pollutant	Limit value [mg/Nm^3]
NO_X	200
SO_2	35
CO	100
Dust	5

According to the investment proposal for construction of a **cogeneration installation utilizing RDF** an emission flow will be generated, which will be discharged into the ambient air from one stationary source (a stack).

[3] In the **EMEP/EEA air pollutant emission inventory guidebook** methods of different complexity are used for determining the level of emissions, describing the major activities in the inventory of emissions. The method complexity level is designated as Tier X, i.e. the higher the value of X, the more complex and precise the method.

[4] **NFR** (Nomenclature for Reporting) – nomenclature for reporting the emissions generating processes, which enables full unification and congruence of all national reporting under the Convention on Long-range Transboundary Air Pollution (CLRTAP);before the secretariat of the Framework Convention on Climate Change (UNFCCC) and before the European Environment Agency (EEA).

The pollutants emitted from the TPP stack after the IP implementation can be classified into two groups:

- general pollutants - nitrogen oxides (NO_x), sulphur oxides (SO_2) common dust (PM_{10}) and carbon oxide (CO), and a cumulative effect is expected of the existing stacks and the new cogeneration installation utilizing RDF;
- specific pollutants - total organic carbon (TOC); hydrogen chloride (HCl); hydrogen fluoride (HF); cadmium/thallium (Cd, Tl); mercury (Hg); inorganic dust substances - Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V (Pb++) and dioxins and furans, which will be generated only by the RDF utilization installation.

The emission limit values (ELV) of harmful substances in flue gas, discharged after the treatment installations of the waste incineration installations are specified in Annex 2, art.22 (1) of Ordinance No. 4/2003.

TABLE 2.4-2 AVERAGE EMISSION LIMIT VALUES FOR 24 HOURS

Harmful substances	ELV mg/Nm^3
Total dust (particulate matter)	10
Gaseous and vaporous organic substances expressed as total organic carbon (**TOC**)	10
Gaseous and vaporous chlorine compounds expressed as hydrogen chloride (**HCl**)	10
Gaseous and vaporous fluorine compounds expressed as hydrogen fluoride (**HCl**)	1
Sulphur trioxide and sulphur dioxide expressed as sulphur dioxide (**SO_2**)	50
Nitrogen monoxide and nitrogen dioxide expressed as nitrogen dioxide, for existing installations of nominal capacity over 6 t/h or for new waste incineration installations (**NO_X**)	200
Carbon oxide	50

TABLE 2.4-3 AVERAGE EMISSION LIMIT VALUES, FOR SAMPLE-TAKING PERIOD BETWEEN 30 MINUTES AND 8 HOURS, OF CONCENTRATION OF HEAVY METALS AND THEIR GASEOUS AND/OR VAPOROUS COMPOUNDS

Harmful substances	ELV mg/Nm^3
Cadmium and cadmium compounds, determined as cadmium (**Cd**)	total 0.05
Thallium and thallium compounds, determined as thallium (**Tl**)	
Mercury and mercury compounds, determined as mercury (**Hg**)	0.05
Antimony and antimony compounds, determined as antimony (**Sb**)	total 0.05
Arsenic and arsenic compounds, determined as arsenic (**As**)	
Lead and lead compounds, determined as lead **Pb**)	
Chromium and chromium compounds, determined as chromium (**Cr**)	
Cobalt and cobalt compounds, determined as cobalt (**Co**)	
Copper and copper compounds, determined as copper (**Cu**)	
Manganese and manganese compounds, determined as manganese (**Mn**)	
Nickel and nickel compounds, determined as nickel (**Ni**)	
Vanadium and vanadium compounds, determined as vanadium (**V**)	

TABLE 2.4-4 EMISSION LIMIT VALUES FOR DIOXINS AND FURANS, DETERMINED AS AVERAGE VALUE FOR SAMPLE TAKING PERIOD NOT SHORTER THAN 6 HOURS AND NOT LONGER THAN 8 HOURS

Harmful substances	BAT, ng/Nm^3
Dioxins and furans	0.1

2.4.1.2.2 DISCHARGE STRUCTURES - ORGANIZED POINT SOURCES (STACKS)

2.4.1.2.2.1 TPP Sofia

The existing and operating discharge structures (stacks) of **TPP Sofia** are three: S1, S2 and S3 The stack of the new installation for RDF incineration with TPP Sofia is S4 (in site B).

The parameters and emissions of the three existing stacks according to permit No.43/2005 and the new stack (in red) with emissions regulated under Ordinance No. 4/2013 are given in **Table 2.4-5**.

TABLE 2.4-5 EMISSIONS FROM TPP SOFIA AFTER IMPLEMENTATION OF THE CHANGES

Stack No.	Operating hours	Discharge Nm^3/h	Emissions per year									
			SO_2	NO_X	CO	Dust PM_{10}	HCl	HF	TOC	Cd, Tl, Hg	Pb++	Dioxins and furans
			t/y									g/y
S 1	360	158,800	2.0	11.4	5.7	0.3						
S 2	7,442	375,400	978	5587	2794	140						
S 3	8,568	1,176,200	352.7	2,015.5	1,007.8	50.4						
S 4	8,000	160,000	64.0	256.0	64.0	12.8	12.8	1.3	12.8	0.06	0.64	0.13
TOTAL		**BEFORE**	**452.5**	**2,585.7**	**1,292.9**	**64.6**	**-**	**-**	**-**	**-**	**-**	**-**
		AFTER	**516.5**	**2,841.7**	**1,356.9**	**77.4**	**12.8**	**1.3**	**12.8**	**0.06**	**0.64**	**0.13**
		Increase	***14.1%***	***9.9%***	***5.0%***	***19.8%***	***-***	***-***	***-***	***-***	***-***	***-***

As seen from **Table 2.4-5**, after the changes all incineration-resulting emissions of nitrogen oxides (NO_x), sulphur oxides (SO_2) total dust (PM_{10}) and carbon oxide (CO) will increase.

Treatment installations

All gas flows pass through treatment installations, and the products from incineration in the new installation will be treated applying one of the basic methods - selective non-catalytic reduction (SNCR) of NOx or selective catalytic reduction (SCR) of NOx.

RIEW Sofia exercises annual control for compliance with the conditions of integrated permit No.43/2005, and of the emission of harmful substances into the ambient air resulting from the operation of **TPP Sofia**.

The power plant submits reports with results from regular checks of harmful substances emissions into the atmosphere, in conformity with Ordinance No. 6 on the procedure and the methods for measurement of emission of harmful substances released in the ambient air by immovable sources of emissions (SG No. 31/1999, as last amended)

2.4.1.2.2.2 TPP Sofia-East

The existing and operating discharge structures (stacks) of **TPP Sofia-East** are four: S1, S2, S3 and S4 The stack of the new installation for RDF incineration with **TPP Sofia** is S5 (in site B).

The parameters and emissions of the four existing stacks according to permit No.30/2005, updated by Decision No.30-HO-ИО-A1/2013 of the Executive Director of ExEA, and the new stack (in red) with emissions regulated under Ordinance No. 4/2013 are given in **Table 2.4-6**.

TABLE 2.4-6 EMISSIONS FROM TPP SOFIA- EAST AFTER IMPLEMENTATION OF THE CHANGES

Stack No.	Operating hours	Discharge Nm^3/h	Emissions per year									
			SO_2	NO_X	CO	Dust PM_{10}	HCl	HF	TOC	Cd, Tl, Hg	Pb++	Dioxins and furans
			t/y									g/y
S 1	3,149	1,900,800	313.9	1,793.6	896.8	76.6						
S 2	6,759	1,209,600	341.4	1,950.6	975.3	3.4						
S 3	526	1,134,000	22.3	127.7	63.8	1.2						
S 4	137	1,134,000	8.5	48.8	24.4	45.4						
S 5	8,000	160,000	64.0	256.0	64.0	12.8	12.8	1.3	12.8	0.06	0.64	0.13
TOTAL		**BEFORE**	**686.1**	**3,920.6**	**1,960.3**	**126.6**	-	-	-	-	-	-
		AFTER	**750.1**	**4,176.6**	**2,024.3**	**139.4**	**12.8**	**1.3**	**12.8**	**0.06**	**0.64**	**0.13**
		Increase	*9.3%*	*6.5%*	*3.3%*	*10.1%*	-	-	-	-	-	-

As seen from **Table 2.4-6**, after the changes all incineration-resulting emissions of nitrogen oxides (NO_x), sulphur oxides (SO_2) total dust (PM_{10}) and carbon oxide (CO) will increase.

Treatment installations

All gas flows pass through treatment installations, and the products from incineration in the new installation will be treated applying one of the basic methods - selective non-catalytic reduction (SNCR) of NOx or selective catalytic reduction (SCR) of NOx.

RIEW Sofia exercises annual control for compliance with the conditions of integrated permit No.30/2005, updated by Decision No.30-HO-ИО-A1/2013 of the Executive Director of ExEA, and of the emission of harmful substances in the ambient air resulting from the operation of TPP Sofia-East.

The power plant submits reports with results from regular checks of harmful substances emissions into the ambient air, in conformity with Ordinance No. 6 on the procedure and the methods for measurement of emission of harmful substances released in the ambient air by immovable sources of emissions (SG No. 31/1999, as last amended)

2.4.1.3 CONCLUSION

Comparison of **Table 2.4-5** and **Table 2.4-6** shows that even AFTER the implementation of the IP project, the amount of emissions in the area of **TPP Sofia** is lower than that in the area of **TPP Sofia-East** BEFORE the implementation of the project, so the potential for absorbing emissions in the area of the former is higher.

That shows that the implementation of the IP project at the alternative site of TPP Sofia is a better option as regards the emission load on the areas around the alternative sites.

2.4.2 *EXPECTED WASTE GENERATION*

2.4.2.1 *WASTE FROM THE CONSTRUCTION AND EXCAVATION WORKS*

Waste from construction and excavation works falls within the Group under code 17 05 00 Soil (including excavated soil from contaminated sites), stones and dredging spoil) , code 17 05 04 - soil and stones).

In the course of construction works also waste from reinforced concrete structures will be transported for disposal, and waste of Group under code 17 01 00 will be generated as well - concrete, bricks, tiles and ceramics under the following codes: - code 17 01 01 - concrete from removal of concrete pavement and demolition of reinforced concrete structures; code 17 03 02 - bituminous mixtures (not containing coal tar) from removal of asphalt pavement; Group code 17 04 00 - metals (including their alloys) under code 17 04 05 - iron and steel.

2.4.2.2 *WASTE WHICH WILL BE GENERATED IN THE COURSE OF OPERATION*

The cogeneration installation utilizing modified solid fuel derived from waste (RDF) will generate process waste from the technology process, the so called remnants or residual products, some of which are classified as hazardous waste and others - as non-hazardous waste. Besides waste from the technology process, which will be limited in quantity, other non-hazardous process waste, hazardous waste and municipal waste will be generated in limited quantities. As a result from repairs construction waste will be generated as well, but that will be infrequently and in limited quantities.

2.4.2.2.1 *NON-HAZARDOUS (INERT) WASTE*

Bottom ash Classification codes - Group code 19 01 *Wastes from incineration or pyrolysis of waste* namely: 19 01 12 *bottom ash and slag other than those mentioned in 19 01 11** – around 36,000 t/y, non-hazardous waste.

The installation will incinerate modified solid fuel derived from waste (RDF), produced in MBT installation after preliminary separation and fragmentation of non-hazardous MSW, followed by biological treatment and packing to certain dimensions. The resulting bottom ash will not be hazardous waste under code 19 01 11* *bottom ash and slag containing dangerous substances*. The slag from the furnace mixed with screenings from the grate, which form at the furnace bottom, is usually classified as non-hazardous waste under code 19 01 12 *bottom ash and slag other than those mentioned in 19 01 11*.*

Bottom ash from incineration consists of grate screenings and slag. The bottom ash quantity is usually approximate 20 % of the quantity of waste depending on the inert materials content in the input RDF, which for incineration of 22.5 t/h in the plant results in around 4 t/h. Bottom ash is of several types: - grate screenings, slag and scrap regenerated from bottom ash. The incineration grate consists of cast-iron blocks, which move in relation to one another. To enable air flux and distribution of the air flowing through the grate in the burning process, the moving grates do not fit tightly and a very small portion of the fine fractions of input waste falls through the grate and is called grate screenings. Grate screenings are usually 0.2 - 1 % of the input incinerated waste, in this case approximately 360 - 1,800 t/y. Grate screenings are usually mixed with slag.

Boiler slag is mainly an inorganic substance, which is cleaned by means of water-bath of the lower section of the furnace. Slag is usually 15 - 20 % of the input incinerated waste and depends almost entirely on the content of non-combustible particles (ash) in the input waste, of which around 90 % leave the installation with the slag. Slag is usually mixed with grate screenings. The total amount of bottom ash (grate screenings and slag) is around 36,000 tons per year from incineration of 180,000 t/y waste.

Scrap - Group code 19 01 00 *Wastes from incineration or pyrolysis of waste* namely: - 19 01 02 *ferrous materials removed from bottom ash* - around 360 t/y, non-hazardous waste. Scrap recovered from bottom ash is about 1 % when MSW is incinerated and probably much less than 1 % when RDF is incinerated. Ferrous and non-ferrous metals can be recovered from bottom ash either on the spot - within the site or in a place outside the plant site.

The metals can be reused and bottom ash can be used in construction. The non-incinerated material content in bottom ash is usually below 1 %. The low amount of metals in bottom ash after RDF incineration does not usually involve envisaging of mandatory separation.

2.4.2.2.2 HAZARDOUS WASTE

Fly ash and boiler dust Classification codes - Group code 19 01 Wastes from incineration or pyrolysis of waste, namely: - 19 01 15* boiler dust containing dangerous substances and 19 01 13* fly ash containing dangerous substances - total about 2,720 t/y of hazardous waste Fly ash and boiler dust are usually taken away by flue gas and separated in filtering, and the RDF incineration installation involves a semi-wet system for flue gas cleaning.

Boiler dust - A part of the particles in flue gas are deposited on the boiler walls and in the boiler pipes. The boiler will be regularly cleaned by means of a mechanical system and the boiler dust will be collected below the pipes. Boiler dust will be mixed with fly ash from flue gas cleaning and then transported for a storehouse for storage. Boiler dust is usually classified as hazardous waste under code - *19 01 15* boiler dust containing dangerous substances.*

Fly ash - In some waste incineration installations separate collection of fly ash particles is applied. In the RDF incineration plant separation will be done by the sleeve filter, where the ash is mixed with remains from semi-dry cleaning of flue gas.

Fly ash contains a certain amount of fine particles of soot, various salts and heavy metals, and the content of those metals is so high that such residue can not be disposed in a landfill for non-hazardous waste but has to be treated in a special installation. Fly ash is under code *19 01 13* fly ash containing dangerous substances*.

In the envisaged technological scheme of the RDF incineration installation boiler dust resulting from the boiler cleaning is mixed with fly ash from flue gas cleaning. The quantity of boiler dust and of fly ash is approximately 1-2 % of the input waste, 340 kg/h when incinerating 22.5 t//h in the plant, or 2,720 t/y.

Residue from semi-dry cleaning of flue gas - Group code 19 01 Wastes from incineration or pyrolysis of waste, namely: - 19 01 07* solid wastes from gas treatment and 19 01 10* spent activated carbon from flue-gas treatment - total about 5,520 t/y, hazardous waste. That residue from semi-dry cleaning is usually classified as hazardous waste under code 19 01 07* solid wastes from gas treatment. That waste will probably contain also the activated carbon released in filtration, and such waste is under code 19 01 10* spent activated carbon from flue-gas treatment .

Different types of residual products will be generated depending on the flue gas treatment system. Most installations use a semi-dry system, in which water is injected for reducing the temperature and hydrated lime is injected for the elimination of HCl, HF and SO_2 from flue gas. Activated carbon is injected additionally for elimination of dioxins and furans (and also mercury, if it is present in flue gas - which is not very likely).

With such a system of flue gas cleaning the residue will have many components: - fly ash containing particles from the combustion process; products from the dry cleaning reaction ($CaCl_2$, CaF_2, $CaSO_3$, $CaSO_4$) excess lime (which has not entered into reaction), and activated carbon with traces of absorbed dioxins, furans and mercury. The quantity and composition content of the product from cleaning will depend mainly on the quantity of HCl and SO_2 in flue gas.

As the installation includes reduction of NOx through Selective Non Catalytic Reduction (SNCR), the waste released by the sleeve filters will contain also traces of NH_3. Heavy metals content will result mainly from fly ash, however mercury content will be higher due to its absorption by activated carbon.

The residual products (residue) from flue gas treatment are expected to be collected in bulk in large silos having storage capacity sufficient for minimum 8 days after generation. The quantity of residue from flue gas cleaning by semi-dry treatment is assumed to be around 4 % of the quantity of incinerated modified solid fuels derived from waste (RDF). It will be released mainly from the sleeve filters - around 690 kg/h in incineration of 22.5 t/h of waste, or 5,520 t/y.

At the scrubber inlet water will be sprinkled in for cooling the gas, and the spent absorption solution flowing out of the wet scrubber will be used in the semi-dry stage for moistening the hydrated lime or cooling the flue gas. The chosen semi-wet system makes it possible to arrange the treatment equipment in the installation without waste water or sludge generation, and no additional treatment or disposal of waste water is necessary. That is why there will be no generation of hazardous waste under codes: *- 19 01 05* filter cake from gas treatment and - 19 01 06* aqueous liquid wastes from gas treatment and other aqueous liquid wastes.*

Waste from shredding of metal-containing waste - Group under code 19 10 Wastes from shredding of metal-containing waste, namely: - 19 10 01 iron and steel waste; 19 10 02 non-ferrous waste; 19 10 03* fluff-light fraction and dust containing dangerous substances; 19 10 04 fluff-light fraction and dust other than those mentioned in 19 10 03; 19 10 05* other fractions containing dangerous substances, and 19 10 06 other fractions other than those mentioned in 19 10 05* - will not be generated as in the operation of the cogeneration plant utilizing RDF the burning matter is expected to be a separated fraction, mechanically and biologically treated in MBT plant, to result in RDF with much lower concentrations of heavy metals. That is why no additional shredding/grinding of the received waste is necessary. It is not likely that hazardous and non-hazardous waste of group 19 10 will be generated from shredding/grinding of metal-containing waste in carrying out additional activities for receiving of other types of waste to be incinerated together with RDF or instead of it in case of RDF lack and of shredding.

2.4.2.2.3 MUNICIPAL WASTE

Municipal waste, including separately collected fractions - Group under code 20 Municipal wastes and similar commercial, industrial and institutional wastes including separately collected fractions:

- **Group under code 20 01**
    - Waste under code 20 01 21* - fluorescent tubes and other mercury-containing waste. Disused lamps up to 20 pieces per year shall be stored in their original packages in the storehouse at the site. Fluorescent tubes unfit for use shall be stored in unbroken and well-closed boxes in a room within the plant's territory and shall be delivered to an authorised firm for further treatment.
    - Waste under code 20 01 36 - discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35.
- **Group under code 20 03** - Other municipal wastes:
    - code 20 03 01 - mixed municipal waste.

Household waste generated from the staff will consist mostly in packages of foodstuff and other articles as well as resulting from the daily activities of the employees. For the number of operating staff - 20- 30 persons in three shifts - the generated MSW is expected to be around 12 - 15 kg/d. MSW will be collected in metal containers and transported to a landfill for non-hazardous waste by vehicles of the respective company responsible for the other sites of the TPP.

2.5 RISK OF FAILURES AND MEASURES FOR PREVENTING /RESPONDING TO EMERGENCIES

In the course of implementation of the investment proposal for **construction of a cogeneration plant utilizing RDF**, like in all such investment proposals, there is a risk of failures and incidents resulting in polluting the components of the environment (soil, water, air) within the sites and close to them and along the transportation routes for RDF delivery and waste disposal.

The table (**Table 2.5-1**) shows the possible failures and incidents, of which there is a potential risk during IP construction, operation, and decommissioning in long-term aspect, in case the necessary measures for prevention or minimisation of risk situations are not taken while implementing the investment intent.

TABLE 2.5-1 POSSIBLE FAILURES AND INCIDENTS

POSSIBLE FAILURE	MEASURES FOR PREVENTION AND/OR ELIMINATION
Risk of incidents and failures in the construction phase	
Possible failure	Measures for prevention and/or elimination
spills of oils, petroleum products etc. from the operated construction and transportation equipment	Use equipment in good repair Availability of sorbents at the respective site
Incidents involving earth collapse or slide during excavation works	Observe the civil works technology
Risk of fire	Observe fire safety instructions Fire localization means must be available at hand
Road accidents	Proper organisation of the road traffic within the IP site and for transportation of raw materials, stuff and waste
Risk of incidents and failures in the operation phase	
spills of oils, petroleum products etc. at the site, in inner roads etc.	Use equipment in good repair, which regularly undergoes technical inspections Availability of sorbents at the respective site; properly trained staff Available information sheets for safe handling of the hazardous substances used at the site
spills of hazardous substances as a result of industrial accidents (Na OH, NH_4 OH, hydrated lime solution)	Available information sheets for safe handling of the hazardous substances used at the site Strict control for observing the operating instructions for work with reagents and preventive measures to eliminate conditions for emergencies
Incidents related to the efficient management of technology processes Prevention of industrial accidents	Observing the technology requirements Eliminating any conditions for occurrence of emergency situations Properly qualified personnel Observing of all requirements of the technology regulations and the WHSFS instructions
Risk of fire	Fire localization means must be available at hand Use equipment in good repair for the operating activities Proper maintenance of the electric network and electric equipment at the site Properly instructed personnel
Road accidents	Proper organisation of the traffic of vehicles transporting waste and prevention of spills
Pollution of the ambient air	Permanent control of the technology process Maintenance and regular inspection of the equipment and of air treatment installations Maintain a green belt around the site Monitor the weather conditions Water-sprinkling of inter-site roads when necessary (control road). Maintain cleanliness of the production site
Contamination of surface/ground water	Implement the monitoring plan. Maintain in proper condition the water supply and the sewerage network of the respective site.
Contamination of adjacent areas	Maintain a green belt around the main site

POSSIBLE FAILURE	MEASURES FOR PREVENTION AND/OR ELIMINATION
Natural disasters	Draw up an Action Plan for response to natural disasters, emergencies and accidents Annually update the Action Plan; Display the safety instructions prominently Train the staff
Risk of incidents and failures in the decommissioning phase	
Possible failure	Measures for prevention and/or elimination
Spills of petroleum products from the used equipment	Use equipment in good repair Availability of sorbents at the respective site
Incidents involving earth collapse or slide	Observe the site decommissioning technology Observe the project documentation requirements; Properly qualified personnel
Risk of fire	Fire localization means must be available at hand Use equipment in good repair for the operating activities Proper maintenance of the electric network and electric equipment in the site post-operation phase Properly instructed personnel
Road accidents	Proper organisation of the traffic of vehicles within the respective site

Accidental local spills of fuels, lubricants and other pollutants on bare ground and on other surfaces shall be immediately deactivated by means of chemicals, raked up and taken out of the site as hazardous waste, in line with the regulatory requirements. Strict control and management for prevention of accidental spills and leaks, which could have a negative effect on the components of the environment. The degree of damage would depend on the scale of an accident.

More significant negative impacts on water and soils in the area during operation and for a certain period after decommissioning are possible only as a result of some emergency situations, connected with disrupting the optimum conditions of technology processes, and in cases of accidents caused by fires and natural disasters (earthquakes, floods). Such a risk in general exists for all considerable-scale industrial and production facilities, and it is particularly high for production facilities involving chemicals.

By observing the regulatory requirements (as regards seismic stability etc.) in designing of buildings and installations, and all technical instructions for the plant operation the risk of accidents can be reduced to a minimum.

2.6 MONITORING

A Control and Monitoring System (CMS) is required in order to control and monitor all processes and components and to maintain automatic operation of the RDF plant, and to ensure strict control and efficient management.

Installing a display is also envisaged for real-time reporting of emissions (by means of a monitoring system). The display will be installed on the façade of the installation of that the data can be seen from a distance.

The waste received for incineration will be controlled, determining its qualitative and quantitative characteristics: calorific value, dust content, organic substance content, content of S, Cl, Hg, Cd, Tl, Sb, As, Cr, Co, Cu, Pb, Mn, Ni, V, Sn, Zn, P_2O_5, PCB_5.

In order to ensure efficient management of the environment and prevent any negative impact of the IP, monitoring of the individual components and factors of the environment is envisaged.

2.6.1 MONITORING OF AIR

The monitoring of air will be performed within the procedures for Integrated pollution prevention and control (IPPC) - environmental responsibility. For implementing the investment proposal both sites are within the scope of the respective integrated permit, namely: permit No.30/2005 for TPP Sofia-East, updated by Decision No.30-НО-ИО-А1/2013 of the Executive Director of ExEA, and permit No.43/2005 for TPP Sofia. After completing the procedure under Chapter Sic of EPA it is required that Toplofikatsia Sofia EAD submits to the competent authority under art.120 of the same Act information, required under art.16 (1) of the Ordinance on the conditions and procedures for issuing of integrated permits.

2.6.2 MONITORING OF WATER

2.6.2.1 MONITORING OF WASTE WATER AND RAINWATER

→ Blackwater/sewage will be discharged in the sewerage network of the site and will be monitored together with those of the TPP. It will be included in the Programme for Internal Monitoring of the waste water of TPP.

→ No industrial waste water is expected from the new plant. No monitoring of such waster is envisaged.

→ Rainwater from the plant site will be connected to the existing sewerage system of the TPP and will be subject to monitoring under the existing programme.

2.6.2.2 MONITORING OF GROUNDWATER OF TPP SOFIA AND TPP SOFIA EAST SITES

In accordance with integrated permits No. 43/2005 for TPP Sofia and No. 30/2005 for TPP Sofia-East, the latter updated by Decision No.30-НО-ИО-А1/2013 of the Executive Director of ExEA, four groundwater monitoring points have been established within the territory of TPP Sofia and three - within the territory of TPP Sofia-East, as follows:

- **At TPP Sofia site (Figure 1.6-1):**

  → MP 1 - beside the WWTP drying bed;

  → MP 2 - beside the mazut unloading platform and the mazut tanks;

  → MP 3 - near a chemical workshop, sodium hydroxide tanks and unloading platform for sodium hydroxide and sulphuric acid;

  → MP 4 - beside the cooling towers.

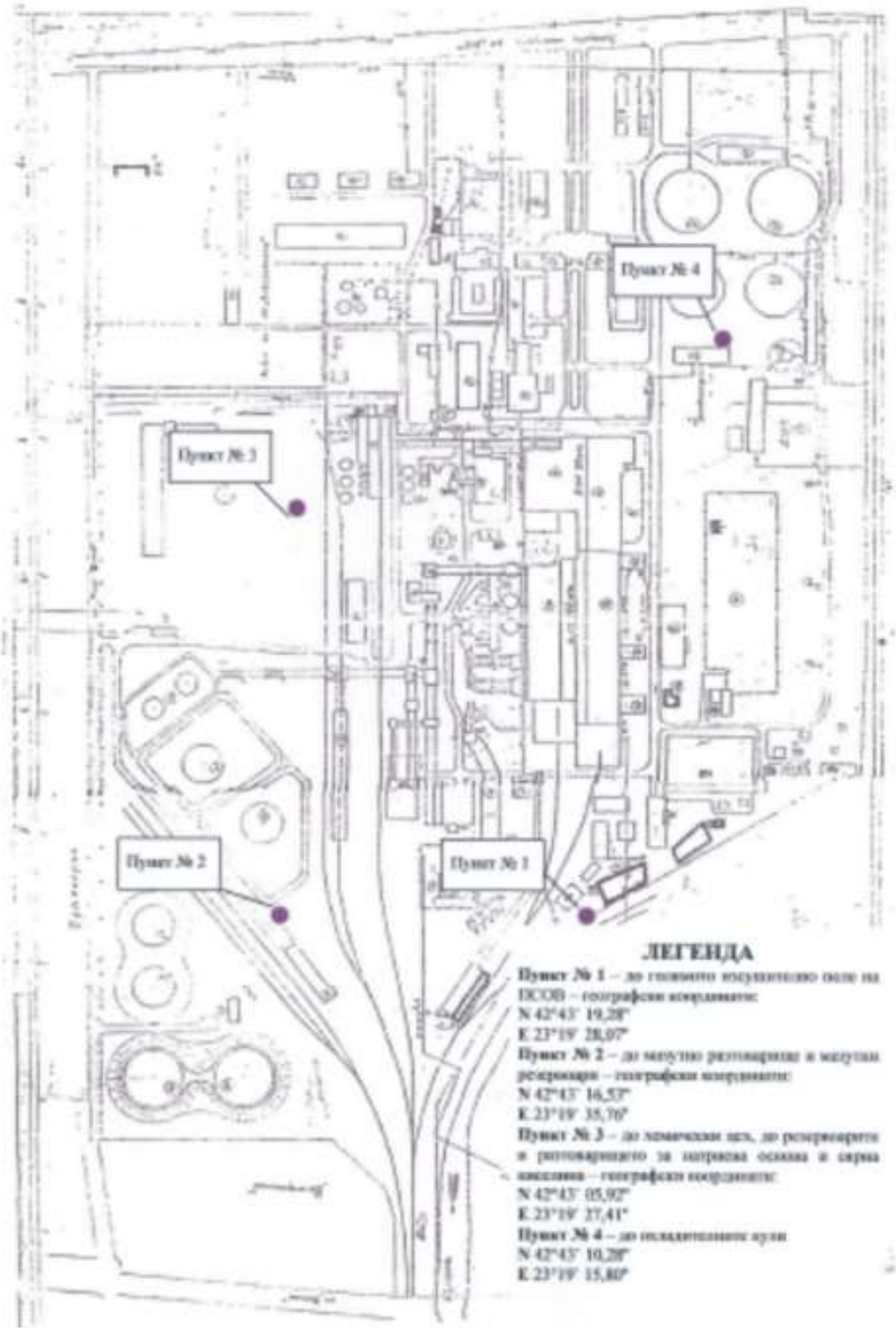


FIGURE 2.6-1 GROUNDWATER MONITORING POINTS AT TPP SOFIA SITE

- **At TPP Sofia-East site (Figure 2.6-2):**

→ MP 1 - a well near Chernoto Ezero (in English: "The Black Lake")
→ MP 2 - monitoring well No.2
→ MP 3 - a well between the gas distribuiton point and the WWTP

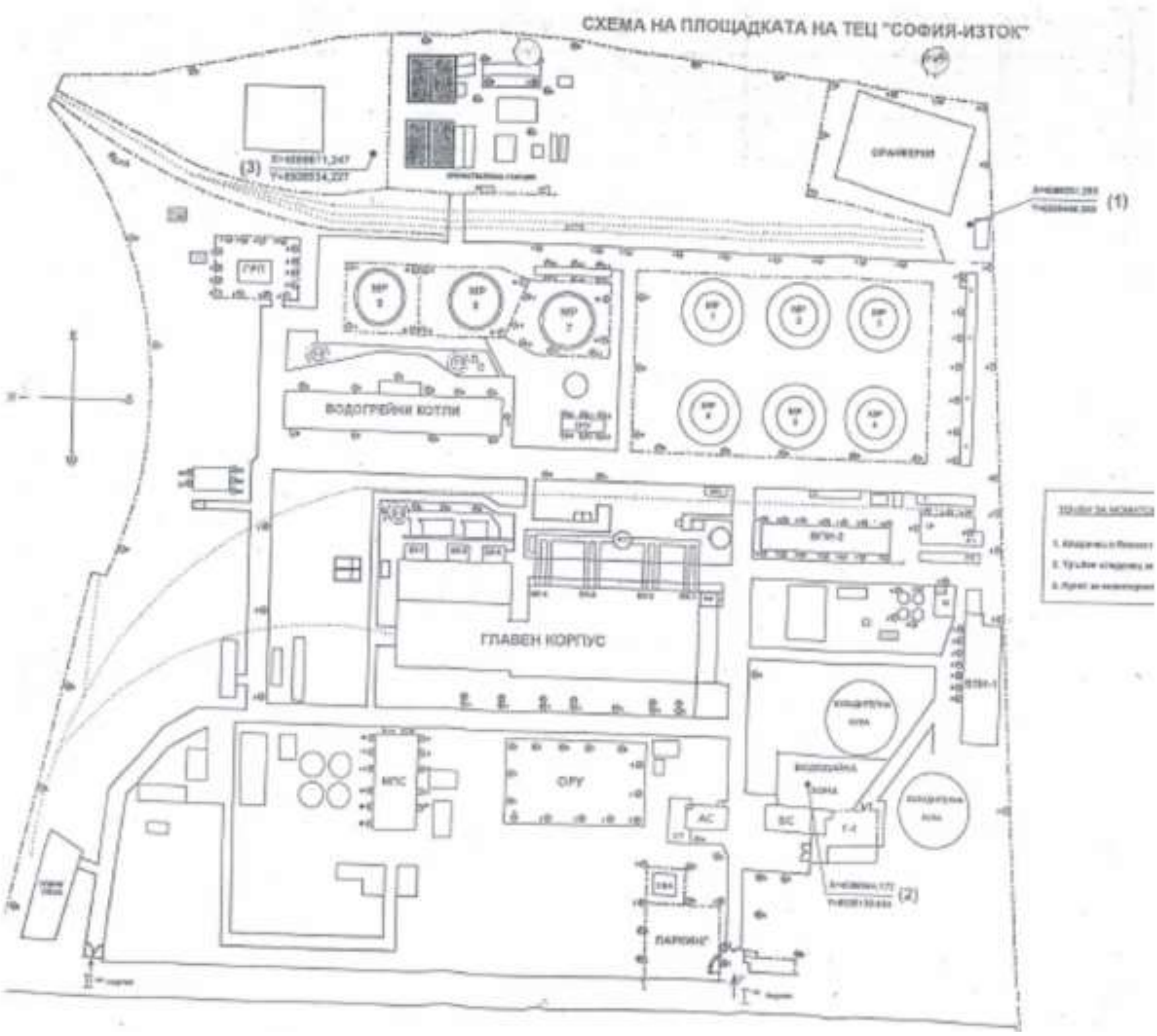


FIGURE 2.6-2 GROUNDWATER MONITORING POINTS AT TPP SOFIA-EAST SITE

The geographic coordinates of the monitoring points are given in **Table 2.6-1**:

TABLE 2.6-1 GEOGRAPHIC COORDINATES

Site	Monitoring point	Geographic coordinates	
		N	E
TPP Sofia	MP 1	42^0 43′ 19,28″	23^0 19′ 28,07″
	MP 2	42^0 43′ 16,53″	23^0 19′ 35,76″
	MP 3	42^0 43′ 05,92″	23^0 19′ 27,41″
	MP 4	42^0 43′ 19,28″	23^0 19′ 15,80″
TPP Sofia-East	MP 1	42^0 38′ 57,75″	23^0 25′ 10,02″
	MP 2	42^0 39′ 01,26″	23^0 24′ 55,54″
	MP 3	42^0 39′ 10,02″	23^0 25′ 13,29″

The geologic and lithologic cross-section and the structure of the monitoring points are illustrated in **Figure 2.6-3** and **Figure 2.6-4**.

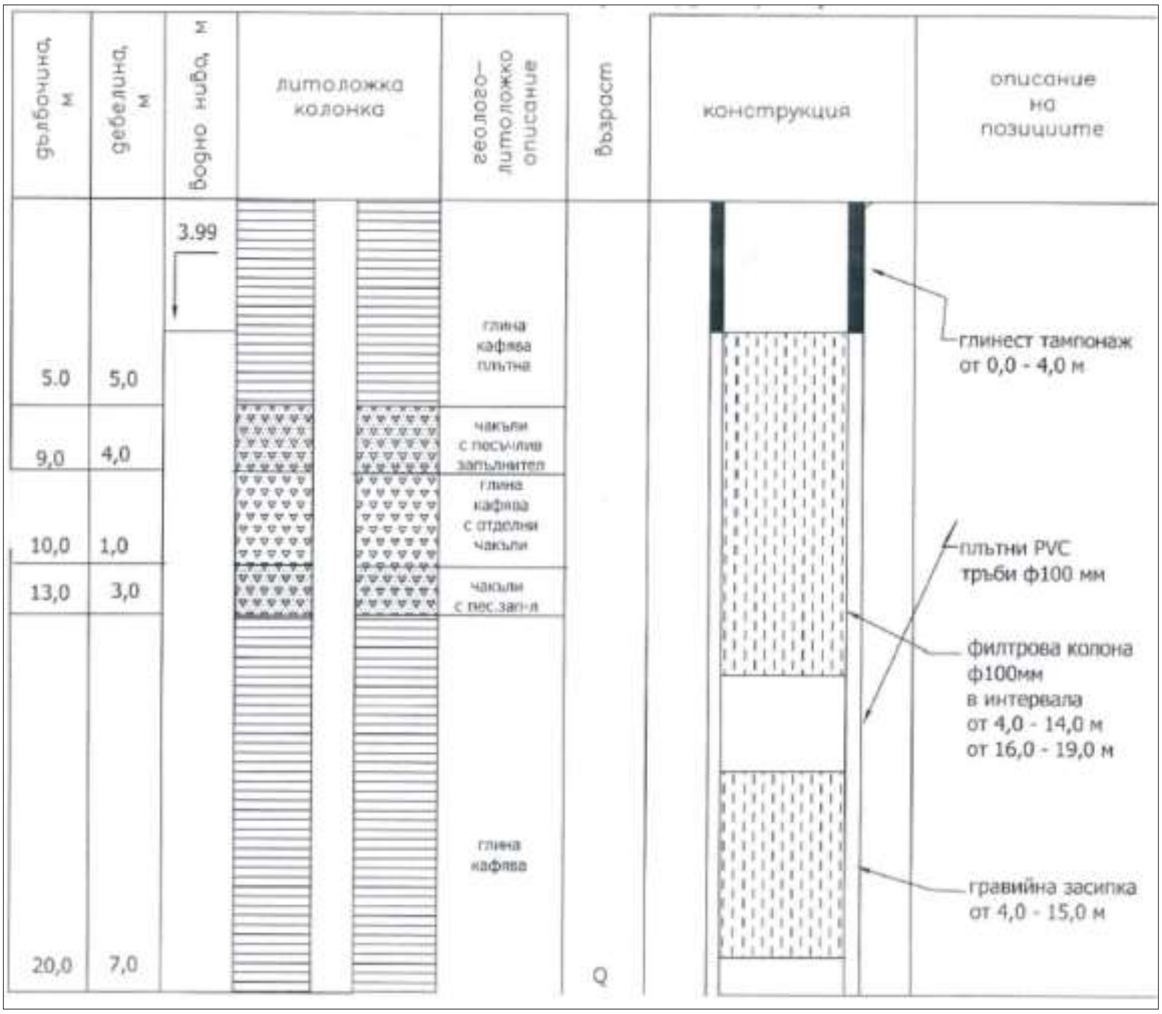
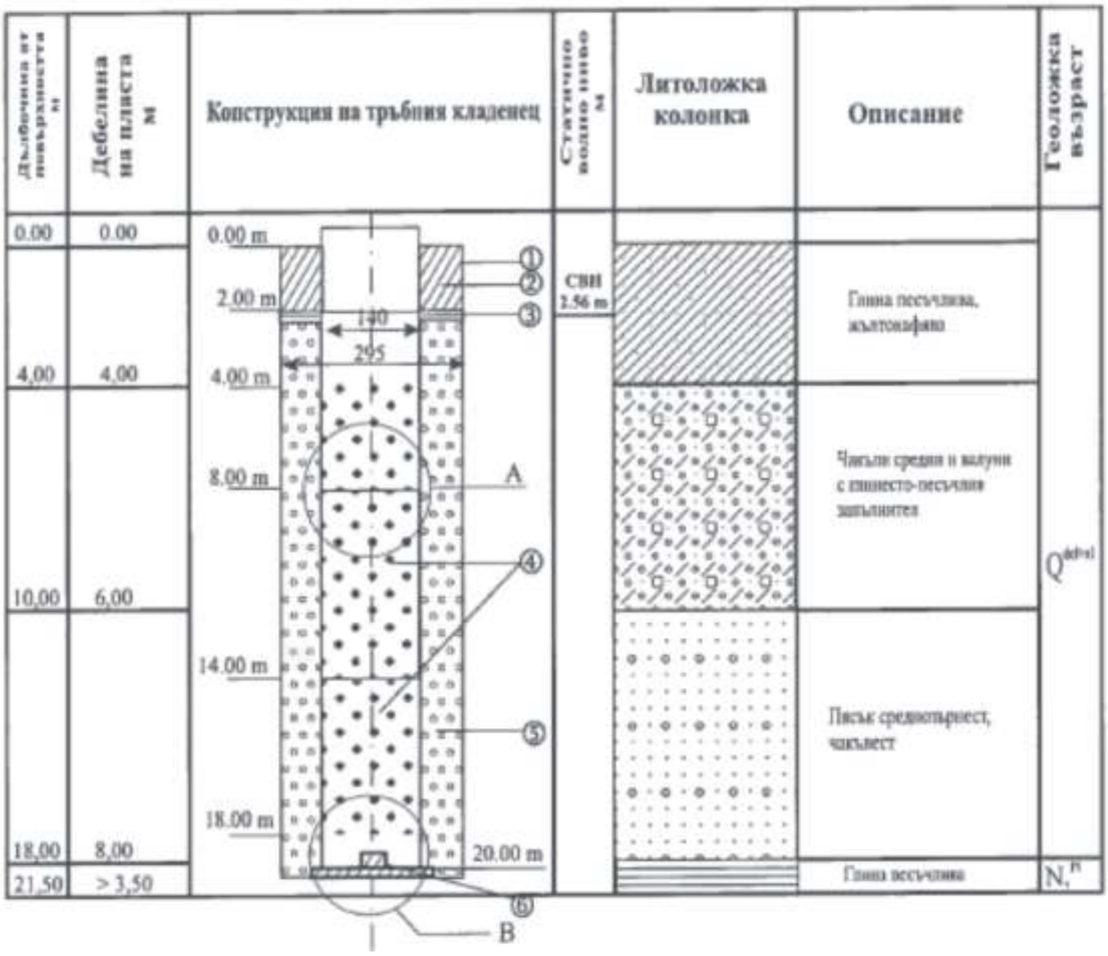


FIGURE 2.6-3 LITHOLOGIC CROSS-SECTION AND TYPE STRUCTURE AT THE MONITORING POINTS OF TPP SOFIA SITE

According to the requirements of the integrated permits the company performs monitoring by checking the following parameters once a year:

- At TPP Sofia site: water level, temperature, general hardness, active reaction, electric conductivity, permanganate oxidation, sulphates, chlorides, sodium, iron, petroleum products and dissolved substances.
- At TPP Sofia-East site: water level, general hardness, active reaction, electric conductivity, permanganate oxidation, ammonium ion, nitrates, nitrites, sulphates, chlorides, phosphates, sodium, iron and petroleum products. The results from ground water monitoring in 2011, 2012 and 2013, provided by Toplofikatsia Sofia EAD with letter No. П-2414/21.05.2014, are given in section 4.2.1.2. below.

The investment proposal implementation necessitates expanding the groundwater monitoring network. In that relation it is deemed expedient to build minimum two more monitoring points (tube wells) close to the investment proposal site, of similar depth and structure as those in **Figure 2.6-3** and **Figure 2.6-4**. For monitoring the following parameters shall be checked once in a year: water level, water temperature, general hardness, active reaction, electric conductivity, permanganate oxidation, ammonium ion, nitrates, nitrites, sulphates, chlorides, phosphates, sodium, iron, manganese, and oil products. The plan shall be prepared in the site design process and shall be agreed with Danube River Basin Directorate and EEA.



1- drilling Ø 295 mm; 2- tube cementing; 3 - clay pad; 4 - PVC tubes and filters Ø 140 mm; 5- gravel pack; 6 - steel carrier Ø 180 mm

FIGURE 2.6-4 LITHOLOGIC CROSS-SECTION AND TYPE STRUCTURE AT THE MONITORING POINTS OF TPP SOFIA-EAST SITE

2.6.3 SOIL MONITORING

The monitoring of soils at TPP Sofia site is performed at three points **Figure 2.6-5.**

- → Point 1 - beside the WWTP large drying bed;
- → Point 2 - beside the mazut unloading platform and the mazut tanks;
- → Point 3 – by the chemical department beside the Na OH and H t_2SO_4 tanks.

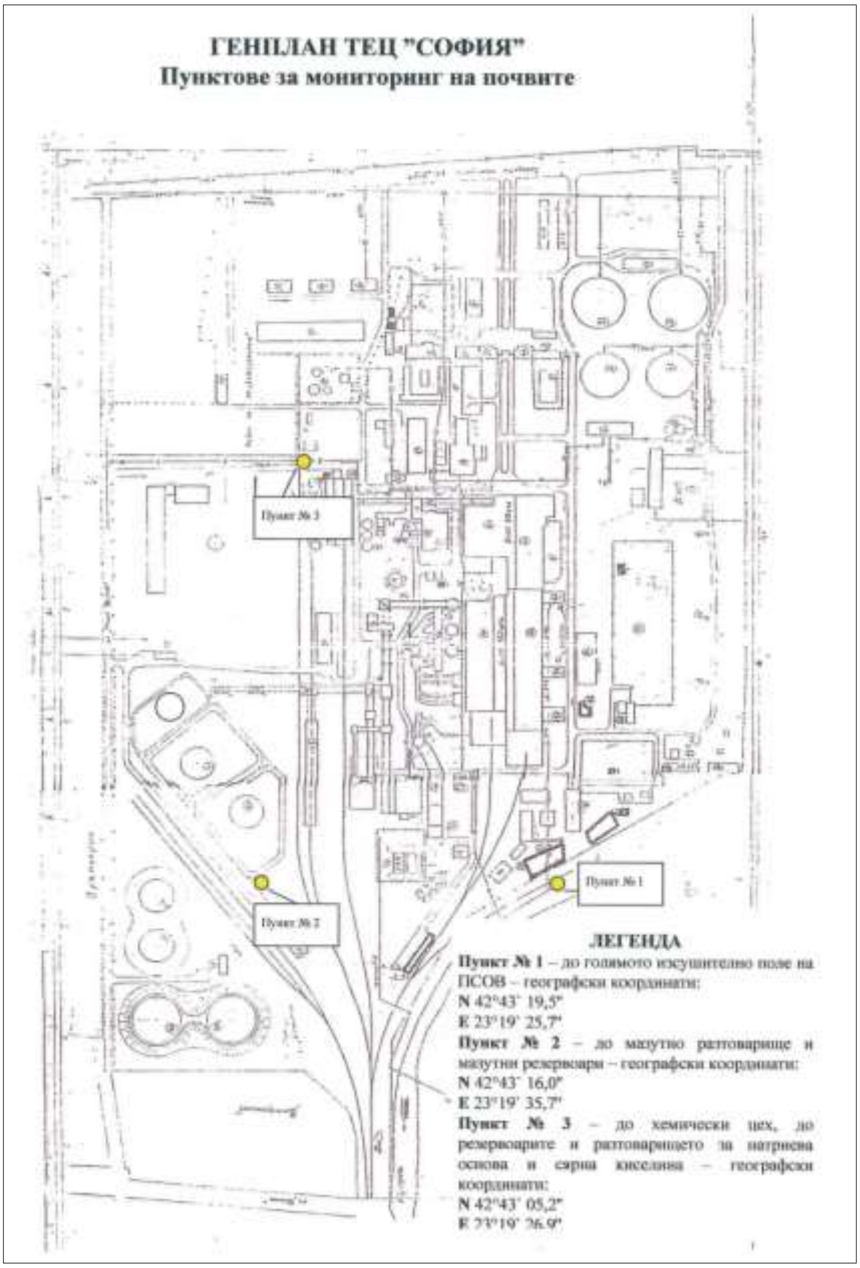


FIGURE 2.6-5 SOIL MONITORING POINTS AT TPP SOFIA SITE

Monitoring of soils is performed at the sites of TPP Sofia and TPP Sofia-East In the operation of the IP plant the data from monitoring at TPP Sofia site will be used. The very installation site is covered with concrete and in the following design stages the possibility to set an additional soil monitoring point will be specified.

2.6.4 MONITORING OF WASTE AT TPP SOFIA AND TPP SOFIA-EAST SITES

Monitoring of waste is performed at the sites of TPP Sofia and TPP Sofia-East and the waste is efficiently managed in accordance with all regulatory requirements.

It necessary to monitor the quality and quantity of waste - both of the waste received as raw material for utilisation and the process waste generated by the new plant.

For the new plant reporting of the amount of waste generated is envisaged - by type and respective characteristics, quantity of waste for temporary storage, and for delivery to companies for further treatment. Documentation and waste management is envisaged in conformity with all applicable requirements of the regulations in force.

The waste generated in the course of plant operation will be monitored for:

- waste and so called process waste - slag - non-hazardous waste, and hazardous waste - fly ash and boiler dust.
- all other waste generated at the site - construction waste, MSW, hazardous and non-hazardous waste from the production.

2.6.5 NOISE MONITORING

The noise levels at the sites of TPP Sofia and TPP Sofia-East are regularly checked. The noise load of work environment is measured. The noise factor in the work environment and natural environment will be monitored in the service period.

2.7 STAGES OF INVESTMENT PROPOSAL IMPLEMENTATION

The investment proposal includes provisional stages:

- construction,
- operation, and
- post-operation (decommissioning); those stages partially overlap in time.

The plant will be constructed according to designs approved in conformity with the requirements of Bulgarian legislation - complying with construction, technical, fire protection, sanitary and environmental norms and standards as well to the best available practices.

A construction programme will be developed for the carrying out of the different types of works.

2.7.1 CONSTRUCTION PERIOD

The basic civil works connected, with the construction of the plant, are

- earth works - tracing the building lot, removal of the humus layer and its temporary storage within the site; excavation works for forming the foundations and the vertical planning; connecting the site to the existing in-company transport network and the underground infrastructure; rehabilitation of adjacent areas - in case damaged in the course of civil works;
- general construction works (shuttering, reinforcement, casting of concrete, etc.);
- assembly works;
- equipment - assembly of all necessary installations; and preparation for performing the necessary technological tests.

2.7.2 COMMISSIONING

After the main production facilities are built, they have to be tested in order to guarantee their safety, integrity and the readiness of the plant for operation.

The plant will be operated in accordance with the requirements of Bulgarian legislation and internationally accepted standards. During operation regular maintenance and monitoring will be performed, from the main control room located in the building. A full set of redundant emission control systems is envisaged so that if a system fails for a certain admissible period, it will not be necessary to stop the incineration process.

Through the Control and Monitoring System (CMS) all processes and components will be controlled and monitored and automatic operation of the RDF utilisation plant will be maintained.

2.7.3 SERVICE PERIOD

The service life of the plant is minimum 30 years. All necessary measures will be undertaken for high-quality operation of the plant and of the safety systems, including additional services to guarantee high quality transport service (RDF delivery and transportation of waste from the operation).

2.7.4 DECOMMISSIONING

Alternatives for decommissioning the plant installations are: - Preservation of the building and dismantling of some of the installations; - Dismantling of all installations; - Clearing out of the site; - Ground base recovery and recultivation.

Monitoring the environment parameters connected with post-operation maintenance of the plant site will be performed according to the Plant Control and Monitoring Plan, which is an integral part of the integrated permit.

The ways to engage stakeholders in the later project stages have not been definitely determined yet but they are expected to include:

Publishing the final EIA report in the website of Toplofikatsia Sofia EAD;

Informing regularly the population affected by the project about the progress of the the stages of project implementation, particularly about construction works and respective schedules; and Development and publication of a complaints mechanism, which will be maintained continuously.

3 INVESTIGATED LOCATION OPTIONS AND/OR TECHNOLOGY OPTIONS AND REASONS FOR THE INVESTIGATION CHOICE MADE, TAKING INTO CONSIDERATION THE IMPACT ON THE ENVIRONMENT, INCLUDING ZERO ALTERNATIVE

3.1 ZERO ALTERNATIVE

"Zero alternative"is non-implementation of the investment proposal for construction of a waste-to-energy plant utilizing RDF. In that case the existing situation will continue, and the new MBT plant (currently under construction at the MSW landfill for Sofia municipality, Sadinata site, the village of Yana) producing modified solid fuels derived from waste (RDF) will not have where to send that fuel for utilisation.

With zero alternative the produced RDF in quantity about 180,000 t/y will have to be disposed back in that landfill (*if no other utilization is envisaged*). So instead of closing the MSW utilization cycle in Sofia municipality, unplanned capacity of the landfill will have to be used for disposal of the RDF prepared for incineration.

Zero alternative means also **not using the opportunity** to replace a portion of the natural gas used in Toplofikatsia Sofia with **a new and alternative energy source (RDF),** which would make energy production in Sofia less dependent on imported gas.. Currently the thermal energy in the district heating system of Sofia is generated entirely from burning of natural gas, namely: by two cogeneration power plants, producing heat and electricity - TPP Sofia and TPP Sofia-East; by two heating plants - "Zemlyane"and "Lyulin", and two other temporary and small heating plants. Using one of the two possible options for location of the IP project, an RDF utilization plant, will enable one of the two big power plants producing heat and electricity to start operating partially on a new and alternative energy source (RDF), and to replace some of the old installations of Toplofikatsia Sofia, some of which are over 50 years old.

The construction of a plant for utilization of modified solid fuel (RDF) is therefore **if high priority** both for Sofia Municipality and for Toplofikatsia Sofia . The RDF utilisation plant will be **a part of the modern solution for waste management** in Sofia municipality and in that way the municipality will meet the strictest requirements regarding waste management. If a cogeneration plant utilizing RDF is not built, that will make it impossible to solve in an appropriate and timely manner the waste management problems in Sofia municipality and will lead to problematic situations connected with exhausting the capacity of the landfill.

The implementation of the RDF utilisation plant project is in line with the priorities of EU policy in the area of waste management, specified in the new Framework Directive 2008/98/EC, based on the principle of five-stage waste management hierarchy: waste minimisation, re-use, recycling, recovery (for example energy generation, like in this case) and disposal

The long-term goal of EU is to make European society a recycling society, striving to minimize waste generation and increase its utilization as a resource, and this is precisely such a case. Waste recycling and recovery is of highest priority in the waste management hierarchy, and the effects on the environment, on the economy and on people are evaluated at European level.

EU regulatory framework and the practice of the member states require that the rules are applied in EU policy.

Waste management policy uses a five-stage hierarchy for waste management. Highest priority is given to waste prevention, next come preparing for re-use, recycling, recovery and disposal. Waste recycling and utilization is of highest priority in the hierarchy. Using waste as a resource is an option for its sustainable management, and the implementation of this IP is considered an opportunity to attain the set goals.

3.2 ALTERNATIVE OPTIONS FOR THE INVESTMENT PROPOSAL IMPLEMENTATION ACCORDING TO THE BEST AVAILABLE TECHNIQUES

3.2.1 ALTERNATIVE TECHNOLOGY OPTIONS

The basic technologies for thermal treatment of waste in incineration installations are the following: grate incineration, rotary furnace,boiling layer, pyrolysis and gasification, but not all incineration technologies are suitable for treating all types of waste (like for example hazardous waste from waste water treatment plants, etc.) Only the following thermal treatment technologies have been considered: **grate incineration and boiling layer** as those are considered to be **the most appropriate for treatment of modified solid fuel (RDF)** where municipal solid waste has been pre-treated. Gasification and other similar technologies are not considered developed to a sufficient degree or are still under development for RDF incineration application. The full cycle of energy recovery through incineration includes the following basic systems: - Combustion chamber / boiler; - Turbine/generator; - Ancillary equipment; - Electric systems; - Monitoring and control system; - Building structures, etc. The options for choosing of a boiler (horizontal or vertical) are not alternative technologies but different technological solutions connected with equipment operation particularities (maintenance, contamination, cleaning, corrosion, steam feeding, etc.)

Option No.1 Grate incineration, which is envisaged in the investment proposal of Toplofikatsia Sofia EAD and described under section 2.1. Description of the grate incineration process

Option No.2 Incineration in a boiling layer - considered as an option alternative to the technology described under section 2.1.

3.2.1.1 CHOICE OF INCINERATION TECHNOLOGY

An analysis has been made in the investment proposal and **grate incineration technology has been chosen** because of the reasons described in detail in section **2.1**.

- → Lower quantities of fly ash - hazardous waste, when **grate incineration technology** is used, compared to boiling layer technology.
- → A higher risk of faults / corrosion of the boiler with boiling layer technology.
- → The boiling layer technology is less frequently used for RDF compared to the grate incineration technology.
- → The boiling layer technology is not so flexible for RDF of less pre-treatment and that makes such an installation less flexible in case of fuel content changes in future.
- → The expected calorific value of RDF (13 GJ/t) is in a range appropriate for the application of grate installations, as with them the limit value is approximately 16 GJ/t.
- → The expected ash contents (15-20 %) is in an appropriate range, above the critical level for grate installations - which is around 10 %.

An evaluation of the best available techniques (BAT) is given in **Appendix 12.2**, prepared according to the requirements of art.99a, paragraph 1 of EPA (amended SG No. 103 of 09.12.2009)

3.2.2 ALTERNATIVE OPTIONS FOR THE LOCATION OF THE INVESTMENT PROPOSAL SITE

3.2.2.1 SITE LOCATION OPTIONS

When choosing the site the installation components have been considered as well as their situation within the site: - electronic scales, unloading hall, bunker, turbine room (condenser room, pump room), mechanical rooms, stack, workshop, and temporary storage of raw materials and waste. The availability of access roads has been taken into account (the parameters of roads, radii etc.) enabling service by heavy and light vehicles.

The following main criteria have been determined, in agreement with Toplofikatsia Sofia , for the selection of the site:

1. Efficient use of RDF for thermal energy and electricity cogeneration;
2. Suitability of the site in size, including access road, possibility for expansion, etc.;
   - → Meeting of the regulatory requirements/criteria;
   - → Restrictions regarding the height of buildings and building density;
   - → Administrative restrictions as regards land use;
   - → Land ownership;
   - → Compliance with the requirements regarding emissions into the ambient air and noise in residential areas and residential buildings in the vicinity of the site;
3. Impact on local transport;
4. Modes for RDF transportation;
5. Cost of transportation of the waste from the production;
   - → Hazardous waste treatment costs;
   - → Non-hazardous waste treatment costs;
   - → Treatment of the waste water of each of the sites;
6. Costs for site preparation and building up;
7. Risk of opposition by the population; Based on the specified main criteria only two sites have been chosen (in a working meeting of the managing committee on 26.07.2013 in Toplofikatsia Sofia EAD) - each site in two different TPPs, namely:
   - → **TPP Sofia with site „B”** as the main site; and
   - → **TPP Sofia-East with site „B”** as an alternative site.

3.2.2.1.1 MAIN SITE - TPP SOFIA (SITE „B”)

TPP Sofia supplies heat to the district heating area "Sofia"", covering the central and the north-east part of the city. The plot of TPP Sofia is in the northern part of Sofia city, in Zadgarov Rayon industrial area, 6 Istoria Slavyanobalgarskaya St., and has total area of 334,945 m^2. Site "B" is in the western section of the plot and its area (around 15 daa) is sufficient for situating the installations and equipment - **Figure 3.2-1**.

Land status - the suggested plot is a part of the existing power plant, and the land is intended for "industrial" use;

Building of industrial installations is allowed and no land use change procedure will be necessary for the concrete site;

Geological and hydrological parameters - The hydrological conditions in Sofia are characterized by presence of subsoil (non-pressure) water and pressure ground water in the upper aquifer of pliocene layer. The water level measured at TPP Sofia site is 10.5 m below the surface. The expected fluctuation of the water level in different seasons is ± 1,80m.

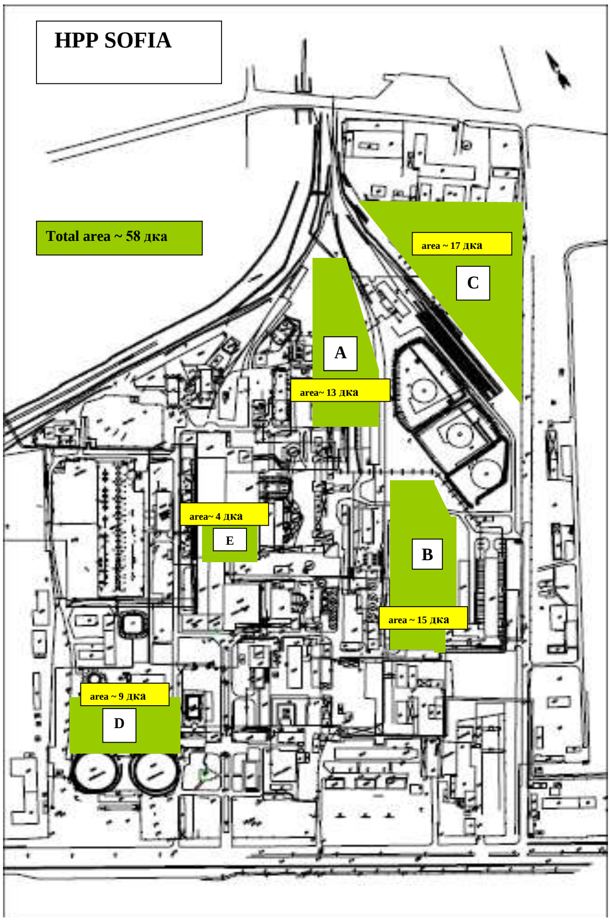


FIGURE 3.2-1 LOCATION OF THE SUGGESTED SITES WITHIN THE TERRITORY OF TPP SOFIA, INCLUDING THE SELECTED MAIN SITE "B"

Power supply - the transformers installed, through which power is supplied for the needs of TPP Sofia, are connected to the national electricity system. The connections to the national grid are: 6.3 kV with 11 power lines of MV buses; 35 kV by overhead lines to N.Kolev substation; 20 kV by one overhead line to a substation of the power supply company; 110 kV with four terminals with one cable to G. Dimitrov substation and three overhead lines to Kurilo substation; 220 kV with two overhead lines to Bobov Dol substation and Stolnik substation. The switchboards in TPP Sofia are: Main switchboard 110 kV; 220 kV; switchboards 20 kV; 10 kV and 6.3 kV.

Water supply to the site - water supply for industrial needs from the main industrial water conduit for Sofia. Water abstraction is from Pancharevo lake near Sofia. The water supply is by means of industrial water main in Nesho Bonchev St. The reserve option to supply water for technical needs in emergency cases is by the city's drinking water supply system The maximum possible water supply is Q = 250 m^3/h.

Connection to the city's sewerage system - There is a functioning waste water treatment plant for treating industrial waste water (chemically polluted water, oiled water); blackwater and sewage are collected in a 10m^3 tank, cooling water and rainwater. The waste water, on one flow, is discharged into the city sewerage system (connection of the local WWTP over Suhodolska river).

Heat supply network - Heat supply to users is through heating mains I, II, III, IV and V for heat supply to the respective district heating areas. A separate industrial heating main supplies heat to the North Industrial Area, where industrial users are located.

Access for transport – access is possible by the existing road network. The main entrance is from the south-west from 202 St., the freight entrance is from the north-east from Nesho Bonchev St.;

railway entrance from the north, with three tracks, for supply of mazut (alternative reserve fuel) in Parva Balgarska Armia St. The railway line is the site's connection to the national railway network.

Necessary preparatory activities – demolish a part of the existing infrastructure; move two hot water pipelines.

3.2.2.1.2 TPP SOFIA-EAST SITE (SITE B)

TPP Sofia-East is located in the eastern part of Sofia city and provides thermal energy for Sofia East district heating region. The plot of TPP Sofia-East is within Gara Iskar industrial area and has a total area of 319,692 m^2 Site "B" is close to the railway line and its area (around 20 daa) is sufficient for situating the installations and equipment - **Figure 3.2-2**.

Land status - the suggested plot is a part of the existing power plant, and the land is intended for "industrial" use; no land use change procedure is necessary. Geological and hydrological parameters - The hydrological conditions in Sofia are characterized by presence of subsoil (non-pressure) water and pressure groundwater in the upper aquifer of pliocene layer. The piezometric level of groundwater pressure has been measured at 6.60 m from the terrain.

Gas supply - the connection to the gas supply network (gas being the basic fuel) is a 6.3 km pipeline from gas-distribution station Kazichene, through the gas distribution point in the site of TPP Sofia-East.

Power supply - the connection to the electricity distribution grid is through TPP Sofia-East substation, 110 кV. There is a connection to a local electricity distribution system 6.3 kV. By means of 6/110 kV transformer and an open distribution system of 110 kV electricity is transmitted to the national electricity system. The own consumption of consumers is 6 kV as well as 0.4 kV.

Water supply to the site - water supply for industrial needs is by the main industrial water conduit of Sofia city, from Pancharevo lake near Sofia. Water is treated in a local WWTP. Fresh water is supplied by the city water supply network for drining water. For industial needs that source is used only in emergency cases.

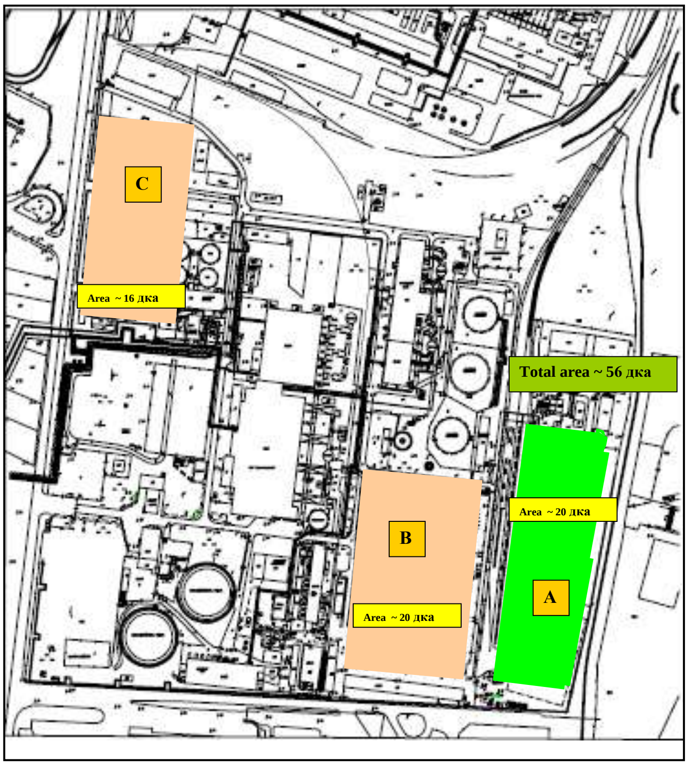


FIGURE 3.2-2 LOCATION OF THE SUGGESTED SITES WITHIN THE TERRITORY OF TPP SOFIA-EAST, INCLUDING THE SELECTED ALTERNATIVE SITE "B"

Connection to the city's sewerage system - waste water is treated in the local WWTP and discharged in the city's sewerage system through main collector station No.2 of WWTP Kubratovo, Sofia. Industrial waste water is led to the local WWTP by means of three separate technological pipelines. After treatment to a required degree they join and discharge water into the city's sewerage system. There is no rainwater collection system at the site.

Heat supply network - The connection to the heat distribution system is via network substation TPP Sofia-East, supplying heat to Sofia-East heating region.

Access for transport – access is possible by the existing road network. The access road is connected with the main road to the city. A railway line connects the site with the railway natwork.

Necessary preparatory activities – demolish a part of the existing infrastructure; in site ""B" it is necessary to demolish the old mazut reservoirs, which creates difficulties for the IP implementation.

4 DESCRIPTION AND ANALYSIS OF THE COMPONENTS AND FACTORS OF THE ENVIRONMENT UNDER ART.4 AND ART.5 AND OF THE TANGIBLE CULTURAL HERITAGE, WHICH WILL BE SIGNIFICANTLY AFFECTED BY THE INVESTMENT PROPOSAL, AND THE INTERACTION BETWEEN THEM

4.1 AMBIENT AIR

4.1.1 BRIEF DESCRIPTION AND ANALYSIS OF THE CLIMATIC AND METEOROLOGICAL FACTORS RELATED TO THE SPECIFIC IMPACT AND ATMOSPHERIC AIR QUALITY

4.1.1.1 TPP SOFIA

The climatic characteristics of the area where **TPP Sofia** is located are determined by the fact that the area belongs to the climatic region of the highlands in the central part of Western Bulgaria, within the temperate continental sub-region of the European continental climate region. According to the division of Sofia and Sofia valley into micro-climate areas the TPP is in the central area of the city.

The latitude and altitude of the area determine the considerable annual amplitude of the flow of solar radiation, and that determines two seasons differing in temperature - winter and summer, and the transitional seasons of spring and autumn. As a result of that the average air temperature amplitude is 9,2°C, at average annual temperature 10.5°C. Winter is relatively cold (the average minimum and maximum temperatures for January are -4.8°C and +1.5°C). Precipitation is lowest in winter (110 - 120 mm). Spring comes early - in the end of February - beginning of March (the average minimum and maximum temperatures for April are +5.6°C and +16.2°C). Spring precipitation is medium in quantity (170 - 180 mm). Summer is warm and humid (average minimum and maximum temperatures for July - +15.5°C and +26.5°C). Summer precipitation is relatively high (190 - 200 mm). Autumn is warm, with first colds towards the end of October and the beginning of November (average minimum and maximum temperatures for November - +3.0°C and +9.8°C). Autumn precipitation is also low (130 - 140 mm). The highland valleys in the central part of Western Bulgaria are favourable for the formation of temperature inversions, and the greatest number of temperature inversions is registered in winter and autumn. The average number of days with ground inversions at night is between 12-13 in February - March and 21-22 in July - August, but the height of the upper line has a reverse progress with a maximum of 960 – 970 m in November - January and a minimum of 820 – 840 m in June - August.

Sunshine duration is one of the main factors regulating the energy conditions in the ground surface - atmosphere system. The region is characterised by annual sunshine duration of 2,021 hours, which is quite high for Bulgaria, and total annual solar radiation around 5100 MJ/m^2. The cloud cover has a maximum in December and January (average 7.1 oktas) After the winter maximum the cloud cover - total and low - decreases and has a minimum in August, mostly of low cloud cover.

Precipitation patterns are of the major factors influencing the self-cleaning of atmosphere. The region is characterised by relatively high annual amount of precipitation - 591 mm. Precipitation is not uniformly distributed in time; the annual course has its maximum in summer - 195 mm and spring - 170 mm, and minimum in winter - 110 mm and autumn - 130 mm. The precipitation minimum is in the end of January, and the maximum - in the end of May and the beginning of June.

Air humidity is kind of criterion by which we could judge about the conditions for air impurities dispersion. The air in Sofia valley is driest in August - 61 %,a nd most humid in December - January - 84 %. The average relative humidity of air is 70 - 78 %, and noon humidity - 40 - 45 %.

The annual wind rose, representative for the area of **TPP Sofia**, is given in **Figure 4.1-1**.

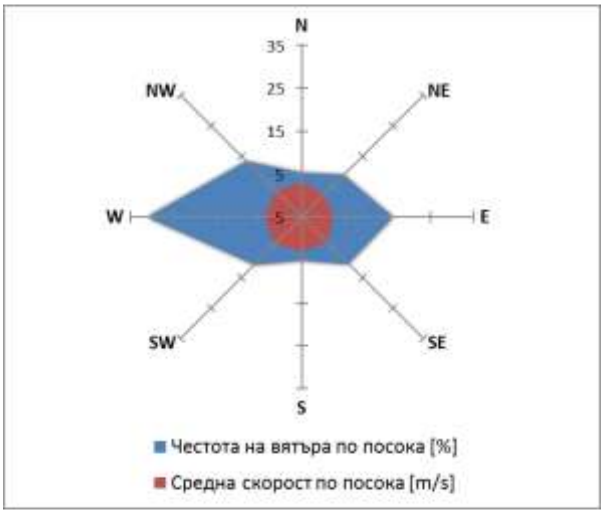


FIGURE 4.1-1 WIND ROSE REPRESENTATIVE FOR THE AREA OF TPP SOFIA CALM WEATHER 49.1 %

The weather is calm (wind speed up to 1 m/s) in 49.1 % of the time. In **Figure 4.1-1** the prevailing zonal transfer (west to east) of wind is easily seen. Higher frequency of north winds is typical for the north-west part of Sofia valley.

Strong winds (speed over 12-14 m/s) are typical of spring and autumn and blow from west - north-west direction.

Pollution potential means the frequency of cases when wind speed is up to 1 m/s. It is expressed in figures from 1 to 100. The pollution potential is considered high when the frequency of light winds is between 75 % and 100 %, and low - when that frequency is between 0 % and 25 %. Pollution potential 25÷50 is medium, and 50÷75 - medium high.

For the area of **TPP Sofia** the pollution potential can be considered **medium high** rather than **medium**.

4.1.1.2 TPP SOFIA-EAST

According to the micro-climate zoning of Sofia and Sofia Valley **TPP Sofia-East** is in the high area micro-climate zone of the suburban area. In its location as well as its micro climate the area where the plant is located is the boundary between the open valley and the city downtown.

Winter here is milder than in the open valley. The average monthly temperature for January is between -1.5 and -2.0°C; the average of the absolute minimum temperatures ranges between -16 and around -18°C. In some very cold winters after cold air passage in conditions of anticyclone and clear sky air temperatures may go down to -26 or -28 °C.

A condition for accumulation of pollutants in the air is the fact that fog periods are frequent and prolonged, and for this region that is to a large extent due to the vicinity of Iskar river. Fogs form mostly in the cold part of the year, as the ground surface becomes very cold, the temperature of air near the ground falls and water steam condenses. As the main factor for fog formation here is radiation cooling, the maximum of fogs is in November, December and January, and minimum (complete absence) is in warm summer months. Fogs lasting for more than 24 hours are typical for the winter period.

On the average foggy days are 32.6 per year, of which 30.5 days are in winter months - November to February. The fog maximum (8.3 days) coincides with the maximum of relative humidity (in December) and is a month before the average temperatures minimum (in January).

The area is open to Vitosha mountain and favours the occurrence of Foehn wind. On the average there are 5-7 days with Foehn wind in the year; that is a strong and gusty wind which causes warmer weather and lower air humidity in a short time. Such wind is most frequent in the end of winter and beginning of spring - February, March.

Summer is warm, the average temperature in July is 19-20°C. Absolute maximum temperatures here are a little lower than those in the city centre area - 37-39°C.

Precipitation patterns have well expressed maximum in the end of spring and beginning of summer. Precipitation is highest in June, in which the average monthly quantity is around 88 mm. The driest period is in the end of summer and beginning of autumn. The precipitation minimum is in August, when the average precipitation amount is around 32 mm. The total annual precipitation is close to that in the other urban areas and is 550-600 mm.

The annual wind rose, representative for the area of **TPP Sofia-East**, is given in **Figure 4.1-2**.

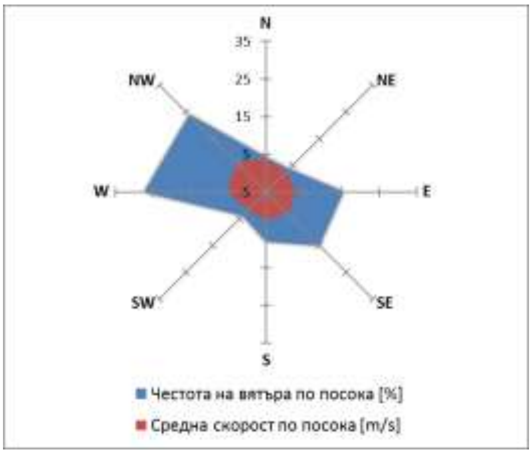


FIGURE 4.1-2 WIND ROSE REPRESENTATIVE FOR THE AREA OF TPP SOFIA-EAST CALM WEATHER 31.1 %

The weather is calm in 31.1 % of the time. **Figure 4.1-2** shows a modified zonal transfer of wind - the west winds blow from the north-west, and the east winds have also a southern component. Higher frequency of winds from the south is typical for the south-east part of Sofia valley.

The pollution potential for the area of **TPP Sofia-East** is **medium.**

4.1.2 AVAILABLE DATA ABOUT AIR POLLUTION IN THE AREA OF THE SITE SENSITIVE ZONES

In the meaning of Ordinance No.12 as regards the norms of sulphur dioxide, nitrogen dioxide, fine dust particles, lead, petrol, carbon oxide and ozone content in atmospheric air (SG No. 58 of 30.07.2012) the major indicators, characterizing the quality of atmospheric air in the layer closest to the ground, are the content levels of:

1. fine dust particles;
2. sulphur dioxide;
3. nitrogen dioxide and/or nitrogen oxides;
4. carbon oxide
5. ozone;
6. lead (aerosol)

4.1.3 AIR QUALITY STANDARDS

Directive 2008/50/EC on ambient air quality and cleaner air for Europe establishes a framework for air quality evaluation at EU level, repealing and replacing the previous air quality directive (96/62/EC) and the three specific ("daughter") directives (1999/30/EC, 2000/69/EC, 2002/3/EC), and Council Decision 97/101/EC.

Directive 2008/50/EC is supplemented by Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

In Bulgarian legislation those directives have been transposed in Ordinance No.11 of 14 May 2007 on the limit values of arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons in ambient air and Ordinance No.12 of 15 July 2010 on the limit values of sulphur dioxide, nitrogen dioxide, fine dust particles, lead, petrol, carbon oxide and ozone content in the ambient air.

Table 4.1-1 and **Table 4.1-2** provide a summary of the air quality standards according to above two directives and the national legislation.

TABLE 4.1-1: LIMIT VALUES FOR PROTECTION OF HUMAN HEALTH

Pollutant	Concent-ration	Amount	Averaging period	Permissible exceeding	Lower threshold	Upper threshold
LIMIT VALUE						
$PM_{2.5}$	20	μg/m^3	1 year	-	12	17
Sulphur dioxide (SO_2)	350	μg/m^3	1 hour	24	-	-
	125	μg/m^3	24 hours	3	50	75
Nitrogen dioxide (NO_2)	200	μg/m^3	1 hour	18	100	140
	40	μg/m^3	1 year	-	26	32
PM_{10}	50	μg/m^3	24 hours	35	25	35
	40	μg/m^3	1 year	-	20	28
Lead	0.5	μg/m^3	1 year	-	0.25	0.35
Carbon oxide (CO)	10	mg/m^3	Max 8 hours average	-	5	7
Benzene (C_6H_6)	5	μg/m^3	1 year	-	2	3.5
TARGET VALUE						
$PM_{2.5}$	25	μg/m^3	1 year	n/a	-	-
Ozone	120	μg/m^3	Max 8 hours average	25 days average for 3 years	-	-
Arsenic (As)	6	mg/m^3	1 year	n/a	2.4	3.6
Cadmium (Cd)	5	mg/m^3	1 year	n/a	2	3
Nickel (Ni)	20	mg/m^3	1 year	n/a	10	14
Polycyclic aromatic hydrocarbons (PAH)	1 *Concentration of Benzo(a)pyrene*	mg/m^3	1 year	n/a	0.4	0.6

TABLE 4.1-2: CRITICAL LOADS FOR PROTECTION OF VEGETATION AND ECOSYSTEMS

Pollutant	Concent-ration	Amount	Averaging period	Permissible exceeding	Lower threshold	Upper threshold
Sulphur dioxide (SO_2)$_5$	20	μg/m^3	1 year in winter	-	8	12

			(1 Oct - 31 March)			
Nitrogen dioxide (NO_2)	30	µg/m^3	1 year	-	19.5	24

The minister of environment and water, on his initiative or after a proposal by the minister of health or by municipal authorities, can determine additional indicators for certain regions, depending on the type of emission sources and the respective risk to human health.

4.1.4 MEASURED CONCENTRATIONS

4.1.4.1 TPP SOFIA

Representattive for the area of **TPP Sofia** are the measurements for ambient air quality at automatic monitoring station **(AMS) Nadezhda.** The following concentrations have been measured for 2012:

Average annual values of indicator PM_{10}

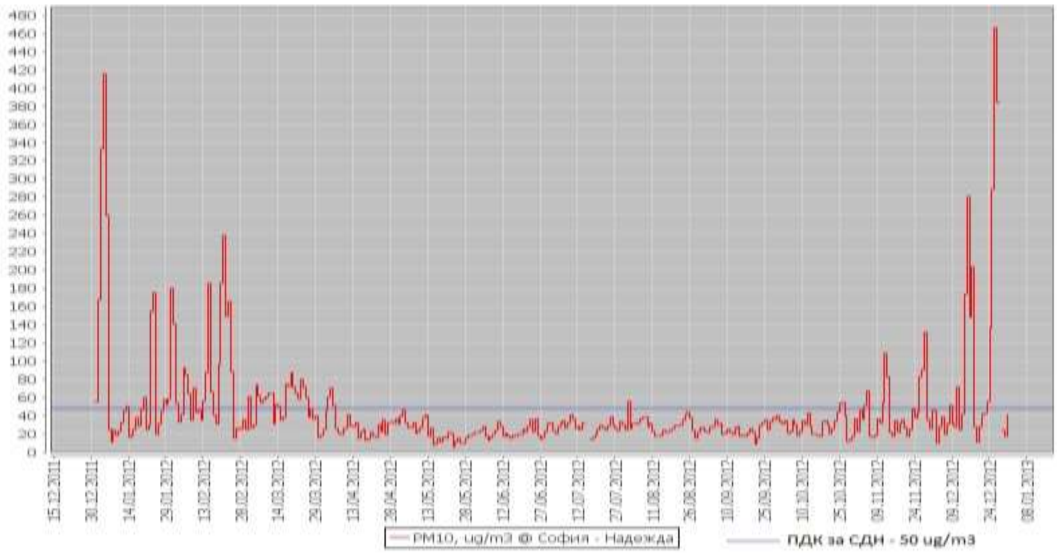


FIGURE 4.1-3 AVERAGE 24-HOUR CONCENTRATIONS OF FINE DUST PARTICLES (PM10) IN 2012 AT AMS NADEZHDA

The average 24-hour concentration for 2012 of PM 10 was 44.67 µg/m^{3}while the limit value is 40 µg/m^3. The number of cases of exceeding the average 24-hour limit values for PM $_{10}$ in 2012, as measured at AMS Nadezhda, is 71 cases of exceeding the ALV24 of 50 µg/m^3 – **Figure 4.1-3**.

The main dust sources are the households, the main roads and construction. The poor cleaning of the street network also influences significantly the amount of present dust.

Average hourly values of indicator sulphur dioxide

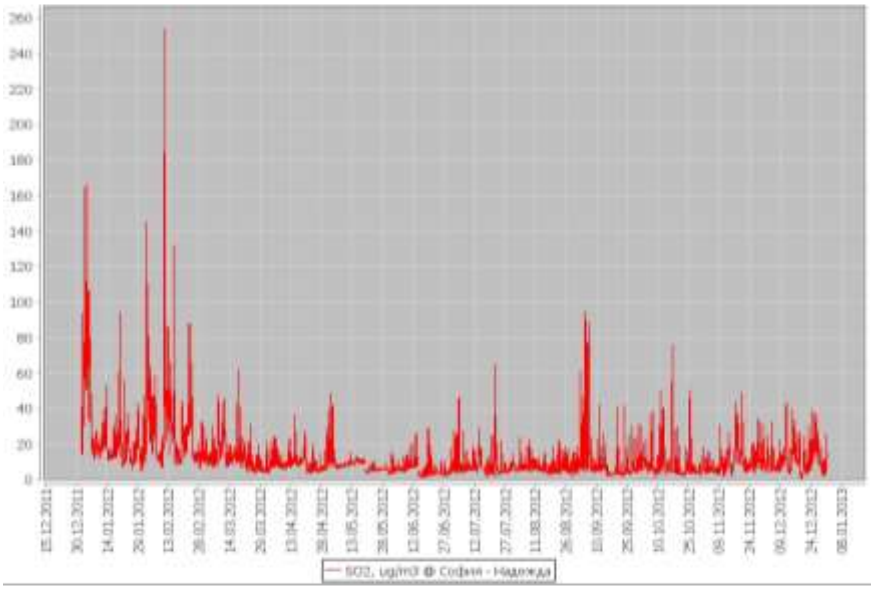


FIGURE 4.1-4 AVERAGE HOURLY CONCENTRATIONS OF SULPHUR DIOXIDE IN 2012 AT AMS NADEZHDA

Average 24-hour values of indicator sulphur dioxide

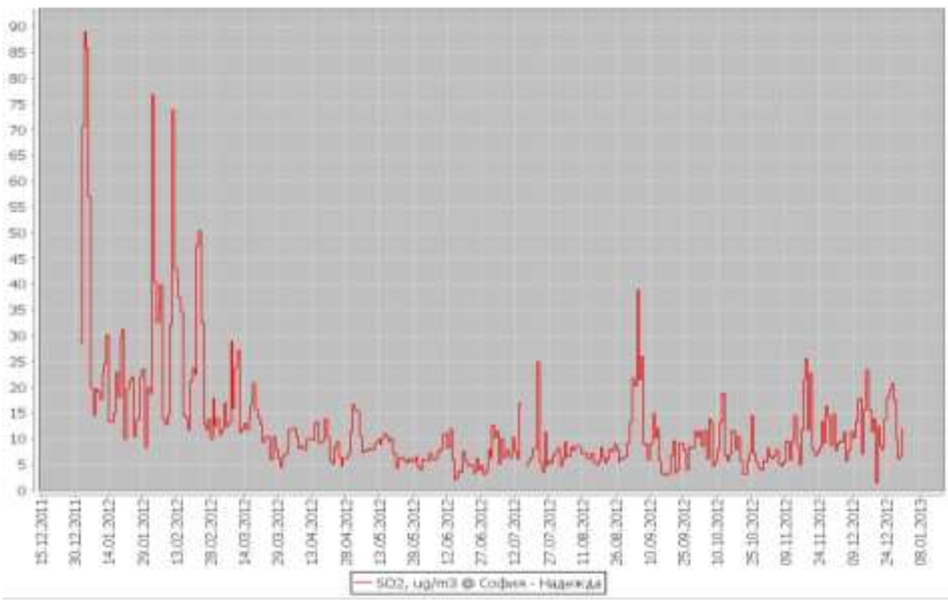


FIGURE 4.1-5 AVERAGE 24-HOUR CONCENTRATIONS OF SULPHUR DIOXIDE (SO_2) IN 2012 AT AMS NADEZHDA

From the figures presented above it is evident that the average hourly and average 24-hour concentrations of sulphur dioxide exceeded the limit values.

Average hourly values of indicator nitrogen dioxide

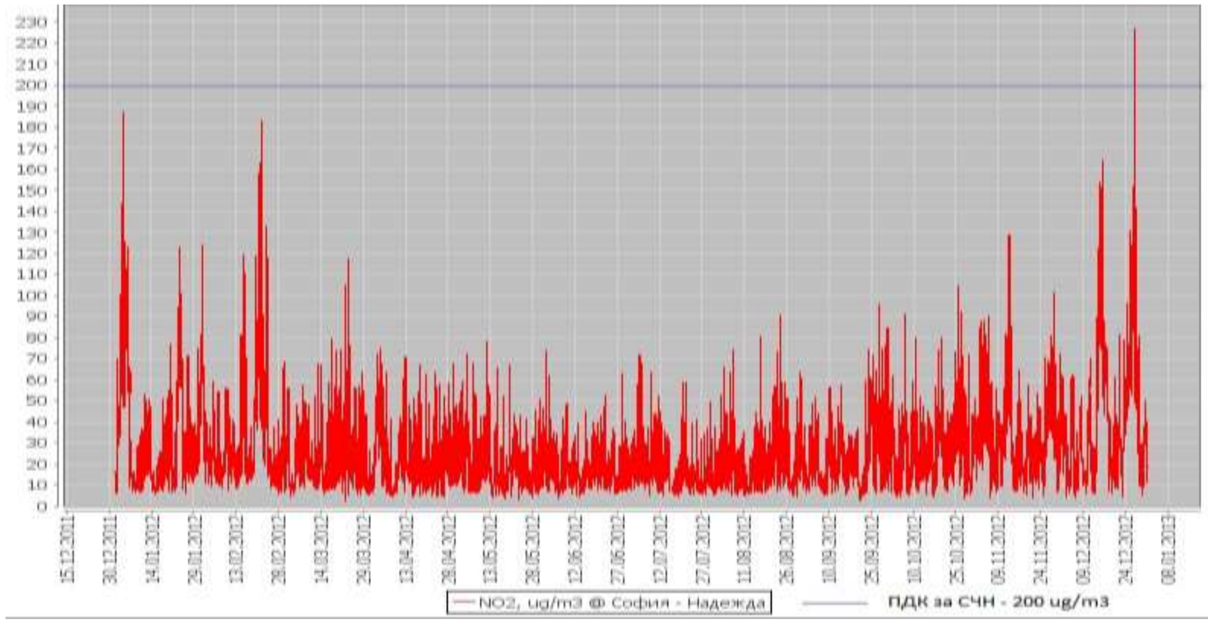


FIGURE 4.1-6 AVERAGE HOURLY CONCENTRATIONS OF NITROGEN DIOXIDE (NO_2) IN 2012 AT AMS NADEZHDA

The average annual concentration of NO_2 for 2012 was 26.02 µg/m^3, the limit value being 40 µg/m^3. The average 24-hour limit value (ALV24) of 200 µg/m^3 has been exceeded on only one day in December.

Average hourly values of indicator ozone

Ozone is a gas found in the upper layers of atmosphere -30-50 km above the Earth surface as well as in the layer closest to the surface. The highest ozone layer has protective functions - protection from UV rays, while in the layer closest to the ground it can have an adverse effect. Ozone is a powerful oxidizer. It is not emitted directly into the atmosphere. It results from the interaction between nitrogen oxides and volatile organic compounds under the influence of high temperatures and sunlight. There are no anthropogenic ozone emissions into ambient air. The natural background levels of ozone in the air are around 30 µg/m^3, but can be also much higher (e.g.. 120 µg/m^3).

Based on observations about the effects of ozone on human health WHO recommends limit one-hour concentration of 150 - 200 µg/m^3, and for eight-hour exposition - 100 - 120 µg/m^3.

The threshold value (average hourly limit value) for population information is 180 µg/m^3, and the population warning threshold (average hourly value) is 240 µg/m^3.

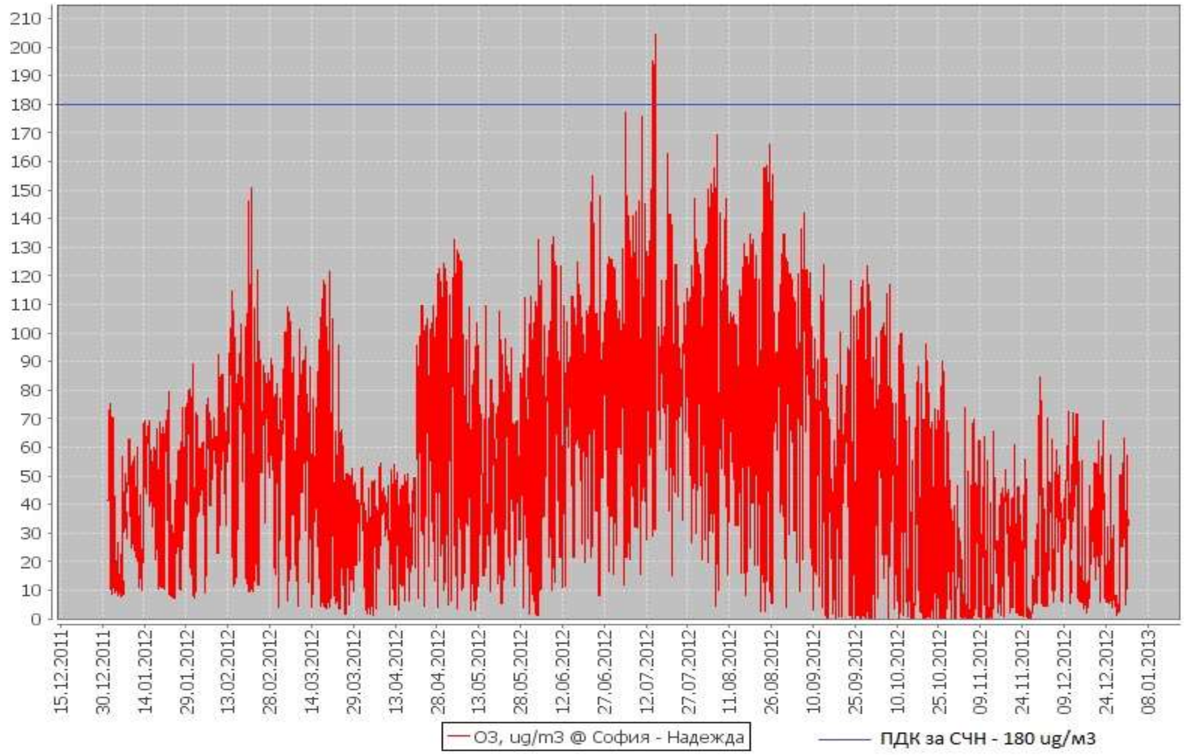


FIGURE 4.1-7 AVERAGE HOURLY CONCENTRATIONS OF OZONE (O_3) FOR 2012 AT AMS NADEZHDA

In the reported period the automatic monitoring stations within the territory of RIEW Sofia have registered exceeding the population information threshold (180 µg/m^3); the exceeding values were registered in August and they have been caused by high temperature and high solar radiation. No values exceeding the population warning threshold (240 µg/m^3) have been registered.

From the presented diagrams it is evident that the variations in pollutants concentrations (except for ozone) in the air layer closest to the ground are considerable in winter months, and that is exactly the heating season. The weather conditions in winter - fog, calm weather, temperature inversions - do not favour dispersion of emissions.

4.1.4.2 TPP SOFIA-EAST

Representative for the area of **TPP Sofia-East** are the measurements for ambient air quality at automatic monitoring station **(AMS) Druzhba.** The following concentrations have been measured for 2012:

Average annual values of indicator PM_{10}

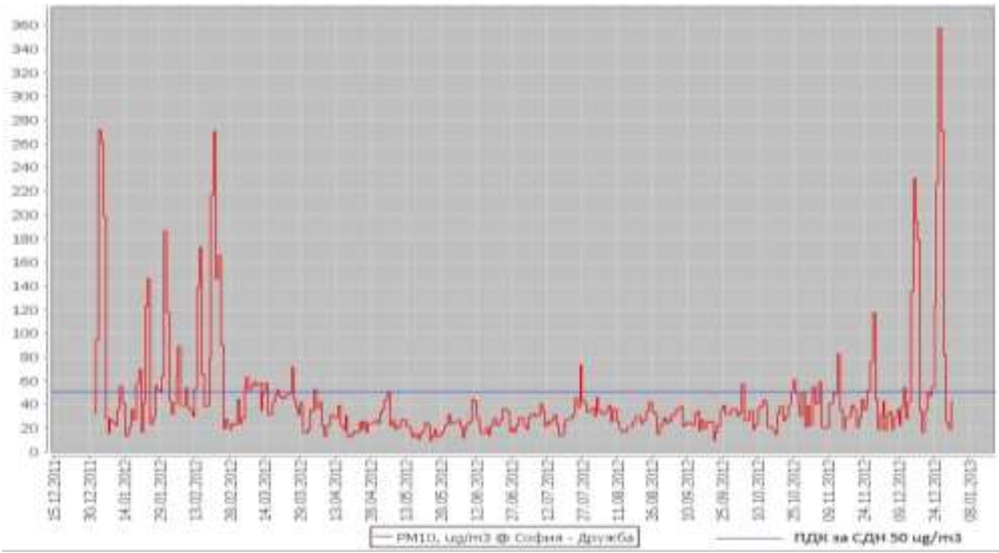


FIGURE 4.1-8 AVERAGE 24-HOUR CONCENTRATIONS OF FINE DUST PARTICLES (ФПЧ$_{10}$) IN 2012 AT AMS DRUZHBA

For 2012 the average annual concentration of PM_{10} is 42.12 µg/m^3 while the limit value is 40 µg/m^3. The number of cases of exceeding the average 24-hour limit values for PM $_{10}$ in 2012, as measured at AMS Druzhba, is 59 cases of exceeding the ALV24 of 50 µg/m^3 – **Figure 4.1-8**.

Average hourly values of indicator sulphur dioxide

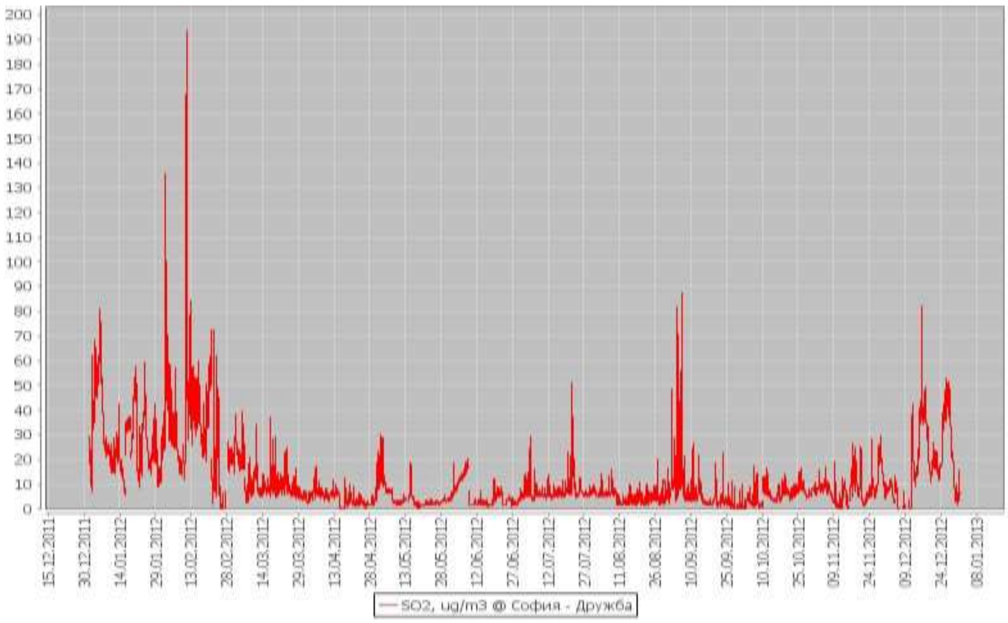


FIGURE 4.1-9 AVERAGE HOURLY CONCENTRATIONS OF SULPHUR DIOXIDE IN 2012 AT AMS DRUZHBA

Average 24-hour values of indicator sulphur dioxide

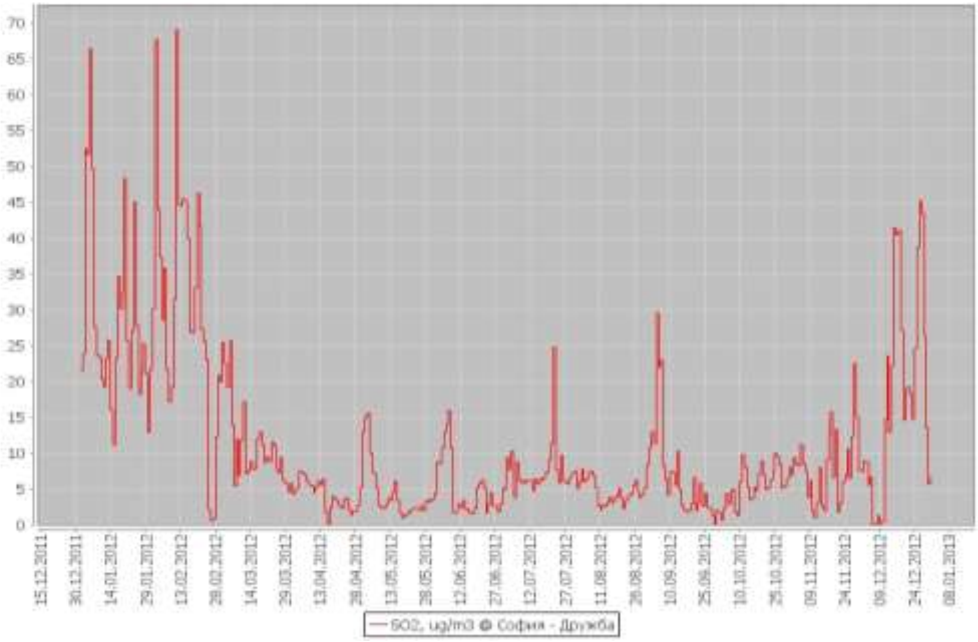


FIGURE 4.1-10 AVERAGE 24-HOUR CONCENTRATIONS OF SULPHUR DIOXIDE (SO_2) IN 2012 AT AMS DRUZHBA

From the figures presented above it is evident that the average hourly and average 24-hour concentrations of sulphur dioxide have not exceeded the limit values.

Average hourly values of indicator sulphur dioxide

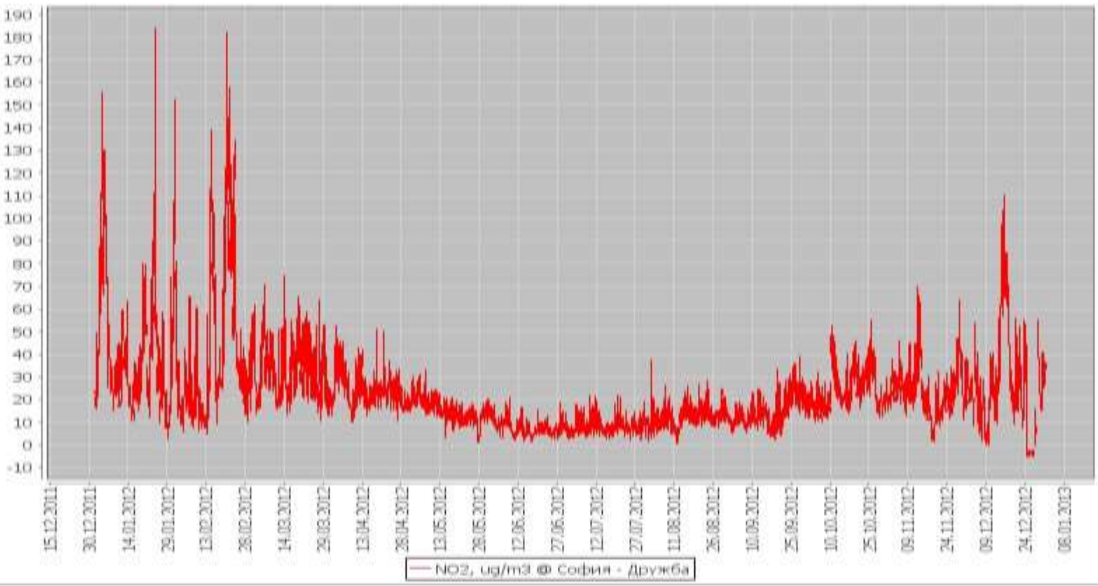


FIGURE 4.1-11 AVERAGE HOURLY CONCENTRATIONS OF NITROGEN DIOXIDE (NO_2) IN 2012 AT AMS DRUZHBA

The average annual concentration of NO_2 for 2012 was 23.07 µg/m3, the limit value being 40 µg/m^3.

Carbon oxide incicator

Carbon oxide is a colourless, odourless, combustible gas, slightly lighter than air. It is one of the most widely spread air pollutants, and is produced by the incomplete burning of carbon-containing substances. The biggest source of carbon oxide is motor vehicles traffic - over 65 % of the total emitted quantity in Bulgaria.

Average hourly values of indicator ozone

Ozone is a gas found in the upper layers of atmosphere -30-50 km above the Earth surface as well as in the layer closest to the surface. The highest ozone layer has protective functions - protection from UV rays, while in the layer closest to the ground it can have an adverse effect. Ozone is a powerful oxidizer. It is not emitted directly into the atmosphere. It results from the interaction between nitrogen oxides and volatile organic compounds under the influence of high temperatures and sunlight. There are no anthropogenic ozone emissions into ambient air. The natural background levels of ozone in the air are around 30 µg/m^3, but can be also much higher (e.g.. 120 µg/m^3).

Based on observations about the effects of ozone on human health WHO recommends limit one-hour concentration of 150 - 200 µg/m^3, and for eight-hour exposition - 100 - 120 µg/m^3.

The threshold value (average hourly limit value) for population information is 180 µg/m^3, and the population warning threshold (average hourly value) is 240 µg/m^3.

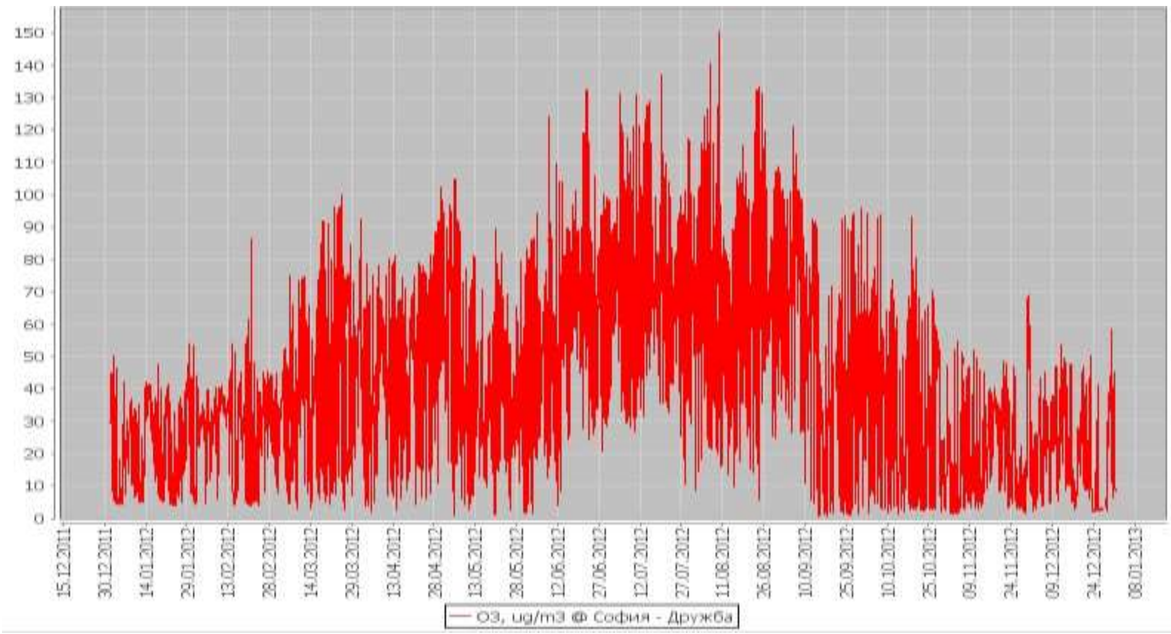


FIGURE 4.1-12 AVERAGE HOURLY CONCENTRATIONS OF OZONE (O3) FOR 2012 AT AMS DRUZHBA

Exceeding neither of the population information threshold (180 µg/m^3) has been registered in 2012 in the area of Druzhba quarter nor of the population warning threshold (240 µg/m^3).

From the presented diagrams it is evident that the variations in pollutants concentrations (except for ozone) in the air layer closest to the ground are considerable in winter months, and that is exactly the heating season. The weather conditions in winter - fog, calm weather, temperature inversions - do not favour dispersion of emissions.

4.1.5 MOTOR VEHICLES TRAFFIC

The ambient air quality (AAQ) in the area of the potential sites within **TPP Sofia** and**TPP Sofia-East** is determined mainly by the gas emissions by motor vehicles in the city thoroughfares close to those plants.

4.1.5.1 TPP SOFIA

Access to the site in **ТЕЦ „София“** is possible by the existing road network, namely from Nesho Bonchev St., which is a crossing of the main thoroughfare in that region - История Славянобългарска St. Data about the vehicle traffic intensity in that street, average for 24 hours, and the traffic specifics is shown in **Table 4.1-3**.

TABLE 4.1-3 AUTOMOBILE TRAFFIC INTENSITY IN ИСТОРИЯ СЛАВЯНОБЪЛГАРСКА ST.

Cars	Buses	Light-duty trucks	Medium-duty trucks	Heavy-duty trucks	Trucks with trailers	TOTAL MV
2,160	200	900	850	560	380	**5,050**

4.1.5.2 TPP SOFIA-EAST

Access to the site of **TPP Sofia-East** is from Dimitar Peshev St. That street is part of the road infrastructure of Iskar district, Sofia municipality. Traffic intensity counting has been done in Dimitar Peshev St. for two weeks, three days a week - on Monday, Wednesday and Friday - in order to find out the spacifics of traffic there. Average data for 24-hour traffic are:

ТАБЛИЦА 4.1-4 AUTOMOBILE TRAFFIC INTENSITY IN DIMITAR PESHEV ST.

Cars	Buses	Light-duty trucks	Medium-duty trucks	Heavy-duty trucks	Trucks with trailers	TOTAL MV
1,530	48	420	420	420	240	**3,078**

The levels of emissions from motor vehicles traffic have been evaluated according to Tier 2 of **EMEP/EEA Air pollutant emission inventory guidebook 2013** regarding basic pollutants from: (a) Passenger cars (**NFR**[5] code **1.A.3.b.i**), (b) Light-duty vehicles below 3.5 t (1.A.3.b.ii), (c) Heavy-duty vehicles up to 32 t, and (d) buses (1.A.3.b.iii) under "Transport" section. Based on that the results from calculating the following emissions are given:

- Ozone precursors - CO, NO_X, NMVOC (non-methane volatile organic compounds),
- Greenhouse gases (CO_2, CH_4, N_2O),
- Acidifying substances (NH_3, SO_2),
- Particulate matter mass - only $PM_{2.5}$ fraction as the higher fraction $2_{.5\div10}$ is neglectfully small in exhaust gases soot.
- Carcinogenic species:
- PAH - polycyclic aromatic hydrocarbons (Benzo (α) pyrene, Benzo (b) fluoranthene + Benzo (k) fluoranthene, indeno (1,2,3-cd) pyrene - for unleaded fuel),
- POP - persistent organic pollutants,
- Toxic substances (DIOX -dioxins and furans; for unleaded fuel)
- Heavy metals.

[5] **NFR** (Nomenclature for Reporting) – nomenclature for reporting the emissions generating processes, which enables full unification and congruence of all national reporting under the Convention on Long-range Transboundary Air Pollution (CLRTAP);before the secretariat of the Framework Convention on Climate Change (UNFCCC) and before the European Environment Agency (EEA).

The following are not covered: fuel evaporation emissions (**NFR** code **1.A.3.b.v**), tyre wear and brake wear (**NFR** code **1.A.3.b.vi**) and road wear (**NFR** code **1.A.3.b.vii**).

The emission load in kilogram per kilometre (kg/km) of traffic in the respective road of the city road network is given in **Таблица 4.1-5.**

ТАБЛИЦА 4.1-5: PRESENT EMISSION LOAD IN KILOGRAM PER KILOMETRE OF THE RESPECTIVE ROAD SECTION (KG/KM)

Road section	CO	NMVOC	NOx	N_2O	NH_3	Pb	$PM_{2.5}$
Istoria Slavyanobalgarska St.	6.631	0.788	11.048	0.036	0.049	1.69E-05	2.73E-01
Dimitar Peshev St.	4.160	0.500	6.588	0.021	0.032	9.94E-06	1.63E-01

ТАБЛИЦА 4.1-5: CONTINUED

Road section	Ideno Pyrene	B(k)F	B(b)F	B(a)P	CO_2	SO_2	benzene	tCO_2eq
Istoria Slavyanobalgarska St.	4.27E-06	1.27E-05	1.22E-05	3.09E-06	1802.68	0.01570	0.0236	**558.83**
Dimitar Peshev St.	2.50E-06	7.27E-06	6.96E-06	1.81E-06	1077.46	0.00976	0.0150	**334.01**

Emissions are discharged directly into ambient air from exhaust pipes of vehicles. The total amount of greenhouse gases expressed in CO_2 equivalent is 558.83 and 334.01 per kilometre of the respective road sections.

4.1.6 DESCRIPTION OF METHODS USED AND RESULTS FROM STUDIES TO DETERMINE THE CURRENT AMBIENT AIR QUALITY

The climatic features of the considered areas have been determined based on information available from the terms of reference, data from the weather stations of the National Institute of Meteorology and Hydrology - BAS, meteorological reference books, data from the current annual weather tables and the Reference Book on the Climate of the Republic of Bulgaria.

The **Regional report on the condition of the environment in 2012** of RIEW - Sofia has been used in describing the ambient air quality (AAQ). The report provides a summary of information on the environment and is prepared in accordance with the requirements of art.22 (3) of **Environmental Protection Act**.

There are 8 points for control of ambient air quality within the territory of SM. The results from two of those points have been used as those two are representative for the areas of **ТЕЦ „София“** and **TPP Sofia-East** - namely AMS Nadezhda and respectively AMS Druzhba.

The main document used in describing the emissions from transport is the **EMEP/EEA air pollutant emission inventory guidebook 2013** developed in support of the Convention on Long-range Transboundary Air Pollution (CLRTAP) and the National Emission Ceilings Directive (**Directive 2001/81/EC** – *NEC Directive*). That guidebook provides expert guidance on how to make an inventory of emissions into the ambient air. The 2013 edition replaces all earlier versions.

4.2 WATER

4.2.1 SURFACE WATER

In both alternative sites there are functioning water supply and sewerage systems. Drinking water is supplied under a contract with Sofiyska Voda AD by the city water supply network; industrial water is supplied by the same operator through the main industrial water conduit for the city of Sofia from Pancharevo lake.

For both sites the city drinking water supply network will be used as an alternative for industrial needs in cases of emergency.

The current scheme of supply of the necessary quantities of drinking waster and industrial water will be maintained for the new plant, by making derivations from the existing water supply networks at the sites.

In both alternative sites there are sewerage networks for blackwater/sewage and for waste water from production. There are no separate rainwater drainage systems. It is envisaged that the existing sewerage networks will be used also for the new plant. The sewerage system is connected to the city's WWTP Kubratovo: for TPP Sofia site - through the left-side Suholol collector, and for TPP Sofia-East site - through the main input collector.

In case of necessity and by the decision of the operator providing water supply and waste water treatment, the contract for water supply and sewerage with Sofiyska Voda AD will be updated in accordance with the regulations and with the integrated permit under EPA after a decision of the competent authority - EEA.

No natural watercourses flow through any of the alternative sites for the IP. The plots envisaged in the investment proposal fall within the following surface water areas[6] according to the first Danube Region Management Plan under the River Basin Management Plan of the Republic of Bulgaria (RBMP).

The main site - TPP Sofia (site B) is within the surface water body of a river within Iskar river valley, under the name Vladayska and code BG1IS500R010. The ecological status of the water body is very poor. The chemical status of the water body is very good.

The alternative site - TPP Sofia-East (site B) is within the surface water body within Iskar river valley, under the name Iskar and code BG1IS500R010. The ecological status of the water body is very poor. The chemical status of the water body is very good.

- Neither of the sites is within sanitary protected areas for drinking water from surface water bodies, according to art.119, paragraph 1, item 1 of the Water Act.
- Neither of the sites is within protected areas according to art.119a, paragraph 1, item 5 of the Water Act - protected areas and zones designated for the protection of habitats and biological species where the maintenance or improvement of the status of waters is an important factor in the protection thereof.
- Neither of the sites is within sanitary protected areas specified under Ordinance No.3 of 16.10.2000 on the conditions and procedure for research, design, approval and operation of the sanitary protections zones around water sources and installations for potable and household water supply and around mineral water sources used for treatment, preventive, potable and hygiene needs.

The main goal of RBMP is to achieve and maintain good condition of water in the Danube river basin under basing management until 2015.

[6] DRBWMD letter Ref. No. 1552/15.11.2013

The goals for protecting the environment and water bodies, and the areas under protection within which IP is, which the measures specified in EIAR take into consideration, and which have been envisaged for preventing and reducing the significant harmful effects on the environment (water) in the design and operation of the IP plant are as follows:

- For the surface water body under code BG1IS5000R010 the environmental goal is "Prevent deterioration of the ecological status, improvement to achieve good ecological status by 2027, maintain and improve the good chemical status".
- For the surface water body under code BG1IS135R026 the environmental goal is "Prevent deterioration of the ecological status, improvement to achieve moderate ecological status by 2021, maintain and improve the good chemical status".

For attaining those goals the RBMP includes sets of measures for preventing and reducing anthropogenic pressure (point pollution sources and diffuse pollution sources) and effects on water resources; monitoring and control measures, including measures concerning water protection zones.

EIAR specifies also measures which have to be observed when implementing the investment proposal and which are envisaged in the programme itself, according to the Basin Directorate's stand, like measures 7.1.5 and 7.1.6, and the investment proposal (IP) is in compliance with measure BG1MS014, which requires optimization of water abstraction for industrial use through the introduction of closed cycles.

4.2.1.1 CHARACTERISTICS OF THE CURRENT SITUATION

4.2.1.1.1 TPP SOFIA SITE

According to the master plan of Sofia the TPP Sofia ground is located in a mixed-type industrial area (part of "Zadgarov Rayon" industrial area)

intended for industrial development, a cemetery and commercial sites. The potential site of the plant is in the western section of the plot of TPP Sofia and its area (around 15 daa) is sufficient for situating the installations and equipment. To the north the TPP site is in immediate vicinity of Suholdolska river.

Water supply to the site - relatively clean water for process needs is supplied through the main industrial water conduit for Sofia. Water abstraction is from Pancharevo lake near Sofia. The water supply is by means of industrial water main in Nesho Bonchev St. The water supply service is provided by the operator Sofiyska Voda AD. The reserve option to supply water for technical needs in emergency cases is by the city's drinking water supply system, The maximum possible supply is Q = 250 m3/hour.

Drinking water for the employees of TPP Sofia is supplied through Sofia city's water supply network.

4.2.1.1.2 TPP SOFIA-EAST SITE

TPP Sofia-East is located in the eastern part of Sofia city and provides thermal energy for Sofia East district heating region. The plot of TPP Sofia-East is within Gara Iskar industrial area and has a total area of 319,692 m^2 Site "B" is close to the railway line and its area (around 20 daa) is sufficient for situating the plant's installations and equipment. TPP Sofia-East uses as fuel natural gas from the national gas supply network, and mazut as alternative fuel (only in cases of gas supply cuts).

The main heat carrier is water in the form of hot water circulating in the network and in the steam-water cycle of the technology process. Water supply to the site - relatively clean water for process needs is supplied through the main industrial water conduit for Sofia. Water abstraction is from Pancharevo lake near Sofia. The water supply service is provided by the operator Sofiyska Voda

AD. The reserve option to supply water for technical needs in emergency cases is by the city's drinking water supply system

Drinking water for the needs of TPP employees Sofia is supplied through Sofia city's water supply network.

4.2.1.2 WATER CONSUMPTION, WATER PREPARATION AND WASTE WATER

4.2.1.2.1 TPP SOFIA

Water is used for household needs - daily consumption by the employees; for technical needs - preparation of water in the hearing system; desalinated (deionised) water for the steam boilers.

The maximum output of the water de-ionisation system is up to 500 t/h.

The maximum capacity of the water treatment system - softening the water from the water supply network - is up to 400 t/h.

The following quantities of water were used for heat and electricity production in TPP Sofia[7]:

- → in 2011 Relatively clean water -2,176,000 m^3; Drinking water - 67,000m^3
- → in 2012 Relatively clean water -2,467,000m^3; Drinking water - 58, 000m^3
- → in 2013 Relatively clean water 2,061,000m^3; Drinking water - 43,000m^3

Water for technical purposes is split into two flows. One flow is directed to the department for chemical cleaning of water (for additional treatment) and has annual discharge around 1,405,339 m3, and the other flow - to the boiler department for cooling the steam in the condensers of turbines and for the cooling systems of lubricating oil, turbines and other units - discharge around 493,381 m3.

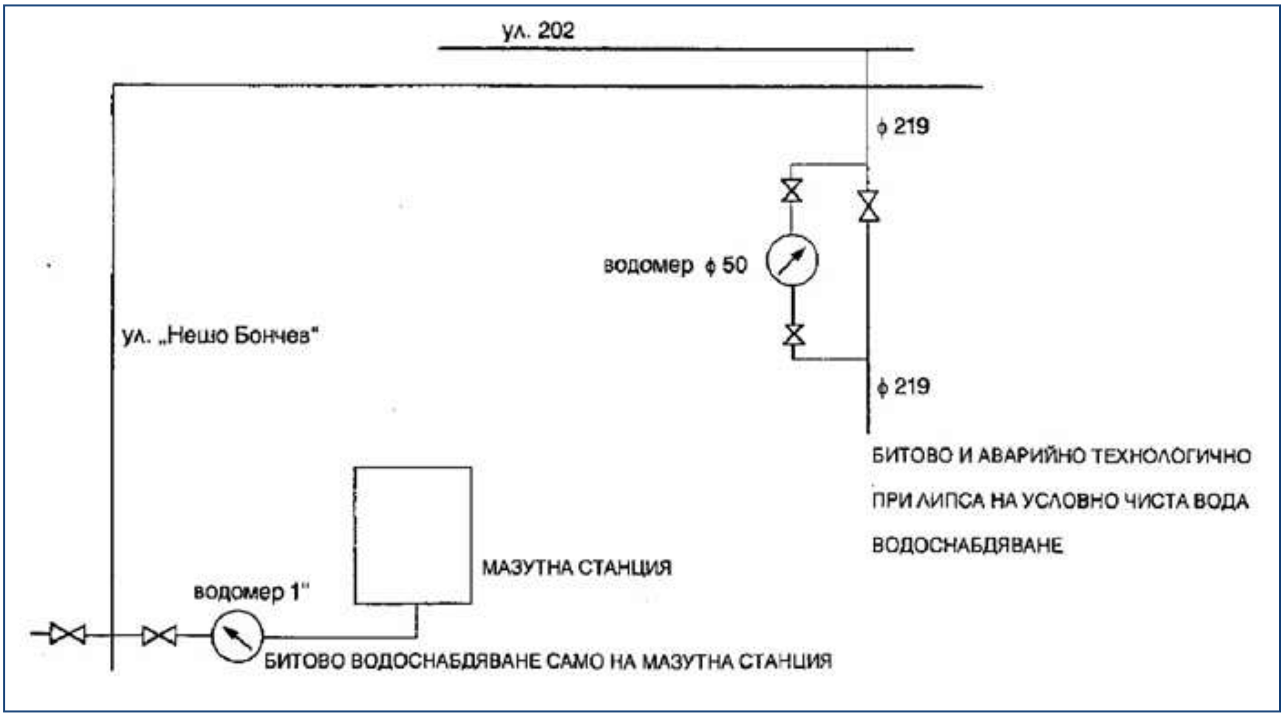


FIGURE 4.2-1 DIAGRAM OF THE MAIN DRINKING WATER SUPPLY FLOWS

[7] Letter No.П-2414/21.05.2014 of Toplofikatsia Sofa EAD

Water treatment for TPP Sofia is carried out in the chemical department - chemical water treatment (CWT). The quantity of relatively clean water fed to CWT is 1,405,339 m^3/y and comprises:

1. Pre-cleaning: The main process here is coagulation by means of polyaluminum oxysulphate in contact with cationgenic polyelectrolyte;
2. Ion-exchange de-ionizing installation: In that installation water is purified by ion-exchange method;
3. Water softening installation: Part of the pre-cleaned water is fed here after coagulation. Here the water is filtered by two mechanical filters and is fed into four sodium-cation filters, connected in parallel.

A separate branch for process waste water has been built in the territory of TPP Sofia, but there is no special rainwater drainage system. Household waste water is collected in a tank of capacity ≈ 10 m^3 in the combined installation of the treatment plant, and from there it is pumped out and discharged into a collector of the city's sewerage system.

Through the mixed-purpose piping system rainwater is led to the treatment plant, into the combined installation for oil water treatment, which comprises a drawing tank, a keeping tank and a collection tank for oil products. Due to the relief of the area that water is collected not only from the TPP site but also from the adjacent streets and Nadezhda overbridge (about 80-100 l/s in rainy weather). Rainwater from the mazut unloading platform goes first through a separation shaft, and oil water from the transformers and from the oils and lubricants department - through oil-collecting pits, and then it is led to the WWTP of TPP Sofia.

Process waste water is organised in the following flows:

- A./ Water with chemical pollutants - generated by the water pre-treatment installation, approximately 100,000 m^3/y ; it is: slag water from mechanical filters after their flushing; water from loosening the filters; water from regeneration of ionites by means of sodium base and respectively sulphuric acid.
- B./ Oil water - generated by: cooling of turbines, washing of garages, cooling of pumps; mazut stock; flushing of boilers. The total annual quantity is about 305,000 m^3 /y.

In TPP Sofia there is a functioning waste water treatment plant, treating process waste water (water with chemical pollutants, oil water, plus rainwater), which after treatment in WWTP, together with blackwater and sewage, collected in a tank of about 10 m^3 capacity in the combined installation of the treatment plant, is discharged into the city's sewerage system and is further treated in WWTP Kubratovo.

4.2.1.2.1.1 Quantity of waste water , by flows, fed to WWTP -TPP Sofia

The wastewater treatment plant of TPP Sofia receives, through separate piping systems into reception tanks, three separate wastewater flows/ oil water, chemically polluted water/ which are treated in the water treatment installations equipped with respective pumping and reagent-adding technological units. Household wastewater is also fed to the aggregate flow into the city's sewerage system.

There is no special slime-collecting piping system, so the sediment from the sedimentation reactors and the slime tanks in the chemical department is led into the oil water piping system.

As there is no rainwater drainage piping rainwater is led into the sewerage systems existing within TPP Sofia, and led to the water treatment installations.

TABLE 4.2-1 INFLOWS INTO THE WASTE WATER TREATMENT PLANT

Year / Flows, mg/m^2	2013	2012	2011
Oil water	741,317	707,977	656,965

Water with chemical pollutants	53,243	53,792	49,200
Household water	43,220	56,210	61,361

The following rates of discharge of flows into the treatment plant have been reported:

- Chemically polluted water (CPW) – 274 m^3/d;
- Oil water (OW) average 900 m^3/d (700 m^3 in summer, 1,100 m^3 in winter).

Chemically polluted water (CPW) is led under gravity to the treatment plant, through a CPW shaft, and received in the CPW reception tank (a drawing tanks with pumps) and from there - into an equalizer (neutraliser) consisting of two sections with a stirring system using compressed air. Neutralisation to pH 6.5 - 9.0 is done with sodium base solution, fed into the neutraliser by means of pumps.

Oil water from the mazut unloading platform, mazut pumping station and mazut tanks is led by means of pumps in the oil water pumping station, and the rest is led under gravity into the treatment plant. The water is collected in a combined installation comprising a drawing tank, a keeping tank and a collection tank for oil products.

After the WWTP water is discharged into the city sewerage system through a collector (left-side Suhodolski) and led to the WWTP of Sofia city. The total amount of waste water discharged annually from the treatment plant is in the vicinity of 439,000 m^3. TPP Sofia has permit No.1010/2003, issued by Sofiyska Voda AD, for discharging waste water into the sewerage system of Sofia city and leading it to WWTP Kubratovo.

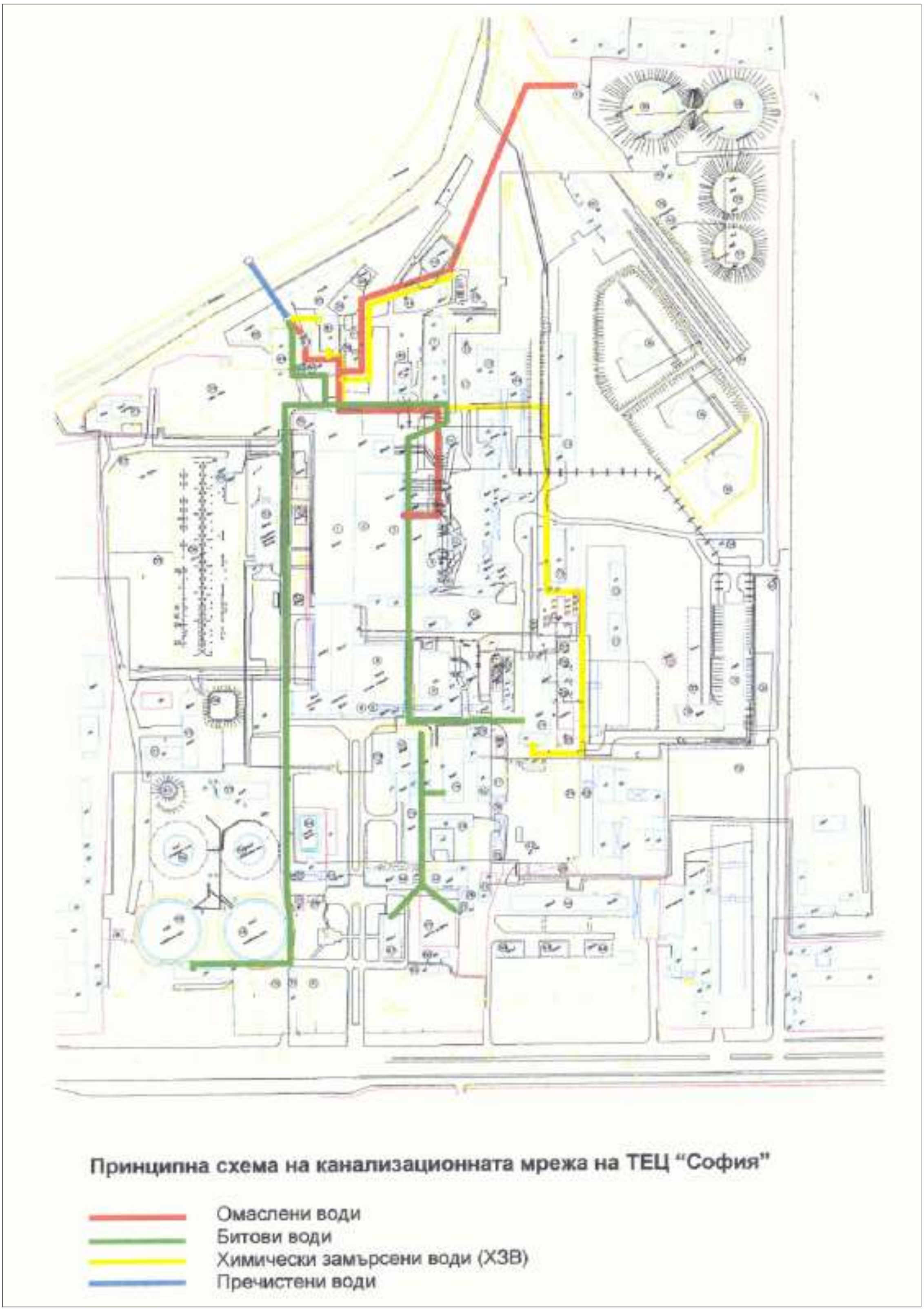


FIGURE 4.2-2 SEWERAGE SYSTEM OF TPP SOFIA

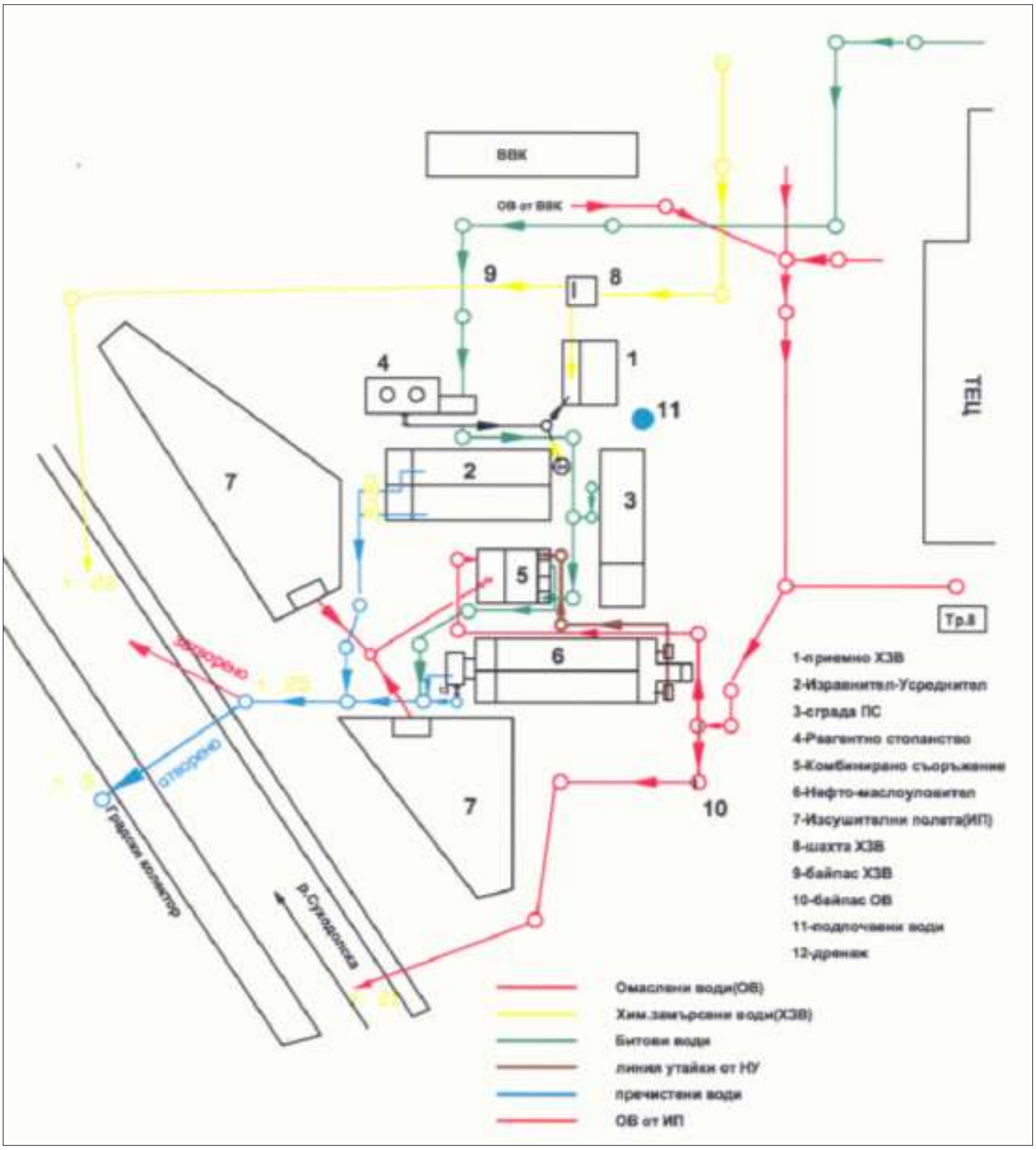


FIGURE 4.2-3 GENERAL DIAGRAM OF THE WWTP OF TPP SOFIA

The integrated permit of the TPP specifies emission limit values (ELV) for process waste water and blackwater /sewage, of certain indicators like pH, oil products, iron $_{total}$, mercury, cadmium, lead, arsenic, copper, total chromium, nickel, total cyanides, zinc content .

Connection to the city's wastewater treatment plant – The connection is to the north-west, over Suhodolska river; it is between the WWTP of TPP Sofia, located at the site, and the sewage system of the city of Sofia, and from there - to the WWTP of Sofia.

The oil water treatment installation receives also rainwater from the site and from the neighbouring streets in the area. In case of emergency situations in the territory of TPP Sofia, in case of torrential rains or power cuts for a longer period of time (more than 1 hour), it is possible to divert the oil water flow through a bypass connection to Suhodolska river. In normal WWTP operation that bypass is closed with a gate, which is sealed by RIEW - Sofia. Before breaking the seal and opening the gate a permission must be obtained first and the engineer on duty in TPP Sofia as well as RIEW Sofia must be informed.

According to information provided by the client [8] a permission of the competent authorities was asked once in 2013, in August, to open the connection of oil water sewerage system to Suhodolska river. That was during the annual TPP repair, and was under strict control of the status of the discharged flow and of the receiving water course.

There is an emergency bypass connection to Suhodolska river also of the chemically polluted wastewater flow, but according to client's data opening that connection and using it has not been necessary so far.

Throughout the year regular own monitoring of waste water is performed in TPP Sofia, and the tests are done by an accredited laboratory. **Figure 4.2-4** shows the results of that monitoring in 2013.

There has not been any exceeding of the emission limit values specified in the integrated permit - **Table 4.2-2**.

9.Резултати от контрола:

ПОКАЗАТЕЛИ	Единица на величината	Метод на контрола (стандарт, др. документ)	Допустима стойност	Резултат от контрола ± неопределеност	Параметри на околната среда
1. Активна реакция	pH	БДС 17.1.4.27	6,50-9,50	8,10 ± 0,15	стандартни
2. Окисляемост перманганатна	mgO_2/dm^3	БДС 17.1.4.16	определя се	3,00 ± 0,08	стандартни
3.Неразтворени в-ва	mg/dm^3	БДС 17.1.4.04	400	8,8 ± 0,10	стандартни
4. Нефтопродукти	mg/dm^3	ВВлМ 1	15,0	1,3 ± 0,18	стандартни
5. Сулфати (SO_4^{2-})	mg/dm^3	БДС 17.1.4.03	400	19,2 ± 0,66	стандартни
6. Желязо$_{об}$	mg/dm^3	БДС ISO 6332	10,00	0,66 ± 0,038	стандартни

10.Дата на провеждане на контрола:14.06.и 17.06.2013 г.
Параметри на ок.среда:T°C=21÷22; Rh%=46; $P_{атм.}$ кPa = 95,5÷95,6

9. Резултати от контрола:

ПОКАЗАТЕЛИ	Единица на величината	Метод на контрола (стандарт, др. документ)	Допустима стойност	Резултат от контрола ± неопределеност	Параметри на околната среда
1. Активна реакция	pH	БДС 17.1.4.27	≥ 6,50 ÷≤9,00	7,90 ± 0,15	T°C = 22;Rh% = 35;kPa=96,4.
2. Неразтворени в-ва	mg/dm^3	БДС 17.1.4.04	400	3,00 ± 0,03	T°C = 22;Rh% = 35;33; kPa =96,4; 95,7.
3.Нефтопродукти	mg/dm^3	ВВлМ 1	15,00	1,80 ± 0,25	T°C = 22;Rh% = 35; 33;kPa =96,4; 95,7
4. Сулфати (SO_4^{2-})	mg/dm^3	БДС 17.1.4.03	400	11,0 ± 0,4	T°C 22;Rh%= 35; kPa =96,4; 95,7
5. Желязо	mg/dm^3	БДС ISO 6332	10,00	0,86 ± 0,05	T°C = 22;Rh% = 33;kPa=95,7.

10. Дата на провеждане на контрола: 04. 12. ÷ 05. 12. 2013 г.

FIGURE 4.2-4 RESULTS FROM MONITORING OF WASTE WATER FROM TPP SOFIA IN 2013

[8] Letter No.П-2414/21.05.2014 of Toplofikatsia Sofa EAD

TABLE 4.2-2 RESULTS FROM MONITORING PERFORMED BY TPP SOFIA OF DISCHARGED MIXED FLOW WASTE WATER FROM THE WWTP OF TPP SOFIA

Months / Parameters	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average	CP limit values
Petroleum products, mg/dm^3	0.35	0.24	0.27	0.30	0.44	0.24	0.26	0.28	0.27	0.37	0.89	0.24	0.35	<*15* mg/dm^3
Active reaction - pH	7.94	7.93	7.91	7.89	7.82	7.88	7.88	7.14	7.83	7.57	7.52	7.58	7.74	6.5÷9.0

4.2.1.2.2 TPP SOFIA-EAST

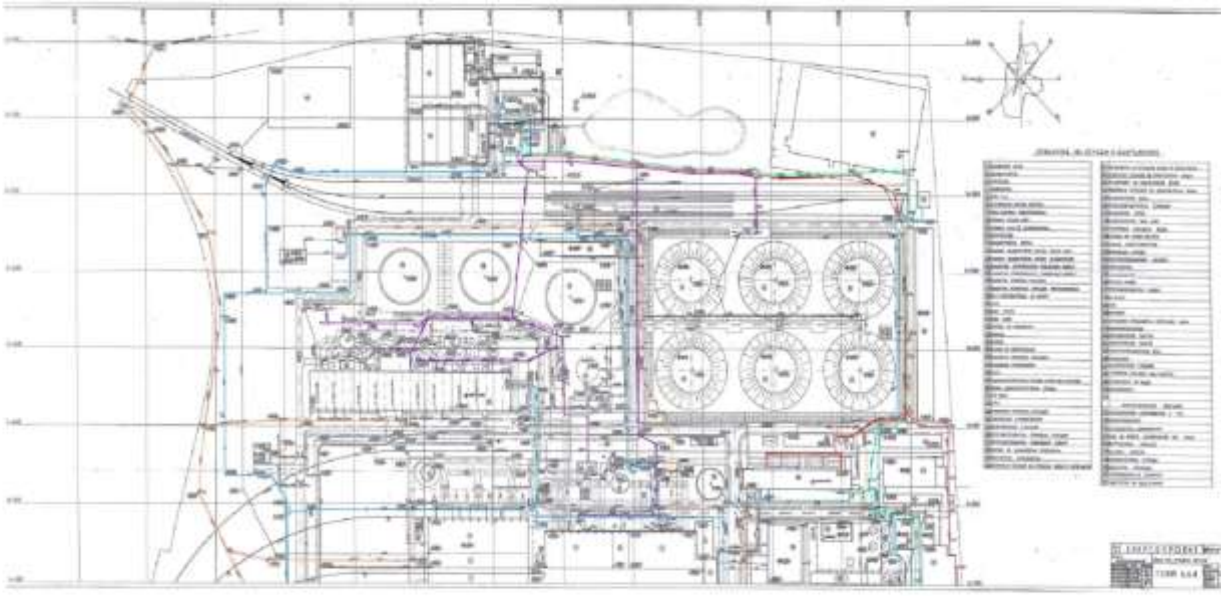


FIGURE 4.2-5 TPP SOFIA-EAST WATER DIAGRAM

Water is used for preparation of heating water, for technical purposes, and as desalinated (deionised) water for the steam boilers; for daily needs - for consumption by employees.

The following quantities of water were used for heat and electricity production in TPP Sofia-East [9]:

→ **2011 -** Relatively clean water -2,176,000 m^3; Drinking water - 35,000 m^3
→ **2012 -** Relatively clean water -2,790,000 m^3; Drinking water - 41,000 m^3
→ **2013 -** Relatively clean water -2,429,000 m^3; Drinking water - 37,000 m^3

The greatest portion of water is used by TPP Sofia-East for cooling the steam in the turbine condensers, and in the cooling systems for lubricating oil of turbines and other units. Water is used also to compensate the losses in the plant's steam-water cycle, loss in the heat transmission network of the heating system and industrial steam supply, in the chemical treatment of water for regeneration of ion-exchange resins, etc. Industrial untreated water is used directly for cooling the installations and for anti-fire purposes. Such water, however, does not meet the requirements as regards steam generators and heating network. To use water as raw material it has to pass through different water purification installations.

Two water pre-treatment installations (WPI) have been built:

→ for the needs of the plant's electricity generation section - WPI-1, and for the needs of the heating section - WPI-2. In the first case, besides the mechanical and colloidal impurities also all anions and cations of salts have to be removed, i.e. raw water is desalinated. In the second case only calcium and magnesium cations are removed, i.e. water is softened.

There are several circulation cycles built in the plant for reducing (optimisation) of water loss.

1. All cooling water of the pumps in the turbine room by relatively clean water (TG144; TG 5) is led back into the free-flow (non-pressure) conduit.
2. Water cooling the air for TG 144 and and the hydrogen for TG 5 (relatively clean water) is led back into the free-flow (non-pressure) conduit.

[9] Letter No.П-2414/21.05.2014 of Toplofikatsia Sofa EAD

3. The cooling of compressors in the boiler room (compressor station) is a closed circuit with negligible losses (chiefly in summer). Water is regularly added up.
4. The seals of pumps in the network pumping station are cooled by softened water, collected in a 5 m^3 tank, from where it is led as feed water for the heat transmission network.
5. The cooling for the condensers of TG144 by means of circulation pumps passes through a cooling tower. Losses due to evaporation are periodically compensated.

There is no separate rainwater drainage system within TPP Sofia-East and most of the rainwater drainage piping is at the same time piping of the blackwater/sewage system. Process waste water is led to the WWTP through three separate collectors and is treated in three separate technological lines. After treatment to the required condition, it is discharged into the city wastewater collector.

→ **Technological line 1**: Oil-polluted waste water from the mazut stock (mazut unloading platform, mazut tanks, mazut stations of energy and water-heating boilers) is led by the oil-water sewage system to the waste water treatment plant. The oil collector has two sections. Steam, aluminium sulphate, lime cream and flocculant ate fed to it.

→ **Technological line 2**: Chemically polluted water from the two water pre-treatment installations is led by the sewage system for chemically polluted waste water to a tank (50 m^3). From there by means of two pumps it is led to a neutralisation reservoir for pH correction. That reservoir has two sections; diffused air is fed along its entire length to facilitate the mutual neutralisation of acid and alkaline flows so that admissible pH values (6.5 - 9.0) are reached at the outlet.

→ **Technological line 3**: The third flow - slag water from the sedimentation reactors and from the mechanical filters of the two water pre-treatment installation - is led by the slag water sewage system to a tank. From there by means of two pumps it is fed to a two-chamber vertical sedimentation reservoir. Water is kept there as long as required; then clarified water is led to the city collector, and under hydrostatic pressure the sedimentation is discharged into drying beds.

Design data of the wastewater treatment plant:

- → oil water treatment capacity - 3,888 m^3/ 24 hours;
- → concentration of oil products - up to 400 mg/l (the oil water received here actually has much lower oil products concentration);
- → chemically polluted water treatment capacity - 2,244 m^3/ 24 hours;
- → slag water treatment capacity - 600 m^3/ 24 hours;

In practice the quantity of process waste water actually treated is much lower than the capacity of the treatment plant by design.

Waste water from TPP Sofia-East is discharged into the city wastewater collector at two discharge points, and from there it is led to the city's WWTP - Kubratovo.

The total quantity of waste water discharged annually from the wastewater treatment plant is approximately 350,000 m^3 of process wastewater and household wastewater. TPP Sofia-East holds Permit No. 1010/2003 issued by Sofiyska Voda AD for discharging wastewater into the city sewerage system of Sofia. The integrated permit of the TPP specifies emission limit values (ELV) for process waste water and blackwater /sewage, for certain indicators like pH, oil products, iron $_{total}$, mercury, cadmium, lead, arsenic, copper, total chromium, nickel, total cyanides, and zinc content . The TPP performs regular own monitoring of waste water

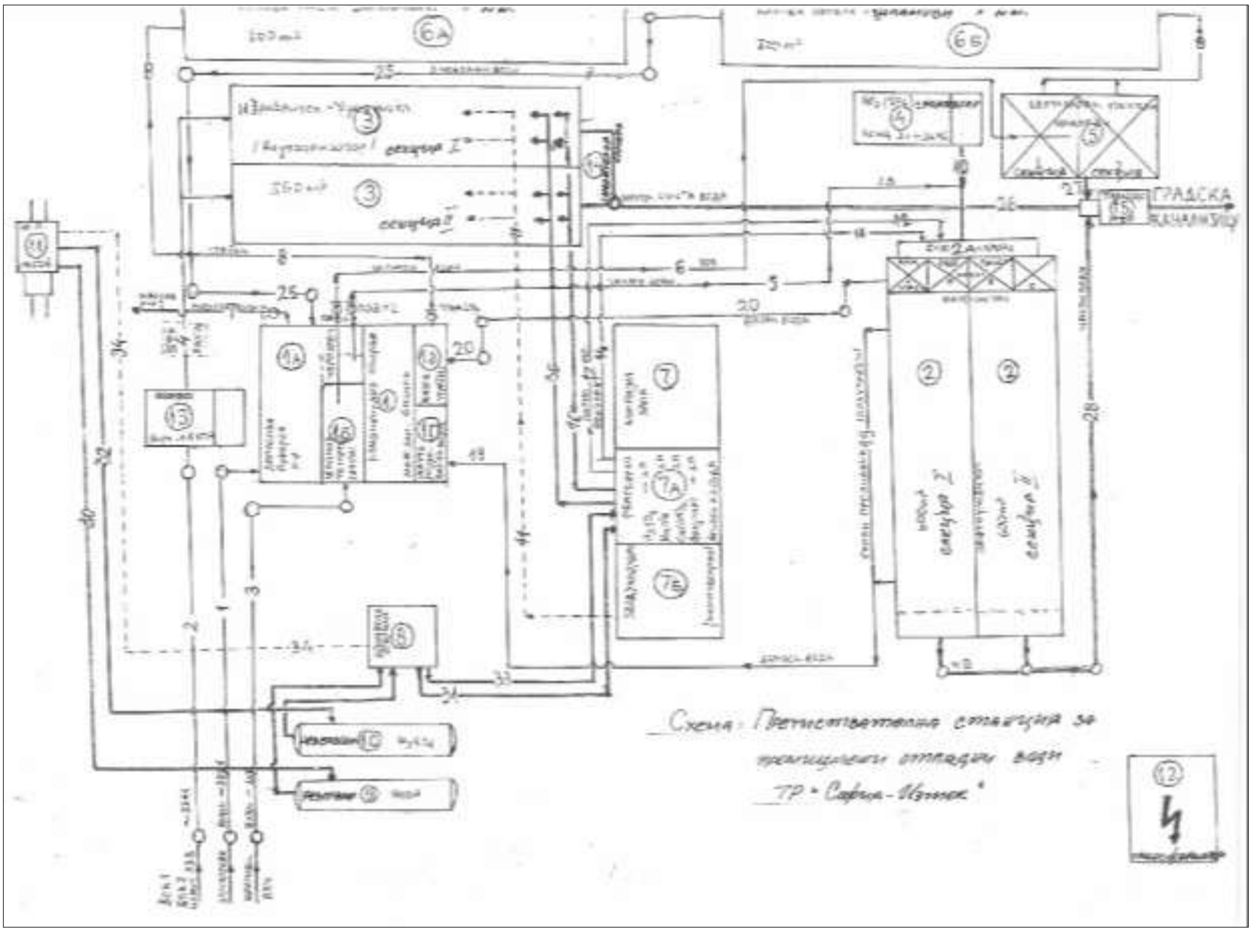


FIGURE 4.2-6 GENERAL DIAGRAM OF THE WWTP OF TPP SOFIA-EAST

The wastewater treatment plant operates in 24/7 mode. In each of the technological lines waste water is collected and treated to the required purification level. Waste water quality is checked before the flows of the three technological lines mix, at such intervals of time as technologically necessary depending on the operation mode. Checking includes quantitative analysis for presence of oil products, checking of pH and visual control for water purity. The data is recorded in an operating logbook. All water, after treatment in each of the technological lines, is mixed immediately before discharging in the city sewerage system.

There is a technological operating instruction for the WWTP, specifying the parameters controlled for ensuring an optimum operating mode of each of the water treatment installations:

- Active reaction - pH;
- Oil products concentration.

The value of those parameters in optimum operating mode for each of the water treatment installations shall be:

- pH - 8.0 ÷8.5;
- Oil products - below 10 mg/l.

The laboratory of the city's WWTP Kubratovo exercises control by taking samples from the water discharged into the collector. Sampling is regular.

General conclusions

- ✓ The drinking water supply network built at the sites of TPP Sofia and TPP Sofia-East is very good. It is technically possible to connect the water supply network of the new plant to the existing water supply network at appropriate points.
- ✓ The industrial water supply network of both power plants is appropriately designed and built, it is reliable, and is well maintained by the operating stuff. Industrial water and water for technical purposes will be reliably supplied to the new cogeneration plant utilizing RDF via connections to the existing systems of the two power plants, at suitable points.
- ✓ The existing local wastewater treatment plants have sufficient capacity to serve also the new plant envisaged in the IP.
- ✓ Own monitoring of waste water has been established in TPP Sofia and TPP Sofia-East and is successfully functioning. The purpose of that monitoring is to ensure compliance with the regulatory requirements and with the conditions of the permits issued by EEA. According to the plants' own monitoring programme the quality of waste water discharged from the plants is controlled in accordance with individual emission limit values, specified in the integrated permits issued by EEA, and in accordance with the conditions for connecting to the city's sewerage system, stipulated in Ordinance No.7/200, SG No.98 on the conditions and procedures for discharging of industrial waste water into the sewerage systems of settlements. Results show that there is no trend for exceeding the limit values of controlled parameters, and no such exceeding has been registered. Control for observing the IELV is exercised by RIEW - Sofia and DRBWMD - Pleven, in accordance with the requirements of EPA and the Water Act.
- ✓ Based on data from the own monitoring of waste water and from the control monitoring by the competent authorities - EEA, reference laboratories, DRBWMD and RIEW -Sofia - we can conclude that the operation of the two power plants does not pose a risk to the condition of surface water in the region, nor does it endanger the operating condition of Sofia's sewerage system, which receives that water.

4.2.2 GROUNDWATER

4.2.2.1 HYDROLOGIC CHARACTERISTICS OF THE REGION

The two suggested sites for the IP implementation are in Sofia valley, the water of which is managed by the Danube River Basin Directorate – Pleven. The Quaternary formations and Neogenic sediments abundant in the valley contain pore spaces groundwater, and therein groundwater body "Pore water in the Neogene-Quaternary layer - Sofia valley" has been specified under code BG1G00000NQ030, illustrated in **Figure 4.2-7**.

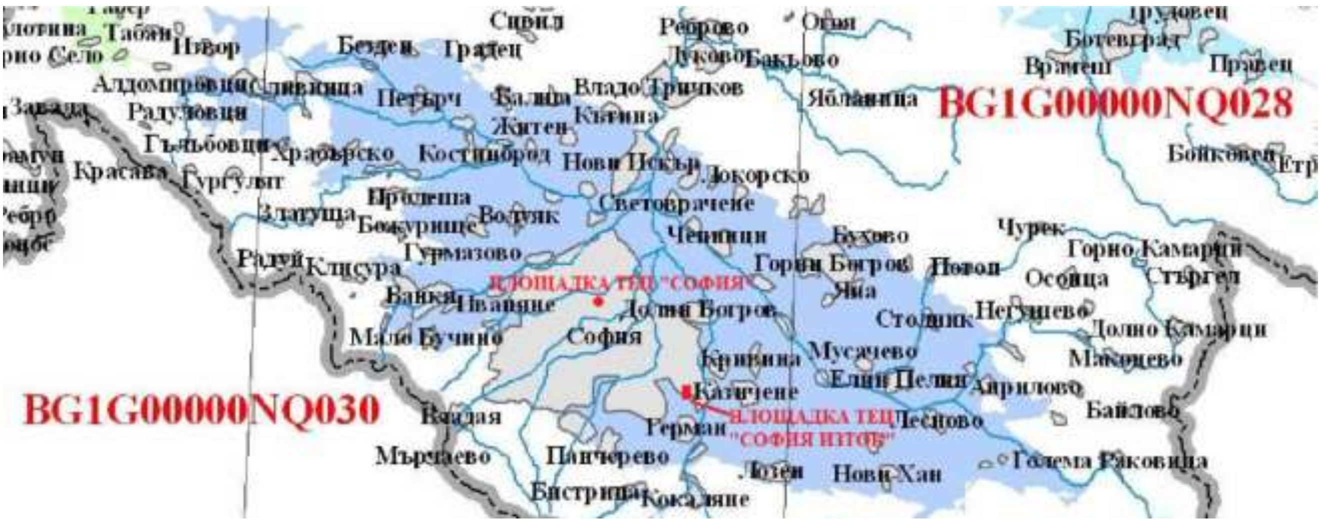


FIGURE 4.2-7 GROUNDWATER BODY "PORE WATER IN THE NEOGENE-QUATERNARY LAYER - SOFIA VALLEY" , CODE BG1G00000NQ030

Groundwater body "Pore water in the Neogene-Quaternary layer - Sofia valley" , code BG1G00000NQ030 comprises pore groundwater accumulated in the sand and gravel of the Lozenets formation in the Neogene and in the Quaternary alluvial gravel-sand formations of Iskar river and its tributaries Lesnovska, Matitsa, Stari Iskar, Perlovska, Vladayska, Banishka, Darvenishka and Slatinska rivers and mixed proluvial-alluvial formations. That water is non-pressure to slight-pressure groundwater, which, due to obvious mixing, form an aggregate subterranean water body. In the Neogene space deposits that is a layered aquifer complex, and in the valley widening and river terraces - single-way or two-way streams. They are fed by infiltrated rainwater and surface water (in irrigation), by Iskar river and its tributaries - when water level is high. Drainage is by Iskar river and the lower of its tributaries, by numerous water abstraction points (drainage points, tube and shaft wells) and through drainage canals. The filtrating capacity of aquifer gravels and sands is characterised by permeability 30÷500 m^2/d and filtration coefficient from 3÷15 to 150 m/d. According to data of RBMP 2010-2015 [10] the groundwater body has the following hydrological parameters: thickness 80 m, permeability 500 m^2/d and filtration coefficient 60 m/d. The protective function of covering layers is distributed as follows: 0 % favourable; 10 % medium and 90 % poor.

Considering the mineral components, the waters are of various types: hydrocarbonate - sulphate - calcium; hydrocarbonate - sulphate - calcium - sodium; calcium - magnesium, etc. Their mineral content is between 10÷150 mg/l and 800÷980 mg/l, and in most cases is in the range of 500÷700 mg/l. The groundwater body (GWB) has been designated as drinking water protected zone under code BG1DGW00000NQ030. The area of groundwater body BG1G00000NQ030 is 1,090 km^2, and the open area without settlements - 892 km^2. According to RBMP 2010-2015 the chemical condition of the GWB and of the drinking water protected zone is good, and the quantity status is also good. According to the opinion of Danube River Basin Directorate the condition of the zone is good (letter No.1552/15.11.2013).

According to 2013 monitoring data (DRBWMD, 2013.[11]), from monitoring under order No.182/ 26.02.2013 of the minister of environment and water:

- → at MP 157 - tube well Alex 2000, Lyulin quarter, Sofia, the water is in good chemical condition and its parameters comply with the quality standards;
- → at MP 161 - tube well Razsadnika - Trebezhko near Elin Pelin, Elin Pelin municipality, Sofia district, the water is in good chemical condition and its parameters comply with the quality standards;
- → at MP 163 - Izola Petrov EOOD drill well near Chepintsi, Novi Iskar municipality, Sofia district, the water is in good chemical condition and its parameters comply with the quality standards;
- → at MP 166 - tube well Keramichna Fabrika near Novi Iskar, Novi Iskar municipality, Sofia district, higher concentrations of sulphate ions in water have been found; the same has been observed in previous years also;
- → at MP 168 - S-MP34 near Novi Han, Elin Pelin municipality, Sofia district, higher concentrations of manganese in water have been found; the same has been observed in 2012 also;

[10] River basin management plan for Danube region 2010-2015

11 Danube River Basin Water Management Directorate, 2014 Condition of groundwater within the area of Danube region basin management in 2013

→ at MP 285 - tube well neat the city's WWTP Kubratovo, Sofia district, higher concentrations of iron and manganese in water have been found; the same has been observed in previous years also.

4.2.2.2 HYDROLOGICAL CONDITIONS AT THE SITES

4.2.2.2.1 TPP SOFIA SITE

The groundwater within the site and around it is a small part of groundwater body BG1G00000NQ030. It has been studied by Energoproekt in the period 1961 - 1976. That groundwater is in layers and bands of clay sand and varigrained sand unevenly spread amidst Neogene clay and sandy clay, topped by Quaternary alluvial clays with gravel inclusions and clayed gravel, of thickness up to 11÷13 m. The water level has been found at 1.70÷3.60 m depth at altitude 525.17÷526.70 m. By water abstraction, flows between 10 and 18 l/s have been obtained, with 4.8÷11.0 m fall. Filtration coefficients around 18 m/d have been calculated (R. Nikolova, 1983 [12]).

Four tube wells of 20 m depth were built in 2006 for groundwater monitoring (Ananiev, 2006[13]). The location of the wells is shown in **Figure 2.6-3** and their lithological cross-section and type structure - in **Figure 2.6-4**. Those wells were drilled through aquifer sand bands 1.0 to 5.0 m thick at depth 4 to 9 m, and 2.0 to 3.0 m thick at depth 9 to 13 m. The static level of water has been found at depth between 3.13 and 3.99 m. Flows of capacity 1.9 l/s to 2,1 l/s have been obtained by filtration tests, with 5.13÷8.16 m fall. The permeability of the aquifer collector, calculated using that data, is within the range 18.0÷26.6 m^2/d, average 23 m^2/d.

In July 2013 within the engineering, geological and hydrological survey of the site of cogeneration plant utilizing RDF, performed by EcoPro Consult - Sofia (Angelov L. at al, 2013 [14]), six drill wells were made at the site envisaged by the investment proposal, of depth 10.6 - 22.0 m. The following was found:

→ The Quaternary formations have been removed and replaced by a 4.0 to 10 m thick anthropogenic level of clays, rubble and construction waste;

→ Amid Neogenic dust clays under that level there are up to three aquifer bands and lenses of clayey sands and clay-covered sands of mixed grain size, unevenly spread; The top of the first sand band, of thickness 0.5 - 1.0 m, is at depth between 6.0 m and 9.0 m; of the second band, 0.5 - 3.3 m thick - at depth between 9.0 m and 12.0 m; and of the third band, 2.0 to 3.7 m thick - at depth between 10 m and 18.3 m. Those are described below in **Table 4.3-1** and illustrated in **Figure 4.3-2**;

→ The measured water levels are found above the top of the first sand band at depth between 2.0 m and 4.0 m within altitude range 526.50 - 528.93 m. The direction of the groundwater flow is south-east, with pressure gradient around 0.05.

The filtration parameters of the Neogenic sands have not been studied, but according to data from water abstraction in the area around the site envisaged in the investment proposal, they are expressed in filtration coefficients 0.5÷1.5 m/d for clayey sands and fine sands, and 8÷20 m/d, at some places - 25 m/d, for medium and large-grain sands.

From the stand of Basin Directorate for Water Management in Danube River Region – Pleven (letter Ref. No. 1552/15.11.2013) it follows that at the site envisaged by the investment proposal and in its vicinity there are not any installations for water abstraction from groundwater, nor safeguard zones specified under Ordinance No.3 of 16.10.2000 on the conditions and procedure for

12 Nikolova, R., 1983 Hydrogeological study of Sofia valley for establishing a system for optimum groundwater abstraction and conservation.

13 Ananiev, B., 2006 Explanatory note for the construction of four monitoring points and on performed filtration tests.

14 Angelov, L., V. Metodiev, Zl. Ushev, 2013 Conceptual design for Cogeneration Plant Utilizing RDF in Sofia at the site of TPP Sofia, Geology part

research, design, approval and operation of the safeguard zones around water sources and installations for potable and household water supply and around mineral water sources used for treatment, preventive, drinking and hygiene needs.

The results from monitoring at the points described in section 2.8 above, for 2011, 2012 and 2013, provided by Toplofikatsia Sofia EAD with letter П-2414/21.05.2014, are shown in **Figure 4.2-3**. The table shows also those checked parameters, which had concentrations higher than the limit values for quality according to Appendix 1 with art.10 (1) of Ordinance No.1/2007 on groundwater studying, utilisation and protection. In 2013 the iron and oil products content was higher than the standard values at all monitoring points. The concentration of sulphates was higher at monitoring points No.1 and No.3 Water levels were measured at depth between 4.50 m and 5.70 m, with seasonal fluctuation up to 0.8 -1.2 m.

4.2.2.2.2 TPP SOFIA-EAST SITE

The groundwater within this site and around it is also a small part of groundwater body BG1G00000NQ030. It has been studied by a number of organisations and research teams ("Energoproekt, 1951-1960; "Vodokanalproekt"1985-1986, "Sofgeoprouchvane" and others). According to data from those studies and examinations the groundwater is in Quaternary alluvial sand clays, sands and gravel with boulders, up to 16-20 m thick, and in the layers and bands of clay sand and varigrained sand under them, unevenly spread among Neogene clays and sandy clays. Water level has been found at depth 1.60÷7.10 m and altitude about 548÷550 m. By water abstraction, flows between 4.0 and 9.5 l/s have been obtained, with 10.5÷23.0 m fall. (Nikolova R., 1983).

A tube well 140 m deep was built in 1995 for supplying drinking water for household needs. Quaternary clays up to 4.2 m depth, sands up to 11 m depth and gravel up to 18.9 m depth were revealed by that. Under them are Neogene sediments of clays, sands and gravel, succeeding each other. The water level was found at depth 2.07 m. The well exploitation has been with 8.33 l/s maximum delivery and 2.95 l/s average 24-hour delivery, based on water abstraction permit No.1264/28.10.2002. The liquidation of that water abstraction point was attested by a statement of findings No.2-BM-66/21.07.2008, and by Decision No.106/01.08.2008 of DRBWMD the water abstraction permit issued to TPP Sofia EAD was terminated.

The groundwater found at the monitoring points is accumulated in Quaternary sands and gravel at depth 4.0 to 18 m (**Figure 2.6-3**).

From the stand of Basin Directorate for Water Management in Danube River Region – Pleven (letter Ref. No. 1552/15.11.2013) it is evident that at the site envisaged by the investment proposal and in its vicinity there are not any safeguard zones specified under Ordinance No.3 of 16.10.2000 on the conditions and procedure for research, design, approval and operation of the safeguard zones around water sources and installations for potable and household water supply and around mineral water sources used for treatment, preventive, drinking and hygiene needs.

The results from monitoring at the points described in section 2.8 above, for 2011, 2012 and 2013, provided by Toplofikatsia Sofia EAD with letter П-2414/21.05.2014, are shown in **Figure 4.2-4**. The table shows also those checked parameters, which had concentrations higher than the limit values for quality according to Appendix 1 with art.10 (1) of Ordinance No.1/2007 on groundwater studying, utilisation and protection. In 2013 iron content at monitoring point No.1 slightly exceeded the standard limit value. Water levels were measured at depth between 1.70 m and 5.25 m, with seasonal fluctuation up to 1.2÷1.9 m.

4.2.2.3 CONCLUSIONS

The described hydrogeological conditions of the two potential sites of TPP Sofia and TPP Sofia-East are similar and comparable. Those conditions do not present any obstacle for the construction of the plant, and therefore are not determining for the choice of a suitable site for implementation of the investment proposal.

FIGURE 4.2-3 GROUNDWATER MONITORING RESULTS FOR TPP SOFIA SITE [15]

No.	Parameters	Unit of measure	Standard quality value	2011				2012				2013			
				MP 1	MP 2	MP 3	MP 4	MP 1	MP 2	MP 3	MP 4	MP 1	MP 2	MP 3	MP 4
1	Water level	m	-	4.50	4.95	4.80	4.50	4.60	4.60	5.20	5.50	5.60	5.40	5.40	5.70
2	Temperature	^0C	-	12	12	12	12	14	14	14	15	14	16	12	15
3	General hardness	m∑q/l	12	11.70	11.10	9.00	2.70	17.3	12.00	12.7	3.30	18.0	10.70	11.90	7.10
4	Active reaction	pH	6.5÷9.5	7.59	7.38	7.56	7.90	7.47	7.31	7.52	7.91	7.23	7.12	7.30	7.31
5	Electric conductivity	µS/cm	2,000	1,181	1,020	1,118	459	1,754	1,125	1,406	498	1,816	1,110	1,360	908
6	Permanganate oxidation	mgQ$_2$/l	5.0	1.44	2.76	1.20	0.96	1.24	4.64	1.08	0.92	0.96	4.64	1.20	1.76
7	Sulphates	mg/l	250	220.90	110.50	172.90	38.40	640.80	241.70	487.10	53.00	635.00	160.00	410.00	91.00
8	Chlorides	mg/l	250	38.00	83.00	22.00	16.00	63.00	22.00	32.00	22.00	85.00	18.00	30.00	41.00
9	Sodium	mg/l	200	-	-	-	-	141.50	50.80	124.50	47.90	161.00	38.00	122.00	48.50
10	Iron	mg/l	0.2	0.010	0.050	0.010	0.022	0.034	0.046	0.039	0.019	0.060	0.042	0.052	0.072
11	Oil products	mg/l	0.05	0.026	0.040	none	none	0.033	0.044	0.029	0.022	0.046	0.130	0.092	0.125
12	Dissolved matter	mg/l	-	710	612	671	276	1,048	675	844	297	1,089	666	816	545

15 Ordinance No.1/2007 on groundwater studying, utilisation and protection

FIGURE 4.2-4 GROUNDWATER MONITORING RESULTS FOR TPP SOFIA-EAST SITE [16]

No.	Parameters	Unit of measure	Standard qality value	2011			2012			2013		
				MP 1	MP 2	MP 3	MP 1	MP 2	MP 3	MP 1	MP 2	MP 3
1	Water level	m	-	3.60	4.16	7.10	2.00	4.76	6.10	1.70	3.50	5.25
2	Temperature	^{0}C	-	15.4	15.2	15.8	16.4	14.1	14.7	-	-	-
3	General hardness	m∑q/l	12	3.10	3.70	3.90	2.90	3.40	6.00	2.72	2.98	5.44
4	Active reaction	pH	6.5÷9.5	7.90	7.70	6.80	8.12	7.92	7.06	8.29	8.13	7.11
5	Electric conductivity	µS/cm	2,000	282	354	435	276	330	665	356	402	796
6	Permanganate oxidation	mgQ_2/l	5.0	0.50	0.70	0.80	2.82	1.12	0.32	0.60	0.56	0.98
7	Ammonium ion	mg/l	0.50	< 0.005	0.007	< 0.005	0.022	0.009	<0.007	<0.013	<0.013	<0.013
8	Nitrates	mg/l	50	2.10	2.14	10.00	1.80	2.00	5.00	3.8	1.4	6.3
9	Nitrites	mg/l	0.50	0.02	0.08	0.002	0.01	0.024	0.013	<0.007	0.014	<0.007
10	Sulphates	mg/l	250	14.41	48.03	76.84	24.00	29.00	130.00	< 20	38	110
11	Chlorides	mg/l	250	10.00	21.00	20.00	9.00	13.00	27.00	< 10	< 10	72
12	Phosphates	mg/l	0.50	0.011	0.017	0.007	0.026	0.150	0.09	< 0.03	< 0.03	< 0.03
13	Sodium	mg/l	200	16.60	15.16	29.96	13.20	15.20	40.50	12.2	14.0	43.9
14	Iron	mg/l	0.2	0.052	0.050	0.030	0.042	0.032	0.010	0.260	0.038	0.078
15	Oil products	mg/l	0.05	< 0.002	< 0.02	< 0.02	0.04	0.02	0.03	< 0.02	< 0.02	< 0.02
16	Dissolved matter	mg/l	-	226	281	344	164	199	405	-	-	-

16 Ordinance No.1/2007 on groundwater studying, utilisation and protection

4.2.2.4 DESCRIPTION OF METHODS USED AND RESULTS FROM STUDIES TO DETERMINE THE CURRENT GROUNDWATER QUALITY

The study of groundwater was performed in 2013 by EcoProConsult - Sofia through:

- → finding, extracting and summarising of information from literature and archive sources about groundwater in the area of the potential sites for the investment proposal implementation;
- → drilling in 2013 for investigation engineering and geological probes in the site of TPP Sofia to find out the aquifer layers and bands in the field and measure the water levels in them;
- → preparation of reports on the engineering geological and hydrological conditions for the site of the cogeneration plant utilizing modified fuel (RDF) (Angelov L., V. Metodiev, Zl. Ushev, 2013) within TPP Sofia site based on the drilling in 2013 and on a report about the site of TPP Sofia-East, deriving available information from literature and archive sources, including data connected with the tube well from which drinking water was abstracted until 2008 for household and other needs.

Apart from that this EIAR describes the actual water level and the chemical condition of the groundwater based on the information requested and obtained from Toplofikatsia Sofia EAD on their own monitoring at the two sites in 2011, 2012 and 2013 (letter No.П-2414/21.05.2014).

The results from the investigation works are the following:

4.2.2.4.1 AT TPP SOFIA SITE:

The results[17] given in **Table 4.2-5.** are obtained from two hydrogeological drill wells made in 1961 by Energoproekt for process water supply, and from the monitoring points.

TABLE 4.2-5 RESULTS FROM HYDROGEOLOGICAL DRILLING IN 1961

Drill well No.	Depth m	Elevation	Static water level (SWL)	SWL elevation	Capacity Q l/s	Drop S m	Relative capacity Q l/s.m
C 5	60.0	527.63	2.50	525.13	10.00	4.90	2.10
C 6	67.5	528.33	3.60	524.73	4.70	5.20	0.90
MP 1	20.0	-	3.65	-	1.2	5.13	0.23
MP 2	20.0	-	3.13	-	1.8	7.48	0.24
MP 3	20.0	-	4.41	-	2.1	7.97	0.26
MP 4	20.0	-	3.99	-	1.9	8.16	0.23

In the six engineering geological drill wells made by EcoProConsult in 2013 [18] only the location of aquifer sand bands was found and the level of groundwater in them was measured - **Table 4.2-6.**

TABLE 4.2-6 ENGINEERING AND GEOLOGICAL DRILLING IN 2013

Drill well No.	Depth m	Site elevation m	Static water level (SWL), m	SWL elevation	Depth and description of sand bands
MP 1	22.0	530.95	4.35	526.60	18.3÷22.0 - medium sand
MP 2	10.6	530.94	2.01	528.93	10.0÷10.6 - clay sand
MP 3	20.0	530.85	4.00	526.85	6.0÷7.0 - coarse sand, slightly loose
					9.0÷10.9 - coarse sand, slightly loose

[17] Nikolova R., 1983

[18] Angelov, L., V. Metodiev, Zl. Ushev, 2013

					16.5÷20.0 - medium sand, with some clay bands
MP 4	20.0	530.68	3.74	526.84	11.6÷13.0 - different grain-size sand with small and medium gravel
					17.5÷18.8 - small and medium gravel with sandy-clay filling
MP 5	15.6	530.51	3.50	527.01	7.4÷7.9 - clay sand
					17.57÷15.0 - coarse sand with clay bands
MP 6	20.0	530.30	3.20	527.10	11.2÷12.2 - different grain-size sand with some clay bands and medium gravel

4.2.2.4.2 TPP SOFIA-EAST SITE

The results from the investigation drilling by Energoproekt in 1966 for water supply of TPP Sofia-East are given in **Table 4.2-7** [19].

TABLE 4.2-7 HYDROGEOLOGICAL DRILL WELLS FOR WATER SUPPLY OF TPP SOFIA-EAST

Drill well No.	Depth m	Static water level (SWL), m	Capacity Q l/s	Drop S m	Relative capacity Q l/s.m
Dr 6	55.0	2.53	6.90	16.20	0.43
Dr 7	54.0	1.96	9.52	13.55	0.70
Dr 8	30.5	2.53	-	-	-
Dr 9	56.5	2.44	9.09	11.09	0.82
Dr 10	54.5	2.54	4.90	10.50	0.46
Dr 11	54.0	3.40	4.08	23.10	1.18

In 2013 the geological and hydrological engineering conditions at that potential site for the investment proposal implementation were characterised based on information from archive sources [20].

4.3 GEOLOGICAL AND HYDROLOGICAL ENVIRONMENT

4.3.1 A BRIEF DESCRIPTION OF THE GEOLOGICAL AND HYDROLOGICAL CONDITIONS; DESCRIPTION OF THE APPLIED METHODS AND RESULTS INVESTIGATION RESULTS TO DETERMINE THE CURRENT STATE OF THE GEOLOGICAL AND HYDROLOGICAL ENVIRONMENT

4.3.1.1 GEOLOGICAL STRUCTURE

In structural aspect the two potential sites of the investment proposal belong to Sofia Valley, overlapping with the graben bearing the same name, bordering to the north and to the south a group of longitudinal faults, which together with transverse and oblique faults have formed its contemporary block structure [21].

[19] Nikolova R., 1983
[20] Angelov L., 2013. Conceptual design for Cogeneration Plant Utilizing RDF in Sofia, Geology part
[21] Yanev Sl., R. Dimitova et al, 1992 Geologic map of Bulgaria, map sheet Sofia, scale 1:100,000

The lithostratigraphic cross-section represents the pre-Neozoic rock bed, which is revealed at the surface in the surrounding mountains and goes down from 27 m depth at Sofia Hali store to 1,180 m depth at the town of Elin Pelin under the Neogenic sediments and Quaternary formations, filling Sofia graben.

The pre-Neozoic rock rock bed includes:

→ *Diabase-phyllitoid complex (Pє-Є)*, consisting of diabase, phyllitoid and amphibole schists and rare phyllite bands. The complex is revealed in block structures between the villages of Zheleznitsa, Pancharevo and Kokalyane;
→ Triassic sediments of the Iskar carbonate group, represented by dolomites and limestone of the Pancharevo formation, Bosnek formation, Radomir formation and Rusinovdel formation. They are revealed at the surface to the north-west of Pancharevo village, north-northeast of Vistritsa village and along the south-west slope of Stara Planina near Sofia.
→ Revealed in the south-east slope of Stara Planina nesr Sofa are *Lower-Middle Jurassic sediments* (quartz sandstone, conglomerates and limestone), *Jurassic-Lower Cretacious sediments of the western Balkan carbonate group* (micrite and massive limestone) *and of the central Balkan Flysch group*(flysch of sandstone, marl and limestone) and *Lower Cretacious rocks* (alteration of limestone, clayey limestone and marl);
→ *Upper Cretacious lithostratigraphic units*, forming the entire western part of Sredna Gora mountain, a small part of which is Lyulin mountain and the hilly region to the north and to the west of it. There are alevrolites, marls, clayey limestone, sandstone, tuffs, tephroid rocks, andesites and other, composing several lithostratigraphic units (limestone-marl unit, lower volcanogenic-sedimentary unit, tephroid flysch unit, upper volcanogenic-sedimentary unit, unit of amphibole and biotite-amphibole andesites, etc)

The Neogenic sediments are divided into a variegated terrigenous formation and Sofia group, which is subdivided into three formations: Gnilyane formation with Balshenski coal-bearing member, Novi-Iskar formation and Lozenets formation with Novi-Han member.

The variegated terrigenous formation ($\boldsymbol{23N_1^m}$) has been ascertained in deep drill wells, of 30 - 400 thickness. It is represented by unevenly alternating variegated clays, sandy clays, alevrolites, sandstone, sand and several coal layers up to 2.0 m thick.

The Gnilyane formation $\left(gnN_1^p\right)$ has varied structure - gravels, conglomerates and varigrained sandstones in the base, and sands, alevrolites and clays further up in the section, of total thickness between 60 and 100-150 m. In the top part of the formation is the Balshenski coal-bearing member composed of lignite in one or several layers with bands of grey and black clays. That formation lies on the variegated terrigenous formation in the central part of Sofia graben and, with blurred boundary, on the pre-Neozoic rock bed.

Novi-Iskar formation $\left(niN_1^p - N_2^d\right)$ is developed all over but on the surface it can be seen as a broken strip in the north-east periphery of Sofia graben. That formation is represented by uniform grey, blue-grey or laminar clays, to the north laterally replaced by sandy clays and sandstone. It lies on the sediments of the Gnilyane formation, with sharply outlined boundary, and in the western part of the graben - also on pre-Neozoic rocks, with blurred boundary. The thickness of the formation varies from 60-100 m in exposed spots to 350-400 m according to drill well data.

The Lozenets formation $\left(IN_2^{d-r}\right)$ is developed in the entire Sofia graben except the peripheral north strip (between the villages Balsha and Lokorsko) where it tapers. It overlaps, with gradual transition, the sediments of the Novi Iskar formation, or with a blurred boundary - the pre-Neozoic rocks. At the surface it is exposed in the graben edges, and in the center it is overlapped by Quaternary formations. It is represented chiefly by sands, gravels, clayey sands, sandy clays and dust clays, alternating in horizontal and in vertical direction. In most of the graben at the base of

Lozenets formation several well-developed lignite layers are found, differentiated as Novi Han member. The thickness of the formation varies from about 50 m to 120-240 m. Different parts of the Lozenets formation section are exposed at the surface. In the southern periphery area of Sofia graben it is composed of coarse terrigenous sediments - gravels, loosely welded together conglomerates, sandstones and sandy clays.

Quaternary formations occupy large area in Sofia valley. The main genetic varieties in it are alluvial deposits, delluvial and alluvial-prolluvial formations, prolluvial-delluvial apron along the periphery of the valley and lake-marsh formations, as well as the culture layer including anthropogenic levels.

Alluvial deposits fill flood river plains *(aQh)* and the non-flood and high river plains *(aQp^3)*. They cover variegated and uneven surface of Neogenic sediments and sediments older than that. They are represented mostly by varigrained gravels (with boulders at some places) with sandy and/or clay-sand filler.

Delluvial formations (dQh) of angular fine and coarse gravels with clay-sandy filler form a 1-3 m wide strip along the terrace of Iskar river at the foot of Lozenska mountain.

Prolluvial-delluvial (pr-dQh-p) and alluvial-prolluvial *(a-prQeop)* formations are widespread in the slopes and at the foots of the surrounding mountains. They are represented by nonsorted or slightly sorted rock fragments with sandy and clay filling.

Lake-marsh formations (IQh) are represented by clays, sands and peat and mark the place of drainage of groundwater from the delluvial-prolluvial apron along the north-east periphery of Sofia graben, to the north-west of Svetovrachane village and Ravno Pole village.

The total thickness of the Quaternary formations in Sofia valley is considerable - from 5-10 m to 85 m near Kazichene quarter.

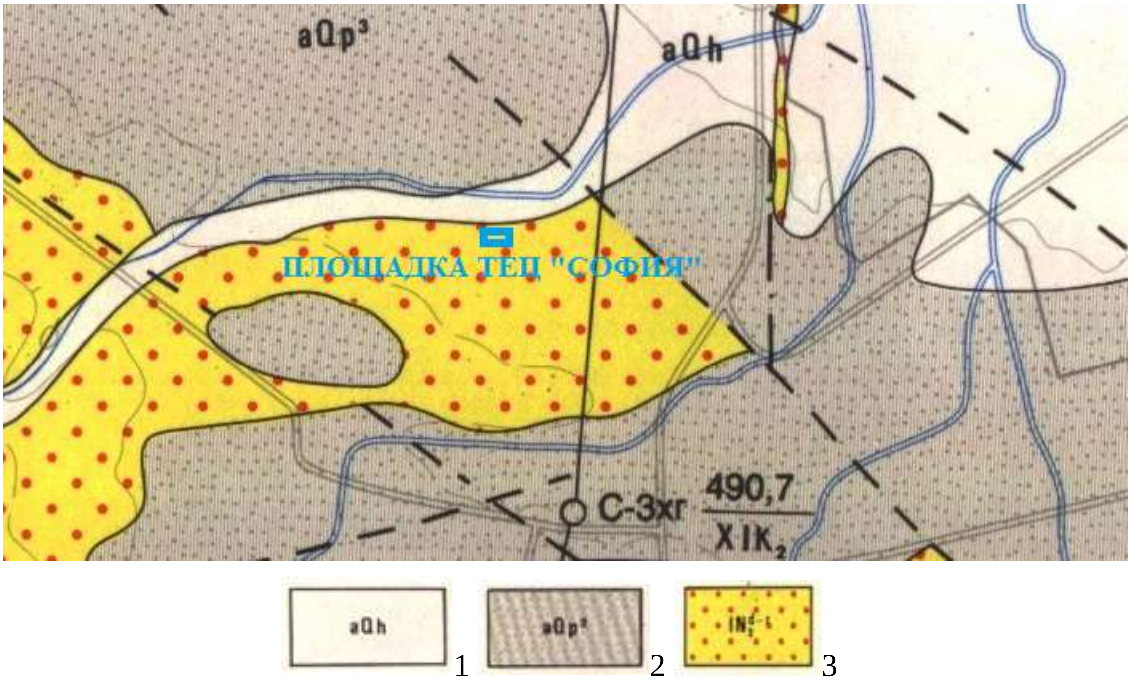
The natural deposits are covered with a layer of soil, at some places also with products from old and contemporary anthropogenic activity - superstructure of roadways, tram and railway lines, construction waste and household waste of variegated make-up and various thickness.

4.3.1.2 ENGINEERING GEOLOGICAL CONDITIONS

The lithographic profile of the immediate engineering geological environment of the alternative sites of the investment proposal includes a culture layer (a soil blanket and mounds), Quaternary formations and Neogenic sediments.

4.3.1.2.1 TPP SOFIA SITE

The site is in the central part of Sofia graben, between Suhodolska and Vladayska rivers, which are tributaries of Iskar river. The geological environment at the site and around it, illustrated in **Figure 4.3-1**, includes Quaternary alluvial formations on the river terraces and exposed at the surface Neogenic sediments of the Lozenets formation, overlapping the sediments of Novi-Iskar and Gnilyane formations.



1- alluvial formations of stream terraces and flood terraces (gravels, sands, clays); 2 - alluvial formations - 1 and II terraces above flood (gravels, sands, clays); 3 - Lozenets formation - Dac-Roman (alternation of clays, sandy clays, alevrolites, sandstones, gravels with coal in the base)

2 - Alluvial-prolluvial formations (gravels, sands)

FIGURE 4.3-1 A FRAGMENT OF A GEOLOGICAL MAP OF BULGARIA MAP SHEET SOFIA, SCALE 1 : 100,000

The exploration and investigation works carried out by EcoProConsult - Sofia in 2013 for determining more precisely the lithological structure and finding out the engineering geological and hydrological conditions included the following:

- Drilling works - drilling of six investigation core drill wells of depth between 10.6 and 22.0 m and total length 108.2 m;
- Description of the geological and lithological varieties through which the bores passed;
- Finding out and measuring the water level;
- Carrying out of field tests of the ground base applying the DPSH (Dynamic Probing Super Heavy) method in the area of dynamic impact on the ground base - 18.30 m;
- Taking of 28 earth samples and making laboratory analyses.

The geodesic coordinates, elevation and depth of the investigation drill wells and penetration probing (DP1) are given in **Table 4.3-1**, and their location is illustrated in **Figure 4.3-2.**

TABLE 4.3-1 INVESTIGATION DRILL WELLS AND PENETRATION PROBING (DP 1)

No. of drill well and penetration probing	Depth, m	Geodesic coordinates		Terrain elevation m
		X	У	
MD 1	22.0	4605930.149	8498742.624	530.95
MD 2	10.6	4605964.128	8498710.806	530.40
MD 3	20.0	4605954.826	8498751.753	530.85
MD 4	20.0	4605985.657	8498776.815	530.68
MD 5	15.6	4605988.732	8498785.920	530.51
MD 6	20.0	4606025.767	8498781.410	530.30
DP 1	20.0	4605954.823	8498754.028	530.83

FIGURE 4.3-2 LOCATION OF THE INVESTIGATION DRILLING AT THE SITE OF TPP SOFIA (ACCORDING TO DATA FROM ECOPROCONSULT, 2013)

Based on the obtained results the following engineering geological varieties were differentiated in the ground base up to 22.0 m below the surface:

- *Layer 1* – A layer of construction waste, clay, ash and variegated gravel Also oil derivatives (mazut) have been found in the area of DP6. The thickness of that layer is between 3.0 and 10.0 m;

- *Layer 2* – Clay, light to dark-brown, with grey and black spots, formed from dust, solid plastic;

- *Layer 3* – Sand, medium to coarse, at some places with medium and coarse gravel, in some spaces changing to clay sand;.

- *Layer 4* – Sandy clay to clay sand, brown, with grey spots, solid plastic. The layer is revealed in the form of lenses and was found by means of investigation drill wells at DP2, DP4, DP5 and DP6. The layer thickness varies from 0.5 m to 2.0 m.

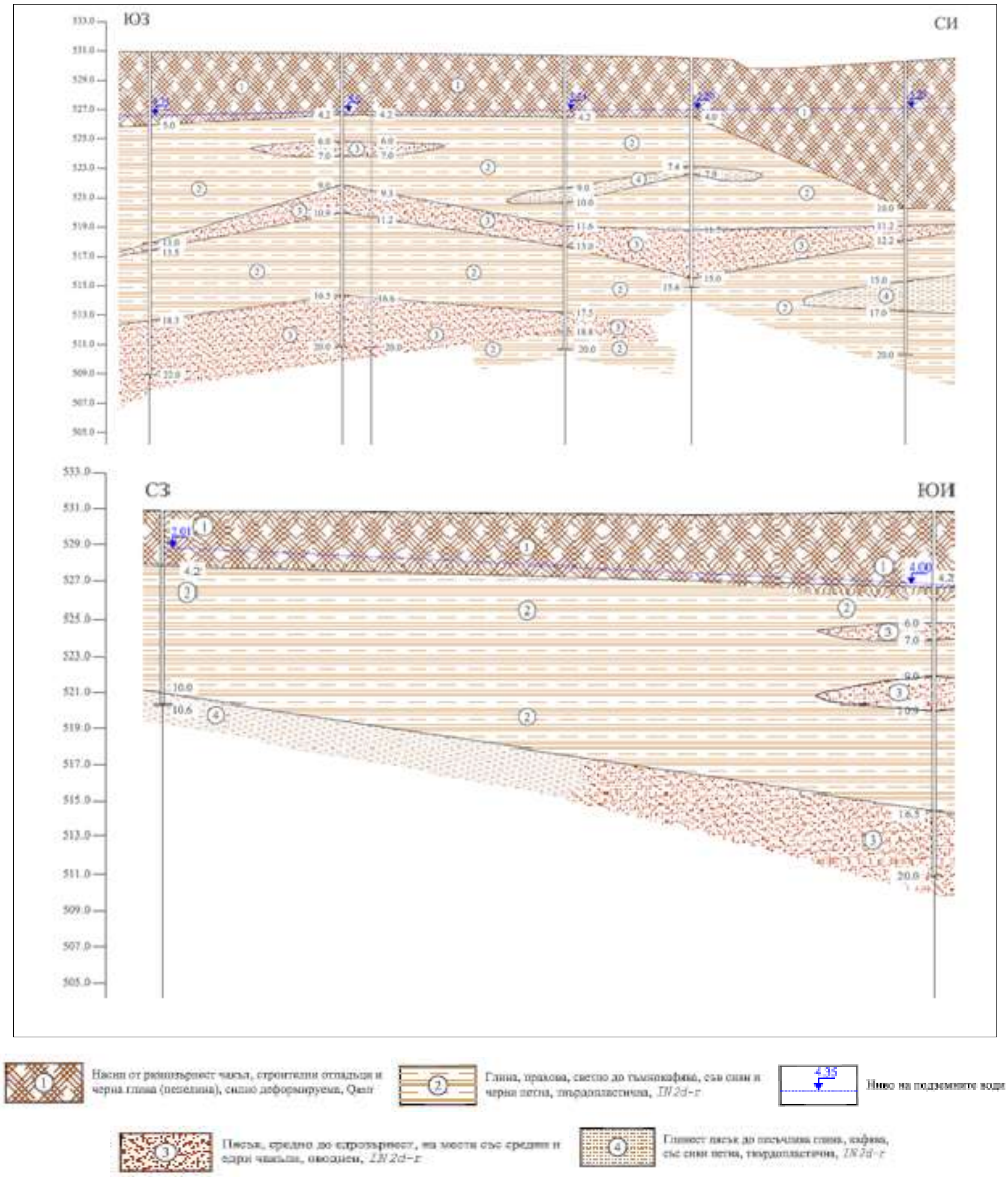


FIGURE 4.3-3 ENGINEERING GEOLOGICAL PROFILES (RCOPROCONSULT, 2013)

The location of the differentiated layers is shown in the engineering geological profiles (**Figure 4.3-3**), and the results from laboratory tests of the physical and mechanical properties of the layers are summarised in **Table 4.3-2**.

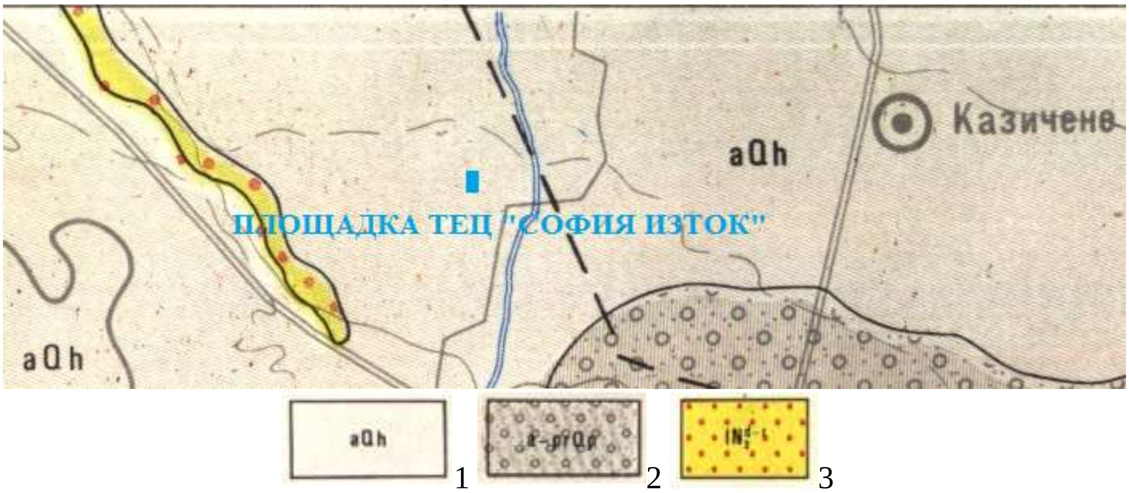
TABLE 4.3-2 PHYSICAL AND MECHANICAL PROPERTIES

No.	Parameters	Unit of measure	Average values of parameters			
			Lithological layer			
			Layer 1	Layer 2	Layer 3	Layer 4
1	Volume weight, γ	kN/m^3	18.4	19.2	20.4	18.9

2	Volume of pores, n	-	-	0.40	0.34	0.41
3	Pores coefficient, e	-	-	0.67	0.51	0.70
4	Water contents, W	%	-	23.2	14.6	21.7
5	Plasticity index, W_p	%	-	32.6	4.6	14.9
6	Consistence index, I_c	-	-	0.99	1.30	0.69
7	Degree of water saturation, S_r	-	-	0.90	0.73	0.82
8	Angle of internal friction, φ:	degree	-	1.8	37.1	22.3
9	Cohesion, C:	кPa	-	64.4	7.0	57.0
10	Compression module, M	MPa	-	8.56	-	9.45
11	General deformation module, E_0	MPa	-	17.0	26.3	19.0
12	Calculated load, R_0	MPa	-	0.28	0.30	0.23
13	Granulometric content: - gravel - sand - dust - clay	 % % % %	 - - - -	 3.01 12.25 36.37 48.37	 16.68 66.40 11.61 5.30	 1.76 52.69 23.97 21.58
14	Consertality coefficient $U = d_{60}/d_{10}$	-	-	-	42.8	93.4

4.3.1.2.2 TPP SOFIA-EAST SITE

The site is in the south-east part of Sofia graben within the left flood plain of Iskar river. The geological environment at the site and around it, illustrated in **Figure 4.3-4**, includes Quaternary alluvial formations, Neogenic sediments of the Lozenets formation, overlapping the sediments of Novi-Iskar and Gnilyane formations [22].



1- alluvial formations of stream plains and flood plains (gravels, sands, clays); 2 - Alluvial-prolluvial formations (gravels, sands); 3 - Lozenets formation - Dac-Roman (alternation of clays, sandy clays, alevrolites, sandstones, gravels with coal in the base)

FIGURE 4.3-4 A FRAGMENT OF A GEOLOGICAL MAP OF BULGARIA MAP SHEET PERNIK, SCALE 1 : 100,000 (ZAGORCHEV IV. ET AL, 1991)

Based on data from archive sources, summarised in the Geology part of the conceptual design of project "Cogeneration plant utilizing RDF in Sofia" (Angelov L., 2013) the following engineering geological layers are differentiated in the ground base of the site:

[22] Zagorchev, Iv., R. Marinova, D. Chunev, 1991. Geological map of Bulgaria Map sheet Pernik, scale 1 : 100,000

- → *Layer 1* – A layer of construction waste, clay and varigrained gravel, thickness up to 1.0 - 1.5 m;
- → *Layer 2* –sandy clay, light-brown to yellow-brown; Found in all space up to around 4.0 m depth;
- → *Layer 3* – fine sand with fine gravel, clay-covered. The bottom of that layer was crossed at maximum depth 3.4 m;
- → *Layer 4* – medium to coarse gravel with sandy filler and boulders. The top of that layer was found at depth from 2.8 to 3.4 m, and its lower boundary was crossed at depth 19.2 m.
- → *Layer 5* – Neogenic sandy and dusty-sandy clay clay, grey. It was found at depth below 16.0 - 20 m

Table 4.3-2 shows the average values of the basic physical and mechanical parameters of the layers according to data from archive sources, contained in the conceptual design, and Appendix 2 with the Norms for designing flat foundations.

TABLE 4.3-3 BASIC PHYSICAL AND MECHANICAL PARAMETERS

No.	Parameters	Unit of measure	Average values of parameters				
			Lithological layer				
			Layer 1	Layer 2	Layer 3	Layer 4	Layer 5
1	Volume weight, γ	kN/m^3	18.4	19.7	-	22.0	19.1
2	Angle of internal friction, φ:	degree	-	21.0	28.0	40.7	33.2
3	Cohesion, C:	кPa	-	24.0	0	0	43.3
4	Compression module, M	MPa	-	8.0	-	-	10.0
5	General deformation module, E_0	MPa	-	16.0	25.0	39.2	20.0
6	Calculated load, R_0	MPa	-	0.20	0.25	0.30	0.22

4.3.1.3 4.3.1.3. HYDROGEOLOGICAL CONDITIONS

The hydrogeological conditions in the two alternative sites for the investment proposal - TPP Sofia and TPP Sofia-East - are within Sofia graben and feature groundwater in the pre-Neozoic rock bed, in the Neogene (lower and upper) and in the Quaternary.

In the pre-Neozoic rock bed of upper Cretacious andesites, tuffs and tufftes, sandstone, marls and marly limestone, upper-Jurrasic limestone, sandy schists and quartzites, mid-Triassic limestone and dolomites and lower-Triassic sandstones, cleft water and karst water is accumulated.

The Neogene contains pore water, forming two aquifers - lower aquifer composed of sands and gravels with clay bands, and upper aquifer which is an aquifer complex of sandy-gravely layers, hydraulically connected.

The Quaternary alluvial and prolluvial gravel-sand formations of Sofia valley contain pore water, which has hydraulic connection with the rivers.

Groundwater in the pre-Neozoic rock bed and in the deep part of Neogene, which has higher temperature, is exclusive state property and is entered under No.102 in Annex 2 to art.14, item 2 of the Water Act as: Sofia valley region - Groundwater in the pre-Neozoic rock bed and the Neogene sediment complex, of temperature above 20 degrees Celsius, including mineral water of the identified occurrences within the territory of Sofa city region, Sofia city and Sofia District, as follows: No.3 - Bankya; No.31 - Kazichene-Ravno Pole; No.74 - Sofia-Batalova Vodenitsa; No.75 - Sofia - Gorna Banya; No.76 - Sofia-Zheleznitsa; No.77 - Sofia-Knyazhevo; No.78 - Sofia - Lozenets; No.79 - Sofia - Nadezhda; No.80 - Sofia - Ovcha Kupel; No.81 - Sofia - Pancharevo and No.82 - Centre.

In the Neogenic sediments and Quaternary formations the following groundwater bodies are identified: "Pore water in the Neogene - Sofia valley" under code BG1G000000N033 and "Pore water in the Neogene-Quaternary - Sofia valley" under code BG1G00000NQ030.

The groundwater body *"Pore water in the Neogene - Sofia valley" under code* BG1G000000N033 is a laminar aquifer complex formed in the unbound or loosely bound and varigrained sediments of the Gnilyane formation and the variegated terrigenous formation. In literature that body is described as *lower Pliocene aquifer*. At the surface it it is revealed as a narrow strip in the northern periphery of Sofia graben between the villages of Balsha and Kremikovtsi and bewteen the village of Bezden and the karst springs near the village of Opitsvet. The groundwater is subartesian in nature. The thickness of water-holding collectors of the groundwater body varies widely, and is average around 120 m. The filtration characteristics of the collectors is quite varied. The average value of permeability is 300 m^2/d and of the filtration coefficient - 40 m/d (DRBD, 2010). Groundwater is hydrocarbonate-sodium, with mineralisation from 700 to 1250 mg/l.

The groundwater body *"Pore water in the Neogene-Quaternary layer - Sofia valley", code BG1G00000NQ030* comprises pore groundwater accumulated in the sand and gravel in the upper part of Lozenets formation in the Neogene and in the Quaternary alluvial gravel-sand formations of Iskar river and its tributaries Banishka, Blato, Kakach, Suhodolska, Vladayska, Perlovska, Lesnovska, Matitsa, Stari Iskar, Darvenishka and Slatinska rivers and mixed proluvial-alluvial formations. The alternative sites of TPP Sofia and TPP Sofia-East are located on that groundwater body. Its hydrological features as well as the hydrological conditions of the two sites are described above in **section 4.2.2 -*Groundwater***.

4.3.1.4 PHYSICAL AND GEOLOGICAL PROCESSES AND PHENOMENA

TPP Sofia and TPP Sofia-East sites are located in level terrain, the product of weathering and erosion-accumulation processes, which resulted in the contemporary appearance of Sofia valley and in the Quaternary formations in it. No physical or geological processes or occurrences have been manifested at the sites or in their vicinity. Landslide processes and occurrences are observed in the periphery of Sofia valley, in the steep valley slopes of Suhodolska, Vradayska and Simeonovska rivers and slopes of excavations, in the slopes of the high river terraces (near Yujen Park, Lozenets quarter, Vladayska river, Slaviya stadium, Heating Plant Zemlyane, near the MSW landfill Suhodol, in the foot of Tenev hill in the town of Bankya, to the north-eat of Geo Milev park, etc.) Also present-day activation of landslide processes within old landslides is observed - beyond the ring road at Dragalevtsi village, at the Botanic Garden of BAS, and Kokalyane village. In the past considerable area of Sofia valley was marshy from drained off groundwater at small depth. Marshy land has been drained and recultivated to a large extent.

The clayey-sandy ground environment of the investment proposal sites, characterised by relatively low shear resistance of clays, high heterogeneity of sand layers and groundwater contained in them are potential preconditions for:

- → bringing about deformations of landslide type in the slopes of the envisaged deep excavations for the foundations of buildings and installations if their design parameters and construction technology are not observed;
- → possible suffosion (washing out of particles of non-bound sands) resulting from water filtration when dewatering/drainage of construction excavations is necessary, in particular the excavation for the foundations of the RDF storage bunker.

4.3.1.5 SEISMICITY

Sofia valley and its surroundings are in the Sredna Gora seismic area where thge maximum expected magnitude (M) of an earthquake in Sofia zone is up to 7.0. A historical review shows that there have been strong earthquakes in Sofia valley with destructive effects on Sofia. Historical documents have been found evidencing seismic events in this area from 15th to 18th century. The earthquakes which occurred in the 19th century are documented more precisely and in more detail. The strongest documented earthquake within Sofia was in the period 18- 30 September 1858. Its intensity was IX degree and its magnitude M = 6.5. In the 20th century the strongest earthquake of intensity VII-VIII and magnitude M = 5.2 was on 17 October 1917. It was followed by weaker seismic shocks, which continued for more than a year. After that earthquake a relatively calm period started. There were around 250 earthquakes in the last 80 years, in the range $2.0<M<4.4$. Seismic studies show that in Sofia zone considerable damage can be expected from earthquakes originaling from local foci, located in the very zone. Earthquakes originating beyond Sofia zone are of VII-VIII degree by Medvedev–Sponheuer–Karnik scale.

Up-do-date forecast maps of seismic zoning have been created. An important end products of zoning are the maps of expected seismic impacts on the earth's surface in degrees according to Medvedev–Sponheuer–Karnik scale for different periods of 100, 1,000 and 10,000 years. Those maps are intended for immediate use in practice and in seismic engineering.

According to the Map of Seismic Zoning of the Republic of Bulgaria for a period of 1,000 years (Annex No.5 under art.15 (2) and art.106 of Ordinance No. RD-02-20-2 of 27.01.2012[23]) Sofia city is within an area of seismic degree IX, where the dimensions of buildings and installations must be calculated with seismic coefficient $K_c = 0.27$. The lithological varieties according to table 1 under art.7 (1) of the Ordinance, constituting the geological environment of TPP Sofia and TPP Sofia-East sites, refer to soil group „**C**".

4.3.1.6 SUBSURFACE RESOURCES

The two potential sites of the investment proposal are within the urban environment of Sofia city, where subsurface resources have not been explored or verified.

4.3.1.7 CONCLUSIONS

The geological structure, engineering geological conditions, physical and geological processes and occurrences, seismicity and the absence of subsurface resources at the potential sites of TPP Sofia and TPP Sofia East are analogous and similar. Those conditions do not present any obstacle for the construction of the plant, and therefore are not determining for the choice of a suitable site for implementation of the investment proposal.

4.4 EARTH AND SOILS

4.4.1 CHARACTERISTICS OF THE CONDITION OF SOILS IN THE SITES AREA CONTAMINATED LAND

According to the soils zoning of Bulgaria the sites are in Sofia region of Sofia-Kraishte province, in the Central Bulgarian sub-zone of maroon forest soils and vertisols within the southern Bulgarian xerothermal zone. As a result from diverse and specific geo-morphological and hydro-climatic conditions, relief and vegetation, soils of three genetic types formed in this relatively small area. The soil mantle is represented mainly by vertisols and maroon forest soils. Less widespread are delluvial, delluvial-meadow and alluvilal-meadow soils, in the river valleys, and anthropogenic soils. The geological base on which the soils are formed is Pliocene and Quaternary alluvial deposits (gravels, sands and sandy clays) and delluvial matter drifted from nearby mountains [24]

[23] Ordinance No.RD-02-20-2/ 27.01.2012 on designing of buildings and installations in seismic areas.

[24] Achkov N., B. Spirov, Al. Levenson et al, 1972 Soil agri-chemical characteristics of UODZS, Gorublyane village, Sofia region Sofia Institute of Soil Science "N. Pushkarov"

Dishovski T. (team leader) 1967 Soil agri-chemical characteristics of the land of Cooperative Farm "Vitosha", Simeonovo village, Sofia Institute of Soil Science "N. Pushkarov"

In the lowlands and valleys the soil-forming materials are mostly Pliocene lake sediments and Quaternary deposits. As a result from neotectonic motions large drift cones formed in them, and at places, due to sinking, natural drainage was impaired and secondary processes of marshing and soil salination developed. The valley nature of Sofia region creates conditions for retaining and additional radiation cooling of air. The lay of Sofia valley is mostly level and plain-hilly. The average altitude is 550 m. The most typical forms here the valley bottom and mountain foots. There are two types of forms in the valley bottom: terraces in the western part and alluvial areas in the eastern part (in the wide valley parts of Iskar river and Lesnovska river).

In climatic aspect the region features relatively good conditions. It is within the climatic area close to mountains and low-mountainous area of central western Bulgaria, in the temperate continental climatic sub-area of altitude between 550 m and 1,000 m, which is characterised by a large variety of terrains. It has different exposure, with prevailing sloping forms, which lends variety to thermal and precipitation conditions. In general winter is as cold as in kettle fields and summer is cool.

As regards passage of air from the north-west, the region is within the orographic influence of Western Stara Planina. Due to that summer precipitation considerably exceeds winter precipitation, the difference is on the average 14-15 % of the annual amount, and in that respect the climate of the area has the typical features of moderate continental climate - summer precipitation over 30 % heavier than winter precipitation, stable and thicker snow cover, frequent strong winds, etc.

TABLE 4.4-1 MAIN CLIMATIC FEATURES OF THE REGION

Region	Annual precipitation	IV - VI	IV - IX	Defficit	Average annual t^0	∑above 10^oC
IV_1	650 mm	220 mm	380 mm	-55 mm	8.7^oC	$2,800^oC$

The region has relatively good heat supply. The average annual temperature is 8.7^0C, for January it is -1.6 to –1.8^oC , and for July - 18 - 19^oC. The thermal conditions in the region are relatively good but do not enable growth of thermophilic plants. Temperature amounts for the vegetation period, depending of the altitude and exposure, are between 2,800 and $3,500^oC$.

Precipitation amounts are high. The average annual precipitation here is 550 - 650 mm, of which 380 fall in the vegetation period. The deficit in atmospheric moisture for the vegetation period is around -55 mm, and considering part of the autumn-winter reserve of moisture in normal-profile soils, moisture can compensate the loss from evaporation to a large extent.

Under those specific geo-morphological and hydro-climatic conditions, lay and plantation in Sofia valley area mostly vertisols and maroon forest soils have formed, and in the vicinity of rivers, which cross the valley - delluvial-meadow and alluvial-meadow soils. In the conditions of intense anthropogenization and industrialisation of the region the share of anthropogenic soils is increasing. The soils of the two suggested sites differ slightly: in the site of TPP Sofia vertisols and their anthropogenic versions have larger share, and in the site of TPP Sofia-East - the alluvial-meadow soils and anthropogenic soils.

4.4.1.1 TPP SOFIA SITE

TPP Sofia-East is located in the industrial area of Sofia city, industrial area Zadgarov Rayon, at 6, 202nd St. (data from deed No.116/29.08.1997 for property ownership). The total area of the plot is

Raykov L., H. Chuldzhiyan, L. Faytondzhiev, 1983 Mapping and diagnostics of soil contamination with heavy metals - Soil science and agricultural chemistry., issue 1, p.42-49

377,310 m^2, on which 50 existing buildings are located with total built-up area 45,987.31 m^2, address: Sofia 1220, 6, 202nd St. The detailed description of adjacent areas is given following the property boundaries in the four cardinal directions, as follows:

(1). To the east - Warehouses

- company Omnipro AD; Central Laboratory of Plant Quarantine and Residual Quantities (new use of the plot of municipal company Sofia Greenhouses) - 55, P. Napetov St., with total area 122.4 daa, built up area 4,200 m^2; status according to Sofia master plan: public area, green area.

- Gas station, TIR service, a warehouse for tyres at 1, 202nd St. (new use of the plot of state enterprise Vitosha - Transport EOOD) with total area according to deed for property ownership 7.7 daa; utilised area - 24.5 daa, status according to Sofia master plan: warehouse area, public area.

(2). To the west - Kotlostroene OOD (8, 202nd St.,) with total area 609.9 daa according to deed for property ownership; utilised area - 138 daa; built up area - 49,659 m^2,status according to Sofia master plan - industrial area.

- Institute for heating and power engineering (8, 202nd St.); the institute uses the plot of Kotlostroene OOD; built up area - 1,830 m^2; status according to the Master Plan of Sofia - industrial area;

(3). To the south - State enterprise BDZ (Bulgarian State Railways) - Logistics Department (7, 202nd St.,) total area 53.6 daa according to deed for property ownership; utilised area - 23.2 daa; built up area - existing situation - 5,394 m^2, status according to Sofia Master Plan - green area.

- State Enterprise for Automatics and Telemechanics (7, 202nd St.) with total area 11.4 daa, built up area 5,560 m^2; status according to Sofia Master Plan: green area.

- State enterprise BDZ (Bulgarian State Railways) - Wagon Works (Central Raolway Station Square) with total utilised area 448 daa; built up area 72,569 m^2; status according to Sofia Master Plan - industrial area.

(4). To the north - State Enterprise "Mladost Commerce" (22, Parva Balgarska Armia St.) with total utilised area 11 daa, built up area 780 m^2.

- "Detska Radost" EOOD - utilised area 12.5 daa, built up area 1,400 m^2.

- "Iskra - Silatronin" AD (2, Prosveta St.) utilised area 57 daa, built up area - existing situation 18,400 m^2; status according to Sofia Master Plan: industrial area.

- KOOP "Metalurgia" (25, Tsvetan Antov St.) utilised area 12.1 daa, built up area 6,100 m^2; status according to Sofia Master Plan: industrial area.

- Municipal Company "Svezhest" (18, Prosveta St.) total area 19 daa according to deed for property ownership; utilised area - 40.3 daa; built up area - existing situation - 12,375 m^2, status according to Sofia Master Plan - industrial area.

- DZI "Avtomobilno Zastrahovane" (insurance company) (1, Konstantin Preslavski St.), utilised area 6.3 daa, built up area (existing situation) - 1,500 m^2, status according to Sofia Master Plan - green area.

- Automobile Club - North (3, Konstantin Preslavski St.), total utilised area 11.1 daa, built up area (existing situation) - 900 m^2, status according to Sofia Master Plan -

- public area.

- State Enterprise "Montazh na Instalatsii i Uredbi" ("Assemblage of Installations and Equipment") (1, Nesho Bonchev St.) with utilised area 38 daa; currently under constriction; status according to the Master Plan of Sofia - green area.

(5). Only to the north-east the plot of TPP Sofia neighbours residential quarters from Orlandovtsi residential district (the nearest building is at 16 m distance from the fence of TPP Sofia To the east, in the immediate vicinity of the fence of TPP Sofia, there are four residential blocks of flats, municipal property, located on a section of the site. The inhabitants of those flats are employees of Toplofikatsia Sofia EAD.

The following types of soil are most common in the region of TPP Sofia: leached vertisols (Bulgarian classification, 1980), eutric vertisols (Bulgarian classification, 1992), FAO – WRBSR (Haplic Vertisol) , occupying considerable area in the western part of the region. They feature large total depth of the soil profile (180 cm), a deep (about 1 m) black humus horizon with average 3-4 % humus content in the surface horizon. Vertisols are formed on Pliocene and Quaternary alluvium with prevailing clay matter content, with available groundwater nearby and under continuous impact of meadow flora, later of agricultural vegetation, and at present again herbaceous vegetation grows there. According to their mechanical content the vertisols in the region of the site are clayey throughout their profile - physical clay content 70-75 % and fine particles (dimensions below 0,001 mm) content 55-60 %. As regards their mechanical content those are the deepest and heaviest vertisols in Bulgaria. Under the humus horizon is a transition horizon (B), dark-brown in colour, with average thickness 70-80 cm. It has prism-lump structure with washed out sides of the aggregations. A typical feature of those soils is the depositing of carbonates in the lower part of the profile in the form of large soft "white eye" deposits, which are sometimes exposed at the surface in the form of pockets.

FIGURE 4.4-1 LAND AND SOILS IN THE REGION OF TPP SOFIA SITE

Due to their heavy mechanical structure vertisols have high water-retantion capacity, low water permeability, and hence - poor water-air regime in the humid periods of the year. The total water retention capacity of such soils is in the range of 32 - 42 %. A particular feature of vertisols is that when moistened, they rise much and become highly plastic and sticky, and when they become dry, they shrink much and become cracked. Such soils are more difficult to cultivate compared to other soils, and they have a relatively short period of optimum humidity to be workable. Their reaction is neutral to slightly alkaline (pH in H_2O is 7.0-7.5, and pH in KCI ranges betwen 5.9 and 6.45).

Vertisols are one of the most fertile types of soil in Bulgaria. The relatively high content of organic matter causes also higher total nitrogen content in them - average 0.114-0.280%, i.e. they have medium nitrogen reserve. The total phosphorus quantities range between 0.100 and 0.130 %. They have a good reserve of total and mobile potassium. They are most suitable for growing of cereals. As regards erosion conditions, the soils within the site are not eroded.

Vertisols have high sorption capacity and high saturation with bases. As regards their resistance to chemical contamination, vertisols have relatively buffer capacity and according to Instruction No. RD-00-11/13.07.1994 of the Ministry of Agriculture and Forestry (art.8 and Appendix No.8) they are rated class 2 (of 5 classes altogether).

The alluvial-meadow soils (eutric fluvisols) prevailing in this area are sparsely stony, slightly sandy-clayey. The humus horizon has depth 30-60 cm, and layers of sands and gravels follow beneath it. Moisture and physical properties: those soils are airy, water permeable, with good heat and air regime but poor water retaining capacity. Reaction is acidic - pH (KCl) ranges between 4.9 and 5.6[25, 26, 27].

[25] Achkov N., B. Spirov, Al. Levenson et al, 1972 Soil agri-chemical characteristics of UODZS, Gorublyane village, Sofia region Sofia Institute of Soil Science "N. Pushkarov"

[26] Dishovski T. (team leader) 1967 Soil agri-chemical characteristics of the land of Cooperative Farm "Vitosha", Simeonovo village, Sofia Institute of Soil Science "N. Pushkarov"

[27] Raykov L., H. Chuldzhiyan, L. Faytondzhiev, 1983 Mapping and diagnostics of soil contamination with heavy metals - Soil science and agricultural chemistry., issue 1, p.42-49

TABLE 4.4-2 SOIL VARIETIES IN THE AREA OF TPP SOFIA AND BASIC SOIL PARAMETERS

Soil variety	Mech. composit. of fallow land	Mech. composit. of sub-fallow land	Humus thickness cm	Soil thickness, cm	Texture coefficient	pH in water	Humus in %	Groundwater level
1 Leached (eutric) vertisols, medium deep to deep	69	73	80	100	1.1	6.2	2.9	600
2 Leached (eutric) vertisols, chromic, medium deep	59	70	60	100	1.3	5.7	1.8	600
3. Slightly leached chromic cambisols, vertisol-like	55	58	30	105	1.2	6.1	1.7	600
4. Slightly leached gleyic vertisols, medium deep	67	71	70	90	1.2	5.9	3.2	600
5. Eutric fluvisols, deep	37	44	85	85	1.2	6.2	1.7	600

TABLE 4.4-3 FERTILITY (YIELD POTENTIAL, BONITET) OF LAND IN THE REGION OF THE SITE FOR BASIC CROPS

Soil variety	Bonitet grade for:											Average agronomic grade
	Wheat	Maize	Soy-bean	Sun-flower	Sugar beet	Large-leaf tobacco	Potatoes	Alfalfa	Grazing-ground, meadows	Apples	Vine yards	
1. Leached (eutric) vertisols, medium deep to deep	93	62	39	69	70	78	33	88	74	64	27	71
2. Leached (eutric) vertisols, chromic, medium deep	92	63	60	66	75	83	39	69	74	64	26	71
3. Slightly leached chromic cambisols, vertisol-like	88	57	42	62	68	80	39	70	73	69	33	69
4. Slightly leached gleyic vertisols, medium deep	94	63	45	70	71	77	39	72	74	64	28	72
5. Eutric fluvisols, deep	88	59	59	62	71	78	42	72	72	67	36	70

Only three of the soil varieties are available in the area of TPP Sofia: those under Nos. 1, 4 and 5 above, respectively leached (eutric) vertisols, medium deep to deep; slightly leached gleyic vertisols, medium deep, and eutric fluvisols, deep. As seen from the table above the mentioned soil varieties have minor differences, both in their features and naturally in their fertility potential. The soils are of category III, and having in mind that in Bulgaria there is no land of category I, they come in second place as regards fertility.

The investigation which was carried out recently showed that the soils that are naturally available in this region have been subject to anthropogenization to different degrees, and have the features of anthropogenic urban soils (class Antrosols, type Urbic) according to FAO classification. Most of the studied soils are filling, with disrupted genetic profile. They consist of earth layers of different origin, composition and properties, including large amounts of construction waste (pieces of bricks, tiles, lime, concrete, sand, rubble) and other admixtures.

The vertisols in the TPP area have a reduced profile due to the construction of buildings, roads and other urban communications. The land that is not built up is reduced, covered with gravel and sand, and pavement and asphalt.

Places where there are open soils, not sealed with asphalt or pavement, are few. Those are the green areas to the north of 202nd street.

The date shows that in the different parts of the site to the west of Nadezhda overbridge, and to the east in the direction of the Central Cemetery, as already mentioned, soil conditions do not provide good conditions for growth of diverse vegetation. The soils are very heavy, and do not enable achieving of good ornamental and hygienic effect around the streets and parks.

Vertisols are deep soils with high yield potential, but using them as agricultural land is almost impossible as the use of most of that land has been changed and it has been included in the plots of the cemetery, the TPP and other built up areas, although they belong to the bonitet group of good land - land of category III.

As regards the possibilities to use the existing soil resources in recovering the environment after building the plant at the site, the soil has been studied in places of existing soils from where it should be possible to take soil material and use it in re -cultivation after completion of earth works and construction works. Excavation and earth works will not be performed beyond the sites of the two thermal power plants, from where to collect humus layer.

TABLE 4.4-4 MECHANICAL COMPOSITION - SECTION 1 IN THE PARK IN THE DIRECTION OF 202ND STREET - VOENNA RAMPA

Horizon and depth in cm	Loss from HCI treatment	PARTICLE SIZE, mm							
		> 1	1-0.25	0.25-0.05	0.05-0.01	0.01-0.005	0.005-0.001	<0.001	<0.01
Ap 0- 25	2.4	0.0	2.0	9.0	13.0	12.2	9.0	52.1	73.6
A^{i} 25- 42	2.5	0.0	1.6	1.9	12.0	8.1	8.2	55.5	72.0
A^{ii} 42- 58	2.3	0.0	1.5	9.8	14.0	8.7	7.3	57.0	72.6
A^{iii} 58- 90	2.2	0.0	1.4	9.7	12.3	8.4	7.2	58.9	73.9
B 90-110	7.7	1.8	6.5	11.8	14,0	15.5	4.6	38.9	60.0
B_{ck}100-140	8.6	1.6	3.4	8.8	15,3	8.1	10.3	44.0	62.1
C_k 140-180	8.7`	0.0	7.5	13.7	13,9	7.0	7.5	41.0	58.0

TABLE 4.4-5 CHEMICAL PROPERTIES

Horizon and depth in	Humus in	Total N%	C : N	$CaCO_3$	pH

cm	%				H_2O	KCI
Ap 0- 25	3.55	0.130	11.5	0.0	6.5	5.4
A^{i} 25- 42	3.25	0.120	12.5	0.0	7.2	5.5
A^{ii} 42- 58	2.75	0.110	13.3	0.0	7.2	5.6
A^{iii} 58- 90	2.5	0.095	12.2	0.0	7.2	6.0
B 90-110	1.8	0.040	14.1	4.4	7.6	6.8
B_{ck} 100-140	1.25	0.036	11.7	7.2	8.2	7.1
C_k 140-180	0.97	0.035	12.0	4.9	8.3	7.2

The mechanical composition of soil samples taken from the green area (after Nadezhda overbridge) and behind the TPP building is light clayey to heavy sandy-clayey along the entire depth of sampling. (**Table 4.4-6**). The relative mass ranges between 1.32 and 2.13. The lower values show presence of larger quantity of minerals, or heavier minerals, but without sufficient organic matter. The data about the sorption properties of soils show that they are saturated with bases (V%) - **Table 4.4-8**)

TABLE 4.4-6 MECHANICAL COMPOSITION - SECTION 2, BEHIND TPP SOFIA BUILDING

Horizon and depth in cm	SIZE OF PARTICLES, mm							
	> 1	1-0.25	0.25-0.05	0.05-0.01	0.01-0.005	0.005-0.001	0.001	<0.01
$A^{i}p$ 0- 22	0.0	4.0	6.5	20.3	6.7	11.2	51.1	69.0
A^{ii} 22- 44	0.0	4.2	6.7	16.6	8.1	10.5	53.8	72.4
A^{iii} 44- 72	0.0	4.1	7.8	14.7	9.3	7.7	56.3	73.6
B 72-105	0.0	4.1	8.4	13.7	11.1	11.0	51.6	73.8
B_{ck} 105-135	0.0	3.7	6.2	10.8	13.8	15.4	50.0	79.1
C_k 135-170	0.0	2.3	12.1	32.6	11.3	10.0	31.8	53.2

The chemical properties of analysed soils, characterizing the soil fertility, are given in **Table 4.4-7**. The values show that in most part the soils are neutral to slightly alkaline (in the surface layer), and as regards the reserve of nutrients - they have medium to good reserve of humus and nitrogen.

TABLE 4.4-7 SOME CHEMICAL PROPERTIES

Horizon and depth in cm	Humus in %	Total N%	C : N	$CaCO_3$ %	pH H_2O
$A^{i}p$ 0- 22	4.2	0.17	14.3	0.0	6.5
A^{ii} 22- 44	2.1	0.10	15.2	0.0	7.2
A^{iii} 44- 72	1.3	0.07	10.4	0.0	7.2
B 72-105	1.8	0.05	20.7	6.7	7.2
B_{ck} 105-135	0.9	0.05	9.6	12.1	7.6
C_k 135-170	1.1	0.04	17.4	16.2	8.2

For the most part the areas are covered with impermeable pavement, and the green areas are contaminated with household waste and in some places with construction waste. Soil materials which could be used for recultivation, are of unclear origin, they are to a high extent mixed from different depths, neither horizons are visible nor clearly distinguishable layers. The soil profile can not be clearly determined - neither by mechanical composition nor by depth, as many inclusions are present.

TABLE 4.4-8 CROSS SECTION 1: SORPTION CAPACITY (MEQU/100 G SOIL) AND SATURATION WITH BASES - 202ND STREET - IN THE DIRECTION OF VOENNA RAMPA

Horizon and depth in cm	mequ/100 g	EXCANGED CATIONS								V, %
		mequ/100 g soil				% of $T_{8,2}$				
		$H_{8.2}$	Al	Ca	Mg	$H_{8.2}$	Al	Ca	Mg	
Ap 0- 25	53.4	2.2	0.0	39.8	10.1	4.1	0.0	74.5	18.9	85.3
A^{i} 25- 42	55.5	2.0	0.0	40.4	10.6	3.6	0.0	72.8	19.1	87.8
A^{ii} 42- 58	52.9	1.6	0.0	40.9	10.8	3.0	0.0	77.3	20.4	89.8
A^{iii} 58- 90	54.1	2.3	0.0	39.7	12.1	4.3	0.0	73.4	22.4	100.0
B 90-110	50.7	0.4	0.0	39.1	11.6	0.8	0.0	77.1	22.9	100.0
B_{ck} 100-140	50.3	0.0	0.0	38.9	11.4	0.0	0.0	77.3	22.7	100.0

TABLE 4.4-9 CROSS SECTION 1: SORPTION CAPACITY (MEQU/100 G SOIL) AND SATURATION WITH BASES - BEHIND TPP SOFIA BUILDING

Horizon and depth in cm	mequ/ 100 g	EXCANGED CATIONS								V, %
		mequ/100 g soil				% of $T_{8,2}$				
		$H_{8.2}$	Al	Ca	Mg	$H_{8.2}$	Al	Ca	Mg	
$A^{i}p$ 0- 22	51.0	7.5	0.0	40.0	3.5	14.7	0.0	78.4	6.9	85.3
A^{ii} 22- 44	49.8	6.1	0.0	40.1	3.6	12.2	0.0	80.5	7.2	87.8
A^{iii} 44- 72	49.9	5.1	0.0	40.5	4.6	10.2	0.0	81.2	9.2	89.8
B 72-105	46.5	0.0	0.0	37.5	9.0	0.0	0.0	80.6	19.4	100.0
B_{ck} 105-135	46.6	0.0	0.0	36.4	10.2	0.0	0.0	78.1	21.9	100.0
C_{k} 135-170	45.2	0.0	0.0	34.4	10.8	0.0	0.0	76.1	23.9	100.0

The data from studying the alkaline and alkaline earth elements in the soils (**Table 4.4-9**) shows that the content of total alkaline elements is around the average content for the soils in Bulgaria. In most case magnesium content is low. The fact that the total sodium content is minimum is positive and there is no risk of soil solonization. The total potassium content in the soils is not high either, but the large quantities of absorbable potassium show that much of the total amounts are in a form accessible for the plants. That finding leads to the conclusion that in all cases of recultivation of ======= areas it will be necessary to import mineral, or organic and mineral substances.

TABLE 4.4-10 CONTENT OF SOME HEAVY METALS IN SOIL SAMPLES FROM THE TWO SECTIONS IN THE AREA OF TPP SOFIA

No. Section	Sampling point	Depth cm	pH /H_2O/	Cu mg/kg	Fe mg/kg	Co mg/kg	Zn mg/kg	Cd mg/kg	Pb mg/kg	Cr mg/kg	Ni mg/kg	S mg/kg
		Found min.	→	< 0.4	< 0.001	< 0.5	< 0.4	< 0.3	< 2	< 0.4	<0.5	< 10
P_1 –202nd St. - in the direction of Voenna Rampa												
1.		0 - 20	7.23	97.8	2.463	14.7	136.9	<	74	36.2	27.7	690
2.		20 - 50	7.46	55.6	2.647	20.6	72.7	<	27	39.7	31.7	327
P_2 – behind TPP Sofia												
3.		0 - 20	7.83	140.7	1.673	5.7	333.6	<	493	27.3	20.5	940
4.		20 - 50	7.52	140.5	2.052	10.0	236.5	<	318	28.4	20.2	988
Background (acc.to Ord. No.3, SG No.39/2002)			>6	60	38,000*	20	160	0.8	45	65	46	0.085% *
Limit values			4 - >7	40-280		20-240	60-370	0.8-3.0	40-80	100-380	35-210	

* *According to Donov, V.,1993. Woodland soil science Martilen Publishing House page 222*

4.4.1.2 TPP SOFIA-EAST SITE

4.4.1.2.1 GENERAL CHARACTERISTICS OF THE LAND

The alternative site for the RDF incineration plant is in the territory of Iskar municipality, which has 2,676.4 ha area including 988.9 ha agricultural land.

The plan of the property shows 319,692 m^2 area, of permanent land use type "Urbanised" and permanent use purpose "for other production of oil, coal, gas and schist products". The site coordinates are: 42°39’ 01” N и 23° 19’ 06” E[28].

FIGURE 4.4-2 ***A SATELLITE IMAGE OF THE SITE OF TPP SOFIA-EAST***

Adjacent to the site are areas for industrial construction, for planting, and mixed-purpose areas. The nearest residential areas are:

- to the north-east - beyond Iskar river, "D. Milenkov" district (~550 m) and to the south - a part of "Druzhba"district (~650 m).
- To the north-east - the large industrial enterprise Sofia Med AD.
- To the west the site abuts Dimitar Peshev St.; to the west of that street there are industrial areas partially used by small enterprises; to the south-east - a residential block of flats.
- To the south - garages;
- To the south-east - a crushed-stone pit, Iskar river, agricultural land.

[28] According to Deed No.98 of municipal private property The following are given in an appendix Deed N.98 of municipal private property; A sketch of landed estate No.42630/12.07.2013, and a List of coordinates outlining the boundaries of the landed estate

The area within a radius of 800 m of the site is industrial area. In the periphery of 1 km zone are blocks of flats of "Druzhba 1" district and houses of the small residential quarter Abdovitsa.

TPP Sofia-East is property of Toplofikatsia Sofia AD.

The area of TPP Sofia-East is intended for installations for thermal energy production, and the area just next to the plant - for industrial construction, building of installations and warehouses for oil products, thermal power plants, gas stations, for planting and miscellaneous functions. Site „B” is located within the territory of TPP Sofia-East and no land use change procedure is necessary.

Site „B“ will occupy an area of 20,000 m in the immediate vicinity to the main produciton facilities in TPP Sofia-East, near the railway line.

4.4.1.2.1.1 Land and soils in the region of the site

As a result from diverse and specific geo-morphological and hydro-climatic conditions, relief and vegetation, soils of three genetic types have formed in this relatively small area: vertisols, eutric and dystric fluvisols, and anthropogenic soils. The first two types, where they are still preserved, are strongly anthropogenized. The variety of soils is due to different degree of progress of soil-forming processes, which has an effect on the depth of soils, their mechanic composition, erosion, and stone content, and as a whole - on their fertility. In general soils are distributed in the region as follows:

- → In Druzhba residential district, which is on the terrace of Iskar river, on land formerly belonging to the village of Gorublyane, eutric and dystric fluvisols have formed and some vertisols.
- → Most of the soils are anthropogenic, originating from the above mentioned soil types. They have been either reduced from vertisols and later buried under soil materials from construction and with construction waste, or vertisols and fluvisols have been buried with the same waste materials.

Vertisols are relatively widespread in the soil region of Sofia, but within the scope of the IP such soils, relatively preserved but largely turfed, are available only to the north of the railway line in Druzhba residential district. Vertisols are formed on Pliocene and Quaternary alluvium with prevailing clay matter content, with available groundwater nearby and under continuous impact of meadow flora, later of agricultural vegetation; and at present again herbaceous vegetation grows there. Most of the vertisols are eutric but there are also calcic vertisols in some areas of the city. Most of them are slightly eroded.

The depth of the well-developed humus horizon is 50 - 70 cm, and of the soil profile - 90 -120 cm. The slightly eroded varieties, as the case here, their depths are 15 - 25 cm less.

The mechanical composition is heavy sandy -clayey with physical clay content (particles smaller than 0.01 mm) 48 - 58 %.

Vertisols feature very poor water permeability and quite high water retention capacity. The total water retention capacity of such soils is in the range of 32 - 42 %. A particular feature of vertisols is that when moistened, they rise much and become highly plastic and sticky, and when they become dry, they shrink much and become cracked.

The humus reserve is poor to medium - 2.45 - 2.72 % in the surface horizon, and the nitrogen reserve (total nitrogen) is medium - around 0.17 %. Vertisols are of the richest types of soil as humus over 1 % is present at depth up to 70 - 90 cm. Carbonates are washed down in the lower end of the soil profile and in the soil-forming base. The reaction of the soil is neutral to slightly acidic - pH (KCI) is in the range 5.9 - 6.45.

Vertisols have high sorption capacity and high saturation with bases. As regards their resistance to chemical contamination, vertisols have relatively high buffer capacity and according to Instruction

No. RD-00-11/13.07.1994 of the Ministry of Agriculture and Forestry (art.8 and Appendix No.8) they are rated class 2 (of 5 classes altogether).

According to the soil investigations, made in the period 1958-1972 by Pushkarov Institute, the naturally spread soils in the region are predominantly eutric fluvisols. In the northern part of Druzhba residential district the soil is fluvisol, highly stony. In the south-west parts also the following varieties are found: alluvial-delluvial (fluvisol), alluvial-delluvial (dystric fluvisols), and moderately leached chernozems-vertisols - accumulated or slightly and moderately eroded. In the immediate vicinity of Iskar river alluvial sands and gravels are common.

The alluvial-meadow soils (eutric fluvisols) prevailing in this area are sparsely stony, slightly sandy-clayey. The humus horizon has depth 30-60 cm, and layers of sands and gravels follow beneath it. Moisture and physical properties: those soils are airy, water permeable, with good heat and air regime but poor water retaining capacity. Humus content ranges between 1.5 % and 3.1 % in the surface horizon, therefore the soils are considered to have poor to moderate humus feature. The reserve of total nitrogen is medium to good (0.10-0.21 %) but the content of nitrogen absorbable by plants is low (11-29 mg NO_3^-/ 1000 g soil). The phosphorus content is medium – 0.113-0.178 %. Mobile phosphates reserve varies widely from poor (below 5 mg P_2O_5/ 100 g) to good (above 10 mg P_2O_5/100 g), and the content of absorbable potassium - from medium (13-20 mg K_2O/100 g) to good (21-47 mg K_2O/100 g). There are no carbonates in the profile also in the bed rock. The reaction is acidic - pH (KCl) ranges between 4.9 and 5.6[29].

The investigation which was carried out recently (1998 - 2009) showed that the soils that are naturally available in this region have been subject to anthropogenization to different extent, and have the features of anthropogenic urban soils (class Antrosols, type Urbic) according to FAO classification. Most of the studied soils are filling, with disrupted genetic profile. They consist of earth layers of different origin, composition and properties, including large amounts of construction waste (pieces of bricks, tiles, lime, concrete, sand, rubble) and other admixtures.

It should be pointed out that this area is under the impact of more than 30 small and large enterprises, including Sofia Med AD, creating a certain risk of exposure to toxic substances, but after the measures undertaken by Sofia Med AD no contamination of the soils in the area by that company is expected.

In the evaluation of the condition of soils in the area of TPP Sofia-East we have used the data from other investigations of ours, most of which were connected with assessment of the environmental impact of Sofia Med AD on the soils in the region. That company is immediately adjacent to the TPP therefore the data about the soils can be equivalent to those for this assessment. The features of the soils in the area have been studied through sections made in the soil at different distances from the plant, in the districts of Druzhba -1, Druzhba -2 and Dimitar Milenkov. Thus all the typical areas in the residential districts, which are in the immediate vicinity of the industrial enterprises and are therefore exposed to strongest impact, have been covered.

The data shows that the mechanical composition of the soils in the area varies widely, even within the same soil section. Some layers are highly clayey, others are sandy or gravely. In general, however, the studied soils have higher sand fractions and skeleton fractions compared to the natural soil type. That increases porosity, but due to the prevalence of coarse pores, it is inactive. There sections with very heavy mechanical composition in the spaces between the blocks of flats and in the grassed areas of Druzhba -2.

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[29] Achkov N., B. Spirov, Al. Levenson et al, 1972 Soil agri-chemical characteristics of UODZS, Gorublyane village, Sofia region Sofia Institute of Soil Science "N. Pushkarov"

Dishovski T. (team leader) 1967. Soil agri-chemical characteristics of the land of Cooperative Farm "Vitosha", Simeonovo village, Sofia Institute of Soil Science "N. Pushkarov"

Raykov L., H. Chuldzhiyan, L. Faytondzhiev, 1983. Mapping and diagnostics of soil contamination with heavy metals - Soil science and agricultural chemistry., issue 1, p.42-49

The soils are neutral or slightly alkaline - the pH (H2O) is about 6-7. In general the soils in Druzhba -2 and Dimitar Milenkov districts have higher alkaline value (pH(H_2O)>7) than those in Druzhba - 1 (pH(H_2O)<7). The hydrolytic acidity ranges between 0.36 mgeqv/100 g (P 6) and 7.35 mgeqv/100 g (P 10), but average for the soils in Druzhba -1 it is about 2 mgeqv/100 g, while the average in Druzhba -2 and Milenkov districts for most of the soils is <1.0 mgeqv/100 g (**Table 4.4-11**).

Comparison between the values of the sorption capacity of soils in the two studied layers 0-5 cm and 30-50 cm shows that they do not differ materially. Good sorption capacity results from sufficient presence of bases (K, Ca, Mg) in the soil, neutral or slightly alkaline reaction and high content of organic matter. In this case the good buffer properties of the studied soils are due to the slightly alkaline reaction, and much less - to the humus in them.

The humus content in the 0-5 cm layer is low to medium - from 1-2 to 3 % (**Table 5.1-2**). In depth (30-50 cm) that content in most cases decreases, and with that also the capability of the soil to block the migration of heavy metals into the profile depth also decreases.

Related to the low humus content in most soil profiles, the total nitrogen content is also low. The 0-5 cm deep layers contain nitrogen in quantity close to the average.

The total phosphorus content is within the values of content in the soils natural for the region. A very important fact is that in almost all soil profiles the total potassium as well as total calcium and magnesium content is low. Considerable to good potassium reserve is typical for the profiles close to the river bed (P_{16}) in D. Milenkov district (P_{14} and P_{15}), and only one profile in Druzhba -1 (P_{11}) where that element is above 3 %.

The content of heavy metals in soils in the area, tested in 17 soil sections, is shown in **Table 4.4-13**. The data shows a wide variety of values, but some regularities can be outlined. The processes, distances and directions of spreading of the pollutants will be considered as a complex in order to explain them better. The duration of impact should also be taken into consideration; i.e. it should be clarified in which areas earth works have been carried out in the recent years, and where such works have not been carried out, or have been - but in the more distant past. The influence of longest duration was in the areas within about 300 m distance from the fence of Sofia Med AD - P1, P2, P3 and P4. It should be taken into consideration, however, that in a long period - 20- 30- 50 years - those soils have undergone certain transformations: mechanic treatment, piling of soil materials, of construction waste, household waste, etc. In our opinion those are the reasons why in places where higher concentrations of heavy metals are expected (to the east, south-east, and north-east, as the wind carries the pollutants mostly in those directions), in some cases exactly the opposite is observed.

The assessment of the contamination of soils has been made in accordance with the legislation currently in force in Bulgaria. The soils have been classified into four groups:

- highly contaminated - the heavy metals content exceeds the limit values over twice; deterioration of soil properties is expected as a result from chemical contamination;
- moderately contaminated - the heavy metals content is 1-2 times higher than the limit value; there is no change in the soil properties;
- slightly contaminated - the heavy metals content is below the limit values but above the background concentrations;
- non-contaminated - the heavy metals content does not exceed background concentrations.

The anomaly coefficient Ka as a ratio heavy metals content in the surface layer 9-5 cm and in depth (30-50 cm) has been calculated. It is based on the existing regularities of the normal distribution of elements in the soil profile. When Ka>=1.5-2 the heavy metals pollution is considered to be of technogenic origin.

The investigation carried out shows that there is pollution of technogenic origin in most of the areas in the region. The data about soil contamination, expressed by the concentration coefficient values (**Table 4.4-14**), shows that almost all soils, in their surface, are polluted with Cu, Zn, Pb and Cd, and almost all profiles up to 300 m (with the exception of P9) are entirely contaminated. The manganese content is lower than the limit values and the bacground values.

The data shows that most of the quantities of heavy metals are retained in the organic matter of the soils, i.e. in the 0-2 cm and 0-5 cm layer, in the main layer of grass roots and above the layer of the roots of trees.

The analysis of the data from investigation of soils as regards their nutrient content (content of humus and basic nutrient elements), their sorption properties and contamination with heavy metals shows that those soils have poor to moderate reserve of humus and nutrients. Their sorption properties are not good in any of the studied sections, in spite of the high saturation with bases. For that reason in the places with more sandy fractions in the soil profile the maximum buffer capacity can decrease when the soils are exposed to higher emissions of acidic gases. At present, due to their good buffer capacity, the soils are contaminated with heavy metals only in the surface layer - 5 cm, and the soils within the 200 m zone around the plant are contaminated also in depth.

The element polluting all soils in Druzhba -1 and Druzhba -2 districts (in relation to background quantities) is cadmium, followed in almost equal values by lead, copper and zinc.

Other degradation processes on the soils, resulting from the operation of Sofia Med AD, have not been observed. There is a sludge depot in the territory of that company, and it is the object of analysis in another section.

TABLE 4.4-11 SORPTION PROPERTIES OF SOILS

Soil section	Depth	pH		Hydrolytic	Total	Sorption	Degree of saturation
		in H_2O	in $CaCl_2$	acidity (H)	bases (S)	capacity (T)	with bases (V)
	cm			mgeqv/100g	mgeqv/100g	mgeqv/100g	%
P 1	0-5	7.69	7.25	0.66	35.93	36.59	98.20
	5-30	8.17	7.48	0.47	34.45	34.92	98.65
P 2	0-5	7.33	6.89	1.70	27.79	29.49	94.24
	30-50	7.40	6.95	1.61	25.75	27.36	94.12
P 3	0-5	5.44	4.97	5.29	15.72	21.01	74.82
	30-50	5.67	5.15	3.50	20.91	24.41	85.66
P 4	0-5	6.91	6.35	2.33	15.07	17.4	86.61
	30-50	6.27	5.13	2.69	15.17	17.86	84.94
P 5	0-5	6.22	6.02	2.33	14.72	17.05	86.33
	30-50	6.06	5.60	2.24	13.97	16.21	86.18
P 6	0-5	5.43	5.37	7.18	25.15	32.33	77.79
	30-50	7.32	5.95	0.45	31.79	32.24	98.60
P 7	0-5	6.16	5.88	2.06	18.66	20.72	90.06
	30-50	5.16	4.93	4.04	19.91	23.95	83.13
P 8	0-5	5.78	5.26	5.20	17.67	22.87	77.26
	30-50	5.55	5.37	4.13	20.24	24.37	83.05
P 9	0-5	6.88	6.76	0.54	20.91	21.45	97.48
	30-50	7.28	6.95	0.36	54.70	55.06	99.35
P 10	0-5	6.08	5.72	7.35	32.80	40.15	81.69
	30-50	7.07	6.83	1.88	38.50	40.38	95.34

Soil section	Depth	pH		Hydrolytic	Total	Sorption	Degree of saturation
		in H_2O	in $CaCl_2$	acidity (H)	bases (S)	capacity (T)	with bases (V)
	cm			mgeqv/100g	mgeqv/100g	mgeqv/100g	%
P 11	0-5	6.90	6.75	0.54	57.50	58.04	99.07
	30-50	7.28	7.16	0.54	51.80	52.34	98.97
P 12	0-5	6.31	6.24	2.42	26.40	28.82	91.60
	30-50	6.90	6.35	1.70	24.60	26.3	93.54
P 13	0-5	6.28	6.16	1.44	40.10	41.54	96.53
	30-50	7.18	6.93	0.45	48.70	49.15	99.08
P 14	0-5	7.43	6.96	0.54	57.80	58.34	99.07
	30-50	7.31	7.00	0.27	53.60	53.87	99.50
P 15	0-5	6.81	6.35	2.24	34.00	36.24	93.82
	30-50	7.25	7.02	0.27	56.50	56.77	99.52
P 16	0-5	7.53	7.04	0.63	56.60	57.23	98.90
	30-40	7.57	6.21	0.36	50.40	50.76	99.29

TABLE 4.4-12 NUTRIENTS CONTENT IN THE SOILS

Soil section	Depth cm	Humus %	Total N% %	Total P %	Total K %	Total Mg %	Total Ca %
P 1	0-5	3.10	0.190	-	0.460	0.345	0.895
	5-30	1.75	0.100	-	0.370	0.335	0.765
P 2	0-2	-	-	0.0735	0.710	0.480	0.975
	2-5	2.70	0.131	0.0630	0.665	0.410	0.915
	30-50	2.34	0.106	0.0540	0.640	0.520	1.250П
P 3	Forest floor	-	-	0.0540	0.365	0.145	1.730
	0-5	1.39	0.206	0.0490	0.500	0.375	0.650
	30-50	1.30	0.107	0.0380	0.415	0.430	0.510
P 4	0-2	-	-	0.0730	0.555	0.420	0.685
	2-5	1.87	0.196	0.0640	0.405	0.405	0.555
	30-50	0.29	0.090	0.0550	0.390	0.455	0.550
P 5	0-5	1.68	0.214	0.0730	0.555	0.465	0.685
	30-50	1.48	0.142	0.0635	0.405	0.395	0.590
P 6	0-2	-	-	0.1595	0.470	0.400	1.460
	2-5	2.57	0.640	0.1610	0.420	0.380	1.470
	30-50	1.13	0.060	0.0470	0.455	0.395	1.595
P 7	0-2	-	-	0.1035	0.370	0.395	0.645
	2-5	1.03	0.129	0.0765	0.495	0.500	0.740
	30-50	0.86	0.091	0.0590	0.500	0.620	0.740
P 8	0-5	1.84	0.295	0.0950	0.565	0.465	0.800
	30-50	0.76	0.069	0.1175	0.980	0.640	0.600
P 9	0-5	0.70	0.037	0.0840	0.460	0.455	0.640
	30-50	1.23	0.034	0.0720	0.410	0.555	1.285
P 10	0-2	-	-	0.1260	0.680	0.440	1.075
	2-5	2.86	0.474	0.0915	0.450	0.450	0.855
	30-50	1.80	0.140	0.0475	0.555	0.425	1.155
P 11	0-5	2.03	0.177	0.0715	0.485	0.530	3.080
	30-50	0.77	0.040	0.0670	0.320	0.755	3.465
P 12	0-5	1.33	0.182	0.1140	0.385	0.420	0.785
	30-50	1.05	0.072	0.0935	0.510	0.575	1.090
P 13	0-5	1.04	0.309	0.0960	0.545	0.495	1.060
	30-50	0.93	0.090	0.0925	0.405	0.565	1.315
P 14	0-5	1.35	0.175	0.0805	0.270	0.320	15.390

Soil section	Depth cm	Humus %	Total N% %	Total P %	Total K %	Total Mg %	Total Ca %
	30-50	0.38	0.033	0.1350	0.310	0.555	1.275
P15	0-5	1.80	0.261	0.0800	0.565	0.470	0.985
	30-50	0.28	0.026	0.0400	0.490	0.615	3.405
P 16	0-5	1.49	0.454	0.1740	0.220	0.445	9.385
	30-40	0.33	0.055	0.0725	0.420	0.620	3.115

TABLE 4.4-13 HEAVY METALS CONTENT IN THE SOILS

Distance from the industrial area	Direction	Soil section	Depth	pH (H_2O)	Cu	Zn	Pb	Cd	Mn	Fe
			cm		mg/kg					%
50 m	W	P 16	0-5	7.53	402.0	875.0	89.5	6.0	1150.0	2.335
			30-40	7.57	602.5	525.0	336.5	3.0	750.0	3.215
200 m	W	P 2	0-2	-	246.0	334.5	325.5	2.5	631.5	3.070
			2-5	7.33	206.5	300.0	459.0	2.0	500.0	2.620
			30-50	7.40	170.5	238.5	405.0	2.0	550.0	3.070
	W	P 3	Forest floor	-	248.5	1000.0	46.0	4.0	340.5	0.340
			0-5	5.44	90.0	286.0	44.5	1.5	500.0	2.195
			30-50	5.67	49.0	57.0	15.0	1.0	450.0	2.495
	NE	P 14	0-5	7.43	49.5	146.5	27.0	6.0	1,000.0	1.515
			30-50	7.31	56.0	60.5	10.0	2.0	650.0	4.595
300 m	S-SE	P 9	0-5	6.88	36.0	69.0	18.5	1.5	550.0	2.465
			30-50	7.28	58.0	72.0	66.0	1.5	800.0	2.945
	S-SE	P 10	0-2	-	98.0	178.5	117.5	4.0	627.5	2.445
			2-5	6.08	48.5	136.0	124.5	4.5	600.0	2.525
			30-50	7.07	48.0	60.5	33.0	1.5	900.0	3.645
500 m	S-SW	P 7	0-2	-	97.0	180.5	63.0	2.5	625.0	2.125
			2-5	6.16	49.0	89.0	26.5	2.0	650.0	2.665
			30-50	5.16	54.0	91.5	20.0	1.5	700.0	3.505
	S	P 8	0-5	5.78	63.0	102.5	31.5	2.5	750.0	3.025
			30-50	5.55	35.5	101.5	21.5	1.5	600.0	3.450
	W	P 11	0-5	6.90	102.0	294.0	77.0	3.0	2250.0	3.025
			30-50	7.28	78.0	73.0	29.5	3.0	550.0	4.415
800 m	NE	P 15	0-5	6.81	108.0	370.0	62.5	2.0	700.0	2.625
			30-50	7.25	38.5	66.5	19.0	2.5	850.0	3.070
1000 m	SW	P 4	0-2	-	61.0	161.5	41.0	1.5	590.5	2.225
			2-5	6.91	49.5	143.0	40.0	1.5	550.0	2.035
			30-50	6.27	36.5	65.5	24.5	1.0	550.0	2.450
	SW	P 5	0-5	6.22	50.5	95.0	34.0	1.5	600.0	2.650
			30-50	6.06	60.0	77.0	34.5	1.5	500.0	3.055
1500 m	S	P 12	0-5	6.31	108.5	80.0	25.0	3.5	550.0	2.745
			30-50	6.90	64.0	72.0	21.5	2.5	850.0	3.345
	SW	P 13	0-5	6.28	45.0	93.0	27.0	2.0	700.0	2.505
			30-50	7.18	58.0	117.0	56.0	2.0	900.0	2.945
2000 m	SW	P 17	0-5	8.28	60.0	101.0	91.5	1.0	1150.0	-
			5-30	8.38	52.0	81.5	67.5	0.5	1150.0	-
2500 m	SW	P 6	0-2	-	109.5	191.5	88.5	2.5	585.0	2.365
			2-5	5.43	82.0	134.5	127.0	2.0	550.0	2.495
			30-50	7.32	74.0	105.5	154.0	2.0	800.0	2.605

TABLE 4.4-14 HEAVY METAL CONTAMINATION IN THE SOILS, EXPRESSED BY MEANS OF THE CONCENTRATION COEFFICIENT $H_{BACKGROUND}$ VALUES (ACCORDING TO BDS)

Distance from the industrial area	Direction	Soil section	Depth, cm	Cu	Zn	Pb	Cd	Mn	ΣH_{background}
				30±25	75±20	25±15	0.3±0.8	622±126	
50 m	E	P 16	0-5	13.4	11.7	3.6	20.0	1.9	50.6
			30-40	20.1	7.0	13.5	10.0	1.2	51.8
200 m	W	P 2	0-2	8.2	4.5	13.0	8.3	1.0	35.0
			2-5	6.9	4.0	18.4	6.7	below	36.0
			30-50	5.7	3.2	16.2	6.7	below	31.8
	W	P 3	0-5	3.0	3.8	1.8	5.0	below	13.6
			30-50	1.6	below	below	3.3	below	4.9
	NE	P 14	0-5	1.7	2.0	1.1	20.0	1.6	26.4
			30-50	1.9	below	below	6.7	1.1	9.7
300 m	S	P 9	0-5	1.2	below	below	5.0	below	6.2
			30-50	1.9	below	2.6	5.0	1.3	10.8
	S-SE	P 10	0-2	3.3	2.4	4.7	13.3	1.0	24.7
			2-5	1.6	1.8	5.0	15.0	below	23.4
			30-50	1.6	below	1.3	5.0	1.5	9.4
500 m	SW	P 7	0-2	3.2	2.4	2.5	8.3	1.0	17.4
			2-5	1.6	1.2	1.1	6.7	1.1	11.7
			30-50	1.8	1.2	below	5.0	1.0	9.1
	S	P 8	0-5	2.1	1.4	1.3	8.3	1.2	14.3
			30-50	1.2	1.4	below	5.0	below	7.6
	W	P 11	0-5	3.4	3.9	3.1	10.0	3.6	24.0
			30-50	2.6	below	1.2	10.0	below	13.8
800 m	NE	P 15	0-5	3.6	4.9	2.5	6.7	1.1	18.8
			30-50	1.3	below	below	8.3	1.4	11.0
1000 m	SW	P 4	0-2	2.0	2.2	1.6	5.0	below	10.8
			2-5	1.7	1.9	1.6	5.0	below	10.2
			30-50	1.2	below	1.0	3.3	below	4.5
	SW	P 5	0-5	1.7	1.3	1.4	5.0	below	9.4
			30-50	2.0	1.0	1.4	3.3	below	7.7
1,500 m	S	P 12	0-5	3.6	1.1	1.0	11.7	below	17.4
			30-50	2.1	below	below	8.3	1.4	11.8
	SW	P 13	0-5	1.5	1.2	1.1	6.7	1.1	11.6
			30-50	1.9	1.6	2.2	6.7	1.5	13.9
2,000 m	SW	P 17*	0-5	2.0	1.4	3.7	3.3	1.9	-
			5-30	1.7	1.1	3.3	1.7	1.9	-
2,500 m	SW	P 6	0-2	3.7	2.6	3.5	8.3	below	18.1
			2-5	2.7	1.8	5.1	6.7	below	16.3
			30-50	2.5	1.4	6.2	6.7	1.3	18.1

A figure in red shows that the value in the respective field is above the upper limit of the element range

4.4.1.3 CURRENT LAND USERS, ADAPTATION OF THE LAND TO THE SITE

4.4.1.3.1 CURRENT USERS AND OWNERS OF LAND WITHIN THE SCOPE OF THE INVESTMENT PROPOSAL

According to the feasibility studies the sites included in the investment proposal are within the building plan of the western and the eastern parts of the city and do not cut into any real estate but only built-up area with streets and boulevards and all communications for its normal functioning. The affected property is in most cases municipal property.

4.4.1.3.2 ADAPTATION OF THE LAND TO THE SITES INCLUDED IN THE INVESTMENT PROPOSAL

For the plant's construction alienation neither of real estate is envisaged, nor of any parts thereof , immediately affected by the envisaged construction, nor of estate which would become unsuitable for construction or use in accordance with site development, health and hygiene, and fire protection rules and regulations as well as with the safety and security requirements.

It is envisaged that after closing down of operations in 30 years recultivation will be carried out to recover the affected land..

4.5 BIOLOGICAL DIVERSITY AND ITS COMPONENTS

4.5.1 GENERAL DESCRIPTION OF THE PLANT AND ANIMAL KINGDOM FALLING WITHIN THE SCOPE OF THE INVESTMENT PROPOSAL

The main site of the IP for **Construction of a cogeneration plant utilizing RDF in Sofia** is located in the northern part of Sofia, in industrial area "Zadgarov Rayon", at 6, 202nd St., within the landed property of TPP Sofia, which has a total area of 334,945 m^2. The considered area is entirely within site "B", located in the western part of the yard of the plant, sufficiently large (approximately 16 daa) for setting up the installations. For the most part the site itself is a concrete-lined ground of rectangular shape, at some places overgrown with grass and shrubs (of tree and and bush species),and metal elements (pipes etc.) are left for storage in many places over the site. Currently the area is enclosed in wire netting. The terrain of the plant is level, flat, the same as the neighbouring territories in the industrial area in this part of Sofia valley. The climate has continental features.

The alternative site of the IP is located in the eastern part of Sofia, in Iskar industrial area, at 6, Dimitar Peshev St., within the landed property of TPP Sofia-East, which covers an area of 319,692 m^2. The considered area is entirely within site "B", located near the railway line, sufficiently large (approximately 20 daa) for setting up the installations. In general most of the territory of the plant is occupied by buildings, halls and installations which serve the water heating process; there is plantation only in some places, and similar to the terrain of TPP Sofia, grass and shrubs prevail. Trees are presented by ornamental species planted artificially as well as naturally grown trees, and at some places there are thick formations of trees and bushes growing in lines, spots and groups. There are some lanes lined with flowers as well as flower beds, and flower pots next to and inside some of the buildings. The grass stand is represented mostly by tall grass but also by low grass species, mainly ruderal species.

4.5.1.1 PLANT KINGDOM

As regards the floristic regions of the Republic of Bulgaria, Sofia municipality is within Sofia district, Sofia region. The region covers the entire Sofia valley and the southern slopes of Stara Planina and Murgash. In the past Sofia valley was occupied by mesophytic forest ecosystems dominated by white oak (*Quercus pedunculiflora*) and field elm (*Ulmus minor*), and currently the land is agricultural, with natural mesophytic grass vegetation (meadows). Quite a large area of the land is urbanized and built up, mostly within the regulated development area of Sofia The southern slopes of the region and dry plain areas were covered with xerothermal forest communities with prevailing Hungarian oak (*Quercus frainetto*), more rare Turkey oak (*Quercus cerris*), and higher up the slopes sessile oak forests prevailed. At present most of the southern slopes are covered with xerothermal grass communities with dominating bluestem (*Dichanthium ischaemum*), bulbous bluegrass (*Poa bulbosa*), volga fescue (*Festuca valesiaca*) and others. Bulgarian endemits are common in the region:crocus (*Crocus reticulatus*), pink carnation (*Dianthus urumoffii*), stonegrass (*Sedum tuberiferum*) and astragalus (*Astragalus wilmottianus*).

Vegetation is the main building block of the green system of Sofia municipality. The green system includes chiefly the green areas open to the public, and above all - the sites within the city and the region, which are subject to regulation. Green areas of restricted access and of special purpose are also an important part of the green system. At present Sofia has three maintenance zones:

→ Urban core - includes the parks, gardens and squares which need intensive maintenance;
→ Parks, gardens and suburban forest preserves under ordinary maintenance;
→ Street maintenance.

The norms regarding the size of public green areas open to the public and for specific use are stipulated by Ordinance No.7/22.12.2003 laying down rules and norms for different types of spatial and territorial development zones According to that ordinance the landed estate with the built infrastructure of TPP Sofia and TPP Sofia-East - the main site and the alternative site - is intended for "production and storage activities"and does not fall within the category "for planting".

In this case as regards the vegetation within the urbanized city environment, the different century-old trees growing in that territory can be considered most valuable plants from conservation, environmental and aesthetic point of view. According to information from the Register of century-old trees in Bulgaria, published in the website of EEA, 123 specimens representative of 18 tree species have been registered as centuries old trees in the territory of Sofia city and in its surroundings (the nearby villages). Those specimens are distributed as follows: pedunculate oak (*Quercus robur*) – 78 trees; turkey oak (*Q. cerris*) – 17 trees; almomd (*Amygdalis communis*) – 8 trees; Hungarian oak (*Quercus frainetto*) – 4 trees; elm (*Ulmus ssp*.) – 4 trees; ailanthus (*Ailanthus altissima*) – 2 trees; spruce (*Picea abies*) – 2 trees, and one specimen of each the following species: sycamore (*Platanus ssp*.), beech tree (*Fagus sylvatica*), pagoda tree (*Sophora japonica*), ash tree (*Fraxinus ssp*.), Scots pine (*Pinus sylvestris*), oak (*Quercus ssp*.), giant sequoia (*Sequoiadendron giganteum*) and mulberry (*Morrus ssp*.). Not any of those trees is within the sites of the two TPPs.

The following species of plants were found in a thorough inspection round the TPP Sofia yard:

The ligneous and frutescent vegetation at the entrance and in the direction of the administrative buildings of TPP Sofia consists of various deciduous and coniferous species like horse chestnut (*Aesculus hippocastanum*), apple tree (*Malus domestica*), weeping willow (*Salix babylonica*), ash tree (*Fraxinus excelsior*), ailanthus (*Ailanthus altissimus*), acacia (*Robinia pseudoacacia*), Lawson cypress (*Chamaecyparis lawsoniana*), Japanese quince (*Chaenomeles japonica*), walnut tree (*Juglans regia*), cherry tree (*Prunus avium*), Thuja (*Biota orientalis*), silver birch (*Betula pendula*), aspen (*Populus tremula*), spruce (*Picea abies*), large-leaved lime (*Tilia platyphyllos*), mulberry (*Morus alba*), indigo bush (*Amorpha fruticosa*), multiflora rose (*Rosa multiflora*), winter creeper (*Evonymus fortunei*), Old man's beard (*Clematis vitalba*), Armenian blackberry (*Rubus discolor*), ivy (*Hedera helix*), grey willow (*Salix cinerea*), purple willow (*Salix purpurea*) and Norway maple (*Acer platanoides*).

The herbaceous vegetation in the yard of TPP Sofia, in the green areas and the spaces between the administration building and different departments comprises various species, predominantly specimens of the poaceae and fabaceae families: barren brome (*Bromus sterilis*), tall oat-grass (*Arrhenatherum elatius*), jointed goatgrass (*Aegilops cylindrica*), slender meadow foxtail (*Alopecurus myosuroides*), hairy melic (*Melica ciliata*), rat's-tail fescue (*Vulpia myuros*), intermediate wheatgrass (*Elymus hispidus*),cocksfoot (*Dactylis glomerata*), Kentucky bluegrass (*Poa pratensis*), wild oat (*Avena fatua*).

The following species from the fabaceae family are present: black medick (*Medicago lupulina*), red clover (*Trifolium pratense*), alfalfa (*Medicago sativa*), Bird's-foot-trefoil (*Lotus corniculatusu*), hairy tare (*Vicia hirsuta*), yellow sweet clover (*Melilotus officinalis*), and tuberous pea (*Lathyrus tuberosus*). From the sour grass (cyperaceae) group prickly sedge (*Carex muricata*) is present.

Miscellaneous grass are also represented: redstem filaree (*Erodium cicutarium*), creeping cinquefoil (*Potentilla reptans*), garden burnet (*Sanguisorba minor*), sow thistle (*Sonchus oleraceus*), daisy (*Bellis perennis*), knawel (*Scleranthus polycarpos*), spring groundsel (*Senecio vernalis*), meadow salsify (*Tragopogon pratensis*), small flower hawksbeard (*Crepis pulchra*), silver cinquefoil (*Potentilla neglecta*), whitetop (*Cardaria draba*), narrowleaf plantain (*Plantago lanceolata*), finger speedwell (*Veronica triphyllos*), bladder campion (*Silene vulgaris*), green spurge (*Euphorbia esula*), wild mignonette (*Reseda lutea*), toad flax (*Linaria vulgaris*), Greek milkweed (*Euphorbia taurinensis*), Dalmatian toadflax (*Linaria genistifolia*), St. John's wort (*Hypericum perforatum*), camomile (*Matricaria chamomilla*), wormwood (*Artemisia vulgaris)*, easten daisy (*Erigeron annuus*), danewort (*Sambucus ebulus*), wild geranium (*Geranium macrorrhizum*), viper's bugloss (*Echium vulgare*), black horehound (*Ballota nigra*), bindweed (*Convolvulus arvensis*), dandelion (*Taraxacum officinale*), spearmint (*Mentha spicata*), curly dock (*Rumex crispus*), cutleaf geranium (*Geranium dissectum*), wood avens (*Geum urbanum*), hops (*Humulus lupulus*), cutleaf teasel (*Dipsacus laciniatus*), gum succory (*Chondrilla juncea*), chickweed (*Stellaria media*), sharp-fringed sow thistle (*Sonchus asper*), field cow-wheat (*Melampyrum arvense*), common cocklebur (*Xanthium strumarium*), Russian chamomile (*Anthemis ruthenica*), long leaved mullein (*Verbascum longifolium*), hedge bindweed (*Calystegia sepium*), Persian speedwell (*Veronica persica*), sheep's sorrel (*Rumex acetosella*), common yarrow (*Achillea millefolium)* and goldmoss stonecrop (*Sedum acre*).

Most of those plant species as well as some other species were found also in the landed estate of TPP Sofia-East alternative site. The following were reported there:

1. The ligneous and frutescent vegetation in front of the administrative building is represented by various deciduous and coniferous species: horse chestnut (*Aesculus hippocastanum*), large-leaved lime (*Tilia platyphyllos*), Norway maple (*Acer platanoides*), spruce (*Picea abies*), wild vine (*Ampelopsis quinquefolia*), wild privet (*Ligustrum vulgare*), cherry plum (*Prunus cerasifera*), oregon grape (*Mahonia aquifolium*), apple (*Malus domestica*), sycamore (*Acer pseudoplatanus*), old man's beard (*Clematis vitalba*), boxelder maple (*Acer negundo*), black poplar (*Populus nigra*), black pine (*Pinus nigra*), yew (*Taxus baccata*), fig-tree (*Ficus carica*), lilac (*Syringa vulgaris*), dewberry (*Rubus caesius*), sweet mock-orange (*Phylladelphus coronaria*), walnut-tree (*Juglans regia*), white willow (*Salix alba*), morello-tree (*Cerasus vulgaris*), peach-tree (*Persica vulgaris*), silver birch (*Betula pendula*) and desert false indigo (*Amorpha fruticosa*).
2. The herbaceous vegetation in the investment proposal territory consists of poaceae communities: cocksfoot (*Dactylis glomerata)*, slender meadow foxtail (*Alopecurus myosuroides*), jointed goatgrass (*Aegilops cylindrica*), Kentucky bluegrass (*Poa pratensis*), bulbous bluegrass (*Poa bulbosa*), rigid ryegrass (*Lolium rigidum*), tall oat-grass (*Arrhenatherum elatius*), intermediate wheatgrass (*Elymus hispidus*), rat's-tail fescue (*Vulpia myuros*), field brome (*Bromus arvensis*) and bushgrass (*Calamagrostis epigeios*).
3. The following species of *Fabaceae* family exist there: black medick *Medicago lupulina*, fodder vetch (*Vicia varia*), alfalfa (*Medicago sativa*), large-flowered vetch (*Vicia grandiflora*), Bird's-foot-trefoil (*Lotus corniculatus*), crown vetch (*Coronilla varia*),sand esparsette (*Onobrychis arenaria*), yellow sweet clover (*Melilotus officinalis*), tuberous pea (*Lathyrus tuberosus*), hybrid clover (*Trifolium hybridum*) and hop trefoil (*Trifolium campestre*).

The following species from the miscellaneous grass group are found there: silvery cinquefoil (*Potentilla argentea*), common sowthistle (*Sonchus oleraceus*), white campion (*Silene alba*), meadow salsify (*Tragopogon pratensis*), wood avens (*Geum urbanum*), wild mignonette (*Reseda lutea*), blue bugle (*Ajuga genevensis*), danewort (*Sambucus ebulus*), hops (*Humulus lupulus*), curly dock (*Rumex crispus*), rough hawksbeard (*Crepis biennis*), common groundsel (*Senecio vernalis*), narrowleaf plantain (*Plantago lanceolata*), green spurge (*Euphorbia esula*), redstem filaree

(*Erodium cicutarium*), field scabious (*Knautia arvensis*), viper's bugloss (*Echium vulgare*), thyme-leaved sandwort (*Arenaria serpyllifolia*), Dalmatian toadflax (*Linaria genistifolia*), prickly lettuce (*Lactuca serriola*), bigroot geranium (*Geranium macrorrhizum*), small flower hawksbeard (*Crepis pulchra*), long leaved mullein (*Verbascum longifolium*), wallflower (*Erysimum difusum*), mount Olympus St. John's wort (*Hypericum olympicum*), garden burnet (*Sanguisorba minor*), chicory (*Cichorium inthybus*), cypress spurge (*Euphorbia cyparissias*), chickweed (*Stellaria media*), wild carrot (*Daucus carota*), mugwort (*Artemisia vulgaris*), cornflower (*Centaurea cyanus*), speedwell (*Veronica acinifolia*), common mallow (*Malva sylvestris*), meadow hawkweed (*Hieracium caespitosum*), Transylvanian pincushion flower (*Cephalaria transsilvanica*), creeping cinquefoil (*Potentilla reptans*), toad flax (*Linaria vulgaris*), sour dock (*Rumex acetosa*), tall mustard (*Sisymbrium altissimum*), thistle (*Cirsium ligulare*), German iris (*Iris germanica*), annual daisy fleabane (*Erigeron annuus)*, evening primrose (*Oenothera biennis*), corn salad (*Valerianella locusta*), downy woundwort (*Stachys germanica*), cutleaf teasel (*Dipsacus laciniatus*), bohemian knotweed (*Fallopia* x *bohemica*), field pepperweed (*Lepidium campestre*), field poppy (*Papaver rhoeas*), camomile (*Matricaria chamomilla*), Canadian horseweed (*Conyza canadensis*), bindweed (*Convolvulus arvensis*) and clustered dock (*Rumex conglomeratus*).

Of the species of conservation status **only one** is found in the yard of TPP Sofia-East **yew (***Taxus baccata***)** included in Appendix No.3 of the BDA and in the Red Data Book of the Republic of Bulgaria, volume I - Plants and fungi (published by BAS and MEW, 2011), in the group of species in danger of extinction. That plant is far from the site of the investment proposal therefore the project does not pose a risk for its development - neither in the construction phase nor in the plant operation phase, if that site is chosen for the project implementation.

There is no any danger for the development of that species within the operating site of TPP Sofia-East.

None of the plant species found in the two sites, envisaged by the IP, and in their adjacent areas are **plants of conservation importance** – included in *Appendix No.2* and *Appendix No.3* of the *Biological Diversity Act* or in any other national or international regulations and documents created for the purpose of registering and conservation of rare and valuable plant species: Red Data Book of the Republic of Bulgaria, volume I - Plants and fungi (published by BAS and MEW, 2011); Red List of Bulgarian vascular plants (Petrova & Vladimirov, 2009), European Red List of Vascular Plants (Bilz, M., Kell, S.P., Maxted, N. and Lansdown, R.V. 2011), IUCN Red List of Threatened Species (2013.2), the Berne Convention, Annex II and Annex IV of Directive 92/43/EEC , and others.

The described species do not participate in the formation of valuable plant communities, respectively habitats, included in *Annex 1* of the Biological Diversity Act and Annex I of Directive Directive 92/43/EEC .

4.5.1.2 ANIMAL WORLD

4.5.1.2.1 CHARACTERISTICS OF THE ANIMAL WORLD IN THE REGION OF THE IP

In zoo-geographical aspect the terrestrial fauna of Bulgaria belongs to the Palearctic zoogepgraphic area of the Holarctic region. Due to the fact that Bulgaria is situated mainly in the Eurosiberian zoogeographic subregion but borders the Mediterranean zoogeographic subregion, two main zoogeographic complexes are ranging here: northern (Eurosiberian) comprising cold-tolerant animal species, and southerm (Mediterranean) comprising many heat-loving species (Josifov, 1988).

According to the zoogeographical classification of Bulgaria (Acc.to Gruev, B., 19988) the IP region is in the Sofia-Radomir subregion of the North-Bulgaria region. In that region Euro-Siberian and European species are more common than Mediterranean species. For example 75 % of the rodents here are Euro-Siberian and European species, and only 19 % are Mediterranean species. A typical feature of the region is its high endemism. One of the most interesting features of the fauna in Sofia-Radomir subregion is its rich ornithological diversity, including a large number of migrating, nesting and wintering birds.

In a narrower aspect, considering the fauna, the territory of Sofia and the urbanized part of Sofia municipality, where the landed estate considered in the IP is, can be divided into ten main habitats, of relatively uniform parameters of the environment:

1. Central city area (old and new buildings);
2. New residential districts (tall buildings);
3. Industrial area of the city;
4. Low buildings - within Sofia municipality and areas zoned for summer houses (individual buildings);
5. Arable and non-arable open agricultural land (fields, meadows, grazing grounds in the outskirts of settlements);
6. Landfills, uncultivated land, damaged land (as a result of excavation, dumping and other activities);
7. Green city system (city parks and park-like compact green areas within the city area and in its periphery);
8. Forests (at the foot of Vitosha, Lyulin, Plana, Lozenska and Stara Planina mountains and field forests);
9. Water bodies (rivers, canals, reservoirs, artificial lakes, small dams, swamps);
10. Road infrastructure with its adjoining vegetation.

As regards zoogeographical regions, the fauna here too is represented chiefly by species typical of the northern and mostly of middle-European latitudes. Some species typical of the southernmost parts of Europe - Mediterranean and sub-Mediterranean species - are also found here, but in relatively small percentage.

As regards the species diversity, three of the environmental areas mentioned above have largest numbers of species: forests, agricultural land, and the green city system. Second in diversity are four habitats: the water bodies; the industrial area; the landfills, uncultivated land, damaged land and village-type building areas. Third in diversity, with the smallest number of species are the new residential districts and the central city area.

As regards rare species, protected species and species in danger of extinction in general for Bulgaria, based on which the conservation importance of a given area or region is determined, the greatest number of such species are in three of the ten habitats mentioned above: the forests, water bodies, and agricultural land; followed by the habitats of landfills, uncultivated and damaged land, and the green city system, while in the other ecosystems the number of such species is minor. The land properties, in which it is suggested to implement the IP, belong to that last group as they are intended for production and warehouse activities and in practice such activities are carried out there.

The features of the considered sites as habitats - areas in the scope of production purpose zones within Sofia - determine the particularities of the animal world in them. The intensive anthropogenization of the urban environment and continuous and systematic polluting here has dramatically influenced the animal world and the formation of nowadays' animal communities. In general, as regards resistance to various levels of anthropogenic load, the fauna of the city can be divided into three categories: synanthropic, eusynanthropic, and environmentally flexible species. In the territories around the urban environment the species structure and animal communities are also very much altered as a result of the radically changed environment of habitats. In this specific case the fauna in the area of the sites envisaged for construction of a cogeneration plant utilising RDF is represented mainly by synanthropic and semi-synanthropic species, whose presence is connected with human activities, and in negligible extent - by species inhabiting natural biotopes and incidentally visiting the sites suggested for the plant. Synanthropic species in their part can be grouped into 5 major groups depending on the extent of synanthropization:

1) Seasonal synanthropes;
2) Passive synanthropes;
3) Initial synurbic;
4) Developed synurbic;
5) Complete synurbic.

As in the sites envisaged in the IP and in the neighbouring areas the landscape is quite unvaried - industrial areas with buildings and installations, but with ligneous and frutescent vegetation of various age and sizes present among those buildings and installations - we have to point out that the fauna here is represented both by species typical for built up urban areas and by species which in the natural environment inhabit areas occupied by thinner or thicker ligneous vegetation. Most of the species registered in this part of the city in observation in different seasons are of a high level of synanthropization - complete synurbic and developed synurbic species. **From the vertebrate fauna birds (Aves) are most numerous.** This part of Sofia has been visited in different years and seasons in the period 1979-2014 for the purpose of fauna observation.

A description of the groups of animal species available in the area of the two sites suggested in IP is given below; where necessary (as regards Invertebrates) the basic conservation target species are pointed out as well as animal species of greater or lower conservation significance, which are included in the Biological Diversity Act, the Red Data Book of the Republic of Bulgaria, volume II - animals (published by BAS and MEW, 2011) and other regulations, and which are present in Sofia and its surroundings. It is pointed out whether in the course of field observation such species have been found available in the sites suggested in the IP and in the neighbouring territories, and also the probability of encountering such species if they have not been observed.

- **Invertebrate fauna**

The first studies of Bulgarian invertebrate fauna were made in 1800 by foreign and Bulgarian scientists. In spite of all the exact number of invertebrates in the territory of the Republic of Bulgaria is not known yet. There are a number of groups not sufficiently studied or even unstudied. Just the Curculionidae in Bulgaria number about 1,000 species, and that is one of the dozens of families within the nearly twenty orders of insects. On the other hand the class of insects is just one of the dozens of invertebrates in Bulgaria. That is why as regards the invertebrate fauna greater consideration should be given to the following target invertebrates, and invertebrate of higher or lower conservation significance, for which data shows that they are available in Sofia valley and at the foot of adjacent mountain slopes; an evaluation of the probability that they inhabit the territory of Sofia and the surrounding areas is also given below.

TABLE 4.5-1 INVERTEBRATE FAUNA

Species	BDA (Annex 2,3)	Bern convention	Directive 92/43/EEC (II, IV)	IUCN Red List (2014.1)
Class Insecta (*Phylum Arthropoda*)				
Stag beetle(*Lucanus cervus*)	Annex 2, 3	+(III)	+ (II)	-
Capricorn beetle (*Cerambyx cerdo*)	Annex 2,3	+ (II)	+ (II,IV)	+(Vul)
Eastern eggar (*Eriogaster catax*)	Annex 2.3	+ (II)	+ (II,IV)	+(DD)
Jersey tiger (*Callimorpha quadripunctaria*)	Annex 2	-	+ (II)	-
Large copper (*Lycaena dispar*)	Annex 2.3	+ (II)	+ (II, IV)	+ (NT)
Lesser purple emperor (*Apatura ilia*)	-	-	-	-
Purple emperor (*Apatura iris*)	-	-	-	-

Species	BDA (Annex 2,3)	Bern convention	Directive 92/43/EEC (II, IV)	IUCN Red List (2014.1)
Chequered blue butterfly (Scolitantides orion)	-	-	-	-
Clouded apollo (*Parnassius mnemosyne*)	Annex 2.3	+ (II)	+ (IV)	-
Glaucopsyche alexis	-	-	-	-
Lesser spotted fritillary (*Melitaea trivia*)	-	-	-	-
Yellow-spotted whiteface (*Leucorrhinia pectoralis*)	Annex 2.3	+ (II)	+ (II, IV)	+(LC)
Green snaketail (*Ophiogomphus cecilia*)	Annex 2.3	+ (II)	+ (II, IV)	+(LC)
Bush cricket (*Saga pedo*)	Annex 3	+ (II)	+ (IV)	+(Vul)
Balkan Pincer Grasshopper (*Paracaloptenus caloptenoides*)	Annex 2.3	-	+ (II,IV)	-
Macrogaster (Callimenus macrogaster)	-	-	-	-

Key:
+Included; **-** Not included; **LC –** Least Concern; **NT –** Near Threatened; **V –** Vulnerable; **E** – Endangered; **CE** – Critically Endangered; **EW -** Extinct in wild; **E** – Extinct; **DD –** Data deficient; **NE** – Not Evaluated

Stag beetle (*Lucanus cervus*). The life cycle of this species is connected with old-growth forests, mostly oak or mixed deciduous forests. It can be found also in old-growth city parks and gardens, where there are old oak trees. The female lays its eggs in old oak stumps. The larvae feed on semi-decayed wood - that species is dependent on the availability of dead wood. In the sites envisaged in IP and in the adjacent areas that species is absent due to the lack of any suitable biotopes - there are neither forests nor parks, old-grown oak trees nor stumps. In the field survey carried out neither presence of that species was found nor any evidence of its life activity.

Capricorn beetle (*Cerambyx cerdo*). The life cycle of this species is connected with old-growth trees - mainly oak trees (mostly pedunculate oak, more rarely sessile oak, beech trees or elm trees) where its larvae develop. It prefers old oak trees which are exposed to the sun, or are diseased or dying. Preferable are moist trunks exposed to the sun, in forests which are in old or decaying phase, as the species is dependent on the availability of dead wood. It is found also in old-growth parks with appropriate trees. In the sites envisaged in IP and in the adjacent areas that species is absent due to the lack of any suitable biotopes - there are no old-grown trees with which the species is connected. In the field survey carried out neither presence of Capricorn beetle was found (imago or larvae) nor any evidence of its life activity.

Eastern eggar (*Eriogaster catax*) That type of butterfly lives in regions with deciduous ligneous and frutescent vegetation. The larva (pupa) lives in the bushes of hawthorn and blackthorn and in some ligneous and frutescent species like birch, pear tree, poplar, barberry, etc. In personal observations in many cases it was found also in wild briar. Although some of the ligneous and frutescent species mentioned above (wild briar and poplar) are available in both sites, presence of eastern eggar was not found - neither imago nor larvae - in the thorough field visits in the landed estate of TPP Sofia and TPP Sofia-East and respectively the two sites suggested for the IP implementation. Based on that and considering the specific urbanization of the areas of industrial purpose where the two plots are, it can be concluded that the sites envisaged in the investment proposal are not sites of that species' reproduction and feeding; in personal observations it was found only beyond urbanized territories. The IP sites are not within a site of significance for the butterflies (acc. to Abadjiev, Beshkov, 2007); there is no evidence of habitats of that species close to any of the two sites.

Jersey tiger (*Callimorpha quadripunctaria*) That type of butterfly inhabits regions with mesophytic vegetation in open spaces and periphery of deciduous forests, in narrow valleys with steep slopes. The caterpillars of that butterfly usually develop on plaintain (*Plantago sp.*) and clover (*Trifolium sp.*), but also on the leaves of oak trees and beech trees. In the scope of the industrial sites of the two TPPs presence of that species was not found in the examinations carried out: despite the availability of mesophytic grass vegetation and the presence of some clover, there are neither open spaces in peripheries of deciduous forests nor valleys with steep slopes. The suggested sites are not suitable and do not offer favourable conditions for development of the butterfly's caterpillars, as they are located within industrial areas characterized by high degree of anthropogenic influence; and most of the main site of the IP, located within the borders of TPP Sofia, is covered with concrete pavement. There infrastructure in the alternative site also - an old greenhouse, a railway line, etc. The IP sites are not within a site of significance for the butterflies (acc. to Abadjiev, Beshkov, 2007); there is no evidence of habitats of that species close to any of the two sites.

Large copper (*Lycaena dispar*). A type of diurnal butterfly. Widespread, although local, throughout Bulgaria up to about 800 m altitude in humid, more rarely in dry, grassy areas near lakes, ditches, excavations, streams, rivers and other sources of moisture. In the field examinations of the sites envisaged by the IP and nearby areas presence of that species was not found. In this case a suitable habitat for that species are some of the green areas within the landed estate of TPP Sofia-East, which to the east borders Iskar river and one of the rubble quarries filled with water in the area between Kazichene village and Sofia, as the grassy places around those water sites have some of the features of that species' habitats. Yet we should take into consideration the fact that the planting in the TPP's property is not suitable and does not offer optimum conditions for development of that butterfly's caterpillars as the land is within an in industrial area with high degree of anthropogenic influence. The IP sites are not within a site of significance for the butterflies; there is no evidence of habitats (acc. to Abadjiev, Beshkov, 2007) of that species close to any of the two sites - the nearest one is in the area of Pancharevo village.

Lesser purple emperor (*Apatura ilia*). That butterfly is distributed in the plains and at the foot of mountains of altitude up to 1,000 m. It inhabits mainly river banks overgrown with willows, forest roads and cuttings in river valleys. The caterpillars feed on willow leaves (*Salix sp.*). The species is widely distributed and frequent in its biotopes. It has not been found during the field examinations - neither in the main site nor in the alternative site envisaged in the IP, nor within the land property of any of the two TPPs. In this case places most suitable for its habitats exist in the vicinity of the plot of TPP Sofia-East, where the alternative IP site is, as TPP Sofia-East borders the course of Iskar river; willows grow along it and they present an appropriate food base for development of the lesser purple emperor's larvae. That is why it is probable that the imago of that species could be sporadically present also in the green areas within the very TPP ground, in search of food or of a repose. To the north the plot of TPP Sofia in its part borders Suhodolska river, but here the river course has been altered; the ligneous vegetation along the river is mainly poplar trees, there are willow trees only here and there; beyond the river are enterprises of Zadgarov Rayon industrial area, and due to all that presence of that species here is much less likely because there are no places sufficiently suitable for habitats and feeding places of the caterpillars. The nearest reported habitat (2001) is in the area of Orlov Most (English: Eagles' Bridge"), Sofia (acc. to Abadzhiev, Beshkov, 2007), and the species itself does not have a significant conservation status.

Purple emperor (*Apatura iris*) That butterfly is distributed in the mountains at altitude between 300 m and 1,700 m, but mostly along river valleys with mixed or coniferous forests, always with the presence of willows (*Salix sp.*), on whose leaves the caterpillars feed. The species is widely distributed and frequent in its biotopes in Bulgaria. It has not been found during the field examinations - neither in the main site nor in the alternative site envisaged in the IP, nor within the land property of any of the two TPPs. As regards suitable habitats in the area of the respective TPP, the information given for the previous species is valid for this one too. The nearest reported habitat

(1896) is in the area of Gorublyane, Sofia (acc. to Abadzhiev, Beshkov, 2007), and the species itself does not have a significant conservation status.

Chequered blue butterfly (*Scolitantides orion*). The butterfly is widely distributed up to 1,700 m altitude. It inhabits dry stony or rocky places with rare vegetation, usually in windy areas. Such habitats are lacking in the area of both the main site and the alternative site for the IP; that species has not been found in the field examinations carried out in the region of the two power plants, and it is not likely to be present. It is certain that the areas envisaged by the investment proposal as well as their surrounding areas are not a place for propagation and feeding of that species. The nearest reported habitat is in the area of Lozenets, Sofia (acc. to Abadzhiev, Beshkov, 2007), and the species itself does not have a significant conservation status.

Clouded apollo (*Parnassius mnemosyne*). Widely distributed but local, up to 2,000 m altitude, in South Bulgaria mostly in the mountainous regions. It inhabits moderately humid or dry bushy places - in mountain slopes, along river valleys, in glades and clearings etc.; such places are absent in this case. It has not been found during the field examinations - neither in the main site nor in the alternative site envisaged in the IP, nor within the land property of any of the two TPPs. The caterpillars feed on fumewort *Corydalis* (Fumariaceae) (Tolman & Lewington 1997), which is lacking in the area of the sites. It is a local species which does not seem immediately endangered in Bulgaria but is of conservation interest considering the fact that it is endangered in many parts of Europe. The nearest habitat is in the area of Knyazhevo, Sofa (acc.to Abadzhiev, Beshkov, 2007).

Glaucopsyche alexis A widely distributed type of diurnal butterfly up to around 1,500 m altitude; it is found in bushy glades, meadows, stony grass-grown slopes, forest peripheries, etc. That species has not been found in the field examinations and it is not likely to be found in or near the territory of any of the TPPs as there are no suitable places for habitats. The nearest habitat is in the area of Lozenets and Knyazhevo, Sofa (acc.to Abadzhiev, Beshkov, 2007).

Lesser spotted fritillary (*Melitaea trivia*). A widely distributed butterfly from the sea level up to around 1,800 m altitude in grassy and bushy places, forest peripheries, and rocky sunny slopes. The caterpillars feed on mullein (*Verbascum*) (Tolman & Lewington 1997), and that is absent in the area of any of the two TPPs and in their surroundings The species has not been found in the examinations carried out; there is some probability that it could be present in the green areas within the two landed estates, but not in the main site of the IP as that is mostly paved with concrete, and there are no blossoming plant species that could provide suitable food base for the adult butterflies. The nearest habitats are in the area of Lozenets and Knyazhevo, Sofa (acc.to Abadzhiev, Beshkov, 2007).

Zerynthia polyxena. A butterfly distributed in the lowlands and at the foot of mountains up to 700 m altitude, inhabiting grassy and bushy areas. Specimens have been found even at 1,900 m altitude in Rila mountain, probably carried away by the wind. The caterpillars' foodplant is birthwort (*Aristolochia* - a plant which is lacking in the land property of the two TPPs and near them; due to that the species was not found in the the field examinations that were made. Still there is some probability that the imago could be present in the green areas within the two landed estates, but not in the main site of the IP as that is mostly paved with concrete, and there are no blossoming plant species that could provide suitable food base for the adult butterflies. The nearest habitat is in the area of Lozenets, Sofa (acc.to Abadzhiev, Beshkov, 2007).

Large blue (*Maculinea arion*). A diurnal butterfly that can be found from the sea level up to around 1,800 m altitude in warm, stony or sandy areas: grassy meadows, glades, mountain slopes. This species is widespread in Bulgaria, it is not endangered. It has not been found in the course field examinations and it is not likely to be found in the territory of or in the vicinity of the two TPPs , as there are no suitable habitats.in that region. The nearest habitat is in the area of Knyazhevo, Sofa (acc.to Abadzhiev, Beshkov, 2007).

Yellow-spotted whiteface (*Leucorrhinia pectoralis*)**.** This species has been reported only twice in Bulgaria, adult specimen were found in Sofia in July and in May and August in Srebarna reserve. It has not been reported in Bulgaria in the last 40 years; neither was it found at the sites of the two TPPs during the examinations. That species inhabits marshlands and lakes - mesotrophic, slightly acidic or neutral reservoirs overgrown with vegetation floating on the surface - like broad-leaved pondweed (*Potamogeton natans*) and with watersides overgrown with swamp horsetail (*Equisetum limosum*). No suitable habitats for that species exist in Sofia any more (acc. to Marinov M., A. Popov) consequently there is not any probability that it can be present in the industrial sites of the two TPPs.

Green snaketail *(Ophiogomphus cecilia)* A dragonfly typical of the plains, distributed near the big rivers in Bulgaria at altitude between 30 m and about 500 m. It has not been found during the field examinations - neither in the main site nor in the alternative site envisaged in the IP, nor within the land property of any of the two TPPs. No big rivers flow through the main site (TPP Sofia) or near it - i.e. there are no places suitable for habitats of that dragonfly and there is not any probability that it can be found here. On the east side of the industrial area of TPP Sofia-East is Iskar river and one of the rubble quarries filled with water in the area between Kazichene village and Sofia; in their area there are suitable biotopes for that species, which if available there in search of food or roosting sites is likely to be sporadically found also within the site of the power plant.

Bush cricket (*Saga pedo*) A type of grasshopper of the Tettigoniidae genus (bush crickets) which inhabit xerothermal calcareous terrains; naturally that species has not been found in the land property of TPP Sofia or TPP Sofia-East or near them, as both terrains have been completely transformed as a result of urbanisation; they are located in industrial areas in which dry grassy communities on calcareous ground, which that species typically inhabits, are lacking. Actually in the places where there is herbaceous vegetation that vegetation is either of secondary origin and results from ruderalization processes, or is the result of artificially created lawns where rye-grass dominates; in both cases those are mesophytic herbaceous types. It is not likely that specimens of the bush cricket are affected in the course of construction or in the course of the plant operation.

Balkan Pincer Grasshopper (*Paracaloptenus caloptenoides*). That type of grasshopper, like the previous one, inhabits dry herbaceous communities. So the sites of TPP Sofia and TPP Sofia-East are not habitats of that species; neither are the adjacent areas. The Balkan pincer grasshopper has not been found in the filed examinations throughout the sites

Macrogaster *(Callimenus macrogaster)* That type of grasshopper is a mesohygrobiont and stenohygrophil inhabiting steppe and plain herbaceous and frutescent communities, which are lacking in the industrial areas of the two TPPs. That species has not been found during the field examinations - neither in the main site nor in the alternative site envisaged in the IP, nor within the land property of any of the two TPPs. In most of the habitats registered in Bulgaria that species was found between the end of 19th century and the 1950s. It has become extinct in almost all habitats around Sofia since the middle of 19th century as well as in some other regions in Bulgaria, and its population density has decreased. Its habitat area in Bulgaria is highly fragmented and the number of habitats drastically decreased in the last decades. The last finds were in Sofia valley near Bezden village (2055, 2006) and in the Eastern Rhodope mountain: in Ivaylovgrad region (1963, 2002) and Plevun (1970). Respectively that species is not present in the areas under potential impact by the IP implementation.

- **Herpetofauna - Amphibia and Reptilia classes**

In the area of Sofia herpetofauna is best represented and richest in the city's green system - the large city parks and gardens as well as in the agricultural land and forests adjacent to the urban environment, while in the industrial areas - within which the grounds of the two TPPs are - the herpetofauna is quite poor and is represented by only a few species. In this case, however, we have to take into consideration that TPP Sofia with the main site borders to the north the course of

Suhodolska river, and near the alternative site of TPP Sofia- East are Iskar river and is an old rubble quarry filled with water, which is a condition for availability of more species in the areas of the two sites (i.e. within the sites and near them). A list of the herpetofauna available in the area of the landed estates of the two TPPs with its conservation status is given in **Table 4.5-2**.

TABLE 4.5-2 A LIST OF THE HERPETOFAUNA IN THE AREA OF THE LAND PROPERTY OF THE TWO TPPS

Species (English and Latin)		Regulations and international conventions			
		BDA (Annex 2, 3)	CITES	Bern convention	Directive 92/43/EEC
Amphibia and Reptilia					
European green toad	Bufo viridis	Annex 3	-	+ (II)	Annex IV
Common toad	Bufo bufo	Annex 3	-	+(III)	-
Marsh frog	Rana ridibunda	-	-	+ (III)	Annex IV
European tree frog	Hyla arborea	Annex 3	-	+ (II)	Annex IV
Yellow-bellied toad	Bombina variegata	Annex 2, 3	-	+ (II)	Annex II, IV
European green lizard	Lacerta viridis	Annex 3	-	+ (III)	-
Common wall lizard	Podarcis muralis	Annex 3	-	+ (II)	-
Slow worm	Anguis fragilis	Annex 3	-	-	-
Aesculapian snake	Elaphe longissima	Annex 3	-	+ (II)	Annex IV
Grass snake	Natrix natrix	-	-	-	-

In the case under consideration the areas within the land property of the two TPPs provide suitable habitat conditions only for two of the species described above - European green toad (*Bufo viridis*) and common wall lizard (*Podarcis muralis*), and both of them were found in the territory of TPP Sofia. One run over specimen of European green toad was found in the street near the main gateway, and one common wall lizard specimen was observed on a support pillar of a reinforced-concrete hall in the western part of the site. No specimens were found in the site within the TPP, considered in the IP. As regards the other species, their habitats are within or near the above-mentioned rivers, which border the grounds of the two TPPs, and only the marsh frog (*Rana ridibunda*) can be found in the area of Suhodolska river, as the river bed here was altered; there are industrial sites on both banks of the river and as a result the river is polluted. Besides marsh frog, in the area of Iskar river and the rubble quarries near Kazichene it is very likely that common toad (*Bufo bufo*), European tree frog (*Hyla arborea*), yellow-bellied toad (*Bombina variegate*), Aesculapian snake (*Elaphe longissima*) and grass snake (*Natrix natrix*) are present also. In any event the area of the two rivers is beyond the major impacts of the IP implementation so in this case the species found within the sites of the two TPPs are of interest.

The European green toad (*Bufo viridis*), although listed in Annex 3 of the BDA, Annex II of the Berne Convention, and Annex IV of Directive 92/43/EEC, is a species quite widely distributed in Bulgaria, and in some cases it might be even more numerous in farmyards than beyond settlements; it is found also in big cities, including in spaces between residential blocks of flats (according to personal observations - in the cities of Sofia, Plovdiv, Peshtera, *Belogradchik* etc.) where it often falls victim to road traffic (like the specimen found at the site of TPP Sofia).

The common wall lizard (*Lacerta muralis*), is also listed in Annex 3 of the BDA, Annex II of the Berne Convention, and Annex IV of Directive 92/43/EEC, but like the species mentioned above this one is also distributed all over the country (except for some areas in large plains) at altitudes from the sea level up to around 2,100 m. The building of roads and railways contributes to its distribution. It inhabits mainly rocky and stony terrains: rock ridges, stone piles, riverside rocks, stone river beds, road beds. It is found in many villages and towns, and also in big cities (acc. to Biserkov, V., 2007. A guide to Amphibia and Reptilia in Bulgaria Sofia, Zeleni Balkani, 196 p.)

Class Aves

From the vertebrate fauna birds (Aves) are most numerous in the areas envisaged in the IP. This part of Sofia has been visited in different years and different seasons in the period 1979-2014, for the purpose of fauna examination. In the region under consideration (the two sites envisaged in the IP, the grounds of the two TPPs plus their adjacent areas) the following species can be indicated, as specified in **List 1** (**Table 4.5-3**):

TABLE 4.5-3 LIST 1: BIRDS (AVES)

1.	Common buzzard (buteo buteo (l.)) – specimens flying over;
2.	Rough-legged hawk (buteo lagopus (pontoppidan)) – specimens flying over in the fall-winter period;
3.	Northern goshawk (accipiter gentilis (l.)) – specimens flying over;
4.	Eurasian sparrowhawk (accipiter nisus (l.)) - specimens flying over, more in number in the fall-winter period;
5.	Eurasian hobby (falco subbuteo l.) - specimens flying over; rare;
6.	Common kestrel (falco tinnunculus l.);
7.	Yellow-legged gull - (larus cachinans pallas) - specimens flying over; rare;
8.	Rock dove, domestic pigeon - (columba livia (gmelin) f. Domestica);
9.	Eurasian collared dove (streptopelia decaocto (friv.));
10.	Long-eared owl (asio otus (l.));
11.	Little owl (athene noctua (scopoli));
12.	Common swift (apus apus (l.));
13.	Pallid swift (apus pallidus (shelley));
14.	Alpine swift (apus melba (l.));
15.	European bee-eater (merops apiaster l.) – in the seasonal migration periods;
16.	European green woodpecker (picus viridis l.);
17.	Great spotted woodpecker (dendrocopos major (l.)) – in the fall-winter period;
18.	Syrian woodpecker (dendrocopos syriacus (ehr.));
19.	Lesser spotted woodpecker (dendrocopos minor (l.));
20.	Crested lark (galerida cristata (l.));
21.	Barn swallow (hirundo rustica l.);
22.	Red-rumped swallow (hirundo dahurica l.) – rare;
23.	Common house martin (delichon urbica (l.));
24.	White wagtail (motacilla alba l.) – in the seasonal migration periods;
25.	Northern wheatear (oenanthe oenanthe (l.));
26.	Black redstart (phoenicurus ochruros (gmelin));
27.	Common nightingale (luscinia megarhynchos c. L. Brehm);
28.	European robin (erithacus rubecula (l.)) – in the fall-winter period;
29.	Common blackbird (turdus merula l.);
30.	Song thrush (turdus philomelos brehm) – in the seasonal migration periods;
31.	Fieldfare (turdus pilaris l.) – in the fall-winter period;
32.	Redwing (turdus iliacus l.) – in the fall-winter period;
33.	Eastern olivaceous warbler (hippolais pallida hhempr.&ehr.);

34.	Icterine warbler (hippolais icterina (vieillot)) – in the seasonal migration periods;
35.	Eurasian blackcap (sylvia atricapilla (l.));
36.	Common whitethroat (silvia communis latham);
37.	Lesser whitethroat (sylvia curruca (l.));
38.	Common chiffchaff (phylloscopus collybita (vieillot)) – in the seasonal migration periods;
39.	Wood warbler (phylloscopus sibilatrux (bechstein)) – in the seasonal migration periods;
40.	Willow warbler (phylloscopus trochilus (l.)) – in the seasonal migration periods;
41.	Eurasian blue tit (parus caeruleus l.);
42.	Great tit (parus major l.);
43.	Long-tailed tit (aegithalus caudatus (l.));
44.	Eurasian wren (troglodytes troglodytes (l.)) – in the fall-winter period;
45.	Spotted flycatcher (muscicapa striata (pallas)) – in the seasonal migration periods;
46.	Collared Flycatcher (ficedula albicollis temminck) – in the seasonal migration periods;
47.	Pied flycatcher (ficedula hypoleuca (pallas)) – in the seasonal migration periods;
48.	Red-backed shrike (lanius collurio l.);
49.	Hooded crow (corvus corone cornix l.);
50.	Rook (corvus frugilegus l.) – in the fall-winter period;
51.	Jackdaw (corvus monedula l.);
52.	Eurasian jay (garrulus glandarius (l.));
53.	Eurasian magpie (pica pica (l.));
54.	Common starling (sturnus vulgaris l.);
55.	House sparrow (passer domesticus (l.));
56.	Tree sparrow (passer montanus (l.));
57.	European greenfinch (carduelis chloris (l.));
58.	European goldfinch (carduelis carduelis (l.));
59.	Eurasian siskin (carduelis spinus (l.)) – in the fall-winter period;
60.	Eurasian linnet (acanthis cannabina (l.)) – in the fall-winter period;
61.	Common chaffinch (fringilla coelebs l.) – in the fall-winter period;
62.	Brambling (fringilla montifringilla l.) – in the fall-winter period;
63.	Eurasian bullfinch (pyrrhula pyrrhula (l.)) – in the fall-winter period;
64.	Hawfinch (coccothraustes coccothraustes (l.)) – in the post-nesting period;
65.	Corn bunting (emberiza calandra l.);
66.	Yellowhammer (emberiza citrinella l.) – in the fall-winter period;

As seen from **Table 4.5-3**not less than 66 bird species can be specified as typical for the areas within the IP scope and the adjacent areas. That variety of species can be considered relatively rich for the region within the IP scope. The species given in List 1 shall not be considered as complete (definitive, maximum possible) number and type of species in that region because more species can be found there in particular during seasonal and other migrations.

Of all bird species most numerous in the IP area are the house sparrow and the common house martin. Apart from those in different periods and seasons large numbers of specimens of the following species concentrate and feed in different open areas in this part of the city (including in flights): tree sparrow, European goldfinch, Eurasian siskin, Eurasian linnet, common chaffinch, brambling, common starling, rook, jackdaw and others.

Within the power plants' yards and their adjacent grounds, occupied mostly by buildings but also by ligneous and frutescent vegetation, the bird species present in large or considerable numbers in the nesting period are predominantly house sparrow, common house martin, common blackbird, European goldfinch, European greenfinch, rock dove, Eurasian magpie, jackdaw and great tit.

As mentioned above, the species listed in List 1 are typical for an area considerable in size: the site of the IP, namely the area for the plant project (the sites in the yards of the two TPPs) as well as the surrounding areas. As the particular sites envisaged in the IP (both the main and the alternative site) and their adjacent grounds have rather small own area compared to the area of the respective region (the industrial areas) within which they are located, **List 1a (Table 4.5-4)** specifies those species which are closely connected with the particular territory. As mentioned above in the description, the plots of each of the power plants, within which the respective IP sites are located (the main site and the alternative site) comprise built up areas and planted areas within the respective industrial area.

In such cases, in a more specific aspect, of greatest significance are those species which are closely connected with the territory of the very site and the neighbouring areas - the species for which in different seasons the given site has been or could be also a breeding ground or an important feed base (**List 1a**).

TABLE 4.5-4 LIST 1A: BIRDS (AVES)

67.	Eurasian sparrowhawk (Accipiter nisus (L.)) - specimens flying over, more in number in the fall-winter period;
68.	Common kestrel (Falco tinnunculus L.);
69.	Rock dove, domestic pigeon - (Columba livia (Gmelin) f. domestica);
70.	Little owl (Athene noctua (Scopoli));
71.	European green woodpecker (Picus viridis l.);
72.	Syrian woodpecker (Dendrocopos syriacus (Ehr.));
73.	Barn swallow (Hirundo rustica L.);
74.	Red-rumped swallow (Hirundo dahurica L.) – rare;
75.	Common house martin (Delichon urbica (L.));
76.	Black redstart (Phoenicurus ochruros (Gmelin));
77.	Common blackbird (Turdus merula L.);
78.	Eurasian blackcap (Sylvia atricapilla (L.));
79.	Common whitethroat (Silvia communis Latham);
80.	Eurasian blue tit (Parus caeruleus L.);
81.	Great tit (Parus major L.);
82.	Hooded crow (Corvus corone cornix L.);
83.	Rook (Corvus frugilegus L.) – in the fall-winter period;
84.	Jackdaw (Corvus monedula L.);
85.	Eurasian jay (Garrulus glandarius (L.));
86.	Eurasian magpie (Pica pica (L.));
87.	Common starling (Sturnus vulgaris L.);
88.	House sparrow (Passer domesticus (L.));
89.	Tree sparrow (Passer montanus (L.));
90.	European greenfinch (Carduelis chloris (L.));
91.	European goldfinch (Carduelis carduelis (L.));
92.	Eurasian siskin (Carduelis spinus (L.)) – in the fall-winter period;
93.	Common chaffinch (Fringilla coelebs L.) – in the fall-winter period;

As seen from **List 1a (Table 4.5-4)**, not less than 27 bird species can be specified as typical for the areas within the IP scope and the adjacent areas, i.e. considerably less in number (over twice).

Of the species in **List 1a** only one - the Syrian woodpecker (*Dendrocopos syriacus* (Ehr.)) - is included in **Annex 2 of the BDA** (Biological Diversity Act) (SG No. 77, Section II - Special areas of conservation, art. 6, item 4 (2) and (3) - the annex specifying the plant and animal species in danger of extinction, the conservation of which is a priority in the territory of Bulgaria.

The Syrian woodpecker is the most numerous woodpecker species in the cities and villages (Yankov, 1986) and in the lowlands in Bulgaria (up to 900 - 1,000 m altitude), and in that altitude range only in forests of considerable area and density the great spotted woodpecker species outnumbers it. Availability of specimens of Syrian woodpecker has been recorded in the IP area (the TPP area) but only outside the nesting period. No nesting has been recorded within the enterprise's territory (including hollow holes in tree trunks); nesting is also not likely as large-size trees are just a few; and besides no signs of internal decay were found on the trunk parts of the trees which are sufficiently large in diameter - and it is exactly internal decay which results in cavities (hollows) suitable for nesting of that sheltered-nesting species. The woodpeckers find such cavities due to their acoustic effect and then peck out holes to reach them. Therefore the power plant area is not particularly suitable for a reproductive habitat of that species. Favourable for the condition of that species in Sofia is the fact that a large number of such couples nest in different parts of the city, including in the northern part.

Specimens of one more species included in Annex 2 - the red-backed shrike - have been recoded, mostly in the periphery of the considered industrial areas of Sofia (industrial area Zadgarov Rayon and industrial area Iskar)

The red-backed shrike inhabits and nests in low ligneous vegetation in open areas, in grassy-bushy and bushy-grassy areas, in forest edges and thinned-out forest sections, and also in settlements, including the cities of Sofia, Plovdiv, Stara Zagora, Shumen, Varna, Burgas, Silistra, Pernik, Sandanski and others, in villages, in the yards of industrial enterprises, including in their interior. That species is quite numerous in Bulgaria, and is available in areas of ranging from the sea level to quite high altitudes; in its nesting period it has been recorded at 1,600 altitude and even at nearly 1,800 m altitude (Mursalitsa peak, 1,791.6 m and its neighbouring peak to the east, 1,795.2 m altitude in the Western Rhodope mountain, 22 June 2006); in the end of its nesting period and outside it the red-backed shrike has been observed also at altitude over 2,000 m in the subalpine parts of Rila and Pirin mountains. Moreover that species is tolerant to human presence, including in its nesting areas, including near a nesting place - within a few metres distance from it. No couples of that species have been recorded in the area of the power plant in the breeding period (spring and summer). Presence of its specimens was recorded there only in the seasonal migration periods. As the investment proposal does not envisage affecting additional areas unaffected until present, actually the IP implementation will not deprive that species from additional areas of its feed base or nesting base in that part of the city. Moreover in different parts of that industrial area there are terrains (areas, plots) suitable for nesting of that species, and that suggests that nesting couples of it could appear in some of them in some years.

- **Class Mammalia**

From the Mammalia class, the sites of the two TPPs and their adjacent areas provide suitable habitats for synanthropic species of small mammals, mostly for complete synurbic types, as the two sites are located within industrial purpose areas where a number of enterprises, service stations, logistic centres and warehouses function.

Of the small terrestrial mammals the species common here are the house mouse (*Mus musculus*), brown rat (*Rattus norvegicus*), and black rat (*Rattus rattus*), which in turna are suitable food base for the European polecat (*Mustela putorius*). It is very likely to find here also southern white-breasted hedgehog (*Erinaceus concolor*), weasel (*Mustela nivalis*) and stone marten (*Martes foina*).

The buildings and halls at the two TPPs sites provide suitable shelter and hiding places for some types of bats inhabiting human settlements - like common noctule (*Nyctalus noctula*), common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), serotine bat (*Eptesicus serotinus*), Savi's pipistrelle (*Hypsugo savii*) and some others. **Those species are common inhabitants of allmost all human settlements in Bulgaria and are nevertheless under protection - they are included in Annex 2 of BDA.** The number of specimens in colonies of urban bat species ranges from 5-20 to 50-150, and to over 1,000 in some rare cases. They live in attics, basements, bunkers, underground garages, gaps and facing of buildings, shafts, chimney stacks, ventilation installations, under bridges, under window shutters and in many other places. In this case only building and operation of a cogeneration plant utilising RDF is within the scope of the investment proposal considered in this EIAR, and the preliminary clearing of the sites envisaged for the plant construction from old buildings and installations in any of the two TPPs is not the object of this EIAR.

The grounds of the two plants are inhabited also by dogs (*Canis fammililaris*) – watchdogs and stray dogs as well as cats (*Felis domestica*) – stray specimens.

4.5.2 COMPONENTS OF THE NATIONAL ECOLOGICAL NETWORK

The nearest areas of NEN are given below:

- **Protected areas declared under the Protected Areas Act:**
  - Protected site Blatata in the territory of Dolni Bogrov village, declared by order 1065 of 24.11.1993, State Gazette issue 102/1993 for the purpose of protecting the natural habitats of rare bird species. The area of the site is 14.8 ha. It is at about 12 km distance to the east from the yard of TPP Sofia and about 7 km distance to the north-east of the yard of TPP Sofia-East. In this protected site it is prohibited to kill, capture, ring or disturb the nesting birds, destroy their nests, collect their eggs, take their young; to perform construction and any other activities which damage the natural appearance of the site or change adversely its water regime. Prohibited are also all types of felling; planting of species not typical for the area; hunting and fishing in the birds' breeding period from 1 April to 30 July; polluting the water and the area, dumping of waste.
  - Protected site Vrana in the territory of Sofia city, declared by order No. RD1027 of 28.12.2001 promulgated in State Gazette issue 16/2002 for the purpose of protecting the habitats of rare and endangered plant and animal species, including yew and ilex, and conservation of the unique forest and unique park with remarkable landscape. The area of the site is 96.8 ha. It is at about 11 km distance to the south-east from the yard of TPP Sofia and about 1.3 km distance to the east- south-east of the yard of TPP Sofia-East. The following is prohibited in this protected site: construction with the exception of repair and/or reconstruction of existing roads, lanes, water supply and sewerage systems, power supply and irrigation systems, fences; grazing of domestic animals; any hunting; bivouacking and making fire in places other than those specified for the purpose; destroying and damaging the natural park vegetation except in carrying out activities envisaged in the management plan; pollution with household waste and any other waste; damaging the existing landscape.
- **Protected zones in Natura 2000 network:**
  - 33 BG 0000113 Vitosha under Directive 2009/147/EC on the conservation of wild birds and Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. The nearest boundary of that zone is at 9 km distance from the plot of TPP Sofia, to the south of it, and at 6.5 km distance from the plot of TPP Sofia-East, to the south of it.

- 33 BG 0000165 Lozenska Planina under Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. The nearest boundary of that zone is at 5.2 km distance from the plot of TPP Sofia-East, to the south-east of it.
- 33 BG 0002004 Dolni Bogrov - Kazichane under Directive 2009/147/EC on the conservation of wild birds. The nearest boundary of that zone is at 11 km distance from the plot of TPP Sofia, to the east of it, and at 4.5 km distance from the plot of TPP Sofia-East, to the east of it.
- 33 BG 0002114 Ribarnitsi Chelopechene (Chelopechene fish breeding ponds) under Directive 2009/147/EC on the conservation of wild birds. The nearest boundary of that zone is at 10 km distance from the plot of TPP Sofia, to the north-east of it, and at about 9.5 km distance from the plot of TPP Sofia-East, to the north of it.

4.6 LANDSCAPE

Description of the main features of the landscape in the area of the investment proposal:

The area of the investment proposal project can be classified according to the two types of landscape zoning adopted in Bulgaria: regional and typological.

According to the **regional landscape zoning** of Bulgaria (**Figure 4.6-1**) the sites of the investment proposal fall within:

B. South Bulgarian mountain valley district
IX. Vitosha- Ihtiman sub-district
58. Sofia region

The given letter indices and numerical indices mark the landscape district, sub-district and regions and correspond to the adopted landscape zoning of Bulgaria.

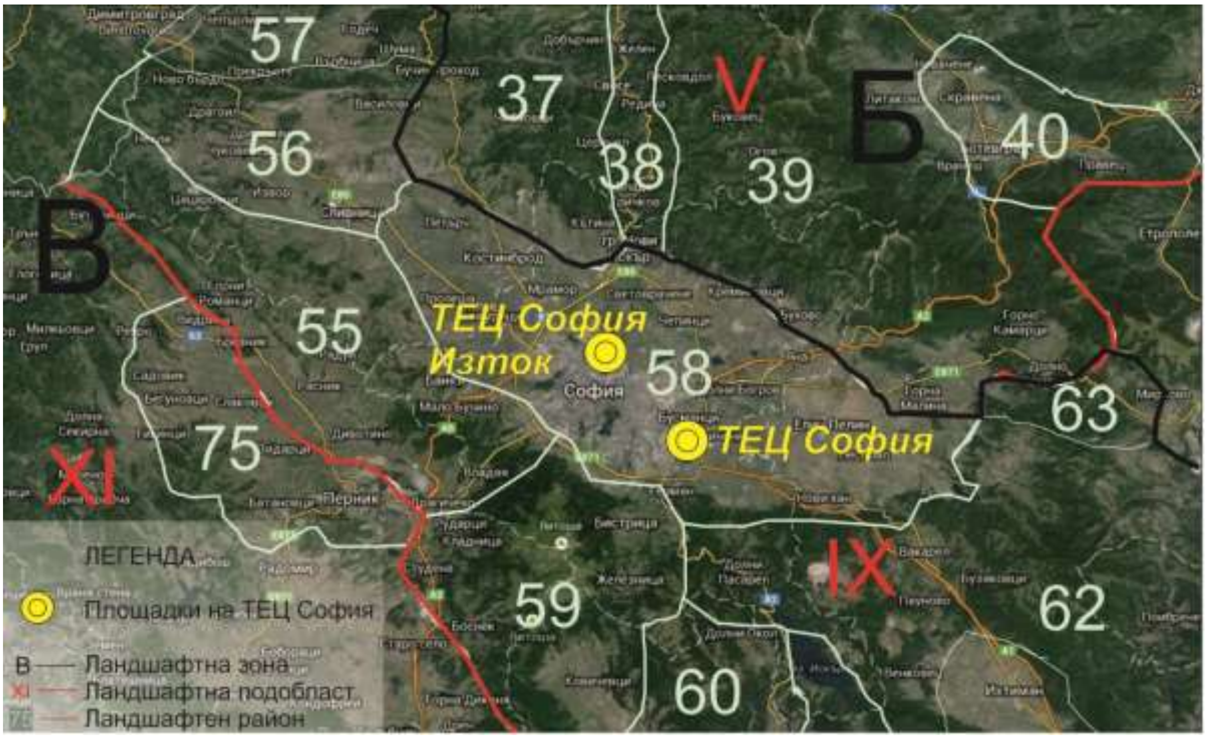


FIGURE 4.6-1 A PLAN OF THE REGIONAL LANDSCAPE ZONING OF THE SITES

According to **the typological landscape zoning** of Bulgaria the sites are within the following landscape structures:

3. Class	Valley landscapes
3.7. Type	Landscapes of temperate-continental meadow-steppe and forest-meadow-steppe valley floors
3.7.15. Sub-type	Landscapes of meadow-steppe, predominantly flat, floors of intermountain valleys
3.7.15.31. Group	Landscapes of meadow-steppe floors of intermountain valleys on loose Quaternary deposits of high degree of agricultural reclaim

The numerical indices of landscape taxonomic classes correspond to the Typological Landscape Zoning of Bulgaria and specify the landscape of the area under consideration.

The accuracy of determining the belonging of a given landscape to the respective class does not fit completely the purposes of classifying a small area like the one envisaged in the investment proposal. The scale in which the regional and the typological landscape zoning is made - 1:400,000 - does not allow detailed characterisation of the landscape of the investment proposal sites, therefore a more detailed classification system has to be applied to them - by the type of ground mantle according to the specific location of TPP Sofia sites.

4.6.1 LANDSCAPE IN THE TERRITORY OF TPP SOFIA PLOT, SITE "B"

The territory of TPP Sofia where site "B" is located is part of the ***anthropogenic landscape***. The total area of TPP Sofia plot is 334,945 m^2. The natural landscape of that area has been radically changed. In the past the soils were removed and the vegetation was annihilated. New deposit soils were formed there and the buildings and installations of TPP Sofia were built on them. Most of the soils have been "sealed" by construction, pavement etc. Basic processes of landscape functioning have been disrupted: the cycle of water and chemical elements, the biomass production, etc.

Of the *anthropogenic landscape* varieties the following are found within the territory of TPP Sofia: *anthropogenic industrial* and *anthropogenic communication* landscape:

- The *anthropogenic industrial* landscape covers the area occupied by technology-requisite buildings connected with the TPP operation.
- The *anthropogenic communication* landscape includes the areas occupied by communication roads and existing high-voltage lines.

There are also other landscape units in the TPP territory, which can be assigned to the ***forest landscape*** Ligneous and frutescent micro-groups have been created for landscaping and improvement of the environment. The area of that landscape is not compact. It is broken by communication connections, buildings, open spaces, etc. The landscape has been created for the purpose of forming an environment. Its presence improves the visual appearance of the anthropogenic landscape; has a favourable effect on the micro-climate and on dust concentration in the ambient air; some areas within it are used for relaxation, etc. The present condition of the vegetation component does not contribute to an adequate positive aesthetic effect of the landscapes in the area because only part of its territory is maintained. Human intervention is necessary in the remaining parts for removing unwanted vegetation etc. The forest landscape is characterised by high sustainability and self-regulation ability.

The total area of site "B" is 15 daa; the site is part of the ***anthropogenic*** and ***forest*** landscapes.

4.6.2 LANDSCAPE IN THE TERRITORY OF TPP SOFIA-EAST PLOT, SITE "B"

The territory of TPP Sofia-East where site "B" is located is part of the ***anthropogenic landscape***. The total area of TPP Sofia-East plot is 319,692 m^2. The natural landscapes of this territory have been altered as a result of the TPP construction and operation. Most of the soils have been "sealed" buildings, pavement, etc. and the vegetation was annihilated. Basic processes of landscape functioning have been disrupted: the cycle of water and chemical elements, the biomass production, etc.

The following varieties of *anthropogenic landscape* are found in the territory of TPP Sofia-East

- The *anthropogenic industrial* landscape covers areas occupied by technology-requisite buildings connected with the TPP operation.
- The *anthropogenic communication* landscape includes the areas occupied by communication roads and existing high-voltage lines.

Ligneous and frutescent vegetation has been planted in the territory of TPP Sofia-East for the purpose of landscaping and improvement of the environment and micro-climate. Those ligneous-frutescent micro-groups can be assigned to the ***forest landscape***. The landscape has been created for the purpose of forming an environment. Its area is not compact. It is broken by communication connections, buildings, open spaces, etc. Its presence improves the visual appearance of the anthropogenic landscape; has a favourable effect on the micro-climate and on dust concentration in the ambient air; some areas within it are used for relaxation, etc. The present condition of the vegetation component does not contribute to an adequate positive aesthetic effect of the landscapes in the area because only part of its territory is maintained. Human intervention is necessary in the remaining parts for removing unwanted vegetation etc. The forest landscape is characterised by high sustainability and self-regulation ability.

The total area of site "B" is 20 daa; the site is part of the ***anthropogenic*** and ***forest*** landscapes.

The following landscapes are found in the neighbourhood of TPP Sofia and TPP Sofia-East sites:

- ***Meadow landscapes*** - Represented in small areas where the meadow-steppe vegetation of former times exists. Most of them at present are occupied by neglected agricultural fields and anthropogenic areas.
- ***Agricultural landscapes*** - Represented chiefly by crop-rotation agricultural landscape. Those are agrarian territories which were used in the past for growing of rotation crops in the land around Sofia. At present most of them are neglected and the appearance of the landscape has been changed.
- ***Aquatic landscapes*** - Those are represented by fluvial aquatic landscape, which comprises the catchment area of the nearby Iskar river and its tributaries. Lake aquatic landscape is also present, comprising the artificial lakes resulting from exploitation of sand-pits and gravel-pits located in the vicinity of the site.
- ***Anthropogenic landscapes*** - Anthropogenic landscapes are represented chiefly by settlement anthropogenic landscape. Its structure includes Sofia city and the nearby settlements.

In the eastern part of Sofia is the territory of Kremikovtsi Metallurgical Complex, which is part of the industrial anthropogenic landscape. It comprises also the areas of quarries, tailing ponds, landfills etc.

Communication anthropogenic landscape is also present. Its structure includes all existing roads of different classes, including country roads, and the power lines crossing a part of the IP area.

The landscapes are at various stages of anthropogenization. The structure of some of them has been materially altered, mainly in the industrial landscape where the vegetation and soil components have been destroyed and also part of the geological base. Least affected are the areas of communication anthropogenic landscape and settlement anthropogenic landscape where the changes are reversible.

4.6.3 DESCRIPTION OF METHODS USED AND RESULTS FROM STUDIES TO DETERMINE THE PRESENT CONDITION OF THE LANDSCAPE COMPONENT

The main and specific approach includes classification of the landscapes according to the regional and the typological landscape zoning of Bulgaria in order to specify the particular landscape in which the IP sites are located. The horizontal and vertical landscape structure is determined by analysing maps and diagrams, the available documentation and scientific literature. The presence of landscapes belonging to lower taxonomic levels is defined as well as their resistance to anthropogenic influence. Based on that the expected impacts on the landscape are forecast.

4.7 WASTE

Different types of waste are generated in the territory of TPP Sofia and TPP Sofia-East - from the production operations, from the daily activities of the staff and from the repairs carried out. The waste generation spots in the power plants are connected with the processes of production or with the type of repair works.

Household waste, construction waste (when repair works are carried out), non-hazardous industrial waste and hazardous industrial waste is generated in the two sites - of TPP Sofia and TPP Sofia-East. Waste is managed observing all the requirements specified in the integrated permits for the two power plants.

4.7.1 WASTE MANAGEMENT IN TPP SOFIA

All waste generated as a result from TPP Sofia activities has been classified under codes and designations in accordance with Ordinance No.3 of 01.04.2004 on wastes classification issued by the minister of environment and water and the minister of health, promulgated in SG No.44/2505.2004, as last amended and supplemented in SG No.23/20.03.2012. As regards the temporary storage of waste and its treatment, waste management is in accordance with the requirements of the legislation in force (the conditions of the integrated permit are observed as well).

Data from the 2013 annual report on the environment, required under integrated permit No.43/ 2005 of TPP Sofia regarding the waste generated in the year.

4.7.1.1 INDUSTRIAL WASTE

Industrial waste type	Waste code	Quantity in 2013	Quantity limit value acc.to permit		Delivered quantity (tons) in 2013	Compliance Yes/ No
		t/y	t/y	t/MWh		
Aqueous sludge from boiler cleansing other than those mentioned in 10 01 22*	10 01 23	0.000	1.5	$1.05x10^{-6}$	0.000	Yes
Linings and refractories from non-metallurgical processes containing dangerous substances other than those mentioned in 16 11 05*	16 11 06	0.000	3 m^3	$2.1x10^{-6}$ m^3/MWh	0.000	Yes
Non-ferrous waste	19 10 02	0.000	2	$1.4 x10^{-6}$	0.000	Yes

Industrial waste type	Waste code	Quantity in 2013	Quantity limit value acc.to permit		Delivered quantity (tons) in 2013	Compliance Yes/ No
		t/y	t/y	t/MWh		
Iron and steel waste	19 10 01	3.000	200	$6.3x10^{-5}$	0.000	Yes
Saturated or spent ion exchange resins	19 09 05	0.000	11 m^3	$7.7x10^{-6}$ m^3/MWh	0.000	Yes

4.7.1.2 GENERAL INDUSTRIAL WASTE

Industrial waste type	Waste code	Quantity 2013	Quantity limit value acc.to permit	Delivered quantity (tons) 2013	Compliance Yes/No
		t/y	t/y		
Ferrous metal filings and turnings	12 01 01	0.510	2.5	0.000	Yes
Non-ferrous metal filings and turnings	12 01 03	0.008	0.2	0.000	Yes
End-of-life tyres	16 01 03	0.300	0.8	0.000	Yes

4.7.1.3 MUNICIPAL WASTE

Waste type	Waste code	Quantity 2013	Quantity limit value acc.to permit	Delivered quantity (tons) 2013	Compliance Yes/No
		t/y	t/y		
Paper and cardboard	20 01 01	0.010	3	0.000	Yes
Mixed municipal waste	20 03 01	11.200	50	11.200	Yes

4.7.1.4 HAZARDOUS WASTE FROM THE PLANT WITHIN THE SCOPE OF ANNEX 4 OF EPA

Industrial waste type	Waste code	Quantity 2013		Quantity limit value acc.to permit		Delivered quantity (tons) 2013	Compliance Yes/ No
		t/y	t/MWh	t/y	t/MWh		
Oil fly ash and boiler dust (ash and dust from mazut fuel combustion)	10 01 04*	0.000	0.000	1	$7x10^{-7}$	0.000	Yes
Mineral-based non-chlorinated engine, gear and lubricating oils	13 02 05*	0.053	$0.265 x10^{-7}$	0.25	$1.75 x10^{-7}$	0.000	Yes
Mineral-based non-chlorinated insulating and heat transmission	13 03 07*	0.000	0.000	5	0.000002	0.000	Yes

oils							
Sludge from on-site effluent treatment containing dangerous substances	10 01 20*	0.000	0.000	150 m^3	$2.1x10^{-6}$ m^3/MWh	0.000	Yes
Interceptor sludges	13 05 03*	41	205.097	1	$7x10^{-7}$	41	No
Fuel oil and diesel fuel	13 07 01*	0.000	0.000	5	#	0.000	Yes
Waste containing oil	16 07 08*	0.000	0.000	5 m^3	$3.5x10^{-6}$ m^3/MWh	0.000	Yes

4.7.1.5 *GENERAL HAZARDOUS WASTE*

Waste type	**Waste code**	**Quantity 2013**	**Quantity limit value acc.to permit**	Delivered quantity (tons) **2013**	**Compliance Yes/No**
		t/y	t/y		
Sludge from on-site effluent treatment containing dangerous substances	10 01 20*	0.000	150 m^3/y	0.000	Yes
Lead batteries	16 06 01*	2.080	0.6	0.000	No
Insulation materials containing asbestos	17 06 01*	0.000	0.5	0.000	Yes
Bituminous mixtures containing coal tar	17 03 01*	0.000	0.5	0.000	Yes
Fluorescent tubes and other mercury-containing waste	20 01 21*	0.0895	0.2	0.000	Yes

4.7.1.6 *CONSTRUCTION WASTE*

Waste type	**Waste code**	**Quantity 2013**	**Quantity limit value acc.to permit**	Delivered quantity (tons) **2013**	**Compliance Yes/No**
		t/y	t/y		
Glass	17 02 02	0.300	1.5	0.000	Yes
Copper, bronze, brass	17 04 01	0.000	1	0.000	Yes
Iron and steel	17 04 05	0.000	10	0.000	Yes
Insulation materials other than those mentioned in 17 06 01 and 17 06 03	17 06 04	137.46	20	137.46	No
Mixed construction and demolition wastes other than those mentioned in 17 09 01*, 17 09 02* and 17 09 03*	17 09 04	1,651.88	3,000	1,651.88	Yes

4.7.1.7 INFORMATION ABOUT THE WASTE DELIVERED IN 2013 FOR DISPOSAL /REUSE OUT OF TPP SOFIA SITE ACCORDING TO CONTRACT

Waste type	Waste code	Name of operator performing the operation	Code of the operation (D/R)	Delivered quantity (tons)
Interceptor sludges	13 05 03*	EUROZAK EOOD REMSI-E EOOD	R	41
Insulation materials other than those mentioned in 17 06 01 and 17 06 03	17 06 04	Sofinvest EOOD	D	137.46
Mixed construction and demolition wastes other than those mentioned in 17 09 01*, 17 09 02* and 17 09 03*	17 09 04	Sofinvest EOOD	D	1,651.88

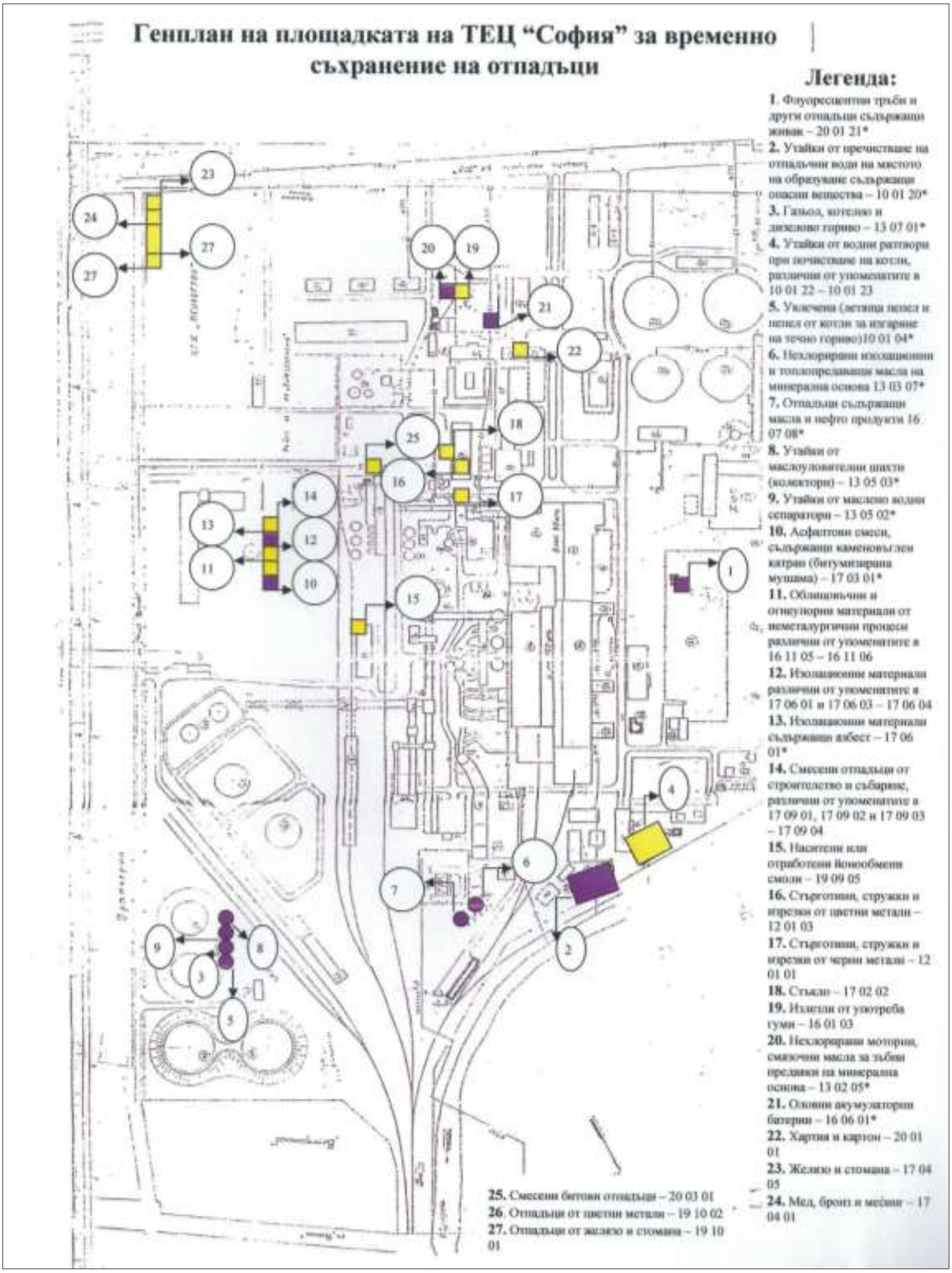


FIGURE 4.7-1 SITES FOR TEMPORARY WASTE STORAGE

4.7.2 *WASTE MANAGEMENT IN TPP SOFIA-EAST*

All waste generated as a result of TPP Sofia-East activities has been classified under codes and designations in accordance with the Ordinance on wastes classification

4.7.2.1 HAZARDOUS WASTE

- **Non-chlorinated engine, gear and lubricating oils** - spent engine, gear and lubricating oils from transportation activities Generated from changing the oils of vehicles and construction machines, about 0.1 t/y. Generation period - after 7,000 km run of the respective machine Code 13 02 02*
- **Lead batteries** - Generated from replacement of old and unserviceable batteries of vehicles and construction machines - around 0.2 t/y. Code 16 06 01*
- - **Sludge from treatment of industrial waste water -** mechanical sediment with traces of oil products, generated in the teratement of oil water - around 4 t/y. Code 19 08 04*
- **Fluorescent tubes and other mercury-containing waste** - Unserviceable fluorescent tubes and mercury lamps generated in preventive replacement and repairs; up to 50 pieces/year. Code 20 01 21*

4.7.2.2 NON-HAZARDOUS INDUSTRIAL WASTE

- **Ferrous metal filings and turnings** - steel filings generated in cold processing of parts necessary for repairs; around 0,3 t/y. Code 12 01 01.
- **End-of-life tyres** - worn out types unfit for use Generated from vehicles and construction machines; about 50 pieces/year. Code 16 01 03
- **Iron and steel** - unfit steel parts disassembled in repairs; around 130 t/y; generated mostly in the non-heating season. Code 17 04 05.
- **Other insulation materials** - non-asbestos thermal-insulation materials, glass wool and mineral wool, generated in repairs; around 3 t/y. Generated mostly in the non-heating season. Code 17 06 02
- **Sludge from WWTP -** mechanical sediments from raw water after treatment with aluminium sulphate from precipitator in the WWTP; up to 50 t/y. Code 19 08 99
- **Mixed municipal waste**- waste generated from the daily activities of the staff; around 36 t/y- **Code** 20 93 01.

4.7.2.3 WASTE COLLECTION AND RECEIVING

- **Non-chlorinated engine, gear and lubricating oils** - Those are stored at the site in a special tank with a dike around it. They are not transported out of the site. They are used as lubricant in minor activities. There is no risk of explosion or fire.
- **Lead batteries** - Waste batteries are collected and stored in a separate room until they reach a certain number and then are delivered to a company for further treatment.
- **Sludge from treatment of industrial waste water** - It is stored in sludge beds located in the area of the WWTP. It is not transported away as the capacity of the beds has not been exhausted yet.
- **Fluorescent tubes and other mercury-containing waste** - Unserviceable fluorescent tubes are stored in intact, well-closed boxes in a room designated for this purpose. They are not disposed ore treated.
- **Ferrous metal filings and turnings** - Those ate collected in a wooden case near the mechanical workshop. When sufficient quantity is accumulated, it is delivered for melting.
- **End-of-life tyres** - Such tyres are stored in a fenced ground outdoors.
- **Iron and steel** - It is stored in a ground outdoors, and from there, after cutting into pieces, is delivered for melting.
- **Other insulation materials** - Glass wool and mineral wool that has been taken down is stored in tightly tied up polyethylene bags in a special ground.
- **Sludge from WWTP** - It is stored in special fields at the WWTP. For the time being it is not transported away as the capacity of the fields has not been exhausted yet.

- **Household waste** - It is collected in metal containers and transported by trucks of the company DITZ EAD.

The activities for collecting the industrial and hazardous waste specified above are performed in compliance with the regulatory requirements regarding handling and disposal of such waste.

4.7.2.4 TEMPORARY STORAGE OF WASTE

A site for temporary storage of insulation materials - Dismantled thermal insulation (glass wool and mineral wool) is stored here. The wool is packed in polyethylene bags, tightly tied up. The site area is 1,000 m^3. There is no enclosure. The distance to the nearest building is about 15 m. Access to the site is provided for motor vehicles, but there is no fire protection system as that waste is not combustible. The site for temporary storage of insulation materials has been built in compliance with the regulatory requirements.

A site for temporary storage of metal waste - Dismantled metal parts are stored here until cutting them into pieces and transportation for melting. The site area is 1,000 m^3. There is no enclosure. The distance to the nearest building is 15 m. Access to the site is provided for motor vehicles. There is no fire protection system as that waste is not combustible. There is no container-washing system. The stored material is not within the scope of the Ordinance on prevention of accidents in operations involving hazardous chemicals.

A site for temporary storage of unserviceable fluorescent tubes - A special room has been designated, size 3.5 x 9 x 4 m, and its is used only for that purpose. The distance to the nearest building is 12 m. Access to the room is provided through a metal door. The site for temporary storage of defective fluorescent tubes has been built in compliance with the regulatory requirements for handling and transportation of industrial and hazardous waste.

Hazardous waste collecting, storage and transportation is performed in compliance with the regulatory requirements in force.

Waste transportation - Apart from the sites for temporary storage of waste the following are transported:

- lead batteries - they are delivered to a company for following processing;
- iron- and steel-containing metal filings and turnings - by own transport to a scrap point;
- household waste - by specialised trucks of a company, with which a contract has been concluded.

The transportation of waste is performed in compliance with the regulatory requirements regarding handling and transportation of industrial and hazardous waste.

No waste re-use, treatment, recycling or disposal is performed at the site.

Control and weighing - The quantity of generated waste is controlled through submission of truck weight receipts and accounting documents. No analysis of the waste are made.

Waste management documents and reporting of waste management activities According to the regulatory requirements in force regarding waste management activities those documents are: a waste register book; annual reports including data cards about waste by types; a report on carrying out waste management activities.

Before starting construction for the IP project the respective site will be prepared for the construction and installation of the new production facilities. At the site of TPP Sofia-East there are out-of-service mazut tanks and respective infrastructure with them, and that is one of the main disadvantages which prevent choosing with priority site "B" of TPP Sofia-East for the IP implementation.

Good waste-management practices are in place in both TPPs.

Depending on the future decisions of Toplofikatsia Sofia AD the waste generated in the operation of the cogeneration plant utilising RDF will be managed independently my the managers of the new facility.

The possibility of the following shall be considered more precisely: integration of some types of waste, with the exception of the so called process by-waste, into the waste management system of the existing plants; many of the existing storehouses can be used for temporary storage of hazardous and non-hazardous industrial waste.

Provided there is strict control and effective management of waste, and provided the suggested measures are strictly observed, not any significant negative impact is expected on the environment, on the employees working at the IP site, or on the population in that area.

4.8 DANGEROUS SUBSTANCES

The Law on the protection from the harmful effects of chemical substances, preparations and products and the by-laws with it are the basis for management of the activities involving dangerous substances.

According to the Law on the protection from the harmful effects of chemical substances, preparations and products, substances are classified as dangerous if, according to their properties, they belong to minimum one of the categories specified in **Table 4.8-1**.

TABLE 4.8-1: PROPERTIES AND CODES OF CHEMICAL SUBSTANCES AND PREPARATIONS

Explosives	E	Harmful	Xn
Oxidizing	**O**	Corrosive	**C**
Extremely flammable	**F^+**	Irritants	**Xi**
Highly flammable	**F**	Sensitizers	**Xi**
Flammable	**F**	Carcinogens	**T, Xn**
Very toxic	**T^+**	Toxic for reproduction*	**T, Xn**
Toxic	**T**	Mutagens*	**T, Xn**
		Dangerous for the environment	**N**

Note: Remote effects on the body (*) have those substances and preparations which cause harm after a longer period of exposure.

Many types of materials, products and mixtures classified as dangerous substances are used in TPP Sofia and TPP Sofia-East. They are used under strict control and management for work with dangerous substances.

The substances which are used have been classified according to the danger categories connected with health risks for the employees and risks for the environment. The instructions for working with dangerous substances are strictly observed in order to prevent situations of health risk for the employees at a given site and risks to the environment.

All instructions for working with dangerous substances are regularly analysed. The purpose of the instructions referring to storehouses for substances classified as dangerous, to reagent stocks, laboratories etc. is to establish rules and requirements for safe storage of harmful and dangerous chemicals and materials. Thus protection from accidents is ensured for the staff, the tangible assets and the environment.

INSTRUCTIONS for safe storage of harmful and dangerous chemicals and materials are applied for storing those in a safe way.

4.8.1 *TYPES AND QUANTITIES OF THE USED RAW MATERIALS AND FUELS CLASSIFIED AS DANGEROUS SUBSTANCES*

- The basic fuel used in the operation of TPP Sofia and TPP Sofia-East is natural gas imported from Russia. Masut used to be the basic fuel in near past but now working with it is subsidiary and determinant only in emergency situations. For that reason mazit will not be included in the tables referring to raw materials, basic and ancillary materials.

Natural gas is a mixture of hydrocarbons, which form the combustible part, and other elements in small quantities, which are the base of the non-combustible (ballast) fraction of gas. The combustible part consists of: methane (CH_4), ethane (C_2H_6), propane (C_3H_8), butane (C_4H_{10}) and other hydrocarbons (C_nH_m); hydrogen (H_2), carbon oxide (CO) and other. The ballast part of the fuel is nitrogen (N_2), carbon dioxide (CO_2), water vapour (H_2O), hydrogen sulphide (H_2S) and small amounts of oxygen (O_2). Methane prevails in natural gas - 75÷98 %

Here is an example of natural gas composition, according to a certificate from the supplier: (CH_4)- 92.96 %, (C_2H_6)- 2.97 %, (C_3H_8)- 0.83 %, (C_4H_{10})- 0.33 %, (N_2)- 2.4 %, (CO_2)- 0.14 %, specific weight 0.725 kg/cm^3, caloricity 8,100 kcal/ nm^3. The range of explosiveness depends on the natural gas composition; the lower explosive limit is 3÷4 %, and the upper explosive limit is 15÷16 %.

- ***Combustible gases***- CAS №- 68476-26-6; EO № 270-667-2; DSD – F+, R12, Repr.Cat 1, R61, Xn, R20-48/20. CLP-Flam: GAS 1 H220: GAS H280 Repr.kat.1A H360,

- ***Liquid fuels***- The fuels used in the plant are diesel fuel, mazut (reserve fuel), petrol in vehicles, and others; they are stored in compliance with the regulatory requirements.

- ***Lubricants*** - Various types and quantities of lubricants are used in the plants' operation: engine and compressor lubricating oils, turbine oils, motor oils, different types of grease. They are accompanied by respective certificates and other documents like safety data sheets, specifying the correct way for their storage, use and handling.

- ***Chemical substances and mixtures*** - Various chemical reagents, certified for work in power plants, are supplied and used for ensuring the main technology process. The basic and more important dangerous substances are: ammonia, sulphuric acid, hydrochloric acid, sodium hydroxide, etc. Chemical substances and mixtures are delivered accompanied by safety data sheets, which is a prerequisite for storing and using them in an environmentally friendly way. When storing hydrazine hydrate, ammonia and other substances and mixtures there is a potential risk of outburst emissions of hazardous toxic substances into the working environment and the natural environment in case of accidents.

4.8.1.1 *TPP SOFIA - CHEMICAL SUBSTANCES AND MIXTURES*

Relatively large quantities of chemical reagents are supplied and used for ensuring the chemical water regimes and for other production and auxiliary activities. Some of those reagents are: sulphuric acid, hydrochloric acid, technical-purpose sodium hydroxide, ferric chloride, ammonia, hydrazine hydrate, hydrated lime, etc.

TABLE 4.8-2 INVENTORY OF STORED DANGEROUS SUBSTANCES AND MIXTURES

No.	Substance/ mixture	Danger ous	Physical form	Available safety instr.list	Available quantity (tons)	Substance mixture
1	Sulphuric acid – H_2SO_4	Yes	Liquid	Yes	86	Substance

No.	Substance/ mixture	Danger ous	Physical form	Available safety instr.list	Available quantity (tons)	Substance mixture
2	sodium hydroxide NaOH	Yes	Liquid	Yes	24	Substance
3	salt - sodium chloride	No	Liquid	Not required	48	Substance
4	Coagulant - Alsul 320	Yes	Liquid	Yes	40	mixture
5	Flocculant - Zetag 7654	No	Solid bulk	Not required	0.225	Substance
6	Ion-exchange resin	No	Solid bulk	Not required	4	Substance
7	Boiler fuel (mazut)	Yes	Liquid	Yes	4,448.714	Mixture
8	Transformer oil (PRISTA Trafo A); Distillates (petroleum), hydrotreated light naphtenic; 2,6-di-tert-butyl-paracresol	Yes	Liquid	Yes	200	Mixture
9	Mineral turbine oil (ТП-32); N-1-naphthylaniline Benzenamine,N-phenil, reaction products with 2,4,4-trimethylpentene. DMSO content(IP 346)	Yes	Liquid	Yes	4	Mixture
10	Mineral turbine oil (TP-46); N-1-naphthylaniline Benzenamine,N-phenil,reaction products with 2,4,4-trimethylpentene DMSO content(IP 346)	Yes	Liquid	Yes	13	Mixture
11	Motor oil SHPD VDS-3 20W-50	Yes	Liquid	Yes	0.020	Mixture
12	Engine oil M16D Phosphorodithioic acid, mixed O,-bis esters,zinc salts Dodecylphenol, mixed izomers	Yes	Liquid	Yes	0.050	Mixture
13	Differential gear oil	Yes	Liquid	Yes	0.017	Mixture
14	Hydraulic oil	Yes	Liquid	Yes	0.018	Mixture
15	Oxygen	Yes	Pressure gas	Yes	0.150	Substance
16	Propane-butane	Yes	Pressure gas	Yes	0.160	Mixture
17	Acetylene	Yes	Pressure gas	Yes	0.032	Substance
18	Hydrogen	Yes	Pressure gas	Yes	0.016	Substance

The storehouses and tanks for storage of dangerous substances and mixtures comply with the regulatory requirements and have been assessed for compliance.

4.8.1.2 TPP SOFIA-EAST

The basic fuel used in the operation of TPP Sofia-East is natural gas 359281 $.10^3$ Nm^3/y imported from Russia. Masut used to be the basic fuel in near past but now working with it is subsidiary and determinant only in emergency situations. For that reason mazit will not be included in the tables referring to raw materials, basic and ancillary materials.

The following dangerous chemicals are stored at the production site of TPP Sofia-East: The ancillary materials include also chemical substances which are not within the scope of the Law on the protection from the harmful effects of chemical substances, preparations and products, namely salt (NaCl) and aluminium sulphate ($Al_2(SO_4)_3$).

- Sodium hydroxide (NaOH) – 49% solution, maximum quantity 174 m^3. It is stored in 2+1 horizontal tanks (48$m^{3;}$ 62 m^3 and 63m^3) with appropriate dike around them. CAS No.1310-

73-2; Danger category and class: C, R35 corrosive; Impact on the environment and population in case of an accident: Has a local effect on the environment. In case of failure in the tanks the base is collected within dikes (140 m^3 and 50 m^3) .

- Hydrochloric acid (HCl) – 36 % solution; maximum quantity 160 m^3. It is stored in 2 horizontal tanks 80m^3 each with appropriate dikes. CAS No.7647-01-0; Danger category and class: C, R34-R37; R23 - asphyxiating, toxic and explosive effect. Type of danger: emits hydrogen chloride; Impact on the environment and population in case of an accident: Has a local effect on the environment. In case of an accident the acid is collected within the dike (170 m^3) and can be pumped into an emergency tank or led by pipes into the WWTP tanks for neutralization with lime.
- Sulphuric acid (H_2SO_4) – 96% solution; maximum quantity 63 m^3. It is stored in a horizontal tank 63 m^3 with an appropriate dike. CAS No.7664-93-9; Danger category and class: C, R35 - corrosive. Type of danger: emits sulphur oxides; Impact on the environment and population in case of an accident: Has a local effect on the environment. In case of failure in the tank the acid is collected within the dike (70 m^3) and lead away into a neutralizer.
- Hydrazine hydrate (N_2H_4) hydrazine 64% – stored in 200 l tanks. Maximum quantity: 2.0 m^3. CAS No.302-01-2; Danger category and class: N, T toxic, exxplosive, R10, R45 T;R 23/24/25 C; R34, R43 N; R50-53 Type of danger - emits N_2H_4; Impact on the environment and population in case of an accident: Has a local effect on the environment and population. In case of hydrazine spills neutralization with sodium hypochlorite (NaOCL) is performed
- Ammonium hydroxide NH_4OH 25% ammonia, maximum quantity: 4.0 m^3. It is stored in a horizontal tank 4.0 m^3 with an appropriate dike. CAS No.1336-21-6; Danger category and class: C, R34; N; R50, 9(1)- asphyxiating, toxic and explosive. Type of danger: emits NH_3; Impact on the environment and population in case of an accident: Has a local effect on the environment and staff. In case of sodium hydroxide spills neutralization by means of water curtain is applied.
- Hydrogen (H) - It is used for cooling turbogenerator (TG) No.5.

Appropriate preventive measures have been introduced and respective instructions are observed in order to prevent accidents while working with the above mentioned dangerous chemical substances.

Good practices for working with dangerous substances and good management are applied in the two departments.

The dangerous substances used in the operation of the new plant, and its decommissioning in future, will be managed independently by the the managers of the RDF incineration plant.

Provided there is strict control and effective management of dangerous substances, and provided the suggested measures are strictly observed, not any significant negative impact is expected on the environment, on the employees working at the IP site, or on the population in that area.

4.9 HARMFUL PHYSICAL FACTORS: NOISE, VIBRATIONS AND HARMFUL EMISSIONS, MICROCLIMATE, ETC.

4.9.1 NOISE CHARACTERISTICS OF THE AREAS

The IP refers to construction of a cogeneration plant utilizing RDF in Sofia. Two possible sites have been suggested for the plant location:

→ The main site - within the site of TPP Sofia, in the western part of the plot.
→ The alternative site - within the site of TPP Sofia-East, near the railway line.

TPP Sofia-East is located in the northern part of Sofia city, in mixed-type industrial area, part of industrial area Zadgarov Rayon. The residential areas closest to the TPP site boundaries are: to the north-east - residential areas between Planinski Tsvete St. and Nesho Bonchev St. (15 m); to the north - a single residential building in a mixed-type industrial area (50 m); to the south-east - four blocks of flats (former departmental residential buildings), (15 m).

The residential areas closest to the TPP Sofia-East site boundaries are: - to the north-east - beyond the river - D. Milenkov residential district (450-550 m); to the south and south-west - a part of Druzhba residential district (650 m); single buildings (350-400 m); a block of flats, Dimitar Peshev St. (400 m).

The distances between the nearest residential buildings and the sites of the new plant are: for TPP Sofia - between 300 and 400 m; for TPP Sofia-East - between 750 and 800 m.

The transport access to the sites of the two TPPs is by rail and by road, through the existing railway network and road networks in their areas: TPP Sofia - through Botevgradsko Shose Blvd., Danail Nikolov St., Istoriya Slavyanobalgarska St. and the street crossing it - Nesho Bonchev St.; TPP Sofia-East - ring road, Botevgradsko Shose Blvd. and Dimitar Peshev St.

Noise sources external to the sites of the power plants are the neighbouring industrial sites and the traffic flows in the above mentioned streets. The noise characteristics of those flows (equivalent noise level - Leq, dBA), at 25 m distance, have been determined through calculations, based on traffic data provided by the client; they are as follows: Istoriya Slavyanobalgarska St. - daytime: 63 dBA; night-time: 54 dBA; Dimitar Peshev St. - daytime: 60.5 dBA; night-time: 52 dBA. The calculations have been made according to the methodology specified in Ordinance No.6 on noise parameters in the environment (2006) and the Methodology for determining road traffic noise levels in road designing (Road Administration, 1995). The main noise sources in the TPP sites environment are the main technological equipment in the production facilities (turbines, generators, pumps, boilers, compressors, etc.) and the outdoor equipment (fans, outdoor switchgears, cooling towers, etc.) as well as the operating transport. The operating mode is continuous so the noise emissions are the same in different periods of the day and night.

In conformity with requirement 12.2.1 of the integrated permits for the two TPPs, the noise levels at the production sites are regularly measured in order to determine, assess and control the existing noise regime. The measurements are made according to the requirements of "Methods for determining the total acoustic power emitted into the environment by industrial enterprises and the noise levels in the impact points" in relation to Annex No.3 of Ordinance No.6 of 26.06.2006 *on the parameters of noise in the environment, taking into consideration the discomfort level in different times of the day and night, the limit values of noise parameters in the environment, methods for evaluating the noise parameters and the harmful effects of noise on people's health.* . Equivalent noise levels are measured at points located in a measurement contour in the territory of each of the power plants, covering the main noise sources. The most recent measurements were made in 2013: TPP Sofia - Measurement Report No. 282 /05.03.2013 and Measurement Report No. 01–0348/18.03.2013 of ExEA (Annex 1); TPP Sofia-East - Measurement Report No. 502/05.04.2013 and Measurement Report No. 01–0556/15.04.2013 of ExEA (Annex 2). The plans of the industrial sites of the two power plants with the location of measurement points (MP) are given in the above mentioned measurement reports.

The results of the most recent measurements made in real conditions are as follows:

4.9.1.1 TPP SOFIA

The calculated level of the total acoustic power emitted from an imaginary point source located in the geometric centre (GC) of the measurement contour is 115.4 dBA. The noise level at the impact point (block 4, История Славянобългарска St. (202nd St.) at 10 m distance from the TPP fence - MP19) is 47.9 dBA - **Table 4.9-1**

TABLE 4.9-1 NOISE LEVEL VALUES

MP No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Leq, dBA	54. 8	58. 4	54. 7	58. 2	53. 5	58. 5	61. 4	66. 4	62. 2	61. 4	66.0	68.7	69. 1	64. 7	60. 1	55. 6	55. 4	57. 6

4.9.1.2 TPP SOFIA-EAST

The calculated level of the total acoustic power emitted from an imaginary point source located in the geometric centre (GC) of the measurement contour is 115.9 dBA. The noise level at the place of impact (a residential area at 290 m distance from the power plant fence - MP15) is 45.5 dBA - **Table 4.9-2**.

TABLE 4.9-2 NOISE LEVEL VALUES

MP No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Leq, dBA	56. 9	58. 7	61. 8	66. 1	61. 5	63. 3	58. 9	55. 4	51. 2	53. 8	53. 6	53. 1	58. 4	61. 4

The measurement reports specify that the measurements were made with noise coming from neighbouring industrial sites and from roads with heavy traffic.

The noise emitted into the environment from the TPP sites does not spread unobstructed into all directions. In some directions it is reflected by the buildings of neighbouring industrial enterprises.

Ordinance No.6 on the parameters of noise in the environment, taking into consideration the discomfort level in different times of the day and night, the limit values of noise parameters in the environment, methods for evaluating the noise parameters and the harmful effects of noise on people's health (MH, MEW, 2006) specifies the following noise level limit values: for production and warehouse areas and zones - 70 dBA for the daytime, evening and night time; for residential areas exposed to the effects of heavy motor vehicle traffic (История Славянобългарска St., Dimitar Peshev St., Prof. Tsvetan Lazarov St.) - daytime: 60 dBA; evening: 55 dBA; night-time: 50 dBA.

According to the data from the measurement reports mentioned above, the present noise levels at the boundaries of the two TPPs sites and at the points of impact do not exceed the noise limit values specified by regulations.

For the residential areas which are close to the TPPs sites and adjacent to main streets, the noise from the intensive traffic flows in those streets is determinant for the noise regime: TPP Sofia-East - a part of Druzhba district, between Dimitar Peshev St. and Prof. Tsvetan Lazarov St.

4.10 CULTURAL HERITAGE

4.10.1 PRESENCE OF MONUMENTS OF CULTURE AND ARCHITECTURE IN THE SCOPE OF THE INVESTMENT PROPOSAL

4.10.1.1 TPP SOFIA SITE (SITE B)

The plot of TPP Sofia is in the northern part of Sofia city, in Zadgarov Rayon industrial area, 6, Istoria Slavyanobalgarskaya St., and has total area of 334,945 m^2. Site "B" is located in the western part of the plot. The urban planning statute of the area where the site is located is "industrial" and there are no single or group culture monuments in that territory.

To the east of TPP Sofia site, bordering Nesho Bonchev St., is the Central Cemetery of Sofia, which by order No.RD 09-486/27.09.05 of the Ministry of Culture have been announced a group monument of culture - a national memorial complex of historical importance.

Within the territory of the Central Cemetery there are some announced monuments of culture:

- War cemetery memorial complex - a historical, architectural and art monument of culture;
- The monument of soldiers of all ranks, who perished in the 1912-1218 wars; the monument is in front of the cemetery entrance and has been announced a historical monument of culture;
- Four monuments of historical importance and four monuments of artistic importance have been announced as single monuments of culture.
- Out of 97 objects which have been studied and suggested at an Expert Committee meeting, 65 have been announced as monuments of culture of artistic importance, by letter No. 400020 of 21.08.1989 of the National Institute of Monuments of Culture.
- The English, German, French and Italian, Romanian, Serbian and Russian war cemeteries have cultural and historical significance.

4.10.1.1.1 MAIN CULTURAL AND HISTORICAL FEATURES

The important cultural and spiritual value of the the Central Cemetery of Sofia is indisputable. It preserves the memory of persons who have huge historical merits and have made their permanent marks in Bulgarian history, culture and social life; the memory of past demographic and migration processes and events which affected Bulgaria and Sofia city; of the social, political and professional structure of society in general and of Sofia in particular; of the ethnic and religious structure; of different citizen and public associations and communities in different periods of history; of the level of planning, artistic and plastic culture of our nation in the past and at present; of the specifics of general, religious, community and group dimensions of the concepts of historical memory and the sacralized forms of culture; of the ritual and spatial specifics of the different ethnic cultures and religious practices, etc.

4.10.1.1.2 TERRITORIAL SCOPE

The boundaries of the monument of culture group as approved by Statement No. 9/31.03.2005 of the meeting of the Expert Council of National Institute of Monuments of Culture according to the existing city planning:

- **Boundaries of the conservation zone:**

- To the west - Nesho Bonchev St. up to its crossing with Saznanie St.
- To the north - Saznanie St. up to its crossing with Zhelezopatna St.
- To the east - Zhelezopatna St., Vlah Kamak St. up to its crossing with Parva Balgarska Armia St., across the industrial area - a line parallel to Kamenodelska St. and at 200 m distance to the east of it;
- To the south - across the railway area, a line at 200 m distance to the south of Grancharska St. up to its crossing with the imaginary continuation of Nesho Bonchev St.

FIGURE 4.10-1 CENTRAL CEMETERY OF SOFIA MONUMENT OF CULTURE GROUP

Site "B" of TPP Sofia site does not border directly Nesho Bonchev St., which is a part of the boundary of the conservation zone of Central Cemetery of Sofia monument of culture group (**Figure 4.10-1**), and is at 80 m distance from it.

4.10.1.2 TPP SOFIA-EAST SITE (SITE B)

TPP Sofia-East is located in the eastern part of Sofia city and is in Gara Iskar industrial area. Site "B" is located near the railway line.

As regards urban planning the plot is industrial and there are no sites of cultural or historical value within it or near it.

The plots of TPP Sofia and TPP Sofia-East and the sites of the investment proposal in particular do not affect, directly or indirectly, any cultural heritage sites.

4.11 TANGIBLE ASSETS

4.11.1 COMPANY ORGANISATION

Toplofikatisa Sofia was established in 1957 by Sofia Municipal Council as a municipal enterprise. In 1978 the municipal enterprise was incorporated with the two thermal power plants of Sofia existing at that time: TPP Sofia and TPP Sofia-East. In 1992, implementing a decision of the Council of Ministers of the Republic of Bulgaria the municipal enterprise Toplofikatsia was transformed into a joint-stock company with a sole owner of the capital, under the name of Toplofikatsia Sofia EAD. At present the sole owner is Sofia Municipality, represented by Sofia Municipal Council. Yet in the years the share capital of Toplofikatsia Sofia EAD has been partially or in full transferred to the government and later again to Sofia Municipality. At present Toplofikatsia Sofia is 100 % owned by Sofia Municipality.

Toplofikatsia Sofia EAD is managed by the board of directors, appointed by Sofia Municipal Council.

The capital of Toplofikatsia Sofia EAD is BGN 107,648,905 (equivalent to EUR 55,040,011) divided into 107,648,905 ordinary shares with BGN 1.00 nominal value each. According to the company's Articles of Association the main activities for which it has been licensed by the State Energy and Water Regulatory Commission include heat and electricity production and heat transmission. Additionally Toplofikatsia Sofia EAD has been certified by the Ministry of Economy and Energy to perform heat metering.

Toplofikatsia Sofia EAD operates four local heating plants (TPP Sofia, TPP Sofia-East, HP Zemlyane and HP Lyulin. Two of the plants (TPP Sofia and TPP Sofia-East) are cogeneration facilities producing thermal energy and electricity while the other two plants produce only thermal energy.

4.11.2 INTERACTION WITH MUNICIPAL AND GOVERNMENT AUTHORITIES

Toplofikatsia Sofia EAD is controlled by Sofia Municipal Council, which appoints the board of directors and takes all important financial and management decisions like for example distribution of company profits, using of investment capital and working capital credits, provision and securing of loans, selection of insurance companies for insuring the company assets, opening and closing down local branches, etc.

The prices at which Toplofikatsia Sofia EAD sells the produced heat and electricity are approved by the State Energy and Water Regulatory Commission (SEWRC). That is why the company has to regularly submit its tariff calculations for approval by SEWRC. That matter is analysed in further details in the tariff section of this report.

4.11.3 REVIEW OF COMPANY REPORTS

After the accession of Bulgaria to EU in 2007 Toplofikatsia Sofia EAD has started making its financial reports in accordance with the International Financial Reporting Standards (IFRS). According to the requirements of art.38 of the Accountancy Act the annual financial statements of Toplofikatsia Sofia EAD are audited by a registered auditor.

4.11.4 BALANCE SHEET SUMMARY: ASSETS, EQUITY AND LIABILITIES

A summary of the balance sheet assets, equity and liabilities of Toplofikatsia Sofia EAD at 31 December 2010, 31 December 2011 and 31 December 2012 is given in the table below:

Balance sheet of Toplofikatsia Sofia EAD at 31 December 2010, 2011 and 2012

In thousand BGN	FY 2010	FY 2011	FY 2012
Property, machines, plant and equipment	325,673	316,581	327,459
Intangible assets	522	585	664
Investment property	1,568	1,465	656
Non-current financial assets	664	664	665
Non-current assets	**328,427**	**319,295**	**329,444**
Inventories	28,770	28,895	22,234
Trade receivables	295,503	324,664	393,626
Other receivables	671	1,803	2,645
Cash	34,308	46,685	29,251
Current assets	**359,252**	**402,047**	**447,756**
TOTAL ASSETS	**687,679**	**721,342**	**777,200**
Share capital	107,649	107,649	107,649
Statutory reserves	10,765	10,765	10,765
Additional reserves	5,884	5,884	5,884

In thousand BGN	FY 2010	FY 2011	FY 2012
Revaluation reserve	199,802	199,801	199,801
Retained profit (loss)	(150,816)	(176,505)	(153,596)
Net profit (loss)	(25,689)	22,909	2,726
Deferred revenue from government bodies and international subsidizing bodies	53,292	56,180	66,465
OWNER'S EQUITY	**200,887**	**226,683**	**239,694**
Financial liabilities (bank loans)	45,501	38,843	32,827
Long-term trade payables	253,443	192,782	135,121
Deferred tax liabilities	12,591	11,187	9,618
Pension payables	1,253	1,318	1,328
Non-current assets	**312,788**	**244,130**	**178,894**
Current amount of long-term financial liabilities	7,202	6,658	6,017
Trade payables	156,512	232,481	339,034
Tax liabilities	3,484	2,430	4,088
Wages and salaries payable, social insurance payable	4,493	4,160	3,729
Other liabilities	2,313	4,800	5,744
Current liabilities	**174,004**	**250,529**	**358,612**
TOTAL LIABILITIES	**486,792**	**494,659**	**537,506**
TOTAL EQUITY AND LIABILITIES	**687,679**	**721,342**	**777,200**

4.12 HEALTH AND SANITATION ASPECTS OF THE ENVIRONMENT

The territory of the investment proposal is in Sofia - Bulgaria's capital and biggest city. It is located in the central part of Western Bulgaria, in Sofa valley, surrounded by Vitosha mountain to the south, Lyulin mountain to the west and Stara Planina mountain to the north. Its total area is 492 km^2, and the average altitude is about 550 m.

TPP Sofia site was selected to be the main site (Site Selection Report, approved by Toplofikatsia Sofia EAD (TS) on 26.07.2013). TPP Sofia is located in the northern part of Sofia, in in Serdika district. The total area of TPP Sofia ground is 334,945 m^2, on which 50 existing buildings are located with total built-up area 45,987.31 m^2. Site „B" (the main site envisaged for the plant location) is in the western section of the plot and has an area of around 15 daa, and the structure discharging emissions into the ambient air (stack) will be at 400 m distance from the outlines of TPP Sofia.

According to the master plan of Sofia, TPP Sofia plot is located in a mixed-type area (part of "Zadgarov Rayon" industrial area), intended for industrial development, a cemetery and commercial sites. Site "B" is within the boundaries of TPP Sofia.

The residential areas closest to the boundary of **TPP Sofia** are as follows:

- → to the north-east - residential buildings of Orlandovtsi (**beyond the fence of the plant** at 15 m distance from it and at over 400 m distance from the stacks);
- → to the north - Suhodolska river and a single residential building (**beyond the fence of the plant** at 50 m distance from it and at 500 m distance from the stacks);

→ to the north-east and east - the cemetery and Parva Balgarska Armia Blvd.; to the south - Istoria Slavyanobalgarskaya St. and four departmental residential buildings **(beyond the fence of the plant**, at 15 m distance from it and at over 400 m distance from the stacks).

The suggested alternative option is **TPP Sofia-East**, located in Iskar industrial area, with total area of 319,692 m^2. Site „B" (the alternative site envisaged for the plant location) is within that plot, has an area of around 20 daa, and the structure discharging emissions into the ambient air is located at 400 m distance from the boundaries of TPP Sofia-East. The areas around the site is industrial area: to the north-east - the large industrial enterprise Sofa Med EAD; to the west - industrial areas with small enterprises; to the south - garages; to the south-east - a crushed-stone pit, Iskar river, agricultural land.

The plot of TPP Sofia-East borders industrial construction areas, planting areas and mixed-purpose areas. Adjacent to TPP Sofia-East are industrial enterprises and plots as follows: - to the north-east - the large industrial enterprise Sofia Med; to the west - the boundary is Dimitar Peshev St. and to the west of that street there are industrial plots partially used by small enterprises; - to the south - garages; - to the south-east - a crushed-stone pit, Iskar river, agricultural land. The area within a radius of 800 m of the site is industrial area. The residential areas closest to the boundaries of TPP Sofia-East ground are as follows: - to the north-east - beyond the river - D. Milenkov quarter (beyond the plot outlines, at 450 m distance); to the south-east - a residential building (beyond the plot outlines, at 350 m distance); and to the south - a part of Druzhba district (beyond the plot outlines, at 450 m distance).

The data about the location of the plant envisaged in the IP shows that that there are not any sites or installations of specific safeguard statute in its vicinity. Not any recreation areas, hospitals, sanatoriums, schools, historical monuments or protected areas, safeguard zones around water sources or around drinking water supply installations are located in the area of the selected sites.

The potentially affected population in the area suggested for implementing the investment proposal can be divided into the following three groups:

- The construction workers involved in the IP project implementation.
- The employees working at the TPP site - 626 persons (142 women and 484 men).
- The employees working at the investment proposal site - 35-37 persons according to design.

The inhabitants of the nearest residential districts for both sites - the main one and the alternative one - are at over 400 m distance from the plants' stacks. An evaluation of the pollutants concentration for those areas as a result from the IP is given in section 5.1.

Sofia is the 13-th largest city in the European Union; at 31.12.2012 its population was 1,302,316 persons, which is 16.4 % of the population of Bulgaria. A trend was observed of gradual population increase compared to the previous twelve years (**Figure 4.12-1**). In 2012 the population of Sofia was **1,302,316** , in 2011 - 1,296,615 and in 2010 - 1,259,446 persons (**Table 4.12-1**). The reason for that increase is chiefly the migration of population from the country to the capital where unemployment is lowest.

TABLE 4.12-1 POPULATION OF SOFIA IN THE LAST 12 YEARS

	TOTAL					CITY			ADJACENT VILLAGES		
	total	men	relative share	women	relative share	total	men	women	total	men	women
2001	1,178,579	558,684	47.40	619,895	52.59	1,124,305	531,780	592,525	54,274	26,904	27,370
2002	1,194,164	566,059	47.40	628,105	52.59	1,138,918	538,648	600,270	55,246	27,411	27,835
2003	1,208,93	572,685	47.37	636,245	52.63	1,153,00	544,998	608,009	55,923	27,687	28,236

	0					7					
2004	1,221,157	578,648	47.38	642,509	52.62	1,164,749	550,766	613,983	56,408	27,882	28,526
2005	1,231,622	584,354	47.44	647,268	52.56	1,174,664	556,194	618,470	56,958	28,160	28,998
2006	1,237,891	588,032	47.50	649,859	52.50	1,180,489	559,674	620,815	57,402	28,358	29,044
2007	1,240,788	589,604	47.52	651,184	52.48	1,183,364	561,266	622,098	57,424	28,338	29,086
2008	1,247,059	592,845	47.54	654,214	52.46	1,189,602	564,461	625,141	57,457	28,384	29,073
2009	1,249,798	594,449	47.56	655,349	52.44	1,192,296	566,062	626,234	57,502	28,387	29,115
2010	1,259,446	598,935	47.56	660,511	52. 44	1,201,448	570,293	631,155	57,998	28,642	29,256
2011	1,296,615	618,227	47.68	678,338	52.32	1,236,606	588,557	648,049	60,009	29,720	30,289
2012	**1,302,316**	**621,526**	**47. 72**	**680,790**	**52.28**	**1,242,012**	**591,675**	**650,337**	**60,304**	**29,851**	**30,453**

The population of the capital continues increasing with every passing year, and its density is the highest for Bulgaria - nearly 4.9 thousand persons per sq.km in 2012. (**Figure 4.12-1**).

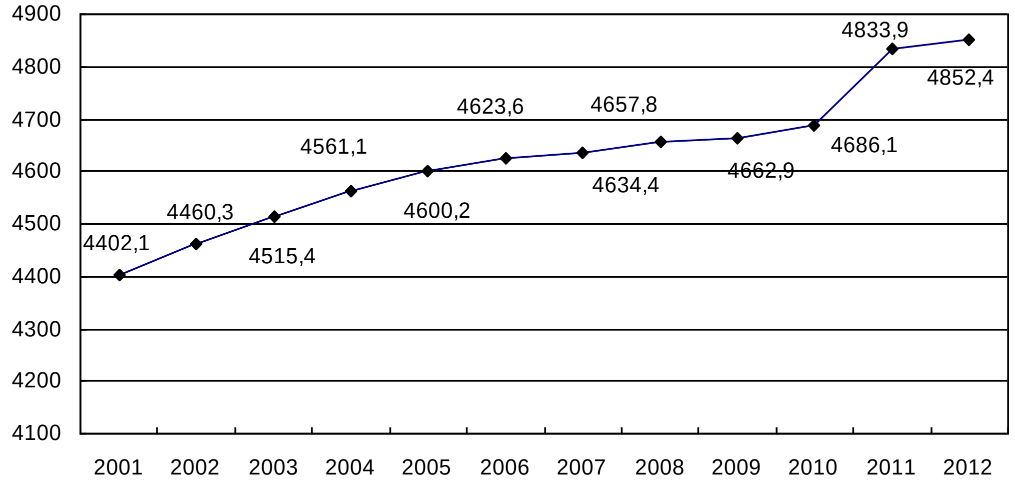


FIGURE 4.12-1 POPULATION DENSITY RELATIVE TO THE TERRITORY OF CITIES AND OTHER URBANIZED AREAS (IN PERSONS PER SQ. KM)

As regards the age structure of population, the adverse trends in the demographic development of Bulgaria are obvious also here, although less marked. There is a continuing process of population ageing, expressed in decreasing of the absolute number and relative share of population aged below 15 and increasing of the share of population aged 65 years and over.

A trend of a slight increase in the relative share of population over 60 years old was observed in the last three years. Such an increase results in change of the age structure (**Figure 4.12-2** and **Figure 4.12-3**), and is a sign of population ageing.

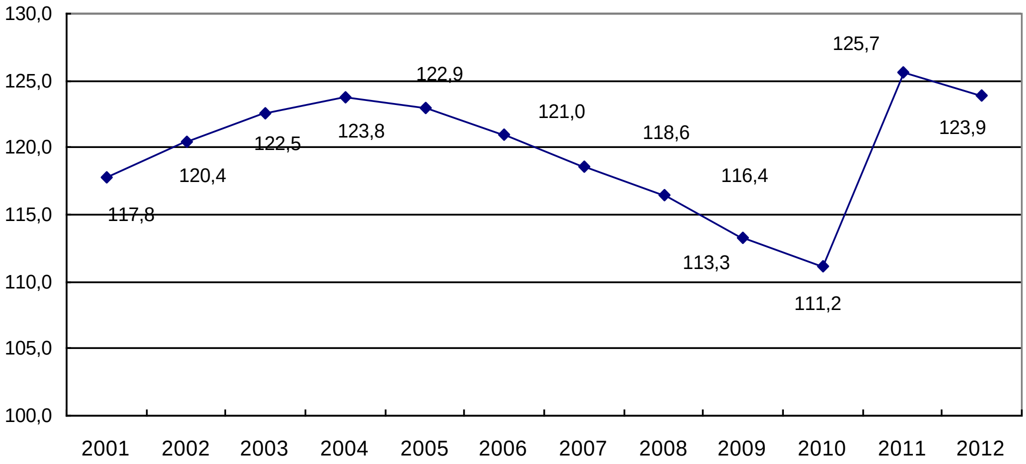


FIGURE 4.12-2 AGE DEPENDENCY RATIO - RATIO OF POPULATION AGED 65 YEARS AND OVER TO POPULATION AGED 0-14 YEARS

However compared to most of the districts in Bulgaria the characteristics of the age structure of population are positive. The capital, Blagoevgrad, Burgas and Varna are the only districts in which more than four persons in working age correspond to each person over 65 years old, and the most favourable ratio is exactly in Sofia.

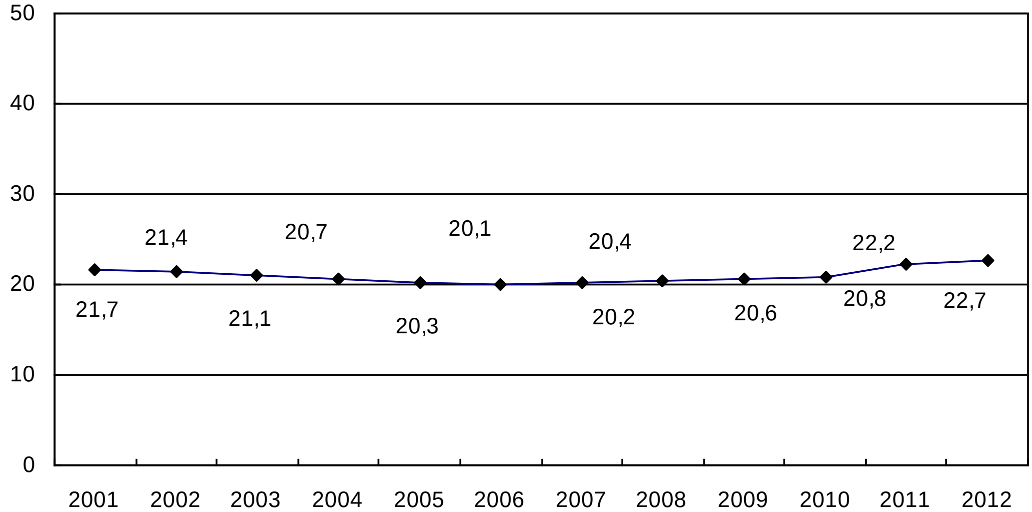


FIGURE 4.12-3 AGE DEPENDENCY RATIO -PEOPLE OLDER THAN 64 TO THOSE AGED 15-64

The natural population growth in Sofia in 2012 was –1.4‰, in 2011 it was – 1.1‰, in 2010 it was + 0.1‰, and in 2009 it was + 0.2‰ (**Figure 4.12-4**).

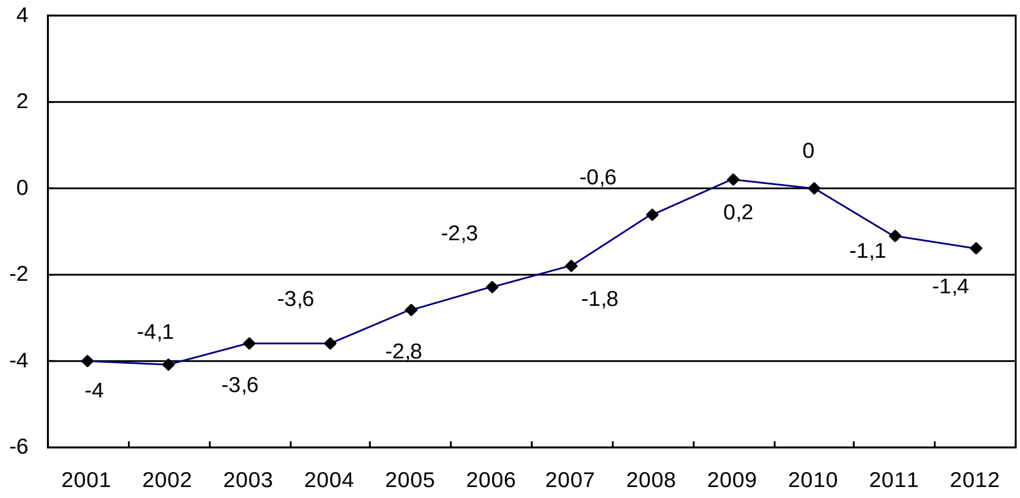


FIGURE 4.12-4NATURAL POPULATION GROWTH RATE

In the last fourteen years the natural population growth was positive only in 2009 and 2010. For 2009 that was due to higher birth rate (**12.3‰).** with nearly the same mortality rate as in 2008, and in 2010 the the number of both born alive and deaths has decreased. That was expected according to the forecasts for the demographic condition of Sofia city population. In the years of rapid economic development gradual improvement of the natural population growth rate was observed; from -4.12 ‰ in 2002 it reached 0.2 ‰ in 2009. Later that positive trend was reversed; in 2011 the birth rate decreased, and if the trend of general mortality rate is kept within the present values, the natural population growth rate is expected to be increasingly negative.

In the years between 2000 and 2009 the birth rate in Sofia increased. It was highest in 2009 - 12.3‰. In 2012 the birth rate was 10.4‰, and is lowest in the last five years.**.**

The data about mortality rate in Sofia shows that it is increasing, like in all Bulgaria. According to data of NSI and of the National Centre of Public Health and Analyses (NCPHA) the standard mortality rate for 2012 in Sofia (1,189.11 per 100,000 people) is lower than the average for Bulgaria - 1,495.8 per 100,000 people. That difference can be explained by the better access to healthcare services and better quality of those services in the capital.

The reasons for 90 % of the deaths in Sofia municipality are due to four groups of diseases: in the first place **are cardiovascular diseases** (hypertonia, ischemic heart disease, myocardial infarction and cerebrovascular diseases); second are**oncological diseases**(most frequent of the digestive and the respiratory system); third are **respiratory system diseases** and forurth - **diseases of the digestive system.**

Data shows that the life style - unhealthy eating habits, overweight, unhealthy habits (alcohol consumption, smoking), inappropriate exercise regime, lack of exercise and stress - is the leading cause for lethal diseases among the population.

Child mortality rate for 2012 was 4.41‰, for 2011 - 4.22‰ and for 2010 - 4.23‰. For the last fourteen years its value was lowest in 2010 and 2011. Child mortality rate for Sofia is much lower than that for Bulgaria, and as regards that very important indicator Sofia can be compared to countries like Austria, Germany and Czech Republic.

The analysis of the health of Toplofikatsia Sofia EAD employees has been assigned entirely to Dr. S. Misheva, head of the occupational health service with the enterprise.

The health analysis is performed applying integrated methods based on using statistic data about the factors of the environment and working process, and the actual absences from work (registered by documents for temporary incapacity for work).

4.12.1 CHARACTERISTICS OF THE HEALTH CONDITION OF ALL EMPLOYEES BY MEANS OF THE INDICATORS OF DISEASE INCIDENCE WITH TEMPORARY INCAPACITY FOR WORK (DITIW) BY MAIN INDICATORS FOR 2012

Data sources: The following have been used as data sources: documents for temporary incapacity for work issued to the company employees; declarations for accidents at work; expert decisions of Work Capability Assessment Commission /Expert National Medical Commission; compulsory preliminary medical examination cards; compulsory regular medical examination cards.

The personal and professional data of altogether 2,283 employees of Toplofikatsia Sofia EAD (721 women and 1,562 men), appointed until 28.12.2012, has been processed. Based on provided lists record files have been made with complete data about accounted documents for temporary incapacity for work for 2012.

The data about **TPP Sofia** is analysed in this report for: average number of employees - 617, of whom 171 women and 446 men, and about **TPP Sofia-East** - average number of employees - 626, of whom 142 women and 484 men.

4.12.2 DATA ABOUT SICK ABSENCE OF EMPLOYEES IN 2012:

According to the adopted methodology the evaluation of above results has been made by the scale of orientation norm groups. Diseases have been recorded at the same frequency in both groups of employees working in: heat and electricity production, and heat transmission.

TABLE 4.12-2 DATA ABOUT SICK ABSENCES OF TPP SOFIA AND TPP SOFIA-EAST EMPLOYEES FOR 2012

Orientation norm groups according to Batkis-Lekarev	Republic of Bulgaria	TPP Sofia	TPP Sofia-East
I. Incidence with temporary incapacity for work			
low - 30-80 per 100 employees		60. 9	
medium - 80-100 per 100 employees	90. 8		85. 7
high - 100-120 per 100 employees			
very high - over 120 per 100 employees			
II. Days of absence with temporary incapacity for work			
very low - up to 600 days per 100 employees			
low - 600-800 days per 100 employees		737	
medium - 800-1,000 days per 100 employees	942. 5		
high - 1,000-1,200 days per 100 employees			1,053. 9
very high - over 1,200 days per 100 employees	-	-	-
III. Average duration of sick absence			
short - up to 10 days			
medium - up to 10.8 days	10. 4		
long - over 12 days		12. 1	12. 3

IV. Percentage of employees of frequent and long sick absence			
low - up to 3 %			
medium - between 3 % and 6 %		4. 9	4. 5
high - over 6 %			
V. Percentage of cases of short sick absence (up to 3 days)			
low - up to 40 %		16. 7	
medium - between 40 % and 60 %			45. 9
high - over 61%			

According to the adopted methodology the evaluation of above results has been made by the scale of orientation norm groups. In the period under examination, morbidity with temporary incapacity for work in TPP Sofia was **low**,and in TPP Sofia-East -**medium**, close to the average rates for Bulgaria.

As regards the indicator "days of absence" (seriousness of cases) the comparison by the scale shows **low** morbidity with temporary incapacity for work for TPP Sofia and **high** for TPP Sofia-East, above the average rate for Bulgaria (737, 1,053.9 and 942.5 respectively). The average duration of a case of sick absence in both plants of Toplofikatsia Sofia EAD is **high (**12.1 and 12.3 respectively) **unlike the duration average for** Bulgaria, which is **average** (10.4). Diseases have been recorded at the same frequency in both groups of employees working in: heat and electricity production, and heat transmission.

- Highest number of cases of temporary incapacity for work has been recorded as a result of respiratory system diseases, represented mostly by relatively mild cases of bronchitis, acute infections of the upper respiratory tract, tracheitis and tonsillitis; most of those cases were of 3-5 days duration.
- The diseases of the the skeletal and muscular system and the peripheral nervous system, mostly among the repair staff, can not be connected to the conditions of work for those professions. Many of the workers have had those diseases before they were employed by this company. The seriousness of diseases of the skeletal and muscular system can be accounted for also by the continuous standing/sitting work position, physical load, work outdoors and other factors, without ignoring the spare time factor, as we do not know how employees spend that time and what their habits are.
- Cardiovascular system diseases are among the most frequent. Those are serious diseases; treatment and recovery involve continuous absence from work. Besides several cases of transitory hypertensive crisis a case of each of the following has been reported: ischemic heart disease, chronic heart failure, cerebrovascular disease. Considering the nature of work and the etiology of diseases, the latter can not be connected with the conditions of the occupational environment.
- The digestive system diseases include cases of gastroduodenitis, duodenal ulcer, colitis, etc. The diet and failure to observe healthy eating norms could be the reason for some of those diseases, but considering the fact that those are isolated cases, they are most probably the result of individual peculiarities and not of unfavourable working conditions.

The analysis of the results for 2012, based on juxtaposition of temporary incapacity for work cases and days for the main groups of disease, and standard values determined in advance for the two power plants is given in **Table 4.12-3**.

TABLE 4.12-3 COMPARISON BY GROUPS OF DISEASES, OF THE FREQUENCY OF CASES AND FREQUENCY OF DAYS OF TEMPORARY INCAPACITY FOR WORK REGARDING MAIN TYPES OF DISEASES IN TPP SOFIA AND TPP SOFIA-EAST

Disease group	TPP SOFIA				TPP SOFIA-EAST			
	Frequency of cases		Frequency of days		Frequency of cases		Frequency of days	
	Annual	Standard	Annual	Standard	Annual	Standard	Annual	Standard
1.Acute infections of the upper respiratory tract J00-J11	**34.6**	**21.6**	**108.6**	71.7	**45.06**	21.6	**210.35**	71.7
2. Pneumonia, bronchopneumonia, J12-18	0.5	**1.1**	10.2	20.9	0.48		7.00	
3. Other respiratory system diseases	**17.6**	**0.9**	9.4	31.7	0.16	0.9	6.37	31.7
4. Eye diseases and disorders - H00-H59	0.5		19.2		0.64	1.8	7.165	7.1
5. Ear diseases and disorders - H60-H95	0.6	1.8	**11.8**	7.1	0.955	3.4	5.573	28.4
6. Diseases of the peripheral nervous system G50-G64	0.8	3.4	16.4	28.4	**6.21**	3.4	**44.43**	28.9
7. Diseases of the nervous system including neuroses G00-G47 and G70-99	0.2	2.6	2.1	21.6	-	2.6	-	21.6
8. Hypertonic disease I 10-I 15	**3.5**	3.4	**60.7**	28.9	2.388	2.5	13.853	24.7
9. Chronic ischemic heart disease I20-I25	1.6	2.5	10.3	24.7	**1.433**	0.8	**40.127**	16.7
10. Other cardiovascular system diseases I	**1.5**	0.8	**29.8**	16.7	**5.732**	1.9	**137.579**	22.5
11. Stomach and duodenal ulcer K25-26	0.5	1.9	16.7	22.5	0.955	2.7	20.541	28.9
12. Gastritis, enteritis, colitis K29, 50-52	-	2.7	-	28.9	**6.369**	5.6	**78.821**	26.3
13. Disease of the digestive system and metaboloc disorders K and E 00-90	5.1	5.6	**46.8**	26.3	0.4777	2.3	7.006	31.4
14. Malignant tumours C00-C97	0.2	2.3	4.3	31.4	0.16	0.9	1.592	20.4
15. Benign tumours D10-48	0.8	0.9	**46.6**	20.4	0.32	1.5	35.83	34.2
16. Reproductive and urinary systems diseases N00-69	0.3	1.5	4.1	34.2	2.3885	3.4	19.267	21.5
17. Female genital diseases N 70-98	1.6	3.4	9.7	21.5	0.318	4.9	4.458	61.1
18. Skin disorders L00-99	0.3	4.9	2.7	61.1	1.592	2.9	31.687	21.5
19. Diseases of the skeletal and muscular system and connective tissue diseases M00-99	**0.9**	2.9	2.7	21.5	**8.12**	4.0	**107.48**	39.6
20. Injuries, poisoning and other consequences of the impact of external causes S00-T98	**5.1**	4.0	**81.12**	39.6	**10.668**		**207.484**	
21. accidents at work with temporary incapacity for work	4.8	0.2	**80.8**		**0.796**	0.2	**93.79**	19.3

From **Table 4.12-3** it is evident that in both power plants the diseases which have higher incidence and seriousness compared to standard data are infections of the upper respiratory tract, and other cardiovascular diseases; for both of those types of disease the values are higher for TPP Sofia-East. Only for TPP Sofia-East the figures are higher than the standard ones concerning gastritis, enteritis, colitis, chronic ischemic heart disease, diseases of the peripheral nervous system, and only for TPP Sofia - concerning hypertonic disease, and other respiratory system diseases.

4.12.3 PREVENTIVE MEDICAL EXAMINATIONS OF THE EMPLOYEES OF TOPLOFIKATSIA SOFIA EAD

Initial preventive medical examinations (all newly appointed employees undergo such an examination; it is performed in a medical institution; health status files are created for all newly appointed staff, with an opinion regarding the person's suitability to work at the given position) and regular annual examinations. The annual examinations for 2012 were performed under "Working Conditions Fund" programme, in which the following specialists participated: specialists in internal and occupational diseases, toxicologists, neurologists, pulmonary specialists, otorhinolaryngologists and laboratory specialists.

In the structure of diiseases most common are:

→ Cardiovascular system diseases - The relative share of cardiovascular system diseases is highest - 37.4 %, represented mostly by arterial hypertonia (35.5 %) and ischemic heart disease (1.9 %). 23 employees (1.4 %) have been newly diagnosed with hypertonic disease. Pathological ECG deviations have been found in 21.3 % of the employees. Left ventricular hypertrophy was diagnosed in 3.9 % of the persons with hypertonia. 1.9 % of the employees have ischemic heart disease. Seven of them have had myocardial infarction; 20 of the examined persons have stable angina pectoris, and two have a rhythm type of ischemic heart disease.

→ Metabolotic disorders - Obese persons share is highest - 13.5 %. In most cases obesity is marked, which is extremely bad for the health. 50 of the employees were diagnosed with type 2 diabetes; four of the examined persons have insulin-dependent diabetes. Diabetes complication - diabetic polineuropatia - was diagnosed in 17 employees. 1.6 % of the employees were diagnosed with thyroid disorders.

→ Diseases of the lungs and bronchi Diseases of the lungs and bronchi were diagnosed in 7.2 % of the examined employees. Pulmonary function tests showed breathing problems in 19.5 % of the examined employees. The most frequent diagnosed disorders were bronchitis (4.4 %) and chronic obstructive pulmonary disease (2 %). Most of the cases were chronic bronchitis having living conditions and infections aetiology in combination of several factors simultaneously - dust, smoking, infections, predisposition to allergies. Toxic pneumofibrosis was suspected in 31 employees (welders, chemical department workers) based on X-ray data. A lung tumour of unknown aetiology and time of presence was observed with two of the employees.

→ In the group of upper respiratory tract disorders are chronic pharyngitis - 5.8 %; chronic sinusitis - 2.8 %; chronic tonsillitis - 2.6 % and allergic rhino-sinusitis - 2 %.

→ Digestive system disorders were diagnosed in 6.6 % of the examined persons. The incidence of ulcer is 2.6 %. The incidence of chronic gastritis is 1.8 %. Irregular diet, night shifts and noise above standard values at some places contribute for gastric and intestinal pathology. 1 % of the examined persons have enlarged liver. Leading risk factors are overweight, past liver infections and systematic use of alcohol.

4.12.4 CONCLUSIONS FROM THE MEDICAL ANALYSIS

1. According to the incidence indicator, morbidity with temporary incapacity for work at Toplofikatsia Sofia EAD for the studied period is in the **high** range according to the evaluation scale;
2. The seriousness of disorders for the examined period according to the days of absence indicator is **high**.
3. Morbidity with temporary incapacity for work of men, according to basic indicators, is in the **medium** range for the entire studied period.
4. As regards women, morbidity with temporary incapacity for work has **low** values.
5. The most frequent cases of illness were in the age group below age 55.
6. For the studied period the frequency of cases in all employee and practice groups was **medium** according to the evaluation scale.
7. The nosological structure of morbidity with temporary incapacity for work shows highest frequency of acute infections of the upper respiratory tract J00-J20, peripheral nervous system disorders G50-G64, diseases of the skeletal and muscular system and connective tissue diseases M00-99, injuries, poisoning and other consequences of the impact of external factors S00-T98, gastritis, enteritis, colitis K29, 50-52.
8. The chronic non-infectious diseases (so-called socially significant diseases) - cardiovascular, pulmonary, mental and endocrine - do not exceed the average morbidity rate for Bulgaria.
9. No occupational diseases cases were recorded in 2012. The cases of workplace accidents are investigated and declared before the National Social Security Institute according to the procedure envisaged by the legislation.

4.12.5 RISK FACTORS IDENTIFICATION AND CHARACTERISTICS FROM THE POINT OF VIEW OF THEIR IMPACT ON HUMAN HEALTH

A comparative assessment of health risks connected with the adverse factors of the environment was made, based on the analyses and expert evaluations of the environment components. It provides grounds for identifying some major risk factors, which have a negative effect chiefly on the health of people working at TPP Sofia and TPP Sofia-East but also on some of the components of the environment and the population in the region of the two sites.

TABLE 4.12-4 RISK FACTORS WITH DIRECT AND INDIRECT IMPACT ON HUMAN HEALTH

RISK FACTOR	Environment /work environment component
CHEMICAL FACTORS / TOXIC GASES	
Dust - substances in dispersed state, with various particle sizes • **Coarse particulate matter - diameter 5-30 μm Those form in mechanical processes.** • **Fine particulate matter - 1 and 3 μm. Those form in condensation and coagulation Fine particulate matter involves higher health risk and in particular respiratory risk.** **The dust pollution locally in the cabs of loaders etc. depends on the loading operations, road traffic, wind, etc. Most significant as regards the harmful effect on people is the content of free silicon dioxide, and that content is high in most cases.**	Ambient air Soil Work environment
Sulphur dioxide - liquid and solid fuels, industrial sites and motor vehicles are sources of emissions. **SO_2 is a gas which has local irritating and general toxic effect, harmful to the respiratory organs (causing acute and chronic bronchitis, asthma etc.) Concentrations of SO_2 above the limit values cause changes in the blood**	Ambient air Soil Plant species Work environment

composition, disrupt metabolism and increase the susceptibility of human body to diseases. It is soluble in water - sulphurous and sulphuric acid form, which even in relatively low concentrations, apart from having a negative impact on people, damage buildings, concrete structures, metals, paints and fabrics, harm the plant (most expressed in coniferous plants) and animal species. Sulphuric acid influences also the soil - it acidifies soils and spoils their productive properties. In some industrial processes, as a result of reaction of sulphur or sulphur-containing compounds with organic substances under high temperatures hydrogen sulphide is emitted, which is an irritant gas. It inhibits the cytochrome C oxidase and other enzymes and causes intracellular hypoxia. Chronic exposition results in eye disorders (conjunctivitis, keratitis) and pulmonary disorders (chronic bronchitis).	
nitrogen oxides - toxic gases which form as a result of detonation, oxyacetylene welding and electric welding. • Irritating effect resulting in non-specific inflammatory disorders of the respiratory system; • Generally toxic - affects mainly the nervous and the hematopoietic systems (methemoglobin formers)	Ambient air Work environment
Carbon oxides (CO; CO_2) - it is formed in all processes in which there are conditions for incomplete combustion of carbon-containing substances (explosions, incomplete combustion of fuels). -General toxic effect, suppression of tissue respiration due to haemoglobin combining into carboxyhaemoglobin and methaemoglobin, resulting in tissue hypoxia (fatigue, dizziness, insomnia, headache etc. - Irritative effect on respiratory tract mucous membrane.	Ambient air Work environment
Dioxins and furans, total hydrocarbons, hydrogen chloride, hydrogen fluoride, heavy metals. Chemical pollutants which have toxic, irritative, mutagenic and carcinogenic effects.	Ambient air Soil Work environment
Oil products: engine lubricating oils, motor oils; diesel fuel. Polycyclic aromatic hydrocarbons are found in settled dust, resulting from thermal destruction of mineral oils. Proven carcinogenic effect for human body. They contain organic pollutants for the soil and water components of the environment.	Soil, groundwater, air, work environment
Lead is one of the most toxic and dangerous heavy metals. Being an anthropogenic toxicant extremely widespread in the environment, lead is included in the lists of significant pollutants issued by different international organisations like the World Health Organisation, the Centre for Disease Control - USA, etc.	Ambient air Soil Work environment
Exhaust gases from the truck traffic, containing mainly: carbon dioxide, carbon oxide, oxygen, carbon, hydrocarbons, aldehydes, nitrogen oxides, sulphur dioxide.	Ambient air Work environment
PHYSICAL FACTORS	
Noise - generated chiefly by machines and installations, in particular such which use compressed air. • Extraaural effects on the central nervous system: irritability, psychic instability, memory failures, lower capacity for work and nervous overfatigue. Effects on the autonomic nervous system: increased vascular tone, heart rhythm changes, variations of arterial blood pressure. Effects on the digestive system: lower quantity and lower acidity of gastric secretions, slower passage and poor absorption of nutritious components. Effects on the respiratory system: changes in the frequency of respiratory motions and increase of the minute respiratory volume. Effects on the endocrine system: increased secretion of catecholamines, adrenocorticopen and thyreotropic hormones. • Specific auditory changes - they usually occur last, after all other functional and pathological changes in the body are already a fact.	Work environment
Microclimate	Work environment

Depends on the climate and the weather in the area. The effect of adverse weather conditions, especially when working outdoors or in vehicle cabins, is connected with the positive or negative thermal balance and respective strain of temperature regulation mechanisms, which depend on the air temperature, humidity and the speed of airflow. **In case of hard physical work and high temperatures - changes in the water and electrolyte balance of the body resulting in the so called thermal stress. Negative changes occur in the physiological and chemical processes in a number of organs and systems (cardiovascular system, digestive system, urinary system, the central nervous system). Poor concentration, poor coordination of movement result in reduced functional capacity and risk of injuries, especially in cases of work at hight.**	
Non-ionizing radiation **Immediate effects in cases of electric arc welding in repair works. Apart from UV radiation the welding process produces also infra-red radiation and electricity.** **Accidents - When combustible materials are nearby there is a risk that explosive mixtures are formed.** **If personal protective equipment is not used the result is:** **- local burns of different severity;** **- general overheating of the body;** **- burns and injuries from electric shock.**	Work environment
Unnatural working position - prolonged sitting/standing position combined with physical efforts, work outdoors and other harm of different severity to the locomotor system.	Work environment
Working in shifts disrupts the rhythm of many important physiological processes and is a stress-generating factor with a wide range of adverse consequences.	Work environment

4.12.6 CONCLUSION

In general, based on the evaluation data of the present condition within the other components, the health and demographic profile of Sofia city, the data about morbidity and temporary incapacity for work and the preventive medical examinations of TPP Sofia and TPP Sofia-East employees, we can point out that the actual health and sanitation risk to the potentially affected population, in normal operating mode at both sites, is admissible and controllable.

4.13 SOCIAL AND ECONOMIC ENVIRONMENT

According to NSI data within the considered regional profiles[30] the employment rate and income in Sofia are high, and unemployment is low. Most of the educational and healthcare institutions of national importance as well as a large number of Bulgaria's administration authorities are concentrated in Sofia. The capital is an absolute leader as regards most infrastructure development indicators. The social environment is favourable, cultural life is intensive.

4.13.1 ECONOMY

Sofia capital district is the most economically developed district in Bulgaria. GDP per capita in the capital has not stopped growing even in the period after 2008 and continues to be over twice higher that the average for Bulgaria. The average annual income in that district (BGN 6,403 per head of a household in 2012) is considerably higher than that in the other districts, and the difference continues increasing.

[30] Key indicators for Sofia district http://www.regionalprofiles.bg/bg/regions/sofia-grad/

Although the labour market in the capital continues to be the best developed one in Bulgaria, its recovery was slow in 2011 and 2012. The employment of population continues to be considerably higher than that in most other districts, and in 2012 55.7 % of the persons aged over 15 were employed. Still compared to the employment rate achieved in 2008 the current rate is low. In 2012 the average annual unemployment ratio in the capital increased to 7.3 % and so it is no more the most favourable unemployment ratio in Bulgaria. In this respect the situation is better in Sofia district and in Stara Zagora.

A drop in the investment activity in the capital has been observed since the beginning of the crisis, and the expenditures of the enterprises on acquiring long-term tangible assets have decreased from BGN 13.4 billion in 2008 to BGN 8.4 billion in 2011. Decrease also in foreign investment has been observed since 2009, although it is slower. Most of the businesses in the capital expect further reduction of their income in the following 12 months (May 2013 - May 2014).

For those reasons the data from the NSI, given in the tables below, shows that the main indicators of poverty and social exclusion in the capital lower than the average for Bulgaria.

TABLE 4.13-1 POVERTY THRESHOLD IN BGN FOR EACH DISTRICT

Year to which the data refers	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
	A single person					Two adults with two children below 14 years old				
Average for Bulgaria	2,548	3,318	3,540	3,420	3,356	5,351	6,968	7,434	7,182	7,047
Sofia city	3,769	4,732	5,249	5,407	4,782	7,915	9,938	11,024	11,354	10,042

TABLE 4.13-2 INEQUALITY IN INCOME DISTRIBUTION - *GINI COEFFICIENT*

Year to which the data refers	2007	2008	2009	2010	2011
	Gini coefficient				
Average for Bulgaria	35.9	33.4	33.2	35.0	33.6
Sofia city	32.8	30.7	30.2	30.4	32.6

TABLE 4.13-3 PERCENTAGE OF PEOPLE LIVING IN POVERTY, BY SEX[1]

Year for which the data refers	2009			2010			2011		
	total	men	women	total	men	women	total	men	women
Average for Bulgaria	45.7	44.2	47.2	43.6	42.5	44.6	44.1	42.9	45.3
Sofia city	28.2	26.5	29.7	29.1	27.7	30.3	32.4	30.9	33.7

ТАБЛИЦА 4.13-4 PERCENTAGE OF PEOPLE LIVING IN POVERTY, BY SEX

Year to which the data refers	2009			2010			2011		
	total	men	women	total	men	women	total	men	women
Average for Bulgaria	45.7	44.2	47.2	43.6	42.5	44.6	44.1	42.9	45.3
Sofia city	28.2	26.5	29.7	29.1	27.7	30.3	32.4	30.9	33.7

TABLE 4.13-5 PERSONS LIVING IN HOUSEHOLDS OF LOW INTENSITY OF ECONOMIC ACTIVITY

Year for which the data refers	2010		2011	
	number of persons, thousand	% of the population	number of persons, thousand	% of the population

Average for Bulgaria	444.4	10.1	473.8	11.2
Sofia city	356.8	32.0	152.4	29.3

TABLE 4.13-6 GDP PER CAPITA

GDP per capita (2010)	**BGN 22,573. 00**
Unemployment ratio (15+) (2012)	7.30% >
Employment ratio (15+) (2012)	55.70% >
Enterprises per 1,000 persons (2011)	78.00 >
Average annual income per household member	BGN 6,403. 00 >
Statistic data for the last 12 years	
Expenditures on acquisition of long-term tangible assets, per capita (2011)	BGN 6,554. 49 >
Direct foreign investment in the non-finance sector, per capita of the average population per year (with accumulation) (2011)	EUR 8,952.72 >
Amounts paid under OP per capita (2012)	BGN 58.10 >

The recovery of economic activity in the capital to its levels before the crisis is hampered by the unfavourable taxation regime and inefficient local administration.

The judicial system in the capital is extremely distrusted by the business as regards corruption, lover than those levels of trust in the authorities of that system being recorded only in Sofia and Kyustendil districts. The rating given by the business is the same as regards also the police and local administration; at a level lower than that is only the trust of representatives of businesses in Veliko Tarnovo district in local public order authorities and in the incorruptibility of local administration officials. In only two districts the general perception of corruption is higher - Veliko Tarnovo and Kyustendil. The levels in Haskovo, Stara Zagora, Sliven and Pernik are similar.

Taxes in the district are higher than the average for Bulgaria; the difference is highest in the retail patent tax rate (BGN 20 m^2 for sites of best location) and the charge for household waste for non-residential property of juristic persons (10‰). Sofia city district is one of the districts where businesses are most actively using the electronic services provided by the administration. In the twelve months preceding the survey over half of the interviewed persons have used such services. Their rating of the services quality is rather positive.

The difficulties in the complete implementation of the "one stop shop" service in Sofia municipality continue - **Table 4.13-7**.

TABLE 4.13-7 RATING OF THE "ONE STOP SHOP" SERVICE INTEGRATION

Rating of the corruption level (2013)	**2.94/ 5**
Rating of the work of local administration (2013)	2.98/ 5
Quality of electronic services (2013)	3.50/ 5
Rating of the judiciary (2013)	2.17/ 5
Non-regulated payments (2013)	3.76/ 5
Real estate tax rate (2013)	1.88‰
Vehicle tax rate (2013)	BGN 1.38 /kW
Annual retail patent tax (2013)	BGN 20.00 / sq.m
Household waste charge (2013)	10.00‰
Rate of the tax on property purchasing (2013)	2.50‰

4.13.2 INFRASTRUCTURE

The capital is an absolute leader as regards most of the analysed infrastructure development indicators. Many of the main roads in Sofia and parts of the ring road were repaired in the last years. Due to the specifics of the administrative and territorial division of Bulgaria, the territory of Sofia (capital) does not include roads which belong to the national road network.

Formally speaking, all highways in Bulgaria reach to the boundary of the district itself. The completion of Lyulin highway in 2011 contributed to improving the connection between the capital and Pernik district, and the commissioning of Trakia highway provided a faster and safer transport connection between the capital and Burgas. The construction of Struma highway, which also starts from the capital, is one of the priorities of the infrastructure policy for the next programming period (2014-2020).

TABLE 4.13-8 INFRASTRUCTURE

Road network density - the total length of highways, first -, second- and third-class roads (2011)	0.00 km/100 sq.km
Railway network density (2011)	13.79 km/ 100 sq. m
Relative share of households which have internet access (2012)	66.19%
Relative share of persons aged between 16 and 74, who have used internet in the last 12 months (2012)	74.20%
Percentage of road pavement in good condition (2010)	0.94%

The rail road network density in Sofia is four times higher than the average for Bulgaria. The second line of Sofia underground was commissioned in 2012. The biggest international airport in Bulgaria is in the territory of Sofia district. In 2012 three quarters of Sofia residents used internet regularly, and nearly two thirds of the households had access to the web at home. The residents of Sofia rate as good the infrastructure development of the district - 3.2/5.0 while the average for Bulgaria is 2.8/5.0.

4.13.3 HEALTH CARE

The health care system in the capital is well developed; a large number of the health care facilities of national importance are located in Sofia. The total number of hospitals is 60, and 19 of them are multiprofile hospitals for active treatment. 4.1 beds in a multiprofile hospital for active treatment correspond to each 1,000 residents of Sofia, while the average for Bulgaria is 4.4. In the last 12 months, until May 2013, 7.5 % of Sofia residents had to go beyond the territory of this district in order to receive a medical service which they need. The average level for Bulgaria is 23 %, and after Sofia that indicator is most favourable for Plovidv district (8 %) and Pleven district (8.6 %).

The most favourable proportion in Bulgaria of the number of local residents and the number of cardiologists is observed in Sofia. Yet the opinion of Sofia citizens concerning both the work of the hospitals and their own health is they are just "satisfactory". Each fourth person who has used medical services in the 12 months before the survey (May 2013) had to make a facilitating payment. Traditionally the child mortality rate in Sofia is low. In the period 2004-2012 better results for some years were achieved only in the districts of Ruse (2004 and 2006), Smolyan (2008 and 2012), Blagoevgrad (2009 and 2012), Silistra (2010) and Kyustendil (2005).

TABLE 4.13-9 HEALTH CARE DATA

Persons having health insurance	86.80%
Number of people served by one general practitioner	1,493. 00
Number of people per one internal diseases specialist (2012)	5,774.00
Number of people per one cardiologist (2012)	4,151.00
Persons who had treatment in a multi-profile hospital for active treatment (MPHAT) per 1,000 people of the population (2012)	238.10
Child mortality rate	4.40‰
Bed space in MPHAT per 1,000 people of the population (2012)	4.10

4.13.4 EDUCATION

There were 281 schools in the capital in 2012, with about 120 thousand children. The relative share of pupils repeating a school year because of poor grades is 0.5%, i.e. out of 200 children in Sofia district only one repeats a school year for such reasons. The education system in the capital also has one of the lowest levels of children dropping out of school - 0.8 % children do not graduate. At the same time in the last five years the percentage of students continuing education in V-VIII grade kept dropping at a rate higher than the average for Bulgaria. That trend is worrying as in school year 2012/2013 only 78.4 % of the potential students enrolled in those grades. The levels are lower than that only in Sliven and Pernik districts.

Sofia city and Sofia district are the districts where the percentage of students who have not passed the final examinations in Bulgarian language and literature is lowest - 2.2 %, the average for Bulgaria being 4.9 %. Students' performance is also traditionally good; in school year 2012/2013 only in Kardzhali district the average grades were higher than those for Sofia. The average grades were good (4.55) for Sofia city and good (4.60) for Kardzhali. The relative share of Sofia residents aged 25-64 who have higher education is nearly 43 %, the average for Bulgaria being 24 %.. In 2012 nearly 40 % of all university students in Bulgaria were studying in Sofia. For all that, due to the continuous emigration of young higher education graduates, the share of Sofia residents who have higher education has been gradually decreasing since 2008, when it was 46 %.

TABLE 4.13-10 EDUCATION DATA

Number of university students per 1,000 persons (2012)	85.00 students
Number of teachers in primary and secondary schools per 1,000 students (2012)	74.00 teachers
Number of students and teachers per school (2012)	4,623.00 >
Statistic data for the last 13 years	
Group net coefficient of enrolment in V-VIII grade (2012)	78.38% >
Relative share of residents aged 25-64 who have higher education (2012)	42.90% >
Students who din not graduate (2011)	0.82% >
Students repeating a school year because of poor grades (2012)	0.50% >
Average grades at the graduation exam in Bulgarian language and literature (2013)	4.55 >
Percentage of poor grades in Bulgarian language and literature (below 3.00) (2013)	2.19 >

4.13.5 SOCIAL ENVIRONMENT

Sofia city district is among the districts with most favourable social environment in Bulgaria - 4.3 % of Sofia residents live in households with low intensity of economic activity. Yet 29 % of the population lives in poverty, and nearly 19 % are below the poverty line for the district. Still the capital has much better results for those two indicators compared to the average for Bulgaria.

TABLE 4.13-11 SOCIAL ENVIRONMENT DATA

Crimes against persons and property, per 1,000 person of the population (2012)	**19.00**
Useful floor area per capita (2011)	25.98 sq. m
Persons living in households of low intensity of economic activity (2010)	4.30 %
Relative share of poor people in relation to the poverty line for the district (2010)	18.80 %
Percentage of people living in poverty (2010)	29.10 %
Rating of the work of institutions (2013)	2.32/ 5
Satisfaction with life (2013)	3.34/ 5 http://www.regionalprofiles.bg/bg/regions/sofia-grad/ - #

In general, according to data from a survey, the population of Sofia city is relatively satisfied with the different aspects of life; the highest ratings, compared to the average for Bulgaria, are given regarding the infrastructure and social life conditions, and the lowest - regarding the environment and the feeling of security. The work of institutions is rather unsatisfactory, and the lowest ratings are given for the judicial system and the police. High crime rates continue to be a problem; the reported number of crimes against persons and property, relative to the number of local population, only in Burgas district is higher than that is Sofia.

Sofia city, Ruse and Varna are the only three districts in Bulgaria in which the visits to theatre or cinema per capita per year are more than one. In Sofia such visits are average 2.4 per person annually, while in Ruse and Varna districts those are 1.2 and 1.3 visits annually.

5 DESCRIPTION, ANALYSIS AND EVALUATION OF THE EXPECTED CONSIDERABLE IMPACTS ON THE POPULATION AND ON THE ENVIRONMENT RESULTING FROM THE IMPLEMENTATION OF THE INVESTMENT PROPOSAL, USE OF NATURAL RESOURCES, RELEASE OF HARMFUL SUBSTANCES IN NORMAL OPERATION AND IN EMERGENCIES, WASTE GENERATION AND CAUSING OF DISCOMFORT

5.1 AMBIENT AIR

5.1.1 SOURCES OF POLLUTION TO THE AMBIENT AIR RESULTING FROM THE INVESTMENT PROPOSAL IMPLEMENTATION - DURING CONSTRUCTION AND DURING OPERATION

5.1.1.1 DURING CONSTRUCTION

Extra gas and dust emissions during construction are due to earthworks, to treatment of dust materials, and to wind erosion of the open areas as well as to gas emissions from vehicles and construction machines (internal combustion engines).

5.1.1.1.1 DUST EMISSIONS

The construction activities include building the main production and administration building of area 5,345 $m^2$and concrete pavement around it of area 10,370 m^2.

The expected dust emissions can be estimated by emission factors specified in **EMEP/EEA air pollutant emission inventory guidebook 2013, NFR** [31] code **2.A.5.b** - Construction and demolition:

$$\begin{Bmatrix} \text{общ прах} \\ \text{ФПЧ}_{10} \\ \text{ФПЧ}_{2.5} \end{Bmatrix} = \frac{\text{брой дни на определена дейност}}{365\ \text{дни}} \times \left\{ \begin{matrix} 0.162 \\ 0.0812\ [\mathbf{kg}] \\ 0.00812 \end{matrix} \times \text{работна площ}\ [m^2] \right\}$$

Hence construction activities at an area of 15,715 m^2 within one year will generate 12.9 t total dust quantity and 3.23 t PM_{10}.

When a a sprinkling system is used for maintaining sufficient moisture at the construction sites, the levels of dust emissions (controlled emissions) are reduced by 80 %[32] according to the following formula:

,

where: E_C is the level of controlled emissions, E is the level of uncontrolled emissions, and C is control efficiency in %.

Dust emissions during construction will be **negligible** and **temporary** and **will not have** any significant **effect on the ambient air quality** and the environment.

5.1.1.1.2 GAS EMISSIONS

Construction equipment

[31] **NFR** (Nomenclature for Reporting) – nomenclature for reporting the emissions generating processes, which enables full unification and congruence of all national reporting under the Convention on Long-range Transboundary Air Pollution (CLRTAP);before the secretariat of the Framework Convention on Climate Change (UNFCCC) and before the European Environment Agency (EEA).

[32] http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s00.pdf.

The area in which the construction works will be carried out will be a source of exhaust gases from the internal combustion engines of the equipment used.

The estimation of emissions can be made according to **Tier 2**[33] of the methodology book **EMEP/EEA air pollutant emission inventory guidebook 2013** for non-road mobile sources and machinery (area sources), SNAP code **0808**, and for carbon dioxide - according to IPCC (**NFR**[34] code **1.A.5.b.iii**), in ICE exhaust gases.

Emissions in exhaust gases from ICE for one hour operation of one excavator of power 420 kW, one caterpillar excavator (220 kW), one grader (200 kW), one bulldozer (180 kW) and one front loader (120 kW) are given in **Table 5.1-1**.

TABLE 5.1-1 EMISSIONS FROM CONSTRUCTION EQUIPMENT

Emissions	Greenhouse gas			Main and specific pollutants				
kg	CO_2	CH_4	N_2O	NO_x	SO_X	CO	NMVOC	PM_{10}
Construction equipment	923.12	0.057	0.040	3.99	0.029	3.99	0.570	0.228

The total amount of greenhouse gas emissions expressed in CO_2-equivalent is 936.7 kilograms.

Emissions are released directly into ambient air from exhaust pipes of equipment with ICE.

Transport operations

The construction activities for building the new plant involve making a large excavation of the entire site of area 51,460 m^3 and backfill with rubble of 4,590 m^3. According to the geological report not any of the earth mass is suitable for level so it will be transported to a landfill (coordinated with the municipality authorities). The materials for level filling will be supplied from places beyond the site. The estimated vehicle traffic for transporting that quantity of earth mass and filling is 25 truck per day.

The emission load from heavy vehicles traffic has been evaluated according to Tier 2 of **EMEP/EEA Air pollutant emission inventory guidebook 2013** regarding basic pollutants from heavy-duty trucks up to 32 tons (**1.A.3.b.iii**).

The emission load in kilogram per kilometre (kg/km) of traffic in the respective road of the city road network is given in **Таблица 4.1-5.**

TABLE 5.1-2: EMISSION LOAD IN KILOGRAM PER KILOMETRE OF TRUCK TRAFFIC

CO	NMVOC	NOx	N_2O	NH_3	Pb	$PM_{2.5}$	Ideno Pyrene	B(k)F	B(b)F	B(a)P	CO_2	SO_2	benzene
0.003	2.5E-04	0.096	3.0E-04	7.3E-05	2.7E-07	0.001	3.5E-08	1.5E-07	1.4E-07	2.3E-08	16.5	8.4E-05	7.5E-06

[33] In the EMEP/EEA air pollutant emission inventory guidebook methods of different complexity are used for determining the level of emissions, describing the major activities in the inventory of emissions. The method complexity level is designated as Tier X, i.e. the higher the value of X, the more complex and precise the method.

[34] SNAP (Selected Nomenclature for sources of Air Pollution) - a nomenclature for reporting of emission-generating processes, which was used until 2002 in CORINAIR methodology. It is used also now in the contemporary EMEP/EEA air pollutant emission inventory guidebook but only for some sources of emissions, while for the sub-sources the new nomenclature **NFR** (Nomenclature for Reporting) is used.

Emissions are released directly into ambient air from exhaust pipes of the vehicles used in the construction. The total amount of greenhouse gas expressed in kilogram equivalent to CO_2, is 16.58 per day.

The estimate of the cumulative effect of transport operations during construciton is given in **section 5.1.3.3**.

5.1.1.1.3 POLLUTANT EMISSIONS FROM LAYING OF ASPHALT PAVEMENT

According to the future technical projects for construction under this IP, asphalt pavement is envisaged for the technological purpose areas as well as for the detour road and the access road. Нивото на емисиите на летливи органични съединения (**NMVOC),** общ суспендиран прах (**TSP)** и фини прахови частици до 2.5 (**ФПЧ$_{2.5}$**) и до 10 микрона (**ФПЧ$_{10}$)** при полагане на асфалтовата смес може да се изчисли по **Tier 1**[35] на методика **EMEP/EEA air pollutant emission inventory guidebook-2013** (**NFR** код **2.D.3.b - Road paving with asphalt**), където емисионните фактори са в размерност грам на тон положен асфалт.

The estimated quantity of bituminous mixture used in building the new installation is 84 tons. The emissions are given in **Table 5.1-3**.

TABLE 5.1-3: EMISSIONS IN LAYING OF ASPHALT PAVEMENT

NMVOC	TSP	PM_{10}	$PM_{2.5}$
kg			
1.344	1,176	252	33.6

5.1.1.2 DURING PLANT OPERATION

5.1.1.2.1 TRANSPORT OPERATIONS FOR RDF SUPPLY AND TRANSPORTATION OF WASTE AND RESIDUES

According to the Terms of Reference, the main parameters of the transportation flows, calculated based on six workdays in a week, for supplying of fuel and transporting of waste for the new plant are as follows:

- **Flow 1** - transportation of RDF from the MBT plant to the new plant - 180,000 t/year; 600 t/day, for which **23 shipments per day** are necessary. The distance to TPP Sofia is approximately 23 km, and to TPP Sofia-East - 27.5 km **- Figure 5.1-1.**

[35] In the EMEP/EEA guidebook methods of different complexity are used for determining the level of emissions, describing the major activities in the inventory of emissions. The method complexity level is designated as Tier X, i.e. the higher the value of X, the more complex and precise the method.

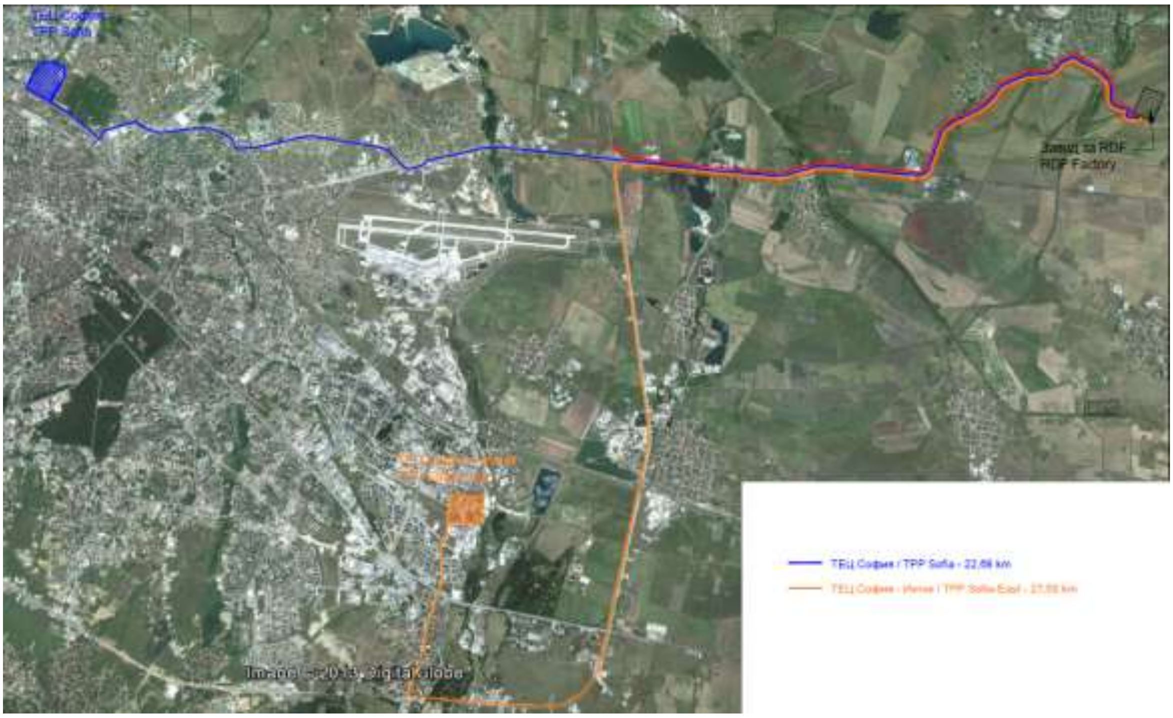


FIGURE 5.1-1 FLOW 1 - TRANSPORTATION OF RDF FROM THE MBT PLANT TO THE POTENTIAL SITES OF THE NEW PLANT

- **Flow 2** - transportation of bottom ash from the new plant to the Vrazhdebna landfill for construction waste - 36,000 t/year; 115 t/day, for which **5 shipments per day** are necessary. The distance to TPP Sofia is approximately 11.5 km, and to TPP Sofia-East - 16.8 km **- Figure 5.1-2.**

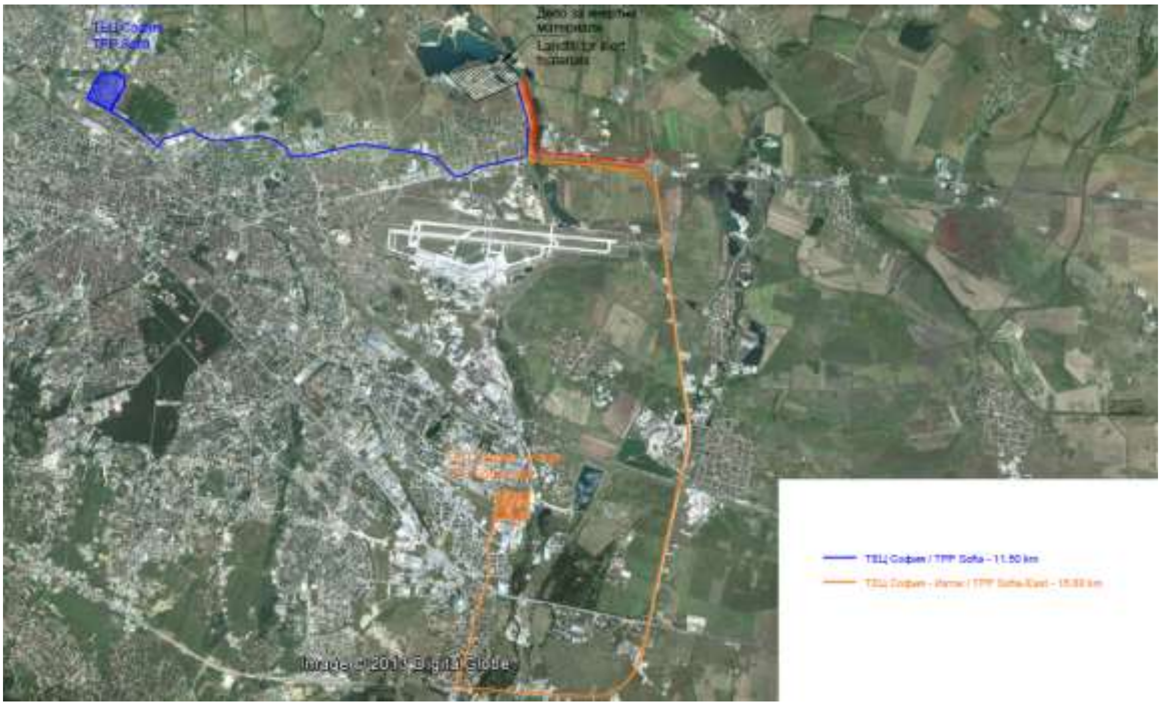


FIGURE 5.1-2 FLOW 2 - TRANSPORTATION OF BOTTOM ASH FROM THE PLANT TO VRAZHDEBNA LANDFILL FOR CONSTRUCTION WASTE

- **Flow 3** – transportation of fly ash (hazardous waste) from the plant to a depot for temporary storage (regional depot Sevlievo - 200 km or Ruse - 330 km) or to a mine in Germany (2,000 km) - 10,800 t/year; 35 t/day, for which 1.4 **shipments per day** are required.

The emission load from the transportation flows has been estimated according to Tier 2 of **EMEP/EEA Air pollutant emission inventory guidebook 2013** regarding basic pollutants from heavy-duty trucks up to 32 tons (**1.A.3.b.iii**) - **Table 5.1-4.**

TABLE 5.1-4: EMISSIONS FROM THE TRANSPORTATION FLOWS DURING THE PLANT OPERATION

Transportation flow	CO	NMVOC	NOx	N2O	NH3	Pb	PM2.5	Ideno Pyrene
	kg							
Flow 1	1.10E-01	1.04E-02	4.00E+00	1.25E-02	3.03E-03	1.11E-05	2.49E-02	1.46E-06
	1.33E-01	1.27E-02	4.84E+00	1.52E-02	3.67E-03	1.34E-05	3.02E-02	1.77E-06
Flow 2	1.2E-02	1.2E-03	4.4E-01	1.4E-03	3.3E-04	1.2E-06	2.7E-03	1.6E-07
	1.8E-02	1.7E-03	6.4E-01	2.0E-03	4.9E-04	1.8E-06	4.0E-03	2.4E-07
Flow 3	5.9E-02	5.6E-03	2.1E+00	6.7E-03	1.6E-03	5.9E-06	1.3E-02	7.8E-07
	9.7E-02	9.2E-03	3.5E+00	1.1E-02	2.7E-03	9.8E-06	2.2E-02	1.3E-06
	5.9E-01	5.6E-02	2.1E+01	6.7E-02	1.6E-02	5.9E-05	1.3E-01	7.8E-06

TABLE 5.1-4: CONTINUED

Transportation flow	B(k)F	B(b)F	B(a)P	CO2	SO2	benzene	kgCO2eq
	kg						
Flow 1	6.35E-06	5.69E-06	9.39E-07	687.94	3.51E-03	3.13E-04	**692.04**
	7.70E-06	6.89E-06	1.14E-06	834.14	4.25E-03	3.80E-04	**839.11**
Flow 2	7.0E-07	6.3E-07	1.0E-07	75.83	3.9E-04	3.5E-05	**76.28**
	1.0E-06	9.2E-07	1.5E-07	1.1E+02	5.6E-04	5.0E-05	**111.44**
Flow 3	3.4E-06	3.1E-06	5.0E-07	3.7E+02	3.1E-02	1.7E-04	**371.46**
	5.6E-06	5.0E-06	8.3E-07	6.1E+02	5.1E-02	2.8E-04	**612.92**
	3.4E-05	3.1E-05	5.0E-06	3.7E+03	3.1E-01	1.7E-03	**3,714. 65**

Emissions are released directly into the ambient air from exhaust pipes of the vehicles used in the construction. The estimate of the cumulative effect of transportation flows in the roads around the potential sites is given in **section 5.13.1.3**.

5.1.2 MODELLING THE DISPERSION OF HARMFUL SUBSTANCES IN THE GROUND-LEVEL AIR

The modelling of dispersion of harmful emissions has been made according to the Methodology for calculating the height of stacks, dispersion, and the expected concentrations of pollutants in the ground-level air - PLUME software/ of 25 February 1998, adopted by the Ministry of Environment and Water, Ministry of Regional Development and Public Works and Ministry of Health.

5.1.2.1 AVERAGE CONCENTRATIONS OF HARMFUL SUBSTANCES IN GROUND-LEVEL AIR

5.1.2.1.1 TPP SOFIA

This section of the software provides standard (average annual) estimates of the expected concentrations by calculating the dispersion of harmful substances in the ground-level air.

Input data:

- *Input parameters of the model* – the area for which pollution is calculated is 7,400 x 4,200 m (37 steps x 200 m in west-east direction and 21 steps x 200 m in north-south direction);
- *Weather conditions* – for the purpose of analysis the wind rose representative for the area has been used - **Figure 4.1-1** and average annual temperature 10.5°C.
- *Parameters of the source* – Modelling is made of all pollutants which will be emitted**AFTER** the changes are implemented, and their levels are compared to those resulting from the enterprise operation**BEFORE** the project is implemented, and reduced to the hours of operation of each source**Table 5.1-5**.

TABLE 5.1-5 PARAMETERS OF THE SOURCES AND ANNUAL EMISSION FOR TPP SOFIA

Stack No.	X*	Y*	H	D	T	Q	SO_2	NO_X	CO	Dust PM_{10}	HCl	HF	TOC	Cd, Tl, Hg	Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	Dioxins and furans
	M				°C	Nm^3/s	**mg/s**	**mg/s**	**g/s**	**mg/s**	**g/s**	**g/s**	**g/s**	**mg/s**	**mg/s**	**µg/s**
S1	3,994.68	2,163.21	120	4.38	110	44.11	63.4	362.6	0.181	9.1						
S2	3,960.13	2,087.19	126	5.30	125	104.28	3,100.6	17,717.7	8.859	442.9						
S3	3,953.21	2,038.81	120	4.80	125	326.72	11,184.6	63,912.2	31.956	1,597.8						
S4	4,105.26	2,066.45	80	1.81	50	44.44	2,029.4	8,117.7	2.029	405.9	0.4059	0.0406	0.4059	2.03	20.29	0.0041

TABLE 5.1-6 PARAMETERS OF THE SOURCES AND ANNUAL EMISSION FOR TPP SOFIA-EAST

Stack No.	X*	Y*	H	D		Q	SO_2	NO_X	CO	Dust ($ФПЧ_{10}$)	HCl	HF	TOC	Cd, Tl, Hg	Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	Dioxins and furans
	M				°C	Nm^3/s	**mg/s**	**mg/s**	**g/s**	**mg/s**	**g/s**	**g/s**	**g/s**	**mg/s**	**mg/s**	**µg/s**
S1	4,637.10	2,229.92	125	5.80	120	528.00	9,953.0	56,874.5	28.437	2,429.9						
S2	4,665.09	2,341.88	125	5.80	130	336.00	10,824.3	61,853.2	30.927	108.0						
S3	4,739.74	2,323.22	120	5.44	90	315.00	708.6	4,049.0	2.024	38.7						
S4	4,758.40	2,379.20	120	5.44	80	315.00	270. 6	1,546. 2	0.773	1,438.4						
S5	4,711.75	2,173.93	80	1.81	50	44.44	2,029.4	8,117.7	2.029	405.9	0.4059	0.0406	0.4059	2.03	20.29	0.0041

Results:

As the average annual rose of wind was used for meteorological data, the resulting estimate of pollution in the ground-level air is average annual. The results about the main pollutants, for which annual limit values have been specified, are given in **Table 5.1-7**.

TABLE 5.1-7 ANNUAL CONCENTRATIONS BEFORE AND AFTER THE CHANGES ARE IMPLEMENTED

Pollutant		Maximum concentration	At distance [m]	size	Average annual limit value (AALV)	Legislation
SO_X	**before**	1.80523	1 647.25	$\mu g/m^3$	**50** [1]	Ordinance No. 12/2010
	after	2.6031	1,296.44			
NO_X	**before**	10.31566	1,647.25		**40/ *26***	
	after	13.41934	1,296.44			
PM_{10} [2]	**before**	0.25789	1,647.25		**40/ *20***	
	after	0.43559	897.20			
CO	**before**	0.00516	1,647.25	mg/m^3	**none**	
	after	0.00587	1,496.22			
TOC		0.00026	697.91	mg/m^3	**no limit value**	
Pb		0.00280		$\mu g/m^3$	**0.5 / *0.25***	Ordinance No. 12/2010
Cd		1.32387		ng/m^3	**5 / *2***	Ordinance No. 11/2007
Ni		0.999905			**20 / *10***	
As		0.199981			**6 / *2.4***	
Cr		0.0015998		$\mu g/m^3$	**0.05**	Ordinance No. 14/1997
HF		0.00003		mg/m^3	**none**	
HCl		0.00026		mg/m^3	**none**	
Dioxin /Furans		0.00000267		ng/m^3	**no limit value**	

[1] Average annual value recommended by WHO

[2] The fraction of fine dust particulate matter is 100% of the total dust.

The granulometric content of lead dust is around and below 10 μm, therefore it is modelled with gravimetric deposition rate 0.01m/s.

The emissions of the elements given in **Table 5.1-7** have been determined based on the content of those nine metals in the RDF, obtained by Sofia Municipality, as given in **Таблица 5.1-8**.

ТАБЛИЦА 5.1-8 RDF COMPOSITION

Element	Unit of measure	Value
S	% w/w	<1.0
Cl	% w/w	<0.75
Hg	ppm	<0.6
Cd	ppm	<4.0
Tl	ppm	<1.0
Sb	ppm	<25
As	ppm	<5
Cr	ppm	<40

Element	Unit of measure	Value
Co	ppm	<6
Cu	ppm	<100
Pb	ppm	<70
Mn	ppm	<50
Ni	ppm	<25
V	ppm	<10
Sn	ppm	<30
Zn	ppm	<400
P2O5	% w/w	<0.3
PCBs	ppm	<50

The content of those nine metals in percentage (in red in **Таблица 5.1-8**), for which an emission limit (ELV) has been specified - **Table 2.4-3**,according to Annex 2 with art.22 (1) of Ordinance No. 4/2013 in flue gas is as follows:

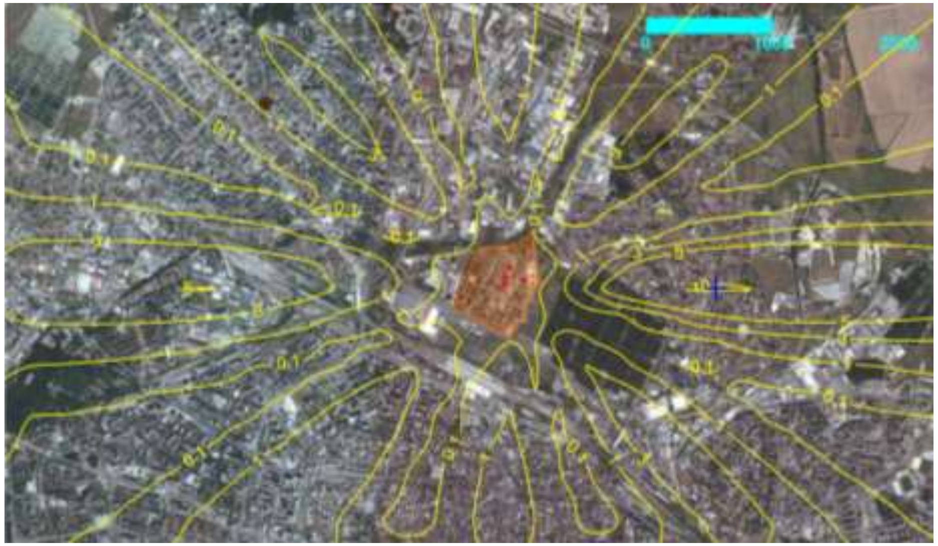
TABLE 5.1-9 CONTENT OF THE NINE METALS IN THE COMPOSITION OF RDF, IN PERCENTAGE

Sb	As	Cr	Co	Cu	Pb	Mn	Ni	V
7.6%	1.5%	12.1%	1.8%	30.2%	21.1%	15.1%	7.6%	3.0%

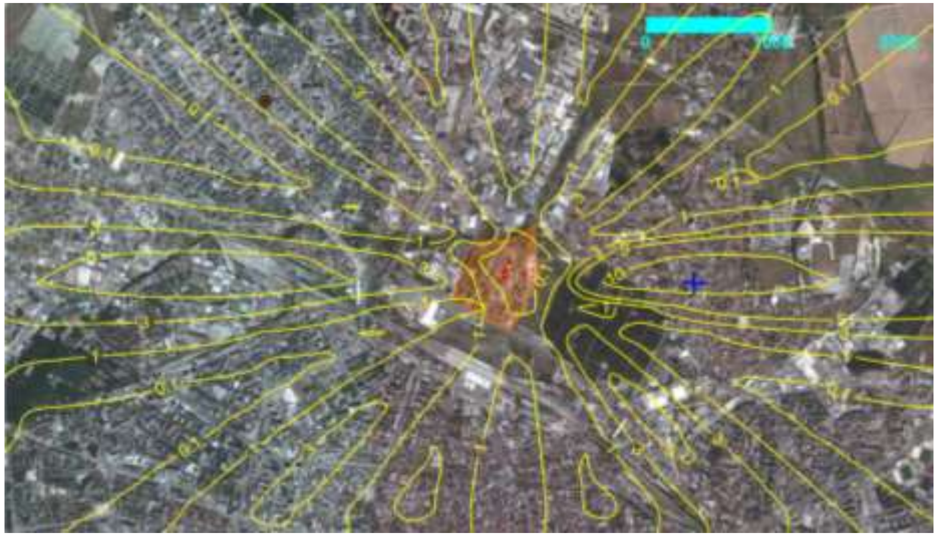
From **Table 5.1-7** it is evident that the average annual limit values (AALV) and lower threshold values are not exceeded for any of those pollutants both <u>BEFORE</u> and <u>AFTER</u> the IP implementation.

Figure 5.1-3 provides a comparison the annual areas of pollution with lead dust <u>BEFORE</u> and <u>AFTER</u> the changes are implemented. The area in orange ( ) shows the outlines of the plant, and the isolines are given in green ( ) for measure [mg/m^3].

<u>BEFORE</u> the changes	**<u>AFTER</u> the changes**



The maximum concentration is**10.31** mg/m^3,
which is 25.8 % of the AALV.



The maximum concentration is**13.42** mg/m^3,
which is 33.5.3 % of the AALV.

FIGURE 5.1-3 AVERAGE ANNUAL AREAS OF POLLUTION WITH NITROGEN OXIDES FROM THE OPERATION OF TPP SOFIA AT ROSE OF THE WIND IN 8 DIRECTIONS

Conclusion about the average annual pollution

The modelling of average annual pollution has been made at maximum discharge and maximum ELV in flue gas, and as the installed treatment installations ensure maximum purification and low concentrations in the exhaust gas, we can conclude that:

IN LONG-TERM ASPECT (average annual pollution) the ambient air quality will not be affected by the operation of TPP Sofia after commissioning of the cogeneration plant utilising RDF. No negative effect on the residential areas or the natural ecosystems in the region is expected.

5.1.2.1.2 TPP SOFIA-EAST

This section of the software provides standard (average annual) estimates of the expected concentrations by calculating the dispersion of harmful substances in the ground-level air.

Input data:

- *Input parameters of the model* – the area for which pollution is calculated is 9,800 x 5,800m (49 steps x 200 m in west-east direction and 29 steps x 200 m in north-south direction);
- *Weather conditions* – for the purposes of study the wind rose provided by the National Institute of Meteorology and Hydrology was used and average annual temperature 10.2°C – **Figure 4.1-2.**
- *Parameters of the source* – Modelling is made of all pollutants which will be emitted**AFTER** the changes are implemented, and their levels are compared to those resulting from the enterprise operation**BEFORE** the project is implemented, and reduced to the hours of operation of each source - **Table 5.1-6**.

Results:

As the average annual rose of wind was used for meteorological data, the resulting estimate of pollution in the ground-level air is average annual. The results about the main pollutants, for which annual limit values have been specified, are given in **Table 5.1-10**.

TABLE 5.1-10 ANNUAL CONCENTRATIONSBEFORE AND AFTER THE CHANGES ARE IMPLEMENTED

Pollutant		Maximum concentration	At distance [m]	size	Average annual limit value (AALV) Lower threshold value (LTV)	Legislation
SO_X	**before**	1.31263	1,651.35	**µg/m³**	**50** (1)	Ordinance No. 12/2010
	after	1.69149	1, 488.48			
NO_X	**before**	7.50073	1,651.35		**40/ *26***	
	after	8.95355	1,688.45			
PM_{10} (2)	**before**	0.25745	1,651.35		**40/ *20***	
	after	0.32387	1,488.48			
CO	**before**	0.00375	1,651.35	**mg/m³**	**none**	
	after	0.00411	1,688.45			
TOC		0.00022	712.23	**mg/m³**	**no limit value**	
Pb		0.00227		**µg/m³**	**0.5 / *0.25***	Ordinance No. 12/2010
Cd		1.07537		**ng/m³**	**5 / *2***	Ordinance No. 11/2007
Ni		0.812212			**20 / *10***	
As		0.162442			**6 / *2.4***	

Pollutant	Maximum concentration	At distance [m]	size	Average annual limit value (AALV) Lower threshold value (LTV)	Legislation
Cr	0.0013995		**µg/m^3**	**0.05**	Ordinance No. 14/1997
HF	0.00002		**mg/m^3**	**none**	
HCl	0.00022		**mg/m^3**	**none**	
Dioxin /Furans	0.0000023		**ng/m^3**	**no limit value**	

(1) Average annual value recommended by WHO

(2) The fraction of fine dust particulate matter is 100% of the total dust.

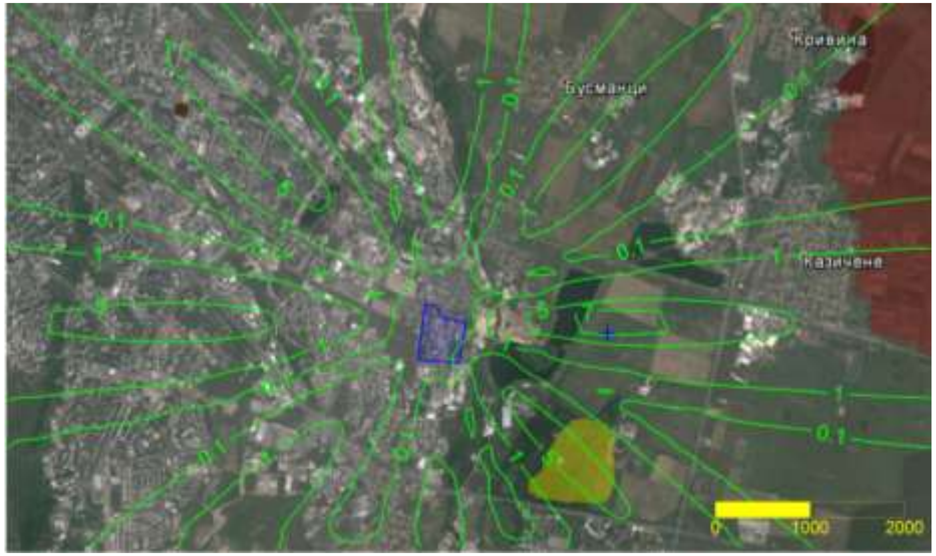
All pollutants <u>BEFORE</u> and <u>AFTER</u> the IP is implemented have values which do not exceed the respective annual limit values for ambient air quality and the lower threshold values.

Figure 5.1-4 provides a comparison the annual areas of pollution with nitrogen dioxide **BEFORE** and **AFTER** the investment proposal implementation. The area in orange ( ) shows the outlines of the plant, and the isolines are given in green ( ) for measure [µg/m^3]. The dot shows the location of automatic monitoring station (AMS) Druzhba for monitoring the ambient air quality, representative for the area of **TPP Sofia-East**.

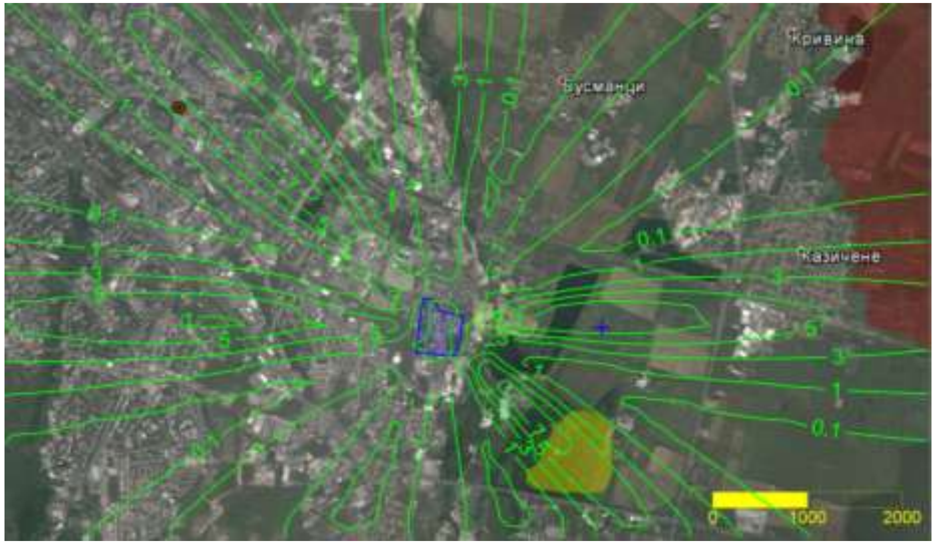
The figures below show to the east of **TPP Sofia-East (**marked in pale red**)** protected zone BG 0002004 **Dolni Bogrov-Kazichene** for conservation of wild birds, and to the south-east (in pale yellow) is the protected zone **Vrana** for protection of the habitats of rare and endangered plant and animal species, including yew and ilex, and conservation of the unique forest and unique park with remarkable landscape.

As seen from **Figure 5.1-4,** nitrogen oxides concentration both **BEFORE** and **AFTER** the IP implementation do not exceed the lower threshold value for protection of natural ecosystems - 19.5µg/m^3 and are within the range 0.1÷1 µg/m^3.

<u>BEFORE</u> the changes	**<u>AFTER</u> the changes**



The maximum concentration is**7.5** mg/m^3,
which is 18.8 % of the AALV.



The maximum concentration is**8.95** mg/m^3,
which is 22.4 % of the AALV.

FIGURE 5.1-4 AVERAGE ANNUAL AREAS OF POLLUTION WITH NITROGEN OXIDES FROM THE OPERATION OF TPP SOFIA-EAST WITH ROSE OF THE WIND IN 8 DIRECTIONS

Conclusion about the annual pollution

IN LONG-TERM ASPECT (average annual pollution) the ambient air quality will not be affected by the operation of TPP Sofia-East after commissioning of the cogeneration plant utilising RDF. No negative effect on the residential areas or the natural ecosystems in the region is expected.

5.1.2.2 MAXIMUM ONE-TIME CONCENTRATIONS IN MOST ADVERSE WEATHER CONDITIONS

A very important characteristic is the maximum possible pollution which can be estimated for given sources by inputting the maximum value of pollutants and the most adverse weather conditions in which it occurs. That is also the only pollution characteristic which can be estimated in case there is no meteorological data for a given area at all. By changing a set of meteorological parameters - wind speed for each of the eight standard directions, and the stability class (*A – highly unstable*, *B – moderately unstable*, *C – slightly unstable*, *D – neutral stratification*, *E – slightly stable* and *F – moderately stable*) the pollution area is calculated in order to determine its maximum characteristics with the respective meteorological parameters and wind speed.

5.1.2.2.1 TPP SOFIA

<u>*Input data:*</u>

- *Input parameters of the model* – the area for which pollution is calculated is 10,600 x 6,800m (53 steps x 200 m in west-east direction and 31 steps x 200 m in north-south direction);
- *Weather conditions* - the set of meteorological parameters, input in the code ofPLUME software, is such as to cover the entire range of possible variations of wind speed and the respective stability classes - **Table 5.1-11**.

TABLE 5.1-11 THE SET OF METEOROLOGICAL PARAMETERS

Wind speed [m/s]	Stability class
1	A , B
2.5	B , C , E
4	B , C , D , E
5.5	C , D
7	D

- *Parameters of the source* – the necessary parameters of the source are given in **Table 5.1-12**. The PLUME model takes into consideration the effects of thermal or mechanical rise of the stream (set in the software code) and as a result the physical height of the stack is increased to reach the so called effective height, which depends on and is directly proportional to the difference between the temperature of gases released from the stack and the ambient air temperature. Therefore the effective heights are lower for higher ambient air temperatures (summer temperatures) and consequently higher maximum values of the pollution. For that reason a temperature of 30°C.is set in the estimation.

TABLE 5.1-12 PARAMETERS OF THE SOURCES AND MAXIMUM EMISSIONS FOR TPP SOFIA

Stack No.	X*	Y*	H	D	T	Q	SO_2	NO_X	CO	Dust (PM_{10})	HCl	HF	TOC	Cd, Tl, Hg	Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	Dioxins and furans
	m				°C	Nm^3/s	**mg/s**	**mg/s**	**g/s**	**mg/s**	**g/s**	**g/s**	**g/s**	**mg/s**	**mg/s**	**µg/s**
S1	3,994.68	2,163.21	120	4.38	110	44.11	1,543.9	8,822.2	4.411	220.6						
S2	3,960.13	2,087.19	126	5.30	125	104.28	3,649.7	20,855.6	10.428	521.4						
S3	3,953.21	2,038.81	120	4.80	125	326.72	11,435.3	65,344.4	32.672	1,633.6						
S4	4,105.26	2,066.45	80	1.81	50	44.44	2,222.2	8,888.9	2.222	444.4	0.4444	0.0444	0.4444	2.22	22.22	0.0044

TABLE 5.1-13 PARAMETERS OF THE SOURCES AND MAXIMUM EMISSIONS FOR TPP SOFIA-EAST

Stack No.	X*	Y*	H	D	T	Q	SO_2	NO_X	CO	Dust (PM_{10})	HCl	HF	TOC	Cd, Tl, Hg	Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	Dioxins and furans
	m				°C	Nm^3/s	**mg/s**	**mg/s**	**g/s**	**mg/s**	**g/s**	**g/s**	**g/s**	**mg/s**	**mg/s**	**µg/s**
S1	4,637.10	2,229.92	125	5.80	120	528.00	18,480.0	105,600.0	52.800	2,640.0						
S2	4,665.09	2,341.88	125	5.80	130	336.00	11,760.0	67,200.0	33.600	1,680.0						
S3	4,739.74	2,323.22	120	5.44	90	315.00	11,025.0	63,000.0	31.500	1,575.0						
S4	4,758.40	2,379.20	120	5.44	80	315.00	11,025.0	63,000.0	31.500	1,575.0						
S5	4,711.75	2,173.93	80	1.81	50	44.44	2,222.2	8,888.9	2.222	444.4	0.4444	0.0444	0.4444	2.22	22.22	0.0044

Results

The results are summarised in **Table 5.1-14** .

TABLE 5.1-14 MAXIMUM ONE-TIME CONCENTRATIONS RESULTING FROM THE OPERATION OF TPP SOFIA

Pollutant		Maximum concentration	size	Weather conditions	Average hourly value (AHV) Lower threshold value (LTV)	Legislation
SO_X	**before**	13.76775	**µg/m³**	Wind speed 4 m/s; Wind direction 135; Stability class B	**350 / -**	Ordinance No. 12/2010
	after	19.4359		Wind speed 2.5 m/s; wind direction 225; Stability class B		
NO_X	**before**	78.67283		Wind speed 4 m/s; wind direction 135; Stability class B	**200 / *100***	
	after	97.02839		Wind speed 2.5 m/s; wind direction 225; Stability class B		
PM_{10} [(1)]	**before**	1.96687		Wind speed 4 m/s; wind direction 135; Stability class B	**none**	
	after	3.24415		Wind speed 2.5 m/s; wind direction 225; Stability class B		
CO	**before**	0.03934	**mg/m³**	Wind speed 4 m/s; wind direction 135; Stability class B	**10/ *5***	
	after	0.0427		Wind speed 4 m/s; wind direction 180; Stability class B		
Pb	0.028794		**µg/m³**	Wind speed 1m/s; wind direction 135; Stability class B	**none**	
Cd	13.61533		**ng/m³**		**none**	Ordinance No. 11/2007
Ni	10.28341				**none**	
As	2.056682				**none**	
Cr	0.016454		**µg/m³**		**none**	Ordinance No. 14/1997
HF	0.00027		**mg/m³**		**0.02*****	
HCl	0.00272				**0.2*****	
TOC	0.00272		**mg/m³**		**no limit value**	
Dioxins and furans	0.00003		**ng/m³**			

[(1)] The fraction of fine dust particulate matter is 100% of the total dust.

The granulometric content of lead dust is around and below 10 µm, therefore it is modelled with gravimetric deposition rate 0.01m/s.

From the table it is evident that the respective limit values of one-time concentrations for ambient air quality and the lower threshold values are exceeded neither BEFORE nor AFTER the IP implementation.

Conclusion about short-term pollution

The modelling of the maximum one-time pollution has been made with maximum release of gas and maximum emissions in the flue gas. It can be concluded that, provided a strict technological mode of the plant operation is ensured:

IN SHORT-TERM ASPECT (maximum one-time pollution) the operation of TPP Sofia, after the cogeneration plant utilizing RDF is commissioned, will not have an impact on the ambient air quality, provided the technological regime of the treatment and purification installations is observed, and there will be no negative effects on the populated areas or the ecosystems.

5.1.2.2.2 TPP SOFIA-EAST

Input data:

- *Input parameters of the model* – the area for which pollution is calculated is 9,800 x 5,800m (49 steps x 200 m in west-east direction and 29 steps x 200 m in north-south direction);
- *Weather conditions* - the set of meteorological parameters, input in the code ofPLUME software, is such as to cover the entire range of possible variations of wind speed and the respective stability classes - **Table 5.1-11**.
- *Parameters of the source* – the necessary parameters of the source are given in **Table 5.1-13**.

Results

Table 5.1-15 provides summarized results from the respective section of the pollutants software.

TABLE 5.1-15 MAXIMUM ONE-TIME CONCENTRATIONS RESULTING FROM THE OPERATION OF TPP SOFIA-EAST

Pollutant		Maximum concentration	size	Weather conditions	Average hourly value (AHV) Lower threshold value (LTV)	Legislation
SO_X	**before**	34.16345	**µg/m³**	Wind speed 4 m/s; wind direction 225; Stability class B	**350 / -**	Ordinance No. 12/2010
	after	37.9389				
NO_X	**before**	*195.21974*			**200 /** *100*	
	after	**210.32169**				
PM_{10} (1)	**before**	4.88049			**none**	
	after	5.63536				
CO	**before**	0.09761	**mg/m³**		**10/** *5*	
	after	0.10138				
Pb		0.027671	**µg/m³**	Wind speed 1m/s; wind direction 270; Stability class B	**none**	
Cd		13.08464	**ng/m³**		**none**	Ordinance No. 11/2007
Ni		9.882662			**none**	
As		1.976532			**none**	
Cr		0.015812	**µg/m³**		**none**	Ordinance No. 14/1997
HF		0.00026	**mg/m³**		**0.02*****	
HCl		0.00262			**0.2*****	
TOC		0.00262	**mg/m³**		**no limit value**	
Dioxins and furans		0.00003	**ng/m³**			

The granulometric content of lead dust is around and below 10 μm, therefore it is modelled with gravimetric deposition rate 0.01m/s.

From **Table 5.1-15** we can see that **BEFORE** the IP implementation nitrogen dioxide concentrations exceed the lower threshold value (LTV). **AFTER** the IP implementation nitrogen dioxide concentrations exceed the average hourly value.

Figure 5.1-5 shows the areas of maximum one-time pollution with nitrogen dioxide **BEFORE** and **AFTER** the IP implementation; the isolines are shown in light green ( ) for measure [μg/m^3]. The dot shows the location of automatic monitoring station (AMS) Druzhba for monitoring the ambient air quality, representative for the area of **TPP Sofia-East**.

The figures below show to the east of **TPP Sofia-East (**marked in pale red**)** protected zone BG 0002004 **Dolni Bogrov-Kazichene** for conservation of wild birds, and to the south-east (in pale yellow) is the protected zone **Vrana** for protection of the habitats of rare and endangered plant and animal species, including yew and ilex, and conservation of the unique forest and unique park with remarkable landscape.

As evident from **Figure 5.1-5,** the concentration of nitrogen oxides both **BEFORE** and **AFTER** the IP implementation in protected zone **Dolni Bogrov-Kazichene** is in the range 1÷5 μg/m^3, and protected zone **Vrana** is not affected..

BEFORE the changes	**AFTER** the changes

The maximum concentration is **195.2** mg/m^3,

The maximum concentration is **210.3** mg/m^3,

FIGURE 5.1-5 AREAS OF MAXIMUM ONE-TIME POLLUTION WITH NITROGEN DIOXIDE RESULTING FROM THE OPERATION OF TPP SOFIA-EAST

Conclusion about short-term pollution

The modelling of the maximum one-time pollution has been made with maximum release of gas and maximum emissions in the flue gas. It can be concluded that, provided a strict technological mode of the plant operation is ensured:

IN SHORT-TERM ASPECT (maximum one-time pollution) there can be a temporary negative local impact on the ambient air quality, resulting from the introduction of a cogeneration plant utilizing RDF at the site of TPP Sofia-East, but it will be far from residential areas.

Note:

Comparison between **Table 5.1-7** and **Table 5.1-10** shows that both BEFORE and AFTER the IP implementation the average annual concentrations resulting from the operation of TPP Sofia are higher than those resulting from the operation of TPP Sofia-East, but always remain below the AALV. The explanation is that the quantity of gas discharged from the stack of TPP Sofia are less, therefore the speed of exhaust gas is lower; consequently the effective height of discharge would be smaller, and that results in higher concentrations in the ground-level air in the area of TPP Sofia.

5.1.3 EVALUATION OF THE EXPECTED CHANGES IN THE AMBIENT AIR QUALITY IN THE AIR BASIN OF THE REGION

5.1.3.1 EVALUATION OF THE IMPACT OF THE AMBIENT AIR POLLUTION ON THE OTHER COMPONENTS AND FACTORS OF THE ENVIRONMENT. IMPACT SCALE

5.1.3.1.1 TPP SOFIA

From the investigation of the impact of the installations of **TPP Sofia** on the ambient air, resulting from building a cogeneration plant utilizing RDF at site "**B**“ we can conclude the following:

- *Lasting (or average annual) effect* - the site **will not** have **any lasting negative effect** on the ambient air as regards the considered pollutants. Provided the respective emission limit values in the flue gas of stacks are observed, the effect will be negligible and will not have any negative impact on populated areas or ecosystems.
- *Short-duration effect* - the site **will not** have **any short-duration effect** on the ambient air as regards the considered pollutants. Provided the respective emission limit values in the flue gas of stacks are observed, the effect will be negligible and will not have any negative impact on populated areas or ecosystems.
- *Cumulative effect* - the site **will not** cause any additional or maximum one-time load in the area under consideration, resulting from the operation of TPP Sofia.

In *annual* and *short-term aspect* the implementation of the project for a cogeneration plant utilising RDF at the site of TPP Sofia will not have a negative impact on the ambient air quality; the expected impact is acceptable both in local and in regional aspect.

5.1.3.1.2 TPP SOFIA-EAST

From the investigation of the impact of the installations of **TPP Sofia-East** on the ambient air, resulting from building a cogeneration plant utilizing RDF at site "**B**“ we can conclude the following:

- *Lasting (or average annual) effect* - the site **will not** have **any lasting negative effect** on the ambient air as regards the considered pollutants. Provided the respective emission limit values in the flue gas of stacks are observed, the effect will be negligible and will not have any negative impact on populated areas or ecosystems.
- *Short-duration effect* - the site **will not** have **any short-duration effect** on the ambient air as regards the considered pollutants. Provided the respective emission limit values in the flue gas of stacks are observed, the effect will be negligible and will not have any negative impact on populated areas or ecosystems.
- *Cumulative impact* - the site **can have a limited, local and transient negative impact** as regards maximum one-time concentrations of nitrogen oxides, in simultaneous operation of **TPP Sofia-East** and **Sofia Med AD** through its maximum discharge. Provided the respective emission limit values are observed concerning the flue gas of both enterprises' stacks, the effect will be small, far from populated areas, and will not have any negative impact on ecosystems.

Note:

The cumulative impact has been modelled for the maximum discharge considering the capacity of both enterprises according to their respective integrated permits. The annual reports of **TPP Sofia-East** and **Sofia Med AD** on the environment show that they do not reach those discharge levels, therefore a cumulative impact is unlikely.

In *annual aspect* the implementation of the project for a cogeneration plant utilising RDF at the site of TPP Sofia-East will not have a negative impact on the ambient air quality.

A *limited and transient local negative effect* is possible in short-term aspect, but its probability is low and its scale is minor.

The impact is acceptable in regional aspect.

5.2 SURFACE WATER AND GROUNDWATER

5.2.1 SURFACE WATER

No natural watercourses flow through any of the optional sites for the IP. The plots envisaged in the investment proposal fall within the following surface water areas[36] according to the first Danube Region Management Plan under the River Basin Management Plan of the Republic of Bulgaria (RBMP).

The main site - TPP Sofia (site B) is within the surface water body of a river within Iskar river valley, under the name Vladayska and code BG1IS500R010. The ecological status of the water body is very poor. The chemical status of the water body is very good.

The alternative site - TPP Sofia-East (site B) is within the surface water body within Iskar river valley, under the name Iskar and code BG1IS500R010. The ecological status of the water body is very poor. The chemical status of the water body is very good.

- ✓ Neither of the sites is within sanitary protected areas for drinking water from surface water bodies, according to art.119, paragraph 1, item 1 of the Water Act.
- ✓ Neither of the sites is within protected areas according to art.119a, paragraph 1, item 5 of the Water Act - protected areas and zones designated for the protection of habitats and

[36] DRBWMD letter Ref. No. 1552/15.11.2013

biological species where the maintenance or improvement of the condition of waters is an important factor in the protection thereof.

- ✓ Neither of the sites is within sanitary protected areas specified under Ordinance No.3 of 16.10.2000 on the conditions and procedure for research, design, approval and operation of the sanitary protections zones around water sources and installations for potable and household water supply and around mineral water sources used for treatment, preventive, potable and hygiene needs.

The main goal of RBMP is to achieve and maintain good condition of water in the Danube river basin under basing management until 2015.

The goals for protecting the environment and water bodies, and the areas under protection within which IP is, which the measures specified in EIAR need to take into consideration, and which have been envisaged for preventing and reducing the significant harmful effects on the environment (water) in the design and operation of the IP plant are as follows:

- ✓ For the surface water body under code BG1IS5000R010 the environmental goal is "Prevent deterioration of the ecological status, improvement to achieve good ecological status by 2027, maintain and improve the good chemical status".
- ✓ For the surface water body under code BG1IS135R026 the environmental goal is "Prevent deterioration of the ecological status, improvement to achieve moderate ecological status by 2021, maintain and improve the good chemical status".

For attaining those goals the RBMP includes sets of measures for preventing and reducing anthropogenic pressure (point pollution sources and diffuse pollution sources) and effects on water resources; monitoring and control measures, including measures concerning water protection zones.

EIAR specifies measures which have to be applied in implementing the investment proposal and which are envisaged in the programme itself, in line with the stand of the Basin Directorate, like:

7.1.5.2 Measures for emission control through prohibiting the discharge of pollutants from point sources, or requirements for issuing of permits and their regular review and updating as regards surface waters:

- → BG1MB052 – Review of the integrated permit and changing the emission limits set in it, or including of new emission limits in the conditions of the permit if the environment is polluted above the quality standards;
- → BG1MB070 – Prohibition on the disposal of waste, materials and substances which hamper the operation of the sewerage networks and of the local treatment plants;
- → BG1MB071 – Control on the persons operating the sewerage networks of cities and villages and on the users for observing the permits for discharging of waste water in the sewerage networks and

7.1.6. Measures prohibiting the introduction of pollutants from diffuse sources of pollution and measures for pollution prevention or control:

- → BG1MB098 – Prohibition on abandoning, non-regulated dumping and burning out, or any other form of uncontrolled waste disposal;
- → BG1MS033 – Applying of industry standards for environmental management and protection.

The investment proposal is in implementation of measure BG1MS014, which requires optimization.

5.2.1.1 DURING CONSTRUCTION

Two alternative sites are considered in the investment proposal of Toplofikatsia Sofia EAD for a cogeneration plant utilising RDF for the plant's location: sire B of TPP Sofia, of area approximately 15 daa, and site B in the territory of TPP Sofia-East, of area approximately 20 daa.

The plant will comprise the following main systems and buildings: A combustion chamber with a radiation and a semi-radiation section as well as a convection heat exchange section / horizontal boiler; a heat accumulator; a turbine/generator - condensers / water stems cycle; ancillary equipment; electric systems; monitoring and control system; main production and administration building; bottom ash storehouse; tanks for diesel generator fuel and for ammonia water; electronic scales and a transport area. The built-up area of the main production and administration building will be 5,345 m^2. It is envisaged that the entire ground outside the building, of area around 10,370 m^2, will be covered with concrete pavement.

Due to the location of the two alternative sites no surface water bodies will be affected by the construction.

The necessary drinking water will be supplied through the existing water supply network of the TPP. In the following design phase the necessary quantity of drinking water for the needs of employees will be determined more precisely as well as the quantity of relatively clean water necessary for the construction operations, which will be performed according to the type and manner of the construction and installation works at the site. Relatively clean water, necessary in "wet"construction processes, will also be supplied through the relatively clean water supply network of the TPP. Portable chemical toilets can be ensured for the workers for the period of construction.

No changes in the water resources, resulting from water abstraction or waste water discharge, are expected during the construction and installation works.

- **Impact scope** - the impact is indirect, negative, low, and limited if the regulatory requirements are observed and the envisaged measured are taken.
- **Impact characteristics** - the impact is temporary, short-term (only for the period of construction) and without a cumulative effect, regional, and reversible after the end of the construction.

5.2.1.2 DURING PLANT OPERATION

Drinking water will be used in the new installation, supplied through tapping of the internal water supply system of TPP Sofia/ TPP Sofia-East connected to the city water supply system, as well as industrial water supplied through tapping of the industrial water main..

No new water-main construction is necessary, apart from branching to the new installation site and building from the existing water supply piping. The new installation utilizing RDF itself will have an established water balance with waste water cycle (a cycle between the cooler before the wet scrubber and the condensing stage after it).

The water for the installation will be prepared by means of a reverse osmosis system operating with output 1.2 m^3/h, of which 1.0 m^3/h will be used for feedwater for the boiler, and the other 0.2 m3/h - for process water (fed in to the cooling stage before the wet scrubber and into the semi-dry stage for moistening the hydrated lime or cooling the flue gas.

External source water includes feed water for the heating network and initial starting of the water network of the new installation.

The quantity of **added fresh water** necessary for the installation is 3.4 m^3/h, of which

- ✓ water for the nitrogen oxides removal system (NOx) – selective non-catalytic reduction (SNCR) – 0.6 m^3/h;
- ✓ additional process water – 1.6 m^3/h;
- ✓ feed water for the installation (preparation of water for the boiler) – 1.2 m^3/h.

Water which will be provided by the condenser (6.7 m^3/h), residual water (feed water) after water treatment (0.2 m^3/h) will be used as:

- - water for moistening of flue gas – 2.1 m^3/h;
- - water for the cooling stage before the scrubber - 6.4 m^3/h.

The tank water quantities of lower quality, which will be derived from the installation (the boiler) will be used for moistening the bottom ash – 0.9 m^3/h.

The water circulating in a cycle between the cooler before the wet scrubber and the condensing stage after it will also be used in the plant operation.

According to design data the industrial **water consumption** (m^3/t of utilized RDF) will be:

- → water for the nitrogen oxides removal system (NOx) – 0.027 m^3/t RDF;
- → additional process water – 0.071 m^3/t RDF;
- → feed water for the installation (water for the boiler) – 0. 53 m^3/t RDF.

Total 0.151 m^3/t RDF or 27,200 m^3/y added fresh water for 8,000 hours operation of the plant per year and utilized 180,000 t RDF.

To ensure filling the process water reservoir of the installation a water conduit is envisaged, water to which will be supplied from the conduit, existing in the site, supplying water for process needs and fire-extinguishing needs: Ø600, pressure 6 atm.

The process water conduit has to have 20 m^3/h– 5.55 l/s capacity. The drinking water supply for the needs of the plant's staff (30 persons) will be around 1.35 $m^3/24$ hours or 0.742 l/s .[37]

According to the regulations the necessary quantity of water for outdoor fire extinguishing is 25 l/s, and for indoor fire extinguishing - 5 l/s. That water will be supplied through a high-pressure water pipeline (a derivation of the existing pipeline for water for industrial purposes and fire extinguishing - Ø600, pressure 6 atm)[38]. According to art.190 of Ordinance Iз-1971 of 29 October 2009 on the engineering and technical rules and norms for ensuring fire safety, with its amendments in force as of August 2013, a redundant supply is required, and each of the two conduits shall have capacity to supply independently all the necessary quantity of water for fire extinguishing purposes.

A ring of 6 dual-head fire hydrants (2x10 l/s), overground, is envisaged around the building for providing outdoor fire extinguishing. The indoor fire extinguishing installation will comprise: a ring of 4 indoor fire hydrants at level ±0.00; vertical branches in each stairwell, and indoor fire hydrants are envisaged at each storey level.

It is envisaged that **the sewerage system** of the cogeneration plant site will comprise two separate sections: one for blackwater/sewage and rainwater, which will not be regenerated, and one for industrial waste water. A separate branch for process waste water has been built in the territory of TPP Sofia, but there is no special rainwater drainage system. There is no separate rainwater drainage system within TPP Sofia-East site either, and the main part of the system is common for rainwater and for blackwater/sewage.

The conditions and requirements for the construction and operation of installations for incineration and of installations for co-incineration of waste envisage that the water from fire extinguishing is

[37] Ordinance No.4 on the design, construction and operation of water supply and sewerage systems of buildings, 2005.

[38] Ordinance Iз-1971 of 29 October 2009 on the engineering and technical rules and norms for ensuring fire safety, and its amendments in force as of August 2013.

collected. According to the IP such water will be discharged into a buffer tank of 70 m^3 capacity. Waste water from fire extinguishing, collected in the buffer tank, will be transported by a tank truck to the local industrial waste water treatment plant of the respective TPP.

The water drained from the boiler (120 m^3) and the deaerator (50 m^3) will be transported by a tank truck to the local industrial waste water treatment plant of the respective TPP. In case needed, a portion of that water (about 40 %) can be led to the buffer tank for temporary storage. The system for collecting waste water from fire extinguishing will be developed in details in the following stage of the project.

Discharge only of blackwater/sewage is envisaged, and the expected discharge is about 1.2 m^3/d or 4.53 l/s. Blackwater/sewage will will be discharged into the existing sewage system of the site and led to the waste water treatment plant of Sofia city (CWWTP Kubratovo). Part of the site rainwater (from the roof of the administration building and from three site drains) will also be discharged into the sewage system of the site. The maximum water quantity is about 103.5 l/s (at maximum rainfall 355 l/s /ha - zone I). It is envisaged that the remaining rainwater quantities (from the building and from 10 drains of the site) will be discharged into the existing street drainage system. The maximum water quantity is as follows:

- branch I - about 210.0 l/s
- branch II - about 240.0 l/s (maximum rainwater quantity).

The flue gas, generated in the plant's production process, will be purified by means of additional treatment installations so that it reaches the limit values and corresponds to the BAT. The technology suggested in the IP is a **combination of dry and wet cleaning with blowing in of hydrated lime and activated carbon (semi-dry) followed by wet scrubber with condensation** *That method makes it possible to reuse in the process all the resulting water so it will not be necessary to discharge waste water into surface water bodies and/or in the city's sewerage system (CWWTP). The semi-dry flue gas purification system and the accessory systems will be such that recirculation will be applied and* ***no waste water will be generated****.*

Other flue gas purification methods, like for example wet purification, generate waste water which would require building of installations for its treatment before discharging it into a water body or into the city's sewerage system.

According to the investment proposal the installation will be equipped with a combined dry-wet (semi-wet) system for flue gas cleaning with sleeve filters after a reactor for injection of hydrated lime and activated carbon . The reason for choosing a dry-wet system for flue gas purification is to optimize the economic efficiency of the installation for its entire service life. Furthermore a dry-wet system enables avoiding problems with waste water as waste water treatment and/or discharge is not necessary. The combined dry-wet system for flue gas purification is relatively simple; it requires a wet scrubber for additional cleaning, which removes most of the residual acid gases (HCl, HF and SO_2) remaining after absorption. Thus the consumption of hydrated lime in the reactor will be limited and consequently the amount of dry residue will be reduced. Fine dust particles, which have absorbed heavy metals and have not been eliminated by the filter, will be eliminated here due to the low pH value of the water solution in the scrubber. The purpose of flue gas condensation after the scrubber is to recover heat by transferring the heat from condensation of water vapour in the flue gas to the heating system. The condenser stage will be installed at the end of the chain of treatment installations and will be the last component of the wet cleaning phase.

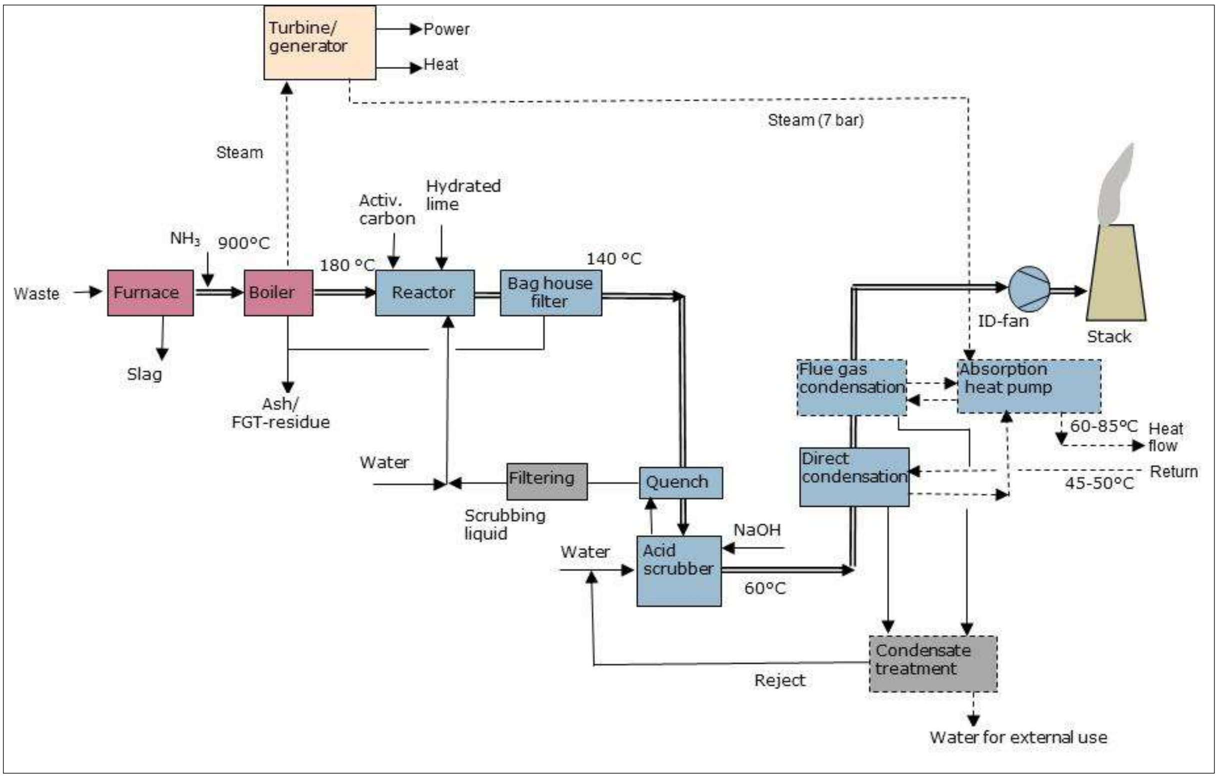


FIGURE 5.2-1 TECHNOLOGY BLOCK DIAGRAM OF PURIFICATION EQUIPMENT (COMBINED DRY-WET SYSTEM WITH CONDENSATION) OF THE RDF UTILIZATION PLANT

At the scrubber inlet water is sprinkled in for cooling the flue gas, and the resulting liquid flowing out of the scrubber is used in the semi-dry stage for moistening the hydrated lime or cooling the flue gas; there it is evaporated. In addition the scrubber makes it possible to utilize the condensation heat present in flue gas, which also further increases the overall plant efficiency.

In **Figure 5.2-1** it can be seen that the technology does not involve generation of industrial waste water.

Figure 5.2-2 below shows the water balance of the installation, which is accomplished by virtue of some specific technological solutions:

→ **Forming a closed water cycle around the wet scrubber** - the water pumped from the bottom of the scrubber is fed to the cooling stage and the semi-dry stage;
  - A semi-wet flue-gas purification system has been adopted, which does not generate any waste water or sediments. A portion of the spent absorption solution flowing out of the wet scrubber will be used in the semi-dry stage for moistening the hydrated lime or the flue gas.
  - In order to maintain the quality of the water for the boiler in the water/steam cycle, smaller quantities of water (compared to the overall quantity) will be discharged from the boiler drum to a water tank.

→ **A portion of the water for technological needs** will be provided through condensation after the wet scrubber by generation of condensate, which after purification will be used as feedwater for the heating network or the boiler; about 25 % of the water from that process will be collected in a water tank. The drainage pipes of the buildings also discharge water into the water tank.
  - The lower-quality water from the tank will be used for moistening the bottom ash, and can - within certain limits - also be used in the flue gas treatment system. Thus waste water will not have to be treated beyond the installation.

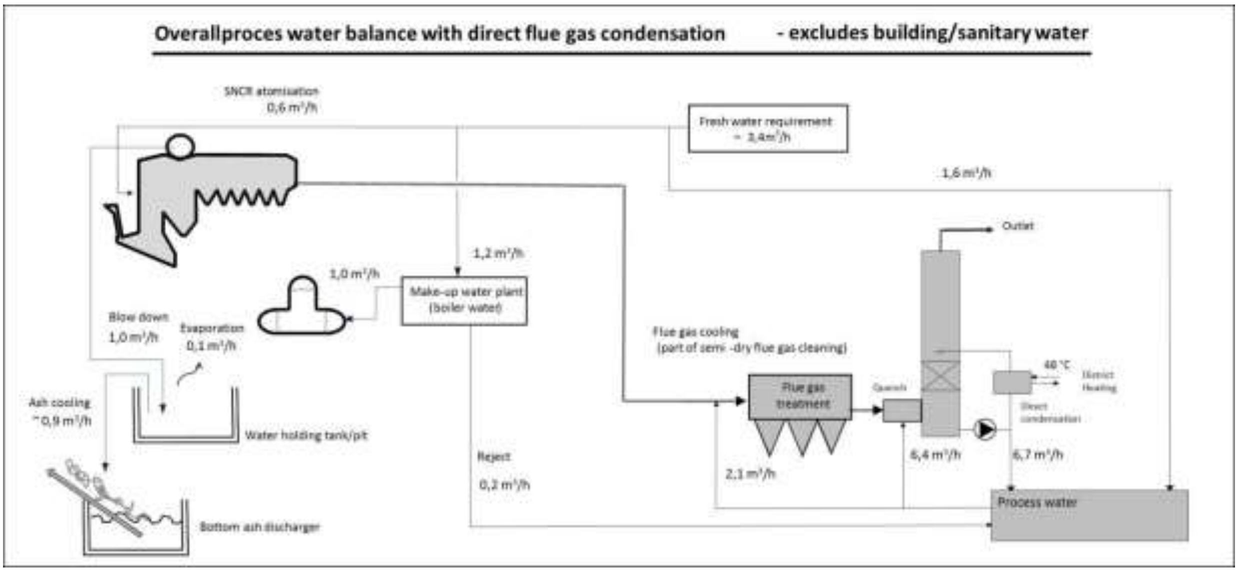


FIGURE 5.2-2 EXPECTED WATER BALANCE OF THE COGENERATION PLANT UTILIZING RDF, ONLY WITH DIRECT FLUE GAS CONDENSATION

In order to maintain the quality of the water for the boiler in the water/steam cycle, smaller quantities of water (compared to the overall quantity) will be discharged from the boiler drum to a water tank. New water will be generated from fresh water in the feedwater installation (or condensate from flue gas).

Approximately 25 % of water in that process will be discharged into a water tank, and the drainage pipes of the buildings will also discharge into the water tank.

The lower-quality water from the tank will be used for moistening the bottom ash, and can - within certain limits - also be used in the flue gas treatment system. Thus waste water will not have to be treated beyond the installation. As a result of direct condensation no excess water will be generated; the envisaged return temperature to the heat transmission network is 48°C.

Conclusion

The selected "semi-wet"technology for flue gas purification with recirculation, and the selection of the other accessory systems be such that no waste water will be generated. The technological solutions described above and the envisaged recirculation are a better solution than those described in the BAT requirements regarding generated waste water (*m. 3.3.1 Volumes of waste waters arising from flue-gas treatment of BREF Code WI)* due to the following specifics:

- Building a closed water cycle around the wet scrubber (compliance with section 4.5.4. of Re-circulation of polluted waste water in wet gas cleaning systems of BREF Code WI);
- The adopted semi-wet flue-gas purification system, which does not generate any waste water or sediments. A portion of the spent absorption solution flowing out of the wet scrubber will be used in the semi-dry stage for moistening the hydrated lime or the flue gas (compliance with *4.5.14 Evaporation of wet scrubber effluent in the incineration process of BREF Code WI*);
- In order to maintain the quality of the water for the boiler in the water/steam cycle, smaller quantities of water (compared to the overall quantity) will be discharged from the boiler drum to a water tank.
- A portion of the water for technological needs will be provided through condensation after the wet scrubber by generation of condensate, which after purification will be used as feedwater for the heating network or the boiler; about 25 % of the water from that process will be collected in

a water tank (compliance with *4.5.5 Additional cooling of feed water of wet gas cleaning systems of BREF Code WI*). The drainage pipes of the buildings also discharge water into the water tank. (compliance with *section* 4.5.9 Separate discharge of rainwater from roofs and other clean surfaces *of BREF Code WI);*

- The lower-quality water from the tank will be used for moistening the bottom ash, and can - within certain limits - also be used in the flue gas treatment system.

5.2.1.3 DECOMMISSIONING

According to the IP the options for decommissioning the plant installations are:

- Conservation of the building and dismantling part of the equipment;
- Dismantling and removal of all the equipment;
- Clearing of the site;
- Recovery of the ground base and soil recultivation.

It is envisaged that the plant will operate for 30 years. Before starting the decommissioning process, the most appropriate method will be selected based on the actual knowledge, the decommissioning project, and the decisions which will be made. That phase will also be subject to environmental impact assessment.

Monitoring the environment parameters connected with post-operation maintenance of the plant site will be performed according to the Plant Control and Monitoring Plan, which is an integral part of the integrated permit.

5.2.1.4 CONCLUSION

During the operation the waste water will not affect the ecological condition of the region. No irreversible negative impact on the environment is expected.

Scope of the impact - local.

Type of the impact - indirect, negative, low. A negative impact could be expected if the technological regulations and regulatory requirements are not observed, or as a result of emergency discharge in case of accidents.

Impact characteristics - the impact is continuous, long-term, without a cumulative effect, and reversible

5.2.2 GROUNDWATER

5.2.2.1 DURING CONSTRUCTION

The chemical and quantitative state of the groundwater body "Pore water in the Neogene-Quaternary layer - Sofia valley", code BG1G00000NQ030, in the area of the investment proposal site, which is within the urbanized environment of Sofia city, has obviously been influenced in the past by the construction and operation of TPP Sofia and TPP Sofia-East and by the water abstraction, which has been performed through tube wells. The results from the own monitoring of the two sites show that the concentration of iron and of oil products in groundwater, as well as of sulphates in the site of TPP Sofia, are higher than the standard ones.

The implementation of the investment proposal will impact both the quantitative and the chemical state of the groundwater body. The effect on the quantitative state will result from the need to drain the pits excavated in the construction process for the foundations and the construction of the planned buildings and installations, below the static level, especially of the pit for the RDF storage bunker, approximately 13 m deep. That will consist in leading away (pumping out) the groundwater seeping from the aquifer sand layers and bands in the slopes and the bottom of the excavated pits.

That effect will be negative, direct, short-term, temporary and reversible, with limited territorial scope, within the created temporary impact zone. It is evaluated as negligible, because the amount of water pumped out is expected to be quite small compared the available resources of the groundwater body.

The effect on the chemical state might consist in infiltration of polluted rainwater or groundwater (chiefly with mechanical impurities), generated in the levelling of the site, in the excavation works, concrete-laying and other works for making the foundations and constructing the respective buildings and installations. That effect will be negative, indirect, short-term, temporary and irreversible, with limited territorial scope, within the created temporary impact zone. The effect is evaluated as negligible, as the quantity of polluted water infiltrated in the course of construction will be small, and practically it will not contain harmful and dangerous substances.

5.2.2.2 DURING PLANT OPERATION

The investment proposal does not envisage using groundwater for drinking and household needs, for industrial or any other needs, therefore during normal operation no impact is expected on the quantitative state of the groundwater body "Pore water in the Neogene-Quaternary layer - Sofia valley", code BG1G00000NQ030.

The investment proposal does not envisage generation and discharge of industrial waste water, and the generated quantities of household waste water as well as a part of the rainwater will be discharged into the existing sewerage system. That circumstance excludes any impact on the chemical state of groundwater in normal operation. Only failures in the sewerage system, spills of oil products or other dangerous substances in road accidents are preconditions which could result in infiltration of pollutants into the groundwater. Such an impact on the chemical state of the groundwater body "Pore water in the Neogene-Quaternary layer - Sofia valley", code BG1G00000NQ030, if it occurs, would be negative, indirect, temporary and of short duration, irreversible, with limited territorial scope in the area of the accident.

5.2.2.3 DECOMMISSIONING

5.2.2.4 CONCLUSION

The impact on the quantitative and chemical state of of groundwater during the construction and operation is not cumulative because of the fact that it will be limited within the investment proposal site and in its immediate vicinity, without any effect on the parameters of water abstraction from other water abstraction installations, allowed in accordance with the Water Act, and will not result in any changes in the present quality of groundwater.

5.3 GEOLOGICAL AND HYDROLOGICAL ENVIRONMENT AND THE BOWELS OF THE EARTH

5.3.1 EVALUATION OF THE POSSIBLE CHANGES IN THE GEOLOGICAL AND HYDROLOGICAL ENVIRONMENT RESULTING FROM THE INVESTMENT PROPOSAL IMPLEMENTATION

5.3.1.1 DURING CONSTRUCTION

The construction envisaged by the investment proposal will objectively involve a negative, direct, long-term, permanent and irreversible mechanical breaking of the bowels of the earth, including some of the aquifer sand layers and bands. It will result from the transportation and construction works, which include excavation and disposal of approximately 60,000 m^3 earth mass from depth between 2-4 m and about 13 m, integrated construction works, transportation of earth, building materials and equipment. That impact will be limited within the investment proposal site and because of that it is evaluated as minor.

Apart from mechanical disruption, there is a potential risk that the bowels of the earth and groundwater in them are negligibly polluted with solid construction waste, spills of oil products from vehicles and construction equipment, etc. Such an impact, if allowed, would be negative, short-term, temporary and reversible. Its scope would be limited - within the territory of the site and the area in the immediate vicinity of it.

The impact on the bowels of the earth during construction will not be cumulative as it will be limited within the investment proposal site and in its immediate vicinity.

5.3.1.2 DURING PLANT OPERATION

Provided the envisaged technical solutions and the recommendations given in this EIAR are observed, the probability of harming/polluting the bowels of the earth during normal operation is excluded.

5.4 EARTH AND SOILS

5.4.1 SCALE OF NEGATIVE EFFECTS ON THE EARTH AND SOILS AND IMPACT ASSESSMENT. TPP SOFIA SITE

Changes in the parameters of the anthropogenized soils will occur during construction for the investment proposal with earth works, which could affect the hydrological conditions as groundwater is not very deep.

In summary we can say that the following main parameters of the soils at the site will be affected:

- Density, filtration properties, water regime (those parameters are not good at present either);
- A portion of the soil layer under the buildings and installations will be removed as well as in depth into the soil and into the geological base, in order to make the foundations of the buildings.

The data from analysing the soils around the two sites shows that the pollution of the soils resulting from the impact of TPP Sofia, TPP Sofia-East and other industrial enterprises is mostly from the period of the plants' operation. The soils in the immediate vicinity of the industrial area are polluted to a higher degree. However presence of metals in quantities significantly exceeding the background ones at over 2 km distance can be found only in prevailing salient windy weather, which is not most typical for that region. Because of that our opinion is that the pollution in the areas at a distance from the power plants is complex and a very small portion of it is due precisely to the operation of TPP Sofia and TPP Sofia-East.

Both suggested sites for the IP implementation are in the territory of the two TPPs, which has already been subjected to anthropogenic influence. The grounds suggested for locating the plant and the auxiliary equipment will be covered with concrete pavement.

5.4.2 ASSESSMENT OF THE IMPACT OF THE INVESTMENT PROPOSAL ON THE LAND AND SOILS

The data about pollution of the soils in the areas of the two TPPs give a picture, based on which the future monitoring will show the impact of the cogeneration plant utilizing RDF. The description of the installation and the production process technology give reasons for prognosticating that the negative impact on the land and soils can be minimised.

5.4.2.1 IMPACT ON THE LAND AND SOILS DURING THE CONSTRUCTION

The effect on the land and soils during construction will be chiefly physical - resulting from earth works and construction works in the construction of buildings and installations for the plant's functioning.

It is envisaged that excavation works of estimated volume about 18,000 m^3 (soil and stones) will be carried out. Waste from the construction and excavation works under code 17 05 04 - soil and stones (not containing dangerous substances) will be generated in making the foundations of buildings, the parking places and the internal roads. If humus is available, it will be removed and stored separately from the other earth, and will later be used in the planting of the area.

The construction works will generate also construction waste, of the following codes: 17 01 01 - concrete; 17 04 05 - metals including their alloys; 17 09 04 - mixed construction and demolition wastes; 20 03 01 - mixed municipal waste generated during construction and site preparation. The construction waste and excess soil will be disposed in the respective landfill, after coordination with Serdika district municipality for TPP Sofia, or with Iskar district municipality - for TPP Sofia-East.

In summary we can conclude that the plant's construction will have effects chiefly on the existing site. Those effects comprise earth works, construction, compressing the unpaved areas by the concentration of construction equipment and materials, littering.

If the earth works are carried out in early spring there is a risk that the building site is flooded by higher groundwater, which will be polluted by toxic materials from the site and could be an obstacle for the construction (especially in the area of TPP Sofia-East, which is near Iskar river, and its water level is strongly influenced by the weather conditions). That is why strict control for the depth of excavation works is necessary. Excavating a pit deeper than 5 m shall not be allowed in that period; at the same time such a pit should enable making robust foundations and ensuring stability of the future installations and buildings.

The neighbouring terrains will be polluted by the traffic of loading and load carrying machinery and possible scattering of construction waste. A good organisation can considerably restrict such pollution.

5.4.2.2 IMPACT ON THE LAND AND SOILS DURING OPERATION

The effects on the land and soils during operation of the plant, envisaged in the IP, will be also chiefly within the production site. Considering the technology of the installations operation, pollution through aerosols and water can be expected as well as resulting from direct disposal of toxic and non-toxic waste on the site ground.

Toplofikatsia Sofia (TS) intends to use RDF (modified fuel) derived from municipal waste, with the purpose of changing the fuel base for energy production by substituting natural gas and improving the efficiency of thermal energy production.

The plant will have one incineration line with capacity to process 180,000 t of RDF per year, equal to 22.5 t of RDF per hour. The nominal calorific value of the supplied RDF - Cvnom is 13 GJ/t, ranging between 12 GJ/t and 14 GJ/t. The plant comprises the following main systems:
A combustion chamber / boiler;

- A flue gas cleaning system;
- A turbine / generator;
- Accessory equipment;
- Electric systems;
- A monitoring and control system;
- Construction works.

The above systems and their operation will generate, at lower or higher degree, pollution of the soils in the area. First of all we have to point out that most of the soils in the territory of the two power plants - TPP Sofia and TPP Sofia-East - are covered by pavements impermeable to water, with buildings and installations. The internal green areas of the enterprise are made on a small portion of the soils. Those green areas take most of the generated pollutants spreading through the air, surface water and waste.

The pollution of the soils in the area around the TPPs will be mostly through air pollutants and waste and less through water.

The cogeneration plant utilizing RDF will have a combined dry/wet (semi-wet) system for flue gas cleaning with sleeve filters, and with injection of activated carbon and hydrated lime.

Before discharging the flue gas, the pollutants content in it will be continuously monitored by means a control station, for example content of CO, NO_X, HCl, SO_2, particulate matter, TOC, NH_3 and possible HF. The following additional parameters will also be measured: the rate of flue gas discharge, temperature, pressure, moisture content, content of oxygen and CO_2.

A dry or semi-wet system of flue gas cleaning generates dry residue, which has to be discharged in a landfill for hazardous waste.

According to the data provided by the investor the expected normal emissions in the discharged gas, within the limit values, will be mainly: - nitrogen oxides reduced to NO_2 - 200 mg/Nm^3; - sulphur oxides reduced to SO2 - 50 mg/Nm^3; - carbon oxide CO - 250 mg/Nm^3; - total dust (PM10) - 10 mg/Nm^3; - total organic carbon (TOC) - 10 mg/Nm^3; hydrogen chloride (HCl)- 10 mg/Nm^3; - hydrogen fluoride (HF) - 1 mg/Nm3; - cadmium and thallium (Cd, Tl) - 0.05 mg/Nm^3; mercury (Hg) - 0.05 mg/Nm^3; - total of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V - 0.5 mg/Nm^3; - dioxins and furans (TEQ) - 0.1 mg/Nm^3.

5.4.2.3 *IMPACT ON THE LAND AND SOILS OF THE PLANT DECOMMISSIONING*

The plant under the investment project will operate all year round and is designed to have 30 years service life with continuous renovation. When the plant under the investment proposal is decommissioned its equipment has to be dismantled and sold for reuse or as scrap. The plant will occupy a small part of the production site area therefore step-by-step activities will be necessary for cleaning, waste treatment in accordance with Bulgarian legislation, recultivation and planting of the free grounds.

Considering the plant capacity, the quantity (according to design) of generated gaseous, liquid and solid pollutants, whose concentrations and discharge comply both with the best available techniques and technologies and with the norms according to Bulgarian legislation, the negative impact on the land and soils can be minimized.

5.4.2.4 *IMPACT ON THE LAND AND SOILS IN EMERGENCY SITUATIONS*

Emergency situations are fires, floods, etc.

In case of fire effects can be expected mostly on the soils of the production site itself - covering it with waste from the fire, surface contamination with fire extinguishing chemicals or soot and gas products, which would settle on them. Fires could start as a result of ignition of the raw material - combustible waste, or in the combustion processes in the installation itself. The pollution of the neighbouring land by aerosols would be similar but to a lower extent.

The pollution would be negative, short-lasting as an occurrence, cumulative (there are also other plants nearby) and long-lasting as regards the time of impact.

In case of flood the land and soils would be considerably polluted from spreading of waste, raw materials, substances, etc. which are used in the technological cycle. Such an impact would be negative, short-lasting as an occurrence, cumulative (there are also other plants nearby) and long-lasting as regards the time of impact - on the soils both within the site and in the neighbouring terrains. Besides, there would be a highly negative impact on the water and soils at a greater distance downstream Iskar river. That is why it is necessary to reinforce and cement the entire site of the installation, to lead the water from its surface into the respective sewerage system, and to maintain the drainage shafts always in perfect condition.

In case of military operations the plant shall stop operating, and all toxic products and dangerous substances shall be properly and safely stored under absolutely strict control.

5.4.2.5 CROSS-BORDER IMPACTS

No cross-border impacts on the soils are expected.

5.4.2.6 FINDINGS AND CONCLUSIONS

The investment proposal project will be implemented in approximately 2 ha area, in the existing grounds of TPP Sofia or TPP Sofia-East. Those activities are economically justified but it is necessary to perform the environmental protection activities in a professional, carefully considered manner, and taking all precautions for protecting the environment. Thus the plant operation can be integrated into a sustainable ecosystem close to other enterprise systems and to the residential districts.

In conclusion we can say that in the period of the plant construction, operation and decommissioning the impact on that component of the environment will be:

Territorial scope of the impact: local - affecting the occupied area. However there is a risk of impact resulting from spreading of waste materials into the neighbouring land, during transportation of such materials to the plant, but if there is strict control and effective management that can be avoided.

Type of impact: limited, provided the requirements of the technology processes are observed in compliance with the standards.

Extent of impact - negligible.

Impact duration - for the period of operation, the period of the plant functioning. The released quantities of dust and gas - nitrogen oxides, sulphur oxides and carbon oxides - will depend on the normal plant operation and the discipline in the operating activities. It is unlikely that dust from the waste transportation reaches the agricultural land. Although the requirement that the trucks shall be covered with canvas, their traffic will have some effect on the land adjacent to the roads.

Frequency of the impact - transitory.

Cumulative and synergistic effects on the environment: Practically there will be no effects on the environment resulting from the normal operation of the RDF utilization plant. If the plant operates normally, the level of impact would be negligible. No dusting of the soils is expected. It is necessary to observe the weather and the maintenance of road traffic, and to regularly sprinkle the internal roads of the enterprise so that no dust is carried away in the air or tramped into adjacent lands.

Taking into consideration the following:

- The plant location - at the site of TPP Sofia or of TPP Sofa-East, which are in industrial areas;
- The distance by road from the site of the MBT plant in Yana village, Sadinata area, to one and to the other of the TPP sites,

We can conclude that the impact on the land and soils will be lower if the site of TPP Sofia (B) is used, as the distance for transportation by road to that site is shorter. Therefore the site of TPP Sofia (B) is more suitable for the construction of a cogeneration plant utilizing RDF.

5.4.3 DESCRIPTION OF THE POTENTIAL CUMULATIVE EFFECTS RESULTING FROM THE IMPLEMENTATION OF THE INVESTMENT PROPOSAL AND OF OTHER EXISTING ENTERPRISES OR INVESTMENT INTENTIONS WITHIN THE SITE AND WITHIN THE AREA OF THE PROJECT

Type of impact of the investment proposal:

Positive - after closing down and recultivation; Negative - during the construction, operation, and in case of emergency situations.

Direct - during the construction, operation and in case of emergency situations. Indirect - during the construction and operation.

Characteristics:

Secondary - during the construction and operation;

Cumulative - during the operation;

Of short duration - in emergency situations; Lasting - during the construction and operation.

Permanent - during operation; Temporary - during the construction.

5.5 BIOLOGICAL DIVERSITY AND ITS COMPONENTS COMPONENTS OF THE NATIONAL ECOLOGICAL NETWORK

Biological diversity and its components Components of the National Ecological Network

5.5.1 DESCRIPTION AND ANALYSIS OF THE IMPACT ON THE PLANT KINGDOM

5.5.1.1 DURING CONSTRUCTION

The main site within the landed estate of TPP Sofia, which will most probably be chosen for constructing the plant after analysing the alternative options, is for the most part a concrete-paved ground, which is currently used for storing outdoors of various equipment and equipment components - pipes etc. Plants are practically lacking in that ground; some grow only in gaps and clefts in the concrete and in the soil which has accumulated at places, where ubiquitous ruderal species have sprouted (some of the species described above in the section describing the estate of TPP Sofia), and at the boundary of the ground itself, where there are also some ligneous specimens, subject to elimination - Canadian poplar, grey willow (one tree) and ailanthus. All those plants will be eliminated in the construction but they are very common and well represented throughout Bulgaria, and, as already pointed out above, they have no conservation importance. Their elimination from the future building site, whose area has anyway been covered with concrete long ago, is not connected with losing precious or rare plant species, spoiling of specific and valuable habitats, or any actual measurable and noteworthy loss of biodiversity and biomass of the flora in the area, which here has anyway been subject to considerable anthropogenic impact when the infrastructure within TPP Sofia was built. The expected impact on the vegetation within the alternative site (TPP Sofia-East) would be similar, if that site is chosen; the difference is that the chosen ground here has not been completely covered, there are more free areas with vegetation outside the built greenhouse and by the railway line. For that reason, in quantitative aspect, a greater number of plants will have to be eliminated here compared to the first site, but here as well that will not have any significant effect on the biodiversity and biomass of the existing flora - in the floristic area and in that part of Sofia.

5.5.1.2 DURING PLANT OPERATION

The operation of the cogeneration plant in Sofia utilizing RDF does not involve any material impacts on the flora in the area of any of the two suggested sites (the main one and the alternative one) or in their adjacent territories. According to the conclusions arrived at regarding the expected impact on the ambient air, the emissions of harmful gases and dust in the air will not exceed the limit values for concentrations in populated areas and ecosystems, specified by the respective regulations. For that reason some impact can be expected only on the vegetation within the landed property of TPP (chiefly resulting from additional generation of PM_{10}), and the expected degree of impact can be defined as very low and negligible, without any material negative influence on the physiological processes of the represented species: some of them may be slightly ailing, or their growth may be slightly slower and their reproductive functions - impeded in the vegetation period, and that only in the first several years after putting the plant into operation, until they gradually adjust to the new conditions of the environment.

5.5.2 DESCRIPTION AND ANALYSIS OF THE IMPACT ON THE ANIMAL KINGDOM

5.5.2.1 INVERTEBRATE FAUNA

5.5.2.1.1 DURING CONSTRUCTION

During the construction of the cogeneration plant utilizing RDF at the respective site (the main one or the alternative one) a large part of the Invertebrates in the soil will be directly affected - mostly removed with the soil, where soil exists, or scared away. Those are geobionts, geophiles and geoxenes like worms, millipedes, etc.. Also some of the available terrestrial fauna will be removed or scared away - mostly some types of ants, spiders, Hemiptera and others. The species that will be affected are widely distributed and numerous in such biotopes, including in the landed estates of the two TPPs; the building will not cause any significant or marked changes in their quantitative parameters within the industrial areas where the power plants are located or within the power plants' sites, all the less so in the typical fauna region (Sofia region) or in the country. In this case the death of invertebrates should be rather considered in the aspect of loss of food base for other vertebrate taxa, but that will be minor, negligible for the area and reversible. Besides a part of the terrestrial invertebrates is periodically destroyed by human activities in the considered sites at present also (run over by vehicles, tramped by activities for storing equipment and material, and the like.)

As regards those 16 target invertebrates of higher or lower importance, which are described in the analytical section of this report and which are distributed in Sofia valley and at the foot of surrounding mountain slopes, the probability that some of them are found in the IP area depends on the presence of respective habitats. In this case the terrains of the suggested sites are not suitable and do not offer favourable conditions for development of those species, as the terrains are located within industrial areas characterized by high degree of anthropogenic influence; and most of the main site of the IP, located within the borders of TPP Sofia, is covered with concrete pavement. There are infrastructure objects in the site of TPP Sofia-East also - an old greenhouse, a railway line, etc. Actually we can assert for sure that there are no habitats within the landed estate of any of the two power plants, which offer optimum suitable conditions for the propagation and feeding of those species. The green areas within the two plants' territories can sporadically and only rarely be used for feeding and roosting by some of the species which are to some extent likely to inhabit some of the neighbouring grounds beyond the power plants; those are as follows:

- TPP Sofia - 2 species: Lesser spotted fritillary (*Melitaea trivia*), *Zerynthia polyxena*;
- TPP Sofia- East - 6 species: Large copper (*Lycaena dispar*), lesser spotted fritillary (*Melitaea trivia*), *Zerynthia polyxena*, lesser purple emperor (*Apatura ilia*), purple emperor (*Apatura iris*), and green snaketail (*Ophiogomphus cecilia*);

For those species the particular territory of 15 daa at the main IP site provides no habitat at all, and of the alternative site only a small area (about 5-6 daa) could be used, which however lacks food base of sufficient quantity and quality. Actually the probability of a negative impact on those species' populations in the area of Sofia city during the plant construction, in any of the two sites, is negligible and close to zero, because both estates with the power plants are in industrial purpose areas, the planting in the two estates is scanty, and the grass vegetation is represented by ruderal species exposed to pollution, therefore it does not provide a suitable food base for the mentioned species. No habitats of theirs have been reported in proximity either. The IP as a whole is not in an area important for the butterflies (acc. to Abadzhiev, Beshkov, 2007).

5.5.2.1.2 DURING PLANT OPERATION

During the operation of the cogeneration plant utilizing RDF we do not expect any material and observable increase of the negative impact involving direct destruction (running over by traffic etc.) of the invertebrate fauna distributed in the area of the respective site, beyond the current impact in the grounds of the two TPPs and the industrial areas where they are located; one way or another that effect is typical of all urbanized areas. In case of migration of specimens of some species to the cleaner areas beyond the power plants' sites no negative impact is expected on the populations of invertebrates, important in conservation aspects, distributed in Sofia valley and at the foot of the surrounding mountain slopes, as the two industrial purpose areas where the two plants are, with the main site and the alternative site, do not provide suitable habitats for those species. Besides, as as the plant will in all cases be located within the city of Sofia and not far from residential areas, in qualitative and quantitative aspect the released gases are expected to correspond to the regulatory requirements regarding emissions and concentrations in the ground-level air in populated areas; respective purification equipment will be ensured for the purpose, in line with the best available techniques. Moreover in accordance with the recommendations and measures specified in the EIAR that equipment will be designed in such a way and of such dimensions that the possible cumulative effect of nitrogen oxides, sulphur oxides and carbon oxide from the stacks of the TPP and of the cogeneration plant utilizing RDF will be within admissible limits and the combined and general impact will not exceed the limit values specified concerning pollution in residential areas. So no considerable negative effects can be expected on the invertebrate fauna inhabiting the industrial areas with the power plants.

Vertebrata

As regards vertebrate species distributed in the area of the main site and the alternative site of IP, if such are present, the more mobile of them (mainly birds and mammals and also some reptiles) are expected to leave the area of the construction activities in advance because they will be disturbed by the noise of delivery and movement of construction and installation equipment into the area. In practice the main impacts will consist mostly in scaring of fast-moving vertebrates away from the area of the building site, if such are present, already when preparing the sites for construction.

5.5.2.2 HERPETOFAUNA - AMPHIBIA AND REPTILIA CLASSES

5.5.2.2.1 EXPECTED IMPACT DURING THE CONSTRUCTION AND OPERATION

As mentioned in the analytical section, the terrains of the two power plants (including the IP sites) are habitats of one amphibian species - the European green toad *(Bufo viridis)* and one reptile species - the common wall lizard *(Podarcis muralis)*, and both of them were found in the territory of TPP Sofia.

The main impact on the former species could be *during the construction* in the form of a risk of death of single specimens due to running over by heavy-duty trucks while transporting the construction materials, and to the operations of construction equipment. That risk is present also now, which has been evidenced by the fact of one run-over specimen in the street near the main gateway of TPP Sofia. As mentioned in the analytical section, in Bulgaria the European green toad is distributed all over the country at altitudes from the sea level up to around 2,100 m, mostly in open grassed spaces, and in some cases it can be even more numerous in farmyards than outside settlements; it is found also in big cities, including in spaces between residential blocks of flats (in the cities of Sofia, Plovdiv and elsewhere according to personal observations), i.e. it is characterised by good synanthropic adaptability. In the area of the IP there are a number of places like the affected territory, which are suitable habitats for that species. Because of that in all cases the death risk will not affect considerably the density of the local population of European green toad, as although that species is among the ones listed in Annex No.3 of BDA, it is anyway common throughout the country in its respective biotopes, and the specimens are in sufficient number to maintain its population structure and functions. That is supported also by the fact that it does not have a status of a species endangered in national and global scale, is not in the category of rare species, and in IUCN Red List of Threatened Species it is mentioned as "slightly affected". That species is not included in the Red Data Book of the Republic of Bulgaria, volume 2 - animals (published by BAS and MEW, 2011).

As regards the latter of the above mentioned species, no death of specimens is expected *during construction* as they are fast moving so they can quickly leave the area of construction activities. There are a number of suitable hiding places and biotopes where they can move and re-settle, if the sites are their permanent habitats.

The plant operation does not involve significant negative impacts on the amphibians and reptiles distributed in the areas of the two power plants and the industrial areas where those are located, because on the one hand no considerable deterioration in the quality of the environment is expected resulting from pollution of its components (air, and indirectly - water and land) and on the other hand the herpetofauna is represented by synanthropic species, which have a higher sensitivity threshold and higher resistance to pollution of the environment compared to those species which avoid cities, villages and their proximity.

5.5.2.3 CLASS AVES

5.5.2.3.1 EXPECTED IMPACT DURING THE CONSTRUCTION AND OPERATION

As seen from the documentation, the anthropogenic load within the area of the IP will be local, both during construction and during operation: only in the territory of the enterprise; the area within which the plant will be is industrial and has been subject to considerable anthropogenic load.

As is is evident from the analysis of the conditions of the species listed in Annex No.2 of BDA given in the analytical section, the IP implementation does not endanger their existence in this region of Bulgaria, in this part of Sofia valley or in Sofia city. That is due chiefly to the fact that no additional and unaffected area will be included, and to the plant's location - in the yard of one of the two power plants, i.e. in an area already affected by human activities. (In particular as regards the Syrian woodpecker it should be pointed out that its representatives visit the territories of the two power plants all year round in search of food, mainly in the ligneous vegetation there).

The following information can be provided regarding the status of special areas of conservation and protected zones (under Natura 2000) in this part of Sofia valley and on the possible impact on them during the construction and operation of the plant envisaged by the IP:

The sites of TPP Sofia and TPP Sofia-East are not within special areas of conservation (SAC) or protection areas (PA) of NATURA 2000 network according to BDA. TPP Sofia site is at about 10 km distance from PA Ribarnitsi Chelopechene (Chelopechene fish breeding ponds) and at about 11 km distance from PA Dolni Bogrov-Kazichene. TPP Sofia -East site is at about 9.5 km distance from PA Ribarnitsi Chelopechene and at about 4 km distance from PA Dolni Bogrov-Kazichene.

Exactlty those distances (10, 11, 9.5 and 4 km) exclude any impacts on the components of those two protection areas during the operation of the plant under this IP.

Building up the area of the two TPPs and their neighbouring areas has already resulted in settling of specimens and couples of synanthropic species, and with increasing the built-up area (the number of buildings respectively) the numbers of those species have also increased, mostly of the so called complete synurbic and developed synurbic species, as the field investigations showed. The field observations in those two industrial areas of the city showed that in the area covered by the yard (within the fence) of the enterprises and in their vicinity the most numerous of the birds are the house sparrow and the common house martin. A considerable number of the following species has been recorded also: rock dove, great tit, common starling, Eurasian magpie, European greenfinch, European goldfinch and some others (for example barn swallow, tree sparrow, black redstart, blackbird, Eurasian jay, jackdaw, hooded crow, and in the fall-winter period - also of the species of common chaffinch, brambling, Eurasian siskin, European robin, hawfinch, fieldfare, redwing, rook and others). Most of those are exactly of the groups of complete synurbic and developed synurbic species (those are species of the groups of actually entirely or partially - but more than isolated couples - propagating in cities and villages). The IP implementation will not change the character (type) of the communities (animal cenosis) already formed in the territory of the enterprises, industrial areas and in those parts of the city because it will not change the character of the environment there (their habitats).

We should point out also that, as no new areas will be affected beyond the present yards of the two power plants, the construction of the plant and its operation will not pose an additional obstacle to the movement of various non-flying species in that area in the directions chosen or established by the respective species or specimens, i.e. it will not cause additional fragmentation of the territories in that part of the city.

As mentioned above, the area of the IP neither borders nor falls within protected areas (PAs or SACs). Due to the character of the plant it can not have any considerable or even any noticeable negative effect on the closest protected sites.

As no areas beyond the yards of the two TPPs (main site and alternative site) will be affected there are no grounds based on which we could assert any well-expressed or even only noticeable negative cumulative effect in those parts of the city.

We should point out that the alternative site in the yard of TPP Sofia-East provides very similar - practically the same - conditions as those of the site in the yard of TPP Sofia, because the two power plants are in industrial areas built up with different buildings and installations. All the animals in both places are of dwelling (urbanised) type.

The IP implementation and the plant operation (at any of the two sites) will by no means be able to have any negative effect on the migration of birds in the area of Sofia city and Sofia valley; just the opposite: during seasonal migration specimens of various migrating species will continue to use the advantages which built up and inhabited by people areas provide to them - food of natural and other origin, shelter, greater protection from predatory animals, etc. In the autumn-winter period individual specimens or flights of some bird species migrating from higher altitudes and from latitudes further to the north will continue settling temporarily in this area in search of food and shelter, spending the winter, for shorter or longer periods of time. Such species are: Eurasian siskin, European goldfinch, Eurasian linnet, common chaffinch, brambling, yellowhammer, fieldfare, redwing, rook and others, and in such periods they too succeed using the advantages offered by built up and not built up sections in the area of the IP. Specimens of those will undoubtedly visit also various areas in the power plant yard and neighbouring areas.

In this case also the circumstance should be taken into consideration that, according to the EIAR conclusion about the impact on the ambient air, in annual and short-term aspect the implementation of the project for a cogeneration plant utilising RDF at the site of TPP Sofia will not have a negative impact on the quality of the air in that region; the expected impact is acceptable both in local and in regional scale.

Therefore we can conclude that the IP implementation and the plant operation (at any of the two suggested sites) will not contribute additionally to the already considerable negative impacts on the avifauna in the region.

5.5.2.4 MAMMALIA

5.5.2.4.1 EXPECTED IMPACT DURING THE CONSTRUCTION AND OPERATION

During construction, as regards vertebrate species distributed in the area of the two power plants' yards, where available in the very sites (for example some rodents) it is expected that they will leave the area of construction activities in advance because they will be disturbed by the noise caused by delivering the construction equipment and its movement in the grounds. No holes, dens or underground niches have been found in the yards, which could be permanent hiding places for some of the terrestrial species. Those are represented mostly by developed and complete synurbic types, which do not have important conservation statute. In this case death of specimens of terrestrial vertebrates is not expected because they are fast-moving and therefore they can quickly leave the building sites area at the beginning of construction works and move to neighbouring areas. As regards bat fauna, in the assessment of the IP implementation impact on it we have taken into account that in this case the the scope of the EIAR covers only the construction and operation of a cogeneration plant utilizing RDF, and any potential demolishing and removal of old buildings and installations from the two power plants' grounds should be considered in separate investment proposals on the preliminary preparation of the site, and that is not the object of this EIAR. In this situation it should be taken into account that parts of the newly constructed buildings for the plant could provide suitable shelter for some synanthropic types of bats, which is actually a positive impact of the implementation of this IP (construction and operation) on the bat fauna.

The plant operation **does not involve significant negative impacts** on the representatives of mammal fauna distributed in the areas of the two power plants and the industrial areas where those are located, because on the one hand no considerable deterioration in the quality of the environment is expected resulting from pollution of its components (air, and indirectly - water and land) and on the other hand the mammals are represented by synanthropic species, which have a higher sensitivity threshold and higher resistance to pollution of the environment compared to those species which avoid cities, villages and their proximity.

5.5.2.5 CONCLUSION

In this situation there are no grounds based on which we could assert that the construction and operation of the planned plant would cause irretrievable damage on the vertebrate and invertebrate fauna in this part of Bulgaria, in Sofia valley or Sofia city, because they will not cause destruction or radical change of the habitats, and as a consequence - extinction or at least appreciable reduction of the numbers (the number of specimens, couples, stocks) of rare species or species in danger of extinction.

5.5.3 DESCRIPTION AND ANALYSIS OF THE EXPECTED IMPACTS ON SPECIAL AREAS OF CONSERVATION AND ON PROTECTION AREAS

As the two sites for the IP are in two of the industrial areas of Sofia city, there is no way that they fall within the scope of protection areas in the meaning of the Protected Areas Act or in special areas of conservation of the European network Natura 2000, or in the vicinity of areas of such nature.

The construction of the cogeneration plant utilizing RDF does not involve violation of the prohibitions within the two protected sites because it will be carried out in the yard of an existing power plant and will by no means involve entering of construction equipment in those sites, damaging their components or polluting with waste. In this respect both the main site and the alternative site are at a sufficient distance and pose no risk whatsoever of such impact. *The operation* of the plant either does not involve violation and will not result in breach of the prohibitions regarding activities in the territory of the two special areas of conservation.

The nature of the IP under consideration, the location of the sites suggested for its implementation (in industrial areas in Sofia city) and above all the considerable distances (4, 9.5, 10 and 11 km) to the nearest four protection areas exclude any impacts on the components of those protection areas during the construction and operation of the cogeneration plant utilizing RDF.

5.5.4 DESCRIPTION OF THE POTENTIAL CUMULATIVE EFFECTS RESULTING FROM THE IMPLEMENTATION OF THE INVESTMENT PROPOSAL AND OF OTHER EXISTING ENTERPRISES OR INVESTMENT INTENTIONS WITHIN THE SITE AND WITHIN THE AREA OF THE PROJECT

No cumulative effects are expected.

5.6 WASTE

5.6.1 EXPECTED GENERATED WASTE, BY TYPE AND QUANTITY, DURING THE PLANT CONSTRUCTION, OPERATION AND DECOMMISSIONING. CLASSIFICATION OF WASTE

In the course of operation of the cogeneration plant utilizing RDF various types of waste will be generated as a result of various activities connected with the production processes.

Generation of municipal waste, construction waste, hazardous and non-hazardous industrial waste is expected at the new plant site. Waste will be managed observing all regulatory requirements and the conditions specified in the integrated permits.

The waste-related activities are regulated by the Waste Management Act and the by-laws with it (*Promulgated SG No. 53 of 13.07.2012*). The main types of waste expected to be generated during the construction and operation of the IP plant and in the long term during its decommissioning have been classified according to Ordinance No.2/ 23.07.2014 on wastes classification (*Promulgated in SG No. 66 of 08.08. 2014*. Treatment methods are also envisaged. At this stage it is not possible to state the exact quantities of waste; the expected estimated quantities are given. The exact quantities shall be specified after the preparation of technical /detailed designs for the investment proposal implementation.

5.6.1.1 WASTE GENERATED IN THE PERIOD OF CONSTRUCTION AND INSTALLATION OF THE EQUIPMENT ENVISAGED IN THE IP; WASTE TYPE, QUANTITY AND CLASSIFICATION

Before starting the construction and installation works at the site chosen for the implementation of the cogeneration plant utilizing RDF project, the site will be prepared and cleared in order to begin the envisaged construction of the planned buildings and installations.

- **Group under code 17 05 - the waste from excavation works for construction of the new buildings and installations is as follows:**
  - → Soil (including excavated soil from contaminated sites) stones and dredging spoil under code 17 05 04 - soil and stones other than those mentioned in 17 05 03* (not containing dangerous substances) will be generated in making the concrete pavement covering the entire site, making the foundations of the production and administration building and the underground installations of the building. For the levelling excavation of unsuitable earth is envisaged, of estimated amount around 7,700 m^3 (soil and stones). The earth works for building the new plant involve making a large pit of the entire site of area 51,460 m^3 (with backfill with rubble 4,590 m^3). All earth mass that will be generated in the excavation is unsuitable for level filling (according to the geological report) so it will be transported to a landfill; additional material for filling will be supplied from places beyond the site No explosives will be used in the excavation works.

In the site preparation in the construction period, including if any existing reinforced concrete structures and the like will have to be demolished, waste also of **group under code 17 01** and **group under code 17 03** will be generated.

- **Group under code 17 01 - Concrete, bricks, tiles and ceramics, of the following codes:**
  - ✓ code 17 01 01 - concrete from carrying out of construction works;
  - ✓ tiles and ceramics of code 17 01 03 - mixed construction waste, about 2 m^3;
  - ✓ code 17 01 07 - mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06* - about 3 m^3.
- **Group under code 17 03 - Bituminous mixtures, coal tar and tarred products:**
  - ✓ Bituminous mixtures of code 17 03 02 other than those mentioned in 17 03 01* - from the removal of about 70 m^2 asphalt pavement (estimated quantity about 15 m^3).
- **Non-hazardous (industrial) waste** - Group under code 17 04 - **metals** (including their alloys)

→ code 17 04 05 - iron and steel, about 0.5 t/y for the construction period;

- **Group under code 12 01 -** Wastes from shaping and physical and mechanical surface treatment of metals and plastics

→ **Ferrous metal filings and turnings**-steel filings generated in cold processing of parts - up to 0.05 t/y for the construction period - code 12 01 01

→ **Non-ferrous metal filings and turnings**. Such will be generated in installation works for equipment and communications - cutting of cables etc., up to 0.02 t/y - code 12 01 03 for the construction period.

- **Group under code 15 01 - Packaging** (including separately collected municipal packaging waste)

→ **Paper and cardboard packaging** Such waste will be generated from boxes and packaging of construction materials and equipment. Code 15 01 01 - about 0.1 t. The waste will be delivered to a specialized company for utilization.

→ **Plastic packages** Such waste will be generated from boxes and packaging of construction materials. Code 15 01 02 - about 0.05 t

→ **Wooden packaging**. Such waste will be generated from wooden packaging of equipment an other items. Code 15 01 03 - about 0.1 t

→ **Metallic packaging** Metal boxes from equipment. 0.1 t. That waste will be delivered for recycling, under a contract in writing, to a company authorised according to the procedures of WMA; code 15 01 04.

- **Group under code 16 01 - End-of-life tyres**

→ End-of-life tyres - worn out types unfit for further use. Generated from vehicles and construction machines; about 50 pieces for the construction period. Code 16 01 03

- **Group under code 17 06 - Other insulation materials**

→ non-asbestos thermal-insulation materials, glass wool and mineral wool, generated in the construction period; around 3 t/y.

→ code 17 06 04 - insulation materials other than those mentioned in 17 06 01 and 17 06 03

- **Group under code 08 01 Waste from production**, wastes from formulation, supply, use and removal of paint and varnish

    → of code 08 01 12 - waste paint and varnish other than those mentioned in 08 01 11

- **Hazardous waste**

    → **Mineral based non-chlorinated hydraulic oils** (from the hydraulic systems of equipment etc.) 13 01 10*. Those will be collected at the place of occurrence, by the companies servicing the equipment, in their own vessels dedicated for the purpose, and will be transported by those companies and delivered to a licensed company, which has passed the respective authorisation procedures, for rendering safe. - 0.05 t

    → **Mineral-based non-chlorinated engine, gear and lubricating oils** (from the lubrication systems of the technological equipment), code 13 02 05*- 0.03 t

    → **Other engine, gear and lubricating oils** - spent engine lubricating oils from transportation activities – 13 02 08*

    → **Lead batteries and accumulators -** The origin of such waste: old and unfit for use batteries from replacement in transport vehicles and construction machines - about 0.05 t for the construction period - code 16 06 01*. Those will be delivered to an authorised company for following treatment.

    → **Packaging containing residues of or contaminated by dangerous substances** (disinfectants, oils etc.). Code 15 01 10* Those will be delivered for following treatment, under a contract in writing, to a company authorised according to the procedures of WMA.

- **Municipal waste (municipal wastes and similar commercial, industrial and institutional wastes) including separately collected fractions - code 20**

- **Group under code 20 01 - Separately collected fractions** (except 15 01)

    → **Fluorescent tubes and other mercury-containing waste -** Unserviceable fluorescent tubes and mercury lamps generated in preventive replacement and repairs; up to 10 pieces/year. Code 20 01 21*

    → **Mixed municipal waste-** waste generated from the daily activities of the staff; around 10 t/y**- Code** 20 93 01 - for the entire construction period.

A list of the expected types of waste, which will be generated during the construction of the cogeneration plant utilizing RDF, with their code and name, according to Ordinance No.2 of 23.07.2014 on wastes classification, promulgated in SG No.66 of 08.08.2014, is given in **Table 5.6-1**.

TABLE 5.6-1 WASTE GENERATED DURING THE CONSTRUCTION

No.	Waste code	Waste type
Construction waste		
1.	17 01 01	concrete
2.	17 03 02	bituminous mixtures other than those mentioned in 17 03 01
3.	17 01 03	mixed construction waste - tiles and ceramics
4.	17 04 05	iron and steel
5.	17 01 07	mixtures of different types of construction waste other than those mentioned in 17 01 06*
Hazardous waste		

No.	Waste code	Waste type
6.	13 01 10*	Mineral based non-chlorinated hydraulic oils (from the hydraulic systems of equipment etc.)
7.	13 02 08*	Other engine, gear and lubricating oils - spent engine lubricating oils
8.	13 02 05*	mineral-based non-chlorinated engine, gear and lubricating oils
9.	15 01 10*	packaging containing residues of or contaminated by dangerous substances
10.	16 06 01*	lead batteries
11.	17 06 04	insulation materials other than those mentioned in 17 06 01* and 17 06 03*
12.	20 01 21*	fluorescent tubes and other mercury-containing waste
Industrial waste /non-hazardous waste		
13.	08 01 12	waste paint and varnish other than those mentioned in 08 01 11
14.	12 01 01	ferrous metal filings and turnings
15.	12 01 03	non-ferrous metal filings and turnings
16.	15 01 01	paper and cardboard packaging
17.	15 01 02	plastic packages
18.	15 01 03	wooden packaging.
19.	15 01 04	metallic packaging
20.	16 01 03	end-of-life tyres
21.	17 06 04	insulation materials other than those mentioned in 17 06 01* and 17 06 03*
Municipal waste		
22.	20 03 01	mixed municipal waste

Due to the IP specifics - construction and operation of the new plant - it is impossible to determine in advance the quantity of generated waste, and for some types of waste that is impossible even with approximation. The quantity of waste will depend on the amount of construction works and the type of installations to be built, the quantity and type of construction materials, the condition of construction equipment as well as on the organisation of construction works and the builders' skills.

According to the Waste Management Act (WMA) before the construction under the IP begins the necessary documents have to be ensured, connected with waste management activities.

5.6.1.2 WASTE WHICH WILL BE GENERATED IN THE COURSE OF OPERATION

In the operation period most sizeable will be the quantity of **technological (process) waste** generated in the technological production cycle (so called technological residues) of the cogeneration plant utilizing RDF.

The management of process waste involves strict control, as it will be considerable in quantity and some of it will be of the hazardous waste category.

The total quantity of technological (process) waste of grate incineration of RDF is expected to be 25 %. including

- non-hazardous inert waste, grate screenings, slag and bottom ash - up to 20 %;
- hazardous waste - around 4 %, maximum 6 % - boiler dust and fly ash, which in this case will be collected together but can also be separated in connection with their following treatment.

Other waste will be generated as well: municipal waste, other non-hazardous industrial waste (apart from the non-hazardous process waste), other hazardous waste (apart from the hazardous process waste) and construction waste form repairs.

Like the other types of waste technological waste (process waste, technological residues) has been classified according to Ordinance No.2 and the European Waste Catalogue (EWC)[39].

5.6.1.2.1 WASTE PRODUCTS (RESIDUES) GENERATED BY THE GRATE RDF INCINERATION INSTALLATION, CLASSIFIED AS NON-HAZARDOUS WASTE

The grate consists of moving cast-iron blocks. To enable air flux and distribution of the air flowing through the grate in the burning process, they do not fit tightly and a very small portion of the fine fractions of input waste falls through the grate and is called grate screenings.

Grate screenings are usually 0.2 - 1 % of the input incinerated waste, in this case approximately 360 - 1,800 t/y. Grate screenings are usually mixed with slag. The European Waste Catalogue does not provide a specific code for that waste but grate screenings are usually classified under EWC code 19 01 12 -"bottom ash and slag other than those mentioned in 19 01 11" of Group 19 01 - Wastes from incineration or pyrolysis of waste.

Boiler slag consists mainly of inorganic substances, which are cleaned by means of water-bath of the lower section of the furnace. The slag is also called "bottom ash". Slag is usually 15 - 20 % of the input waste and depends almost entirely on the content of non-combustible particles (ash) in the input waste, of which around 90 % leave the installation with the slag. Slag is usually mixed with grate screenings.

The installation will incinerate modified solid fuel derived from waste (RDF), produced in the MBT plant located in Yana village, Sadinata place, after preliminary separation and fragmentation of non-hazardous MSW, followed by biological treatment and packing to certain dimensions.

The resulting bottom ash will not be hazardous waste under code 19 01 11* *bottom ash and slag containing dangerous substances*. The slag from the furnace mixed with screenings from the grate, which form at the furnace bottom, is usually classified as non-hazardous waste under code 19 01 12 *bottom ash and slag other than those mentioned in 19 01 11*.*

Bottom ash from incineration consists of grate screenings and slag. The bottom ash quantity is usually approximate 20 % of the quantity of waste depending on the inert materials content in the input RDF, which for incineration of 22.5 t/h in the plant results in around 4 t/h. Bottom ash is of several types: - grate screenings, slag and scrap regenerated from bottom ash.

The total quantity of grate screenings and slag is considered to be 20 % of the input waste, in this case approximately 36,000 t/y resulting from 180,000 t/y input waste.

The slag from the furnace mixed with grate screenings is usually classified as non-hazardous waste under code 19 01 12 - "bottom ash and slag other than those mentioned in 19 01 11" - 36,000 t/y (the classification according to the European Waste Catalogue is the same).

By means of a magnetic separator it is possible to collect most of the iron contained in the slag, and such an outgoing flow is also considered to be non-hazardous waste, EWC code 19 01 02.

TABLE 5.6-2 TYPICAL CONTENT (ANALYSIS OF 7 DANISH PLANTS)

No.	Element	Unit of measure	Range	Average
1	Ca Calcium	g/kg TS	60 - 79	75
2	Fe Iron	g/kg TS	54 - 88	75

[39] **European Waste Catalogue** - 2000/532/EC: Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 19(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (notified under document number C(2000) 1147) (Text with EEA relevance)

No.	Element	Unit of measure	Range	Average
3	Al Aluminium	g/kg TS	42 - 61	50
4	Na Sodium	g/kg TS	18 - 30	25
5	K Potassium	g/kg TS	11 - 15	15
6	Mg Magnesium	g/kg TS	7.7 - 9.3	8.5
7	S Sulphur	g/kg TS	4 - 7.3	5
8	Ti Titanium	g/kg TS	4 - 5.5	5
9	Cu Copper	g/kg TS	1.8 - 3.6	3
10	Zn Zinc	g/kg TS	1.9 - 3.0	2.5
11	Cl Chloride	g/kg TS	1.4 - 4	2
12	Pb Lead	g/kg TS	0.87 - 2.2	1.5
13	Ba Barium	g/kg TS	1.2 - 1.8	1.5
14	Mn Manganese	g/kg TS	0.84 - 1.5	1
15	Cr Chromium	mg/kg TS	230 - 620	350
16	Ni Nickel	mg/kg TS	130 - 400	250
17	Mo Molybdenum	mg/kg TS	19 - 98	50
18	As Arsenic	mg/kg TS	8.5 - 15	12
19	Cd Cadmium	mg/kg TS	0.75 - 2.2	1.5
20	Hg Mercury	mg/kg TS	< 0.08	0.05

According to Directive 2010/75/EU the organic content in slag shall be less than 3% . incineration loss.

Slag is often used in civil engineering, for example in building of roads. Many countries have specific legislative regulation concerning the infiltrate of residual products.

Scrap - Group code 19 01 *Wastes from incineration or pyrolysis of waste* namely: - 19 01 02 *ferrous materials removed from bottom ash* - around 360 t/y, non-hazardous waste. Scrap which can be recovered from bottom ash is about 1 % when MSW is incinerated and probably much less than 1 % when RDF is incinerated. Ferrous and non-ferrous metals can be recovered from bottom ash either on the spot - within the site or in a place outside the plant site. The metals can be reused and bottom ash can be used in construction. The non-incinerated material content in bottom ash is usually below 1 %. The low amount of metals in bottom ash after RDF incineration does not usually suggest envisaging of mandatory separation.

The total amount of slag is often used in civil engineering, for example in building of roads.

5.6.1.2.2 TECHNOLOGICAL WASTE PRODUCTS (RESIDUES) GENERATED BY THE GRATE RDF INCINERATION INSTALLATION, CLASSIFIED AS NON-HAZARDOUS WASTE

→ **Fly ash and boiler dust**

Fly ash and boiler dust are usually led away by flue gas and separated in filtering, which in the RDF incineration installation is part of the semi-wet system for flue gas cleaning.

Scrap - Group code 19 01 Wastes from incineration or pyrolysis of waste namely: - 19 01 15* boiler dust containing dangerous substances and 19 01 13* fly ash containing dangerous substances. - approximately 2,720 t/y total; hazardous waste.

Boiler dust - A part of the particles in flue gas are deposited on the boiler walls and in the boiler pipes. The boiler will be regularly cleaned by means of a mechanical system and the boiler dust will be collected below the pipes. Boiler dust will be mixed with fly ash from flue gas cleaning and then transported to a storehouse for storage.

Boiler dust is usually classified as hazardous waste under code - 19 01 15* boiler dust containing dangerous substances. Its chemical composition is similar to that of fly ash, that is why in many cases the two types of waste are mixed and transported together to a place for hazardous waste disposal.

Fly ash - In some installations separate collection of fly ash particles is applied. In the RDF incineration plant separation will be done by the sleeve filter, where the ash is mixed with remains from semi-dry cleaning of flue gas.

Fly ash contains a certain amount of fine particles of soot, various salts and heavy metals, and the content of those metals is so high that such residue can not be disposed in a landfill for non-hazardous waste but has to be treated in a special installation. Fly ash is under EWC code *19 01 13* fly ash containing dangerous substances*. It has to be treated in a special installation or disposed in a landfill for hazardous waste. In the envisaged technological scheme of the RDF incineration installation the boiler dust resulting from the boiler cleaning is mixed with fly ash from flue gas cleaning.

The quantity of boiler dust and of fly ash is approximately 1-2 % of the input waste, approximately 340 kg/h when incinerating 22.5 t//h in the plant, or 2,720 t/y.

Fly ash is often separated by means of an electrostatic precipitator (filter) or textile filter.

TABLE 5.6-3 CONCENTRATION OF ELEMENTS IN FLY ASH FROM DIFFERENT COUNTRIES

Element	Average	Range 25%-75%	No.
	g/kg	mg/kg	
Ca	107	95,000 - 120,000	20
Cl	74	40,000 - 102,000	24
Si	160	130,000 - 180,000	14
Mg	15	14,000 - 17,000	15
Fe	25	18,000 -33,000	20
Al	71	59,000 - 81,000	18
K	36	30,000 - 41,000	19
Na	31	23,000 - 38,000	17
Zn	28	16,000 - 35,000	26
S	26	21,000 - 33,000	20
Pb	11	6,300 – 15,000	25
Ti	8.7	7,500 – 9,400	17
Mn	1.3	1,000 – 1,600	19
Ba	1.7	940 – 2,600	18
Sn	1.4	860 – 1,800	15
Cu	1.2	930 – 1,300	25

No. - the number of the different samples Source: IAWG (1997)

TABLE 5.6-4 CONCENTRATION OF ELEMENTS (MICRO ELEMENTS) IN FLY ASH FROM DIFFERENT COUNTRIES

Element	Average	Range 25%-75%	No.
	mg/kg	mg/kg	
Hg	8.0	2.3 - 10	17
Cd	390	240 - 480	26

Element	Average	Range 25%-75%	No.
	mg/kg	mg/kg	
Sb	530	340 - 690	12
Cr	650	430 - 840	26
Sr	280	140 - 400	12
Ni	140	91 - 110	25
As	130	49 - 200	17
V	51	32 - 63	15
Ag	55	33 - 75	10
Co	51	30 - 69	17
Mo	40	25 - 37	13
Se	14	11-18	12

No. - the number of the different samples Source: IAWG (1997)

→ Residue from semi-dry cleaning of flue gas

Group code 19 01 **Wastes from incineration or pyrolysis of waste**, namely: - 19 01 07* solid wastes from gas treatment and 19 01 10* spent activated carbon from flue-gas treatment - total about 5,520 t/y, hazardous waste (approximately 3 % of the total quantity of treated waste).

That residue from **semi-dry cleaning of flue gas** is usually classified as hazardous waste under *code 19 01 07* solid wastes from gas treatment.* That waste will probably contain also the activated carbon separated in filtration, and such waste is under *code 19 01 10* spent activated carbon from flue-gas treatment* .

Different types of waste (technological residue) will be generated depending on the flue gas treatment system.

Most installations use a semi-dry system, in which water is injected for reducing the temperature and hydrated lime is injected for the elimination of HCl, HF and SO_2 from flue gas. Activated carbon is injected additionally for elimination of dioxins and furans (and also mercury, if it is present in flue gas).

With such a system of flue gas cleaning the residue will have many components: - fly ash containing particles from the combustion process; products from the dry cleaning reaction ($CaCl_2$, CaF_2, $CaSO_3$, $CaSO_4$); excess lime (which has not entered into reaction), and activated carbon with traces of absorbed dioxins, furans and mercury (if present in the flue gas) The quantity and composition of the product from cleaning will depend mainly on the quantity of HCl and SO_2 in flue gas.

As the installation includes reduction of NOx through Selective Non Catalytic Reduction (SNCR), the waste separated by the sleeve filters will contain also traces of NH_3. Heavy metals content will result mainly from fly ash, however mercury content (if mercury is present in the flue gas) will be higher due to its absorption by activated carbon.

Different types of technological residue will be generated depending on the flue gas treatment system.

The residue quantity is usually 4-5 % of the input RDF, of which 1-2 %-points - roughly 1/3 - comes from the fly ash. That residue is hazardous waste, and its disposal in landfills is usually not allowed; it has to be transported to a special install installation for treatment or to be disposed in a depot under special conditions as hazardous waste (in EWC its code is 19 01 07* solid wastes from gas treatment).

An example of the chemical composition is given in the table below, where the elements are dispersed in respective calcium salts.

TABLE 5.6-5 RESIDUE FROM SEMI-DRY CLEANING

Residue, chemical composition	kg/t	%
$CaCl_2$	7.9	19.1
CaSO4 and CaSO3	4.5	10.8
CaF_2	0.3	0.7
$Ca(OH)_2$	6.2	15.1
$CaCO_3$	3.4	8.2
Fly ash (inorganic)	15.0	36.3
Lime admixtures	1.7	4.0
Activated carbon	0.5	1.2
Chemically bound water	1.9	4.5
Total, incl. water	41.3	100.0

The heavy metal content is due mostly to the fly ash. Mercury content, however, is expected to be higher due to its absorbing with activated carbon.

Residue from wet cleaning of flue gas - - an option of wet cleaning of flue gas is not preferred for development in the following design phases. If a wet-scrubber system is applied instead of the semi-dry one described above, the particles and products from reaction will be collected in the waste water and not in the dry residue as described above. The wet scrubber system generates waste water containing hydroxide sediment, salt and particulate matter. The sediment is usually passed through a filter press, where filter cake is formed. Thus the residue would be filter cake and waste water. The quantity of filter cake is approximately 1 kg dry substance per ton of treated waste. The filter cake is classified under code 19 01 05* - filter cake from gas treatment (in EWC it is also under code 19 01 05* -other fractions containing dangerous substances The wet scrubber method allows extracting SO_2 for the production of plaster (with traces of CaF_2 and heavy metals). The quantity is approximately 6 -7 kg/t of waste depending mostly on the SO_2 content in flue gas, which in turn depends on the sulphur content in the input waste. As selling the plaster in the market can be difficult, it is often disposed in landfills.

A dioxin filter is often integrated in the wet scrubber system.

This option of wet cleaning of flue gas generates polluted waste water, which has to be treated, and that is the most important disadvantage and reason to prefer the **semi-dry flue gas cleaning** option.

The residual technological waste (residue) from flue gas semi-dry treatment in the suggested option is envisaged to be collected in bulk in large silos having temporary storage capacity sufficient for minimum 8 days after generation. The quantity of residue from flue gas cleaning by semi-dry treatment is assumed to be around 4 % of the quantity of incinerated modified solid fuels derived from waste (RDF). It will be released mainly from the sleeve filters - around 690 kg/h in incineration of 22.5 t/h of waste, or 5,520 t/y.

At the scrubber inlet water will be sprinkled in for cooling the gas, and the spent absorption solution flowing out of the wet scrubber will be used in the semi-dry stage for moistening the hydrated lime or cooling the flue gas.

The chosen semi-wet system in this concrete case makes it possible to arrange the treatment equipment in the installation without waste water or sludge generation, and no additional treatment or disposal of waste water is necessary.

That is why there will be no generation of hazardous waste under codes: - 19 01 05* filter cake from gas treatment and - 19 01 06* aqueous liquid wastes from gas treatment and other aqueous liquid wastes.

Waste from shredding of metal-containing waste - At this stage, in this case, incinerating only RDF with minimum content of heavy metals, such waste will not be generated. However in future, if the plant is provided with additional shredding equipment when using mixtures of harder and less calorific waste, it is possible that waste of Group under code 19 10 is generated - wastes from shredding of metal-containing waste, namely: 19 10 01 iron and steel waste; 19 10 02 non-ferrous waste; 19 10 03* fluff-light fraction and dust containing dangerous substances; 19 10 04 fluff-light fraction and dust other than those mentioned in 19 10 03*; 19 10 05* other fractions containing dangerous substances, and 19 10 06 other fractions other than those mentioned in 19 10 05*. In the technology process currently adopted, above mentioned types of waste of group 19 10 will not be generated.

The operation of the cogeneration plant utilizing RDF involves incineration of separated fraction of RDF (modified solid fuel derived from waste), which has undergone mechanical and biological treatment in the MBT plant, and has much lower concentrations of heavy metals. That is why no additional shredding/grinding of the received waste is necessary.

In case there is no RDF, the plant will be able to utilize alternative fuels, such as: low-grade RDF - of low calorific value; low grade/fresh biomass of low calorific value; sludge (dehydrated, 10 % dry substance content, maximum 10 % of the total mass). If at a later stage it becomes necessary to shred non-standard RDF produced by the MBT plant and/or shredding of envisaged waste of lower calorific value, mixed with RDF, a mobile shredder or similar equipment has to be installed for reducing the size of fuels received in the bunker. The mobile shredder (connected with the bunker) will be able to reduce the size of larger pieces and to prevent blocking the hopper and the grate.

It is envisaged that such a shredder can be installed at the bunker edge, at the side of unloading. Also a special unloading area has to be ensured in the reception hall, where trucks transporting waste of size above the admissible and/or with unwanted components could be unloaded for RDF inspection and categorization. That area has to be at such location as to cause minimum blocking of movement. Activities for unloading and categorization of large-size fractions will be necessary in rare cases, and even if followed by shredding, they will not generate additional waste. That is why it is unlikely that hazardous or non-hazardous waste of group *19 10 - waste from shredding/grinding of metal-containing waste* would be generated.

5.6.1.2.3 TOTAL QUANTITY OF WASTE GENERATED IN THE OPERATION OF THE COGENERATION PLANT WITH GRATE INCINERATION OF RDF

5.6.1.2.3.1 Municipal waste (municipal wastes and similar commercial, industrial and institutional wastes) including separately collected fractions

Group under code 20 01 - Separately collected fractions (except 15 01)

- **Fluorescent tubes and other mercury-containing waste** - generated in preventive replacement and repairs; up to 20 pieces/year. Code 20 01 21*;
- Waste under code 01 36 36 - **discarded electrical and electronic equipment** other than those mentioned in 20 01 21, 20 01 23 and 20 01 35.
- Code 20 01 01 - **paper** and **cardboard**;
- Code 20 01 02 - **glass**.

Group 20 03 - Mixed municipal waste- waste generated from the daily activities of the staff; around 4 t/y**- Code** 20 93 01.

For the number of operating staff - 20- 35 persons in three shifts - the generated MSW is expected to be around 12 - 15 kg/d. MSW will be collected in metal containers and transported by vehicles of the respective company responsible for the other sites of the TPP for following treatment (currently disposal).

Construction waste during operation will be generated only by repairs:

Group under code 17 01 - Concrete, bricks, tiles and ceramics, of the following codes: - code 17 01 01 - concrete - about 2-3 m^3/y ; code 17 01 03 - tiles and ceramics - about 0.2 $m^{3.}$. - code 17 01 07 - mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06* - about 1 m^3.

Group 17 03 - code 17 03 02 - bituminous mixtures other than those mentioned in 17 03 01* - (containing coal tar) from repairs of the asphalt pavement, max. 0.5 m^3/y;

Group 17 04 - metals (including their alloys): code 17 04 05 iron and steel. approximately 0.05 t/y from repair works;

Other insulation materials - non-asbestos thermal-insulation materials, glass wool and mineral wool, generated in repairs; around 05 t/y. Code 17 06 02.

Group under code 12 01 – from preventive repairs of machines and equipment:

- **Ferrous metal filings and turnings**- steel turnings generated in cold processing of parts - up to 0.01 t/y - Code 12 01 01 in the plant maintenance, preventive repairs, planned and emergency repairs;
- **Non-ferrous metal filings and turnings** under code 12 01 03 - generated in installation works of equipment and communications - cutting of cables etc.; up to 0.005 t/y.

Group under code 15 01 - Packaging (including separately collected municipal packaging waste)

- **Paper and cardboard packaging** - code 15 01 01 - generated from boxes and packaging of construction materials and equipment during repairs; approximately 0.05 t/y. Those will be delivered to a specialised company for utilization.
- **Plastic packaging** - code 15 01 02 - generated from boxes and packaging of construction materials; approximately 0.03 t/y;
- **Wooden packaging** - code 15 01 03 - generated from wooden packaging of equipment etc., approximately 0.1 t;
- **Metallic packaging -** code 15 01 04 **of equipment -** 0.02 t**.** That waste will be delivered for recycling, under a contract in writing, to a company authorised according to the procedures of WMA.
- Waste under code 15 02 03 - **absorbents, filter materials, wiping cloths, protective clothing** other than those mentioned in 15 02 02.

Group under code 16 - Wastes not otherwise specified in the list

Out-of-use tyres, which result from maintenance and preventive repairs of the vehicles and construction equipment, are non-hazardous waste under code 16 01 03 - end-of-life tyres. In routine and preventive repairs out-of-service equipment may be removed, under group code 16 02- wastes from electrical and electronic equipment: of code 16 02 14 - discarded equipment other than those mentioned in 16 02 09 to 16 02 13, and of code 16 02 16 -components removed from discarded equipment other than those mentioned in 16 02 15. Group under code 16 11 - waste linings and refractories. When boiler maintenance and repairs are carried out, single-time generation is possible of such waste which includes silicates, carbonates and clays, usually classified as non-hazardous waste under code 16 11 16 - linings and refractories from non-metallurgical processes others than

those
mentioned in 16 11 05.

The summary characteristics of non-hazardous production waste includes also the waste from the installation for grate incineration of RDF, classified as non-hazardous (inert) waste, described in detail under the process waste section.

- **Bottom ash** Classification codes - Group code 19 01 00 *Wastes from incineration or pyrolysis of waste* namely: 19 01 12 *bottom ash and slag other than those mentioned in 19 01 11** – **36,000 t/y**, non-hazardous waste.
- The summary characteristics of non-hazardous production waste includes also waste from the installation for grate incineration of RDF, classified as non-hazardous - **the slag from the furnace mixed with grate screenings -** EWC code 19 01 12 - bottom ash and slag other than those mentioned in 19 01 11 - 36,000 t/y.
- **Scrap** - Group code 19 01 00 Wastes from incineration or pyrolysis of waste namely: - 19 01 02 ferrous materials removed from bottom ash - around 360 t/y, non-hazardous waste.

5.6.1.2.3.2 Hazardous waste

Group 13 - Oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12 and 19)

Group under code 13 01 Waste hydraulic oils

- code 13 01 10* - **mineral based non-chlorinated hydraulic oils** from the hydraulic systems of equipment, etc. Those oils will be collected at the place of occurrence, by the companies servicing the equipment, in their own vessels dedicated for the purpose, and will be transported by those companies and delivered to a licensed company for rendering safe - 10 t/y.

Group under code 13 02 - waste engine, gear and lubricating oils

- code 13 02 05***mineral-based non-chlorinated engine, gear and lubricating oils** from the lubrication systems of the technological equipment -1.0 t/y.

Group under code 13 03 - waste insulating and heat transmission oils

- code 13 03 07* **mineral-based non-chlorinated insulating and heat transmission oils** about 1.0 t/y

Spent engine and lubricating oils are generated chiefly in the maintenance of pumps, compressors, vehicles and construction equipment. Waste oils are usually classified as hazardous waste under code 13 02 05* as well as 13 01 10*. Cooling oils for power transformers are cooled by the ambient air or through forced air stream circulation, and are usually classified as hazardous waste under code 13 03 07*.

Group 15 - Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified

Group under code 15 01 - packaging (including separately collected municipal packaging waste)

- code 15 01 10* -Packaging containing residues of or contaminated by dangerous substances (disinfectants, oils etc.). That waste will be delivered, under a contract in writing, to a company authorised according to the procedures of WMA to render it safe;

Group under code 15 02 - absorbents, filter materials, wiping cloths and protective clothing.

Absorbents and filter materials (oil filters) will be generated in the operation of the ventilation systems, construction and fitting equipment, as hazardous waste under code 15 02 02* absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, and protective clothing, contaminated by dangerous substances.

Group under code 16 - Wastes not otherwise specified in the list

Group under code 16 06 - batteries and accumulators

Replacing parts of the operating and redundant power supply of the equipment, the emergency lighting, and the maintenance of vehicles will give unserviceable batteries and accumulators, which are usually hazardous waste under code 16 06 01* - lead batteries.

Those will be delivered, under a written contract, to a company authorised according to the procedures of WMA, for following treatment. A company possessing the required permit under the mentioned act will be sought for contracting, and the waste will be delivered to it at the place of its formation.

The summary characteristics of production waste includes also waste from the installation for grate incineration of RDF, classified as **hazardous waste**.

- **Fly ash and boiler dust** are usually led away by flue gas and separated in filtering, which in the RDF incineration installation is part of the semi-wet system for flue gas cleaning;
- **Residue from semi-dry cleaning of flue gas** - Group under code 19 01 00 Wastes from incineration or pyrolysis of waste, namely: - 19 01 07* solid wastes from gas treatment and 19 01 10* spent activated carbon from flue-gas treatment - total about 5,520 t/y, hazardous waste (approximately 3 % of the total quantity of treated waste).

5.6.2 WASTE COLLECTION, STORAGE, TRANSPORTATION AND TREATMENT HAZARDOUS AND INERT WASTE TRANSPORTATION DIAGRAM. NEED FOR TEMPORARY STORAGE.

5.6.2.1 WASTE MANAGEMENT IN THE CONSTRUCTION PERIOD

- **Construction waste**Concrete (17 01 01) and bricks (17 01 02) waste will be generated as a result of construction works carried out at the site envisaged for IP implementation. The possibility shall be considered of the Client assigning the construction company to do the management of all waste generated during the site preparation for construction and during the entire construction period (that is an usual practice with similar projects). Construction waste will be disposed at the landfill for construction waste. All earth mass that will be generated in the excavation is unsuitable for level filling (according to the geological report) so it will be transported to a landfill; additional material for filling will be supplied from places beyond the site No explosives will be used in the excavation works.
- All types of waste generated as a result of the construction (17 04 05, 12 01 01, 12 01 03, 15 01 04) will be delivered for recycling to a company possessing a permit under art.67 or an integrated permit under art. 35 (1) of the WMA and a contract concluded in writing according to art.39 (1) of the same act.
- Waste packaging (15 01 01, 15 01 02, 15 01 03) will be separated in the course of the installation works. Within the territory of each of the sites a place will have to be designated for storing the packages from the equipment and installations. Sorting them by type shall be organised (wooden, plastic, metal, paper and cardboard) and they shall be delivered to specialized companies for recycling.
- The expected quantity of municipal waste is about 10 **t/y** - ; that is envisaged to be collected in containers and regularly transported to the landfill for municipal waste in the territory of Sofia municipality. The waste will regularly transported by the company responsible for waste collection and transportation; a respective contract will be concluded between that company and the subcontractor for the construction.

- It is likely that hazardous waste of group 13 is generated in the maintenance of the construction equipment, if that equipment has not undergone recent technical service according to the kilometres of run or number of hours in operation. The usual practice in most building sites in such cases is that the service companies responsible for the equipment repair and maintenance collect spent oils on the spot in their own vessels, transport the oils and deliver them to companies authorised according to the WMA procedures for disposal in a safe manner. Places for hazardous waste collection shall be designated in line with the respective fire safety and regulatory requirements.
- It is likely that spent batteries (16 06 01*) of the vehicles and equipment fall into disuse during the construction. It is envisaged that end-of-life batteries are delivered to the persons specified under the Ordinance on accumulators and batteries (serviceable and non-serviceable), adopted by Council of Ministers Decree No.351 of 27.12.2012, promulgated in SG No 2 of 08.01.2013, effective 08.01.2013, as amended SG No.6 of 22.01.2013, as last amended and supplemented SG No.51 of 11.06.2013, effective 11.06.2013.
- Paint and varnish packages, containing dangerous substances, shall be collected and temporarily stored according to the regulatory requirements in a B-B cube or in another type of tightly closing container, marked with clear signs of the type and the hazard level of the waste, and shall be delivered on the spot, under a contract, to a company authorised according to the respective WMA procedures for further treatment.
- The waste generated during construction will be managed in conformity with the regulatory requirements; special areas will be allocated for handling and temporary storage of the waste by types. The waste intended for final rendering safe and disposal will be delivered under a contract to companies authorised according to art.25 (1) item 1 of the WMA (Promulgated in SG No.53 of 13.07.2012) or possessing an integrated permit issued according to the procedures of the EPA.
- Fluorescent tubes unfit for use will be delivered to a specialised company for following treatment according to the regulatory requirements.

5.6.2.2 WASTE MANAGEMENT IN THE OPERATION PERIOD

Process waste and technological residues, which will be generated by the cogeneration plant utilizing RDF has been classified as non-hazardous and hazardous waste.

- **Non-hazardous (inert) waste**

  Bottom ash - 36,000 t/y- The slag from the furnace mixed with grate screenings -36,000 t/y
  Scrap - approximately 360 t/y, non-hazardous waste.

The project proposal envisages transporting the slag and disposing it in the landfill for construction waste Vrazhdebna of Sofia municipality.

Transportation of bottom ash from the plant to Vrazhdebna landfill for construction waste - 36,000 t/year; 115 t/day. The distance to TPP Sofia is around 11.5 km, and to TPP Sofia-East – 16.8 km .

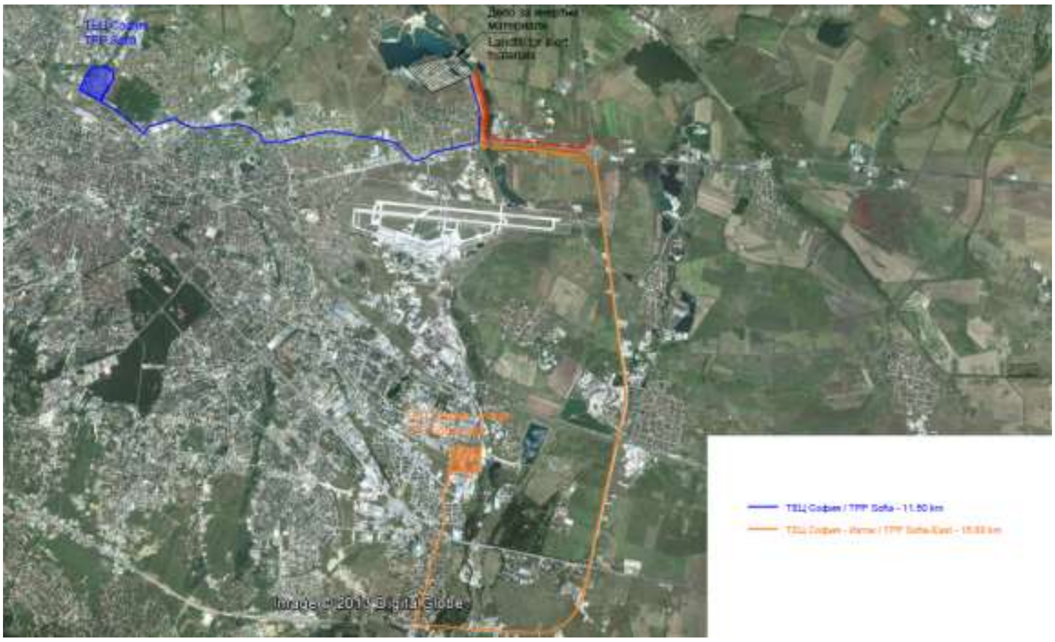


FIGURE 5.6-1 TRANSPORTATION OF BOTTOM ASH FROM THE PLANT TO VRAZHDEBNA LANDFILL FOR INERT MATERIALS

In most countries it is possible to use slag in construction, for example as filler in road construction. That possibility has to be explored in the following design phases. Inert materials produced by slag are 70 - 80 % of its quantity; the remaining 20- 30 % is dust, which is disposed in a landfill for inert materials. In Bulgaria the market for inert materials produced from slag is limited. The price of inert materials produced from slag (in iron production) is between BGN 3.8 and 4.6 per ton.

Another possibility is to apply following treatment of the slag. That possibility can be examined in details in the following project design phases, providing technical and economic justification of the technical solutions suggested in the preliminary phase.

The slag can be rendered more inactive through secondary incineration, for example in a rotary furnace like the solution of Babcock, Wilcox & Vølund, or by high-temperature treatment, as in the processes of Martin Syncom Plus. It turns into a grass-like substance /glass. It is possible to treat slag under high temperature (usually higher than 1,200 -1,300 ^{0} C). At such temperature the silica in slag will melt and the melted silica (vitro =glass) will coat the material, which can be used for various purposes.

- **Scrap** -It will be stored temporarily at the plant site and regularly delivered for recycling, to a company possessing a permit under art.67 or an integrated permit under art. 35 (1) of the WMA; a certificate of origin shall be available and a contract concluded according to art.39 (1) of the same act.

- **The fly ash and residue from flue gas cleaning are classified as hazardous waste.**

The solution envisaged in the project is to dispose hazardous waste in a landfill for hazardous waste. Silos provide possibility for temporary storage of waste at the site - for 8 days; it is suggested that after that the fly ash (hazardous waste) is transported from the plant to a depot for temporary storage (regional depot Sevlievo - at 200 km or Ruse - at 330 km) or to a mine in Germany (2,000 km); maximum 35 t per day.

It is necessary that SM seeks a real possibility for rational solution of the problem; investigations need to be made for determining a site for a hazardous waste depot located at a shorter distance from the plant.

The technical possibilities shall be investigated more precisely for separation from the fly ash of the more toxic waste of spent activated carbon, which has absorbed Hg and dioxins, and for its treatment separately from the fly ash.

The residual product from the flue gas cleaning system is hazardous waste for which there is no treatment method. However there are several ways for stabilizing that waste.

Three methods have been tested in Denmark, VKI/KARA, DRH and Ferrox. They are based on bathing with water solution with an added stabilizing agent like CO_2 or ferrous compounds.

Additional quantity of water would be necessary for removing the chlorides to a considerable degree, and the resulting liquids would have to be purified before they are led to the sewerage system. That would also generates a waste product containing a small quantity of heavy metals. Bathing eliminates the most soluble salts and mitigates some of the dangerous properties of the residual product, especially alkalescence, but some of the heavy metals and calcium sulphates would remain, which necessitates their extraction. That is why the stabilized residual product is not a useful product that could be used with slag, for example in construction. The waste could be disposed at somewhat stricter conditions than the raw residue instead.

The process VKI/KARA has been developed by DHI (Danish Hydraulic Institute, the former VKI) in cooperation with KARA/NOVEREN and others. In that process the residue is extracted by means of water, the ratio between liquid/solid substance being approximately 3, ans the residue is stabilized through treatment with carbon dioxide and/or phosphoric acid; slightly soluble salts result - like carbonates and phosphates. Besides the salts have a buffer capacity; that will maintain a pH reducing the extraction of heavy metals.

Also another method of correcting the pH can also be developed in details.

the Ferrox process uses ferrous sulphate for stabilization, in which heavy metals combine in ring compounds (chelates). 8 days

Solidification - In some countries, for example France and to some extent Switzerland, fly ash is stabilized through cementing (solidification) and then disposed in special depots. Solidification slows down the extraction of soluble substances from the residue but can not prevent the extraction of chlorides, which remain soluble regardless of solidification. As the substances soluble in water (mostly chlorides) are a large part of the mass, the extraction threatens the mechanical stability of the solidified product. **The other waste generated in the operation period** will be temporarily stored at the plant site in conformity with the legislation in force; Toplofikatsia Sofia has experience of many years in that.

- **Construction waste** - resulting from repairs; will be disposed at the landfill for construction waste .
- **All types of metal waste** (17 04 05, 12 01 01, 12 01 03, 15 01 04) and scrap will be stored temporarily at the plant site and regularly delivered for recycling, to a company possessing a permit under art.67 or an integrated permit under art. 35 (1) of the WMA; a certificate of origin shall be available and a contract concluded in writing according to art.39 (1) of the same act.
- **Waste packaging** (15 01 01, 15 01 02, 15 01 03) -Will be stored temporarily at the site, sorting it by type shall be organised (wooden, plastic, metal, paper and cardboard) and it shall be delivered to specialized companies for recycling.
- The expected quantity of **municipal waste** is about 4 t/y; its is envisaged to collect it in containers and periodically transport it to landfills for MSW in the territory of Sofia municipality. The waste will regularly transported by the company responsible for waste collection and transportation; a respective contract will be concluded for the purpose.
- It is likely that hazardous waste of group 13 is generated in the maintenance of the vehicles; it will be temporarily stored at the plant site in conformity with regulatory requirements. It

will be regularly delivered to a company authorised according to the WMA procedures for disposal in a safe manner. The places for hazardous waste collection shall correspond to the respective fire safety and regulatory requirements.

- **It is envisaged that end-of-life batteries** (16 06 01*) of the equipment are delivered to the persons specified under the Ordinance on accumulators and batteries (serviceable and non-serviceable), adopted by Council of Ministers Decree No.351 of 27.12.2012, promulgated in SG No 2 of 08.01.2013, in force as of 08.01.2013, as amended SG No.6 of 22.01.2013, as last amended and supplemented SG No.51 of 11.06.2013, effective 11.06.2013.
- **Paint and varnish packages, containing dangerous substances**, shall be collected and temporarily stored according to the regulatory requirements in a B-B cube or in another type of tightly closed container, marked with clear signs of the type and the hazard level of the waste, and shall be delivered on the spot, under a contract, to a company authorised according to the respective WMA procedures, for further treatment.
- Fluorescent tubes unfit for use shall be stored temporarily at the plant site, in unbroken and well-closed boxes and shall be periodically delivered to an authorised firm for further treatment.

The transportation of waste will be performed in compliance with the regulatory requirements regarding handling and transportation of industrial and hazardous waste.

No waste re-use, treatment, recycling or disposal will be performed at the site.

Control and measuring - The quantity of generated waste will be controlled.

Waste management documents and reporting of waste management activities: According to the regulatory requirements in force regarding waste management activities those documents are: a waste register book; annual reports including data cards about waste by types;

Before starting construction for the IP project the respective site will be prepared for the construction and installation of the new production facilities.

Good waste-management practices are in place in both TPPs.

The waste generated in the operation of the new plant, and in its decommissioning in future, will be managed independently by the the managers of the RDF incineration plant.

Provided there is strict control and effective management of waste, and provided the suggested measures are strictly observed, no significant negative impact is expected on the environment, on the employees working at the IP site, or on the population in that area.

5.6.3 ENVIRONMENTAL IMPACT ASSESSMENT

5.6.3.1 CONSTRUCTION PERIOD

During the construction of the facilities in the IP implementation, temporary effects on the environment are expected, only within the IP site and only in the construction period. The impact will be negative, directly on the site, as the waste will be generated at the place of the construction activities.

As regards frequency the impact is expected to be temporary; as regards duration - of short duration (during the construction of the IP facilities); and it will be reversible because the generated waste will be at the site only temporarily before it is transported for following treatment.

5.6.3.2 SERVICE PERIOD

The plant's operation itself is directly connected with minimizing the waste of Sofia city and using that waste as an energy resource, and that is assessed as a highly positive action, connected with *undertaking an important step towards meeting the requirements for sustainable waste management policy in EU states*.

Continuous impacts on the environment are expected during the operation of the plant envisaged in IP.

Besides energy the RDF incineration will generate also **process waste, so called technological residue**, altogether 25 % of the input waste used as a resource for energy generation.

According to this technological solution the waste generated by the plant as technological residue for disposal will be:

- 20 % non-hazardous inert waste;
- < 5 % hazardous waste.

The other waste, which will be generated at the IP site, will be stored there temporarily and regularly delivered to companies for following treatment.

5.6.3.3 IMPACT OF THE WASTE - THE SO CALLED TECHNOLOGICAL RESIDUE

5.6.3.3.1 IMPACT OF THE NON-HAZARDOUS WASTE - TECHNOLOGICAL INERT WASTE: SLAG

In normal operation of the plant, and provided all suggested measures for strict control and management of the technology processes are observed, and the waste is transported to the landfill, no significant negative impact is expected on the environment

As regards frequency the impact is expected to be constant; as regards duration - lasting (during the plant's life-time); and it will be reversible because the generated waste will be stored at the site only temporarily before it is transported for disposal; and in future the possibilities for its partial utilization will be explored.

5.6.3.3.2 IMPACT OF THE HAZARDOUS WASTE - TECHNOLOGICAL RESIDUE: FLY ASH, BOILER DUST AND WASTE FROM FLUE GAS TREATMENT

In normal operation of the plant, and provided all suggested measures for strict control and management of the technology processes are observed, and the waste is transported to the places specified for the purpose, no significant negative impact is expected on the environment

As regards frequency the impact is expected to be constant; as regards duration - lasting (during the plant's life-time); and it will be reversible because the generated waste will be stored at the site only temporarily (up to 8 days) before it is transported for disposal; and in future the possibilities for its partial utilization will be explored.

Impact of the hazardous waste - technological residue - fly ash, boiler dust and waste from flue gas treatment

In normal operation of the plant, and provided all suggested measures for strict control and management of the technology processes are observed, and the waste is transported to the places specified for the purpose, no significant negative impact is expected on the environment

As regards frequency the impact is expected to be constant; as regards duration - lasting (during the plant's life-time); and it will be reversible because the generated waste will be stored at the site only temporarily before it is transported for disposal. It is recommended that possibilities are explored in future for partial separation of that waste and for its separate disposal, seeking possibilities to dispose part of the hazardous waste under less strict conditions but beyond the IP site.

Therefore the impact will be negative and direct on the IP site, on the respective transportation routes and on the landfills which will be used observing the suggested measures; the extent of impact is not high. As regards frequency the impact is expected to be constant; as regards duration - lasting (during the plant's life-time); and it will be reversible because the generated waste will not be stored at the site but will be transported for disposal; and in future the possibilities for its partial utilization will be explored.

5.6.3.3.3 OTHER WASTE

The impact is assessed as direct, primary, negative, reversible, local and of realtively small scope, within the production site envisaged by the IP.

5.6.3.4 IN EMERGENCY SITUATIONS

During the construction and operation of the IP plant emergency situations can occur in case of accident - spills, fire, or as a result of natural calamities (like earthquakes, floods etc.) During operation emergency situations can occur as a result of road accidents. The impact expected in such situations is negative, direct, temporary, transient and reversible.

5.6.4 DESCRIPTION OF THE POTENTIAL CUMULATIVE EFFECTS RESULTING FROM THE IMPLEMENTATION OF THE INVESTMENT PROPOSAL AND OF OTHER EXISTING ENTERPRISES AND/OR INVESTMENT INTENTIONS WITHIN THE SITE AND WITHIN THE AREA OF THE PROJECT

A cumulative effect is expected during construction but of the waste-related operations are coordinated with the TPP, such an effect can be avoided or minimized.

5.6.4.1 DURING PLANT OPERATION

Waste - *so called technological residue, process by-waste:* The cumulative effect can be avoided or minimized if there is effective waste management and strict control for coordination of the operations for waste receiving, temporary storage and transportation to the designated landfills (waste accumulation at the IP site over the specified limits shall not be allowed), observing strictly the conditions and requirements regarding waste transportation and disposal, and minimizing the risk of emergency situations.

Other waste - No cumulative effect is expected during operation provided waste is managed effectively.

5.7 HAZARDOUS SUBSTANCES. TYPES. CLASSIFICATION. STORAGE METHODS. IMPACT.

5.7.1 DURING CONSTRUCTION

The Law on the protection from the harmful effects of chemical substances and mixtures and the by-laws with it are the basis for management of the activities involving dangerous substances. According to that law chemical substances and mixtures, possessing any of the dangerous properties listed in **Table 5.7-1**, are classified as hazardous.

TABLE 5.7-1 DANGEROUS PROPERTIES OF CHEMICAL SUBSTANCES AND MIXTURES

Properties and codes of chemical substances and mixtures	
1. Explosives (E)	8. Harmful (Xn)
2. Oxidizing (O)	9. Corrosive (C)
3. Extremely flammable (F^+)	10. Irritant (Xi)
4. Highly flammable (F)	11. Sensitizers* (Xi)
5 Flammable (F)	12. Carcinogens* (T, Xn)
6. Very toxic (T^+)	13. Toxic for reproduction* (T, Xn)
7. Toxic (T)	14. Mutagens* (T, Xn)
	15. Dangerous for the environment (N)

Note: Remote effects on the body (*) have those substances and preparations which cause harm after a longer period of exposure.

In the recent years a number of decrees, ordinances and other by-laws were promulgated with annexes and lists of classification and codification of hazardous substances in accordance with different international conventions on: handling, storage, transportation, import, export and cross-border movement of hazardous substances (chemical substances and mixtures).

The following will be used **during the construction** of the cogeneration plant utilizing RDF envisaged in the IP:

- diesel fuels, petrol, hydraulic oils etc. - in the construction machines and equipment and in the transportation vehicles;
- pains and varnish - in industrial design;
- disinfectants of municipal waste.

It is envisaged that using of hazardous substances during the construction of the IP facilities will be under strict control and management of the work with such substances. The substances, which will be used in the construction, have been classified under the hazard categories regarding the risk to the health of those working in different sections and to environment.

The IP construction activities involve using hazardous substances of the oil products group - diesel fuel, mineral-based oils, and also asphalt, dangerous paint and varnish - in some of the finishing works:

- Use of fuels for the specialized construction machinery for the realization of the construction part of individual sub-projects in: terrain preparation; making the communication, power supply, water supply, road and other infrastructure; additional operations.
- Use of fuels for the road vehicles necessary for delivery and movement of materials, equipment and machinery.
- The vehicles and construction machines that will be used require lubricating oils (motor oils), which, although in small quantities, have toxic properties making them dangerous for people and the environment.
- Finishing works involve using paints and varnishes, containing organic solvents or other dangerous substances.
- Chlorinated lime - used for disinfection of waste and other items.

Table 5.7-2 lists the chemical substances, which will be used in the construction of the IP plant, with their numbers according to CAS and EC. Their classification in groups, categories and hazard precautions has been made according to Regulation Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP).

TABLE 5.7-2 HAZARDOUS CHEMICAL SUBSTANCES WHICH WILL BE USED IN THE CONSTRUCTION OF THE IP PLANT

Article	Used in	EINECS No.	CAS No.	Classification 67/548/EEC - Hazard symbol - R risk phrase - S safety - phrase	Classification (EC) No.1272/2008 CLP H phrases - hazard warning P - safety recommendations
Diesel fuel	Construction equipment and transport vehicles	269-822-7	68334-30-5	Xn,F,N, Xi R40, R20- R 65 R38 R51- R 53	H226, H304, H315, H332, H351, 373 H341 ,
Motor oils	Construction equipment and transport vehicles	309-874-0	101316-69-2	Xn,N,Xi sources of PAH R21/22, R36- R 36/38; R38 R50- R 52 S 25; S 26 ; S 37	H350
Mineral-based oils	Construction equipment, transport vehicles, machinery			Xi ,Xn, N R21/22, R36- R 36/38; R38 R50- R 52 S 25; S 26 ; S 37	H302/312, H314, H315,H19, H400,
Chlorinated lime (O,C,N)	Disinfection of mixed municipal waste	231-908-7	7778-54-3	O,C,N	H314
Oxidised asphalt Id. No. 649-034-003	Asphalt pavement of grounds etc.	265-196-4	64742-93-4	Xn, Xi R20, R45 R 46 S 20/21; S 36/37	H332;,H340;, H350 P- 102; P- 262; P- 270;P- 280
Petrol	Transportation vehicles	-	-	Xn, Xi, F,N R12; R 38; R46;, R62-63; R 65; R 67, R51-53;	H224;,H304; H315;, H336;H361;,H411 P- 201; P- 210; P- 301
Transformer oil with inhibitor additive	Used for filling up in transformer power substations	265-156-6/ 64742-53-6	128-37-0/ 204-881-4	N R50-53;	H304;,H400; H410
Paint and varnish (Xn, Xi, F)	Finishing the interior, external decoration elements, etc.	203-539-1, 203-905-0, 201-083-	107-98-2, 111-76-2 78-10-4	Xn, Xi, F R10; R 66-67; R20/21;, R60- S 23; S 36/37/39 S 36	H226 H302,; H312, H332
Paint and varnish	Finishing the interior, external decoration elements, etc.	234-324-0 and other	11099-06-2 and other	Xn, Xi, F R10; R 66-67; R20/21;, R60 S 23; S 36/37/39 S 36-	H226;,H336; H332;,;
Paint and varnish	Finishing the interior, external decoration elements, etc.	204-658-1, 203-603-9, 215-535-7, 203-933-3 and other	123-86-4, 108-65-6, 1330-20-7, 112-07-2 and other	Xn, Xi, F R10; R 66-67; R20/21;, R60- S 23; S 36/37/39 S 36	H226, H332
Lubricating	Construction	265-157-1	64742-54-7	F ,Xn	H412

Article	Used in	EINECS No.	CAS No.	Classification 67/548/EEC - Hazard symbol - R risk phrase - S safety phrase	Classification (EC) No.1272/2008 CLP H phrases - hazard warning P - safety recommendations
grease - mix of special calcium soap mineral oil 50-75% and additive. 0.25 - 2.5 %	equipment, transport vehicles, machinery	270-128-1	68411-46-1	R52/53; R 65; R66,	
Hydrated lime - Calcium di-hydroxide	In construction works and disinfection of municipal waste	207-838-8	497-15-8	Xi, R36, R37, R38, R41, R43,	H315 H318 H335
Portland cement	In carrying out construction works	266-043-4	65 997-15-1	Xi, R36, R37, R38, R41, R43,	H315 H318 H335
Portland cement modif.additives and mineral filler calcium di-hydroxide	In carrying out construction works	1305-62-0	215-137-3	Xi, R36, R37, R38, R41, R43, R66 S 2; S 22;S 26; S 26; ,	H315 H318 H335,

According to data from standardization documents, scientific literature and practice, the chemical substances and mixtures listed in **Table 5.7-2** have the following toxic properties:

- Fuels for road vehicles: Contain polycyclic aromatic hydrocarbons. They harm the central nervous system, respiratory organs, the circulatory system, liver and other internal organs, the lipid metabolism and the skin - petroleum acne. They have intoxicating effect on people. They worsen the condition of people with hypertension and cause tachypnea. They increase the sensitivity of persons, which is often accompanied by anemia and other negative conditions. The safe storage method is putting PAH in metal vessels in the ground or indoors. Vehicles will be refuelled at a petrol station beyond the IP site. No fuel will be stored at the plant site.
- Lubricating oils: They harm the nervous system, the functional condition of the liver, the lipid metabolism; in case of exposition to their aerosols, they cause lipoid pneumonia, petroleum acne, eczema, dermatitis and melanosis (which can develop in malignant cases), folliculitis, hyperpigmentation, solar dermatitis. They have effects remote in time - mutagenic, carcinogenic, and are toxic for reproduction. The latter refers chiefly to spent petroleum oils. Lubricating oils produced in dry distillation of solid fuels are especially dangerous. The oils produced by synthetic methods are less dangerous and apart from that they have much better operating features. The order of oils storage and use is the same like that of fuels, but their quantities are much lower because of the low specific consumption.
- Paint and varnish They cause acute and chronic disorders due to irritation or allergic reactions. They harm the nervous and the respiratory systems, the liver, the endocrine balance and the skin. Paint and varnish will be delivered on the spot immediately before they are used, in containers insulating from the environment, and will be used in accordance with the labelling information and operating instructions.
- Asphalt - - transportation hazard class 9. When laying it the WHSFS instructions shall be observed - registration number under REACH 01-2119498270 -36-0013, UN list - UN3257.

Local spills of fuels, lubricants and other pollutants on bare ground and on other surfaces shall be immediately deactivated by means of chemicals, raked up and taken out of the site as hazardous waste, in line with the regulatory requirements. No negative impact is expected on the environment components - air, water, soil, flora, fauna; there is no health risk to the residents of the area.

The investment proposal does not envisage activities for storing or handling hazardous substances in such quantities as would require issuing a permit under art.104 of EPA.

5.7.2 SERVICE PERIOD

Hazardous chemical substances and mixtures will be used in the operation of the IP plant, in the main technology processes and in the transportation of raw materials and waste.

The main operations of the plant involve using sodium hydroxide, ammonia water, hydrated lime and activated carbon.

Hazardous chemical substances and mixtures will be used in the technology process for the operation of machines and installations as well as in the maintenance of waste transportation vehicles (limited quantities of waste - so called technological residues).

5.7-3 HAZARDOUS CHEMICAL SUBSTANCES AND MIXTURES IN THE TECHNOLOGY PROCESS

Article	Used in	EINECS No.	CAS No.	Classification 67/548/EEC - Hazard symbol - R risk phrase - S safety phrase	Classification (EC) No.1272/2008 CLP H phrases - hazard warning P - safety recommendations
Sodium hydroxide NaOH	In the main operations of the installation	233-245-3	1310-73-2	- C ; - R35; - $S_,$, S_{45}, S_{37}, S_{38}, S_{39}.	H314; P210, P261, P305, P351, P338
Ammonia water NH_4OH- 25%	In the main operations of the installation	215-647-6	1336-21-6	- C ; - R34- R50 - S_{26} S_{45}, S_{37}, S_{38}, S_{39}.	H314; H335; ; H400; P261, P273, P280 P305, P351, P310, P338
Hydrated limeCa$(OH)_2$	In the main operations of the installation	215-137-3	1305-62-0	Xi - R36,R37 R38 S_{24} S_{25}, S_{26}, S_{37}, S_{46}	H315; H319; ; H335; P102, P232, P235 P261, P280, P285, P301 P302, P304, P312 P313, P330, P332, P337, P3381 P340, P351, P352 P362,
Activated carbon	In the main operations of the installation	202-859-9	100-51-6	- Xn ; - R20,R21 R22 S_{26}	H302; H332; P304, P340
Diesel fuel	Construction equipment (in repair works) and transport vehicles	269-822-7	68334-30-5	Xn,F,N, Xi R40, R20- R 65 R38 R51- R 53	H226, H304, H315, H332, H351, 373 H341 ,
Motor oils	Construction	309-874-0	101316-69-	Xn,N,Xi	H350

Article	Used in	EINECS No.	CAS No.	Classification 67/548/EEC - Hazard symbol - R risk phrase - S safety - phrase	Classification (EC) No.1272/2008 CLP H phrases - hazard warning P - safety recommendations
	equipment (in repair works) and transport vehicles		2	sources of PAH R21/22, R36-R 36/38; R38 R50- R 52 S 25; S 26 ; S 37	
Mineral-based oils	Construction equipment (in repair works) and transport vehicles			Xi ,Xn, N R21/22, R36-R 36/38; R38 R50- R 52 S 25; S 26 ; S 37	H302/312, H314, H315,H19, H400,
Oxidised asphalt Id. No. 649-034-003	Pavement of grounds etc. (in repair works)	265-196-4	64742-93-4	Xn, Xi R20, R45 R 46 S 20/21; S 36/37	H332;,H340;, H350 P- 102; P- 262; P- 270;P- 280
Petrol	Transportation vehicles	-	-	Xn, Xi, F,N R12; R 38; R46;, R62-63; R 65; R 67, R51-53;	H224;,H304; H315;, H336;H361;,H411 P- 201; P- 210; P- 301
Transformer oil with inhibitor additive	Used for filling up of transformers	265-156-6/ 64742-53-6	128-37-0/ 204-881-4	N R50-53;	H304;,H400; H410
Paint and varnish (Xn, Xi, F)	Finishing the interior, external decoration elements, etc.	203-539-1, 203-905-0, 201-083-	107-98-2, 111-76-2 78-10-4	Xn, Xi, F R10; R 66-67; R20/21;, R60- S 23; S 36/37/39 S 36	H226 H302,; H312, H332
Paint and varnish	Finishing the interior, external decoration elements, etc.	234-324-0 and other	11099-06-2 and other	Xn, Xi, F R10; R 66-67; R20/21;, R60 S 23; S 36/37/39 S 36-	H226;,H336; H332;,;
Paint and varnish	Finishing the interior, external decoration elements, etc.	204-658-1, 203-603-9, 215-535-7,	123-86-4, 108-65-6, 1330-20-7, 112-07-2 and other	Xn, Xi, F R10; R 66-67; R20/21;, R60- S 23; S 36/37/39 S 36	H226, H332

Article	Used in	EINECS No.	CAS No.	Classification 67/548/EEC - Hazard symbol - R risk phrase - S safety phrase	Classification (EC) No.1272/2008 CLP H phrases - hazard warning P - safety recommendations
		203-933-3 and other			
Lubricating grease - mix of special calcium soap mineral oil 50-75% and additive. 0.25 - 2.5 %	Construction equipment, transport vehicles, machinery	265-157-1 270-128-1	64742-54-7 68411-46-1	F ,Xn R52/53; R 65; R66,	H412
Hydrated lime - Calcium di-hydroxide	In construction (repair works) and disinfection of municipal waste	207-838-8	497-15-8	Xi, R36, R37, R38, R41, R43,	H315 H318 H335

Hazardous chemical substances and mixtures will be used in the technology process for the operation of machines and installations as well as in the maintenance of waste transportation vehicles (limited quantities of waste - so called technological residues).

5.7.3 POTENTIAL IMPACT OF THE DANGEROUS SUBSTANCES ON PEOPLE AND ON THE ENVIRONMENT

5.7.3.1 ON PEOPLE AND ON THE ENVIRONMENT IN THE CONSTRUCTION PERIOD

The use of dangerous substances during the construction of the plant envisaged in the IP will be controlled. During the construction mainly fuels for the vehicles and construction machinery will be used, and lubricating oils in much smaller quantities; also paints and varnishes. Oil replacement and refuelling of vehicles will be performed out of the IP site in appropriate services and petrol stations, and diesel fuel for construction equipment of non-standard size will be supplied by a tank truck. When all WHSFS instructions are observed, no negative impact on the work environment or the natural environment is expected.

The construction works for building the IP facilities involve additional, transient impact of some dangerous substances. That will result from using mainly diesel fuel in heavy excavation and construction machinery; petroleum lubricating oils; from construction dust; cement; generation of construction waste containing hydro-insulation materials and hydrocarbon resins; hydro-insulation materials; polymer glues; paints and varnishes; special pavement. Table **Table 5.7-4** shows the dangerous substances and products, which can pose a risk chiefly to **the health of workers performing the construction works.**

TABLE 5.7-4 DANGEROUS SUBSTANCES AND PRODUCTS WHICH CAN POSE A RISK CHIEFLY TO THE HEALTH OF WORKERS PERFORMING THE CONSTRUCTION WOKS

Chemical substance or preparation CAS No.	Hazard sign	Adverse health effects	Risk exposition

Spent motor oils: PCB's 1336-36-3	Xn Harmful N-Dangerous for the environment	Harmful. Risk of cumulative effects. They harm the nervous system, cardiovascular system, the liver and kidneys. Mutagens. Harmful to the environment, especially for aquatic organisms.	Chronic disorders if work safety requirements are not observed.
Diesel fuel 94114-59-7	Xn Harmful	Risk of cumulative effects. An allergen. Harms the nervous system, the skin, haematopoiesis, liver, kidneys. A mutagen. Harmful to the environment, especially to aquatic organisms.	Chronic disorders if work safety requirements are not observed.
Cement	An irritant An allergen.	Irritates the skin, eyes and respiratory tract. An allergen. Contains pollutants (Cr-VI, Cd, Co, Ni) and is under control acc.to Council of Ministers Decree 156/2004. Inflammatory and allergic effects on the skin and mucosa	Chronic disorders if work safety requirements are not observed.
Paints, varnishes, glue Polymers	Xi Irritants Xn Harmful	Harm the nervous system, liver, endocrine system, respiratory organs, skin and mucosa. Cause allergic disorders.	Chronic disorders if work safety requirements are not observed.

The substances listed in the table above can cause chronic disorders if work safety requirements are not observed, and if personal protective equipment is not used where required or recommended according to the instructions in the labels of those substances, in conformity with the Ordinance on classification, labelling and packaging of dangerous chemical substances.

All hazardous substances shall be delivered together with a certificate and detailed instructions regarding their storage and work with them - safety data sheet (SDS).

If WHSFS instructions for work with hazardous substances are strictly observed (*mandatory use of personal protective equipment and other measures*), *no risk to the health of employees, of the population in the region, or to the environment is expected.*

Potential impact of the hazardous substances on the environment: direct, of short duration, transitory, negligible. When the safety instructions for work with hazardous substances are observed and any possible small accidental spills are eliminated in timely manner, the likelihood of such impact is minimized.

- Provided the requirements of WHSFS instructions are observed and there is control of the technological and occupational discipline, no health risk is expected for the people working with hazardous substances.
- No risk to the health of the residents in the region of the site is expected as relatively small quantities will be used, the sites are remote, and measures connected with such substances have been envisaged.
- The envisaged measures regarding storage of substances classified as hazardous and regarding control in working with such substances are in conformity with all regulatory requirements. Spills and leaks, which could have a negative impact on the components of the environment - air, water, soil, flora and fauns - and pose a risk to the health of the population in the area, are almost excluded provided there is strict control on the use of hazardous substances and mixtures

The mentioned hazardous substances have significance only for the health of workers involved in the plant construction and operation. Firms licensed for specific construction works will be engaged in the construction. For limiting the risk the following have important role: organizations with proven experience; using of well-maintained construction machinery and heavy-duty trucks; their ensured fuelling with high-quality fuels; replacement of lubricating oils beyond the site; efficient instructions; use of personal protective equipment and suitable clean workwear; providing of conditions for personal hygiene.

5.7.3.2 ON PEOPLE AND ON THE ENVIRONMENT IN THE OPERATION PERIOD

Hazardous chemical substances and mixtures will be used in the operation of the IP plant, in the main technology processes and in the transportation of raw materials and waste. The main operations of the plant involve using sodium hydroxide, ammonia water, hydrated lime and activated carbon.

Sodium hydroxide NaOH - CAS No.1310-73-2; Danger category and class: C, R35 corrosive; Impact on the environment and population in case of an accident: Has a local effect on the environment. In case of failure in the tanks the base is collected within dikes. In case of sodium hydroxide spills neutralization by means of water curtain is applied.

Ammonium hydroxide NH_4OH – ammonia water - 25% ammonia. The tank has the necessary dike. CAS No.1336-21-6; Danger category and class: C, R34; N; R50, 9(1)- asphyxiating, toxic and explosive. Type of danger: emits NH3; Impact on the environment and population in case of an accident: Has a local effect on the environment and staff.

Hydrated lime - CAS No.1305-62-0; Danger category and class: Xi, R36; R37; R38; Impact on the persons working with hydrated lime: causes burns if it has direct contact with the skin or eyes.

Activated carbon: CAS No.100-51-6; Danger category and class: Xn, R20; R21; R22; Impact on the environment if activated carbon with absorbed toxic substances is spilt. If there is strict control and management, and if the consequences of an accident are eliminated quickly, the impact is reduced to zero.

Potential impact of the hazardous substances on the environment: direct, of short duration, transitory, negligible. When the safety instructions for work with hazardous substances are observed and any possible small accidental spills are eliminated in timely manner, the likelihood of such impact is minimized.

5.7.3.3 IN EMERGENCY SITUATIONS

During the construction and operation of the IP plant emergency situations can occur in case of an accident - spills, fire, or as a result of natural calamities (like earthquakes, floods etc.) During operation emergency situations can occur as a result of road accidents. The impact expected in such situations is negative, direct, temporary and transient. No cumulative effects are expected.

5.8 HARMFUL PHYSICAL FACTORS:

5.8.1 SOURCES OF NOISE. FORECAST AND ASSESSMENT OF THE NOISE LOAD. VIBRATIONS AND THERMAL RADIATIONS. IMPACT ASSESSMENT.

5.8.1.1 DURING CONSTRUCTION

The construction activities include building the following:

- → For the main production: an administration building (unloading hall, RDG bunker, boiler room, production area, room for slag unloading, flue gas treatment room, silos for consumables/waste products, turbine hall, heat condensers, pumping station, a room for a reserve diesel generator, transformers, administration, staff, control room, crane, stack);
- → A bottom ash storage room (a separate building);
- → A tank for diesel generator fuel and for ammonia water (a separate ground);
- → A heat accumulator (a separate ground);

→ Transport area - access roads, parking places, etc.

The plant construction includes different types of work: excavation, levelling, concrete casting, reinforcement, shuttering, installation, transportation, etc., carried out by means of construction and installation machinery and equipment and vehicles - sources of noise in the environment. It is envisaged that the following machinery will operate simultaneously: 2 excavators, 2 front loaders, 6 dump trucks and 1 container transporter. The construction and installation machinery will be situated in the site of the future new plant. The ticks used for delivering the necessary materials and equipment and transporting the waste will also be a noise source. The levels of noise emitted by the main types of machines, which will be used, are: an excavator – 80 ÷ 91 dBA, a front loader – 78 ÷ 86 dBA, a bulldozer – 88 ÷ 105 dBA, a lorry-mounted crane – 84 ÷ 95 dBA, concrete-laying machinery – 87 ÷ 94 dBA, trucks – 80 ÷ 92 dBA. The equivalent noise level expected at the building site, close to operating machinery, is about 90 dBA. All construction activities except transportation will be performed within the site of the new plant.

The investment proposal does not envisage building additional external road infrastructure. In either of the sites building only an internal road network will be necessary in order to enable access to the plant site.

The expected equivalent noise level generated by the most intensive service transportation during earth works is about 49 dBA, at 25 distance from the traffic axis. That transportation will not change the noise characteristics of the transport flows in the main streets of the truck transport routes in the respective areas: (Botevgradsko Shose Blvd., Danail Nikolov St., Istoria Slavyanobalgarska St., the ring road, Tsarigradsko Shose Blvd. and Dimitar Peshev St.).

The expected equivalent noise levels, reaching the residential object closest to TPP Sofia site and exposed to the noise - block of flats No.4, at approximately 300 m distance from the new plant -are: from the construction operations at TPP Sofia site - up to 50 dBA; from the servicing trucks travelling in Nesho Bonchev St. - up to 40 dBA. The expected noise levels are considerably lower than the limit value of hygiene standards for daytime - 60 dBA.

Due to the large distance between the residential areas and the alternative site of the new plant in the territory of TPP Sofia-East (over 700 m) the construction activities will not be a source of noise for them (expected level up to 50 dBA). The trucks serving the construction are not going to be a noise source for them either, as they will directly join the traffic flow in Dimitar Peshev St.

The construction activities at the sites of the two power plants will be a source of noise above the limit value for the neighbouring industrial areas.

The noise from construction activities will have an impact for a limited period - only in the daytime.

5.8.1.2 DURING PLANT OPERATION

Sources of noise in the departments of TPP Sofia and TPP Sofia-East are: the equipment in the industrial premises, the open units and installations, the service vehicles, etc. The most intensive noise in the department rooms is generated by turbines, fans, boilers, pumps and pump transmission drives, pipelines and their fittings, compressors, etc.

Besides the plant installations and equipment, located indoors, a source of noise into the environment will be also all operations connected with receiving, storing, loading and unloading of raw materials, ancillary materials, etc. The main unloading operations of the RDF bunker will be performed in a closed unloading area.

No passport data of the noise parameters of envisaged equipment has been provided at this stage. According to the design most of the equipment in the new plant's building shall comply with the requirement regarding the level of equipment-generated noise - up to 80 dBA, and those units generating the loudest noise (the turbine, some pumps, compressors, slag conveyor belts, air coolers and steam condensers) - up to 85 dBA. To meet that requirement it is envisaged that the units of the equipment, generating the most noise, will be located in enclosed and noise-insulated areas (rooms), or within noise-insulating casings.

Noise penetration from the rooms through the external walls of the building, enclosing them, will depend on the noise-insulation property of those walls. The main production area - the administration building - comprises three spaces: the unloading hall, RDF storage bunker, and production hall. The space design solution of that building restricts the spreading of noise from the various sources (main and ancillary) into the environment. Two types of façade panels are envisaged for the different spaces: HPL panels and sealed glass units, 8 mm /20 mm /8.8 mm thick, with average sound insulation capacity not lower than 35 dB. The expected level of noise penetrating the enclosing structures of the plant's building and spreading into the environment is up to 55 dBA. The walls of the auxiliary buildings (warehouses and storage rooms, oils and lubricants department) will be made of panels or brickwork, of average sound insulation capacity over 40 dB, therefore high levels of noise penetrating them, from various activities within the buildings, is not expected.

There will be also outdoor sources of noise at the new plant site, however at this stage there is no information about their acoustic characteristics. According to the design the main requirement complied with is that the noise emissions from the new plant shall not exceed the noise limit value of 70 dBA for the production site area.

The vehicles supplying RDF for the plant's operation and transporting the waste - bottom ash and fly ash - will also be a source of noise to the environment. The expected equivalent noise level generated by the three flows will be around 49 dBA, at 25 m distance from the truck traffic axis. The general flow will not change the noise parameters of the traffic flows in История Славянобългарска St. and Dimitar Peshev St. which are the access roads to the sites of the two power plants. After leaving the plants' area the three flows will divide and travel in different routes, and will not influence the noise parameters of the traffic flows in the roads.

The expected equivalent noise levels, reaching the residential object closest to TPP Sofia site and exposed to the noise - block of flats No.4, at approximately 300 m distance from the new plant -are: from the plant operation - up to 35 dBA; from the servicing trucks travelling in Nesho Bonchev St. - up to 40 dBA. The expected noise levels are considerably lower than the limit value of hygiene standards for daytime - 60 dBA.

Due to the large distance between the residential areas and the alternative site of the new plant in the territory of TPP Sofia-East (over 700 m) the plant's operation will not be a source of noise for those residential areas. The trucks serving the plant operation are not going to be a noise source for them either, as they will directly join the traffic flow in Dimitar Peshev St.

5.8.2 VIBRATIONS. IMPACT ASSESSMENT. VIBRATIONS AND HEAT RADIATION. IMPACT ASSESSMENT.

Vibrations are expected in the work environment during the construction; they will result from the operation of certain types of construction machinery and transport vehicles.

Spreading of vibrations from the equipment (like compressor room, steam turbine, etc.) into the environment is not allowed during operation.

5.8.3 DESCRIPTION OF POTENTIAL CUMULATIVE IMPACTS

Noise levels higher than those currently existing in that area are expected at the new plant site. They will not exceed the limit value of 70 dBA, including at monitoring points (MP) Nos. 1, 2, 3, 4 of the measurement outlines of TPP Sofia (**Table 4.9-1**) and MP Nos. 3, 4, 5 of the outlines of TPP Sofia-East (**Table 4.9-2**,) of **section 4.9.1**.

In the impact areas of the two power plants no change in the current noise regime is expected after the IP project implementation because the expected noise levels from the new plant will be much lower than those measured at present: at TPP Sofia - minimum 13 dBA lower; at TPP Sofia-East - over 25 dBA lower (Measurement reports - Annexes 1 and 2).

5.9 LANDSCAPE

5.9.1 ASSESSMENT OF THE EXPECTED CHANGES IN THE LANDSCAPE

5.9.1.1 DURING CONSTRUCTION

Assessment of the IP implementation activities, which can have an impact on the landscape components, will be made for each of the two sites separately.

5.9.1.1.1 TPP SOFIA SITE (SITE B)

The construction of the IP project will be carried out at the industrial site of TPP Sofia. Construction itself will be carried out in several stages: earthworks, construction and assemblage works, and installing the equipment. In the phase of excavating the pits for the foundations there will be significant changes in the landscape structure. The landscape components subsoil, soil and vegetation will be directly affected. The excavation works during construction will affect directly the subsoil component. The impact is assessed as direct, lasting, permanent but of small scope, within the building site envisaged by the IP. The vegetation will be destroyed. The humus layer will be removed and disposed separately. The impact on the landscape components soils and vegetation is assessed as direct, primary, negative, reversible, local and of relatively small scope, within the building site envisaged by the IP.

Changes in the landscape appearance - aesthetic and spatial - will be made within the building site during the construction and assemblage works. New anthropogenic elements will be included in the landscape structure. The impact will be temporary - until the plant's decommissioning - and the landscape can be recovered.

The social and economic functions of the landscape in site "B" of TPP Sofia will not be changed in the IP construciton period.

5.9.1.1.2 TPP SOFIA SITE, SITE B

The construction of the IP project will be carried out at the industrial site of TPP Sofia-East. The construction will include earthworks, construction and assemblage works, and installing the equipment. The excavation works for making the foundations will affect directly the subsoil component. The impact is assessed as direct, lasting, permanent, but of small scope, within the building site envisaged by the IP. The vegetation here will also be destroyed and the humus layer will be removed and disposed. The impact on the landscape components soils and vegetation is assessed as direct, primary, negative, reversible, local and of small scope, within the building site envisaged by the IP.

Changes in the landscape appearance - aesthetic and spatial - will be made within the building site during the construction and assemblage works. New anthropogenic elements will be included in the landscape structure. The impact will be temporary - until the plant's decommissioning - and the landscape can be recovered.

The social and economic functions of the landscape in site "B" of TPP Sofia-East will not be changed in the IP construction period.

No chemical pollution of the landscape components is expected in the territory of the two building sites in the construction phase. As source of pollution and possible impact can be only the exhaust gases from the internal combustion engines of construction machinery - CO, NOx, CH4, SO2, hydrocarbons. The amount of emissions will be limited, within the work day, and temporary - until completion of construction at the sites.

The IP project construction period does not involve chemical pollution of the landscape components.

The neighbouring landscapes shall be protected through observing strictly the regulated boundaries of the areas of removal, loading and transportation of earth mass, waste and other materials.

The preferred option for the investment proposal implementation is the site of TPP Sofia, site "B", as construction would not change the social and economic functions or use of the landscape there. The impact on the vegetation components would be fairly minor.

5.9.1.2 DURING PLANT OPERATION

5.9.1.2.1 TPP SOFIA SITE, SITE "B"

During the operation of the IP plant the structure of the landscape will not be changed. Sources of impact on the landscape components can be harmful gas emissions and waste.

In case of accidents local pollution of the vegetation and soil components is possible.

5.9.1.2.2 TPP SOFIA-EAST SITE, SITE "B"

The IP construction period does not involve chemical pollution of the landscape components. Sources of impact on the landscape components can be harmful emissions, polluted waste water and waste.

In case of accidents, local pollution of the vegetation and soil components is possible.

5.9.1.3 CONCLUSIONS:

→ In the IP construction phase there will be significant changes in the landscape structure. The landscape components subsoil, soil and vegetation will be directly affected.
→ The subsoil component will be directly affected by excavations. The impact is assessed as direct, lasting, permanent, but of small scope, within the building site envisaged by the IP.
→ The impact on the landscape components soils and vegetation is assessed as direct, primary, negative, reversible, local and of small scope, within the building site envisaged by the IP.
→ Changes in the landscape appearance - aesthetic and spatial - will be made within the building site during the construction. New anthropogenic elements will be included in the landscape structure. The impact will be temporary - until the plant's decommissioning - and the landscape can be recovered.
→ The social and economic functions of the landscape will not be changed in the IP construction period.
→ The IP project construction period does not involve chemical pollution of the landscape components.
→ The IP plant operation period does not involve negative impact on the landscape components.
→ In case of accidents, local pollution of the vegetation and soil components is possible.

5.10 CULTURAL HERITAGE - EXPECTED IMPACT ON SITE OF CULTURAL VALUE WITHIN THE SCOPE OF THE INVESTMENT PROPOSAL

5.10.1 DESCRIPTION OF THE POTENTIAL IMPACTS IN ALL PROJECT PHASES AND THE RELATED ACTIVITIES

5.10.1.1 TPP SOFIA SITE (SITE "B")

The IP implementation and the use of natural resources are not expected to have any impact, direct or indirect, on the Central Cemetery of Sofia monument of culture group located nearby, because the existing infrastructure and the existing road network will be used, and besides the distance between the IP site and the monument of culture group is about 80 m, and that site does not border the monument of culture group. Negative impact of forecast emissions is not expected either as they will be within the normal and within the limit values.

5.10.1.2 TPP SOFIA-EAST SITE (SITE "B")

As no sites of cultural value have been found at the site of TPP Sofia-East or in its vicinity, the IP implementation is not expected to have any impact, direct or indirect, connected with the use of natural resources or due to harmful emissions.

5.11 HEALTH AND SANITATION ASPECTS

5.11.1 EVALUATION OF THE HEALTH-ASSOCIATED RISKS DURING THE CONSTRUCTION AND OPERATION OF THE PLANT UNDER THE IP. HEALTH PROTECTION MEASURES; POSITIONS INVOLVING RISK; ENSURING OF HEALTHY AND SAFE WORK CONDITIONS AND FIRE SAFETY.

5.11.1.1 DURING THE PLANT CONSTRUCTION

It is planned to build the following: main production and administration building; bottom ash storehouse; diesel generator fuel tanks and ammonia waster tanks in two different areas, and a heat accumulator. A transport area will be built too (access roads, parking places, etc.). It should be pointed out that the site selected as a main one - TPP Sofia site (Site Selection Report, approved by Toplofikatsia Sofia EAD (TS) on 26.07.2013) - will have advantages already in the construction period because of the fact that in order to carry out the construction at the site of TPP Sofia-East first the existing mazut bunkers (buried in the ground) will have to be removed. Their demolition would make the IP implementation more difficult and could involve a considerable environmental risk. Apart from that the electricity transmission grid will have to be made anew as its present height would not enable building the new facility.

The main technological operations for the IP implementation involve work mainly in the over-ground part of the plant and finishing works. The construction will include the following: earthworks, supplying of materials to the site and making reinforced-concrete foundations, construction of the main building and ancillary grounds as well as building an appropriate infrastructure. The operations involving truck traffic, work of heavy-duty construction machinery, use of large quantities of construction materials generate additional noise and vibrations. The air will be polluted with irritating and harmful gases, general soil dust and construction dust and fine dust particles of size 2.5 μm to 10 μm. Due to the self-cleaning processes of the atmosphere and settling of larger dust particles at some distance from the source, the concentration of pollutants in the ambient air decreases very quickly and reaches the required limit values.

In case of an accident the building site could be polluted with spent lubricating oils used in the heavy machinery, fuels and construction waste containing corrosive substances, hydro-insulation and electro-insulation materials, glues, organic solvents and waste polymers, but such pollution would be local and in a limited area.

The following materials will be necessary for the construction: concrete, sand, gravel, cement, lime, reinforcement, as well as: bricks, and roofing materials, shuttering for reinforced concrete structures, pipes, electric cables, etc. Electricity, water and others will also be necessary in the construction.

The main risk factors for the workers involved in the IP plant construction are connected with dangerous substances (**Table 5.11-1**), adverse physical factors of the work environment, physical and psycho-sensory load on those directly involved in the construction, and the risk of failures and accidents at work (**Table 5.11-2)**.

TABLE 5.11-1 DANGEROUS SUBSTANCES, PREPARATIONS AND MATERIALS* OF ADVERSE EFFECTS ON THE HEALTH DURING THE CONSTRUCTION WORKS FOR BUILDING THE IP PLANT (ACCORDING TO THE SAFETY DATA SHEETS)

Chemical substance, preparation CAS No.	Hazard sign	Adverse health effects	Risk exposition
Carbon oxide 630-08-0	F+ Highly flammable T Toxic	Highly flammable, toxic if inhaled - causes hypoxia and hypoxaemia. Causes carboxyhemoglobin formation. Harms the nervous system, the cardiovascular system, the haematopoiesis. Toxic for the reproduction.	In emissions of exhaust gases
Carbon dioxide 24-38-9		Asphyxiant - replaces oxygen in the air Harms the nervous system	In emissions of exhaust gases
Nitrogen oxides 10102-44-0	T+ Toxic Xn Harmful	Toxic - harm the alveoli of the lungs causing lipid peroxidation. In high concentrations they cause pulmonary oedema, alveolitis. Irritate the respiratory tract, the eyes and the skin; cause chronic bronchitis, frequent pneumonias	In emissions of exhaust gases
Sulphur dioxide 7446-09-5	T Toxic, C Corrosive	Toxic if inhaled - harms the respiratory and the nervous systems, the heart. In high concentrations causes chemical burns. Irritates the respiratory tract, eyes and skin. Has strong unpleasant odour. Dangerous for the environment.	In emissions of exhaust gases
Diesel fuel 8006-61-9	Xn Harmful N Dangerous for the environment	Harmful Risk of cumulative effects. An allergen. Harms the nervous system, the skin, haematopoiesis, liver, kidneys. A mutagen. Dangerous for the environment.	Chronic disorders if work safety requirements are not observed.
Cement	Xi An irritant An allergen.	Irritates the skin, eyes and respiratory tract. An allergen. Contains pollutants (Cr-VI, Cd, Co, Ni). Subject to control under Council of Ministers decree No.156/2004** (hexavalent chromium content up to 0.0002 %). Inflammatory and allergic effects on the skin and mucosa.	Chronic disorders if work safety requirements are not observed.
Asphalt 84989-11-7	T Toxic	Chronic harm to the haematopoiesis, respiratory system, liver, skin, endocrine glands and the immune system. Classified as human carcinogen of 2-nd category, an allergen and photo-allergen.	Chronic disorders if work safety requirements are not observed.
Polyurethane and epoxy coatings of surfaces, glues	Xi An irritant Allergens	They cause acute and chronic disorders due to irritation or allergic reactions of the respiratory system (bronchial asthma) and the skin.	Using without advance information in advance from the labels and directions for use.
Soil dust, construction		Causes chronic inflammation of the upper respiratory tract, chronic bronchitis, eye	Excavation works. Tuck traffic, operation of

Chemical substance, preparation CAS No.	Hazard sign	Adverse health effects	Risk exposition
materials dust PM2.5, PM5, PM10		inflammations, aggravates cardiovascular conditions.	heavy-duty construction machinery, using large quantities of construction materials.

* Law on the protection from the harmful effects of chemical substances, preparations and products; Law on the amendment and supplementation of the Law on the protection from the harmful effects of chemical substances, preparations and products, Council of Ministers decree (CMD) No.316, with Ordinance on the classification, packaging and labelling of existing and new chemical substances, preparations and products, and CMD No.174 amending and supplementing CMD No.316.

** CMD No.156 amending and supplementing the Ordinance on dangerous chemical substances, preparations and products whose trade in and use are subject to prohibition or restrictions, adopted by CMD No.130.

The harmful effects of chemicals used in the construction machinery and trucks can be controlled if diesel fuels are used complying with the requirements of the Ordinance on the requirements regarding liquid fuels quality and the conditions and procedures for their control, adopted by CMD No.156 of 15.07.2003, promulgated SG No. 66 of 25.07.2003, effective 1.10.2003.

The other harmful impacts connected with the construction activities for building the facilities under the IP, which could occur, are summarized in **Table 5.11-2**.

TABLE 5.11-2 ADVERSE IMPACTS ON THE HEALTH, CONNECTED WITH PHYSICAL FACTORS OF THE ENVIRONMENT, PHYSIOLOGICAL LOAD AND ACCIDENTS DURING THE CONSTRUCTION OPERATIONS FOR BUILDING THE IP FACILITIES

Harmful factors	Adverse health effects	Risk exposition
Physical factors of the environment		
Noise and vibrations* from construction machinery, trucks and construction operations	Hearing damage in the high frequency range, neuroses, neurasthenia, high blood pressure, disturbed metabolism and immune system.	Tuck traffic, work with heavy-duty construction machinery, using large quantities of construction materials. Work with old and poorly maintained machines, poor roads, unsafe operator's cabins, working without hearing protectors.
Microclimate beyond the area of comfort**	Work outdoors. Feeling cold or frozen; overheating. damage to the cardiovascular system and locomotor system; infectious diseases.	Lack of places for rest. Inappropriate work clothes, gloves and shoes.
Physiological and ergonomic factors of the work environment		
Lifting of heavy objects	Damage to the joints, the skeletal system; cardiovascular problems.	Failure to observe the requirements of Ordinance No.16/1999***
Physical fatigue and stress	Damage to the joints, the skeletal system; neurological and cardiovascular problems.	Failure to observe the requirements of Ordinance No.15/1999****
Psychical and sensory overload	Neuroses, neurasthenia, cardiovascular problems, stress	
Unnatural working position	Damage to the joins, the skeletal system	Specific construction activities
Failures and accidents		
Accidents at work Injuries	Falling into pits, from high, being buried under earth mass, injuries caused my heavy duty machines or equipment	Specific construction activities
Fires, explosions	Burns, injuries, suffocation Electric shock	Lack of protection against electric shock

Harmful factors	Adverse health effects	Risk exposition
		Improper storage of oil products and fuels
Road accidents	Injuries, burns, damage by petroleum fuels, burying under inert materials	Transportation of large quantities of construction materials

* BDS 14478-82 Noise. Limit values at the workplace. General requirements regarding measurement.
** BDS 14776-87 Industrial microclimate
*** Ordinance No.15 on the conditions, procedures and requirements for development and observing of physiological regimens of work and rest at the workplace.
**** Ordinance No.16 on the physiological norms and rules for manual operations with heavy objects

5.11.1.2 EXPOSITION CHARACTERISTICS

Territorial scope of the impact: local, within the building site of IP. No negative impacts on the population in the adjacent areas are expected.

Duration: Short duration (within the work day), temporary - in the two years of the plant construction.

Type of impact: Direct, reversible after the end of construction.

Extent of impact: low.

5.11.1.3 DURING THE PLANT OPERATION AFTER THE IP IS IMPLEMENTED

The main stages in the utilization of waste in energy production are the following: waste reception; storage; pre-treatment (at the plant site or beyond it); feeding of waste to the combustion chamber; thermal treatment of waste; utilization (for example in the boiler) or rendering safe; flue gas treatment (cleaning); treatment of the waste products from flue gas cleaning; leading (discharge) of gas into the ambient air; disposal of the waste from the plant operation. A comparative assessment of health risks connected with the adverse factors of the environment was made, based on the analyses and expert evaluations of the environment components. It provides grounds for identifying some major risk factors, which have a negative effect chiefly on the health of the population and those working at the site (**Table 5.11-3**).

Table 5.11-3 shows the main risk factors and the environment components affected by them, as well as assessment of the risk of impact of each factor on the health of the population and of those working at the site.

TABLE 5.11-3 RISK FACTORS WITH DIRECT AND INDIRECT IMPACT ON HUMAN HEALTH

RISK FACTOR	ENVIRONMENT /WORK ENVIRONMENT COMPONENT HEALTH RISK
CHEMICAL FACTORS /TOXIC GASES	
Dust - substances in dispersed state, with various particle sizes • **Coarse particulate matter - diameter 5-30 µm Those form in mechanical processes.** • **Fine particulate matter - 1 and 3 µm. Those form in condensation and coagulation A subgroup is of ultra-fine dust particles is differentiated - ≤0.1 µm (Fine dust particles are connected with higher risk to the health, especially to the respiratory system).** **Dust particles of size up to 5 µm have a marked irritative**	Ambient air Work environment Residential environment The data shown in section **2.6.1** and the modelling (**section 5.1**) prove that in the plant's service period no cumulative effect is expected of the existing stacks and the new cogeneration plant utilizing RDF; that refers to all emissions from the combustion: nitrogen oxides (NOx), sulphur oxides

RISK FACTOR	ENVIRONMENT /WORK ENVIRONMENT COMPONENT HEALTH RISK
effect on the respiratory system (chronic laryngitis, pharyngitis, bronchitis, emphysema) and the skin (irritation, reddening and burns). Continuous contact with the skin can cause eczema caused by the allergic effect of soluble chromates ((hexavalent chromium) which are present in cement although in small quantities. Most significant as regards the harmful effect on people is the content of free silicon dioxide.	(SO_2) total dust (PM_{10}) and carbon oxide (CO). The emissions into the ambient air from the stacks at the two sites are not expected to exceed the emission limit values (ELV) A comparative analysis of data gives reasons to prefer the site of TPP Sofia. No health risk to the population is expected. For those working at the site the risk is negligible and controllable when the technology requirements and SHW rules are observed.
Sulphur dioxide - liquid and solid fuels, industrial sites and motor vehicles are sources of emissions. SO_2 is a gas which has local irritating and general toxic effect, harmful for the respiratory organs (causing acute and chronic bronchitis, asthma etc.) Concentrations of SO_2 above the limit values cause changes in the blood composition, disrupt metabolism and increase the susceptibility of human body to diseases. It is soluble in water - sulphurous and sulphuric acid form, which even in relatively low concentrations, apart from having a negative impact on people, damage buildings, concrete structures, metals, paints and fabrics, harm the plant (most expressed in coniferous plants) and animal species. Sulphuric acid influences also the soil - it acidifies soils and spoils their productive properties. In some industrial processes, as a result of reaction of sulphur or sulphur-containing compounds with organic substances under high temperatures hydrogen sulphide is emitted, which is an irritant gas. It inhibits the cytochrome C oxidase and other enzymes and causes intracellular hypoxia. Chronic exposition results in eye disorders (conjunctivitis, keratitis) and pulmonary disorders (chronic bronchitis).	
Nitrogen oxides - toxic gases which form as a result of detonation, oxyacetylene welding and electric welding. – Irritating effect resulting in non-specific inflammatory disorders of the respiratory system; – Generally toxic - affects mainly the nervous and the hematopoietic systems (methemoglobin formers)	
Carbon oxides (CO; CO_2) - it is formed in all processes in which there are conditions for incomplete combustion of carbon-containing substances (explosions, incomplete combustion of fuels). -General toxic effect, suppression of tissue respiration due to haemoglobin combining into carboxyhaemoglobin and methaemoglobin, resulting in tissue hypoxia (fatigue, dizziness, insomnia, headache etc. – Irritative effect on respiratory tract mucous membrane.	
Specific pollutants - total organic carbon (TOC); hydrogen chloride (HCl); hydrogen fluoride (HF); cadmium/thallium (Cd, Tl); mercury (Hg); inorganic dust substances - Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V (Pb++) and dioxins and furans, which will be generated only by the RDF utilization installation. The mentioned stable pollutants have unidirectional toxic, sensitizing and irritating effect on the skin and the mucous membranes of the respiratory system and eyes; they aggravate chronic disorders of the respiratory syste; they are carcinogens and mutagens. They have cumulative effects with proven consequences to the body remote in time.	
Oil products: mazut, naphta; engine lubricating oils, motor	

RISK FACTOR	ENVIRONMENT /WORK ENVIRONMENT COMPONENT HEALTH RISK
oils; diesel fuel. Polycyclic aromatic hydrocarbons are found in settled dust, resulting from thermal destruction of mineral oils. Proven carcinogenic effect on the human body. They contain stable organic pollutants for the soil and water components of the environment.	
Exhaust gases from the truck traffic, containing mainly: carbon dioxide, carbon oxide, oxygen, carbon, hydrocarbons, aldehydes, nitrogen oxides, sulphur dioxide.	
PHYSICAL FACTORS	
Noise - generated chiefly by machines and installations, in particular such which use compressed air. • Extraaural effects on the central nervous system: irritability, psychic instability, memory failures, lower capacity for work and nervous overfatigue. Effects on the autonomic nervous system: increased vascular tone, heart rhythm changes, variations of arterial blood pressure. Effects on the digestive system: lower quantity and lower acidity of gastric secretions, slower passage and poor absorption of nutritious components. Effects on the respiratory system: changes in the frequency of respiratory motions and increase of the minute respiratory volume. Effects on the endocrine system: increased secretion of catecholamines, adrenocorticopen and thyreotropic hormones. • Specific auditory changes - they usually occur last, after all other functional and pathological changes in the body are already a fact.	Work environment Residential environment The main sources of noise during the plant operation will be: outside the industrial building - the transport vehicles delivering RDF and transporting the waste products (bottom ash and fly ash); inside the industrial building - the equipment (boilers, pumps, turbines, fans, compressors etc.). As seen from the forecast data given in **section 5.8.1**, the limit value of hygiene standards for a 24 h period (60 dBA) will not be exceeded for the residential area closest to the IP site in TPP Sofia. The traffic noise will not have a negative impact on the residential districts because they are at over 400 m distance. As a source of noise the plant operation will not have a negative impact on the population close to the two sites. According to the design requirements the noise at which the people working at the new plant's site and in its building are exposed shall not exceed 70 dBA, i.e. it will be lower than the limit value for work environment. (85 dBA). No risk to the health of employees or residents is expected provided the SHW norms are observed.
Microclimate The effect of adverse microclimate conditions, connected with the positive or negative thermal balance and respective strain of temperature regulation mechanisms, which depend on the air temperature, humidity and the speed of airflow. In physical work at high ambient temperatures - changes in the water and electrolyte balance of the body resulting in the so called thermal stress. Negative changes occur in the physiological and chemical processes in a number of organs and systems (cardiovascular system, digestive system, urinary system, the central nervous system). Poor concentration, poor coordination of movement result in reduced functional capacity and risk of injuries, especially in cases of work at hight.	Work environment with overheating parameters of the microclimate in the production buildings in the phases of: feeding to the combustion chamber; - thermal treatment of the waste; - waste utilisation (e.g. a boiler) or disposal; - flue gas treatment (cleaning);
Non-ionizing radiation Electric arc welding. Apart from UV radiation the welding process produces also infra-red radiation and electricity. Accidents - When combustible materials are nearby there is a risk of fire. If personal protective equipment is not used the result is: - local burns of different severity; - general overheating of the body; - burns and injuries from electric shock.	Work environment No risk to the health of employees and residents is expected is the norms for safety and health at work **(**SHW) are observed and emergency situations are prevented.
Work in shifts Disruption of the 24-hour rhythm, reduced duration and poor	Work environment When working in shifts it is particularly important

RISK FACTOR	ENVIRONMENT /WORK ENVIRONMENT COMPONENT HEALTH RISK
quality of sleep, disruption of the 24-rhythm of a number of body systems, greater fatigue, higher susceptibility to diseases, frequent absence from work for health reasons. The main health problems include higher incidence of cardiovascular, intestinal, metabolic diseases and diabetes, conditions of higher stress at work, and accidents, including accidents at work.	to follow the main recommendations regarding the number of consecutive shifts, the shifts rotation, duration, etc., some of which are given below: Maximum number of consecutive shifts: - avoid working night shift all the time; - reduce the number of consecutive night shifts (maximum 3); - reduce the number of consecutive morning shifts (maximum 3); - the number of consecutive afternoon shifts shall not exceed 3. Shifts rotation: Shifts should be "rotated" forward, clockwise (morning - afternoon - night).

5.11.1.4 EXPOSITION CHARACTERISTICS

Territorial scope of the impact:

Within the building and the site of the cogeneration plant utilizing RDF

Duration:

For the period of service life of the IP plant - 30 years at 24-h technology process

Type of impact: During the plant operation, the exposition will depend on an employee's position and assignment in shift work. Provided the requirements regarding health and safety at work are observed, the negative effects on the staff of about 35 persons will be within the limit values of health norms, and on the residents - negligible.

Extent of impact: negligible

5.11.2 HEALTH RISK IN EMERGENCY SITUATIONS

In normal operation the functioning of the plant after the IP project implementation does not involve any risk or danger of **large-scale accidents** involving risk of the impact of hazardous substances, which could be harmful to people's health or to the environment beyond the industrial site.

In conclusion we can point out that after the implementation of the project of a cogeneration plant utilizing RDF in Sofia, if all requirements regarding the plant's management and operation are observed, neither significant negative impact on the environment is expected nor risk to the health of the staff or to the residents of the area.

5.11.3 HEALTH PROTECTION AND RISK MANAGEMENT MEASURES CONCERNING EMPLOYEES

1. The newly employed persons shall be acquainted with the basic rules and requirements regarding workplace health and safety and fire safety at the site territory.
2. It is obligatory that the employees are acquainted with the specific risks to human health, connected with the concrete technologies and used materials, and with the protection methods and equipment; personal and collective protective equipment; special workwear - importance, way of using it and storing it. Regular instructions aim to maintain and update the WHSFS knowledge and skills.
3. Provision of information about dangerous substances at work, health risks, training an information on respective protection measures and actions, which shall be undertaken for

self-protection and protection and protection of the other workers, and access to the safety data sheets of the used chemical substances and mixtures.

4. Provision of appropriate information and training the employees for using correctly and safely the operation equipment so as to minimize the their exposition to noise. Use of technical means for noise control; noise reduction by enclosing the sources within protective screens; noise-absorbing lining; false noise-insulating ceilings; maintenance of the equipment and the workplace and work organisation aimed at reducing the noise impact (limiting the duration of exposure and the noise intensity; appropriate work time organisation with sufficient breaks).
5. For the persons working with video displays - provide training and information on the requirements concerning the specific equipment, work environment, software used, and potential risks of impairing one's eyesight and muscle-skeletal system; risk of mental stress.
6. For work with machines, observing the requirements specified in the respective machine's documents and in the technological instructions shall be ensured.
7. Special and protective workwear and personal protection equipment,
   – corresponding to the work conditions for each position, shall be ensured
   – and there should be control for using them.

5.11.3.1 *ASSESSMENT OF THE POSSIBILITY OF COMBINED, COMPREHENSIVE, CUMULATIVE AND REMOTE IMPACT OF THE ESTABLISHED RISK FACTORS*

- Combined impact is that of the gas pollutants having local irritative effect and dust aerosols of organic solvents and hydrocarbons. Those harmful chemical factors have a cumulative effect on the nervous system.
- Combined is the effect of gases -local irritants, and that of dust aerosols and cooling microclimate (in the cold and transition periods of the year); of noise and vibrations; of bituminous materials and UV radiation.
- Remote is also the impact of high carcinogenic-probability substances - 3,4 benzpyrene. Lower carcinogenic probability is that of the bitumen, released during insulation works.

Conclusion The expected impacts during construction will have a scope limited only within the main building site. They will affect mainly the construction workers. The health risk is tolerable and controllable.

5.11.3.2 *HEALTH PROTECTION AND RISK MANAGEMENT*

All construction and repair works will conform to Ordinance No.2 of 22.03.2004 on occupational health and safety in construction and installation works - annexes No.1 to No.5 with art.2(2), and Ordinance No.4 of 27.12.2006 on limiting harmful noise by envisaging noise insulation of buildings in their design and on the noise-control rules and norms applied in construction.

- Reduction of dust emissions by sprinkling of water in the places where dust is formed (in dry and windy weather). Use of concrete and solutions prepared in a special concrete-preparation plant, and machine laying of concrete.
- Prevent spillage of oil products. In case of spillage - undertake immediate measures for its localization, removal and transportation of the oil products to suitable places of disposal.
- After the completion of construction and assemblage works the places of temporary outdoor storage of construction materials shall be cleaned. That will prevent dust emissions into the ambient air in dry and windy weather.
- Keep the construction machinery in good repair and use them under optimum load; that will reduce the quantity of exhaust gases on one hand, and on the other - the noise and vibrations.
- The work and rest regimes for positions exposed to vibrations shall be developed in such a way that the total exposition (contact with vibrations) per shift does not exceed 90-120 min.

- Carrying out of construction and assemblage works at night shall not be allowed.
- In all professional activities it is obligatory to use clothes suitable for the season, and personal protective equipment if there are harmful factors of the work environment (dust masks, hearing protectors, anti-vibration gloves) and to apply a rational work and rest regime.

5.12 RISK OF EMERGENCY SITUATIONS

5.12.1 PREVENTION OF ACCIDENTS

According to its production activities Toplofikatsia Sofia EAD (the site of the cogeneration plant utilizing RDF through incineration) **is not** in the scope of Chapter 7, Section I of the EPA concerning prevention of large-scale accidents involving hazardous substances as an enterprise and/or installation of low or high risk potential.

Of the substances specified in the lists of Annex 3 under art.103 (1) of EPA (as last amended and supplemented in SG No. 32 of 2012) the following will be stored at the site of the **cogeneration plant utilizing RDF**: diesel fuel (a 50 m^3 tank) - for a diesel generator of 1,250 kW power.

Two burners have been envisaged (25 MW each) operating with natural gas, in the combustion chamber for starting the burning process and for stabilizing the temperature of incineration of low calorific value fuel (fresh biomass, dehydrated sludge etc.)

The following emergency situations are possible, with impact on the environment and people: fire involving diesel fuel or gas explosion, which would result in emissions of pollutants. The risk spots are the gas discharge valves and places connected with the gas transmission network, and the risk of fire is connected with the diesel fuel tank.

In case of incorrectly treated RDF or waste of low calorific value the result could be higher concentration of methane gas in the bunker, which is a condition for fire.

5.13 CUMULATIVE IMPACTS - BY COMPONENTS

5.13.1 AMBIENT AIR

5.13.1.1 CUMULATIVE EFFECT OF THE SIMULTANEOUS OPERATION OF THE INSTALLATIONS OF TPP SOFIA AD AND OTHER OPERATIONS IN THE AREA ON THE AMBIENT AIR POLLUTION

There are not any other enterprises with similar combustion installations in the area of TPP Sofia. Therefore there will be no cumulative effect as regards nitrogen oxides, sulphur oxides and carbon oxide.

5.13.1.2 CUMULATIVE EFFECT OF THE SIMULTANEOUS OPERATION OF SOFIA MED AD AND THE INSTALLATIONS OF TPP SOFIA-EAST AD ON THE AMBIENT AIR POLLUTION

5.13.1.2.1 ANNUAL POLLUTION

Data about the parameters and capacity of the stacks of **Sofia Med AD** has been provided to **TPP Sofia-East** with letter No.48-00-0106/24.06.2014.

The parameters of the organised sources of emissions of **Sofia Med AD**, necessary for the evaluation of pollution in ground-level air, resulting from its simultaneous operation with **TPP Sofia-East** are given in **Table 5.13-1**.

TABLE 5.13-1 PARAMETERS OF THE SOURCES OF SOFIA MED AD

Point source No.	Physical parameters			Operating parameters		Emission limit values acc. to integrated permit (IP) No.142-Н0-И0-А2/2012						
	Height	Diameter	Maximum discharge acc.to IP	Discharge gas temperature	Work hours per year	SO_x	NO_x	CO	Dust (PM_{10})	Pb	THC	Dioxins and furans ng/Nm^3
	m		Nm^3/h	ºC	h	mg/Nm^3						ng/Nm^3
1	60	3.00	17,699	80	3,000		500		20			
2	25	1.23	70,000	100	6,000		400		20		50	0.4
3	18	1.89	36,000	30	3,600				20			
4	25	1.60	110,000	50	6,200				20	0.5	50	0.4
5	21	0.62	21,000	40	3,600				20			
6	15	0.45	12,000	30	800				20			
7	15	0.20	20,000	30	800				20			
8	22	0.50	1,600	60	4,400	35	250	100				
9	21	0.60	3,000	210	4,800		500		20			
10	21	0.60	3,000	210	4,800		500		20			
11	22	0.50	1,000	60	3,000	35	250	100				
12	21	0.55	10,000	140	4,800		500		20			
13	22	0.50	3,000	200	3,400		500		20			
14	22	0.26	5,000	100	3,400	35	250	100				

The assessment of the average annual cumulative pollution from simultaneous emissions by the two enterprises is given in **Table 5.13-2**

TABLE 5.13-2 ANNUAL CONCENTRATIONS RESULTING FROM CUMULATION OF THE EFFECT OF TPP SOFIA-EAST AND SOFIA MED

Pollutant	Maximum concentration	At distance [m]	size	Average annual limit value (AALV)/LTV	Standard acc. to
SO_2	1.69159	1,488.5	μg/m^3	**50** [(1)]	Ordinance No. 12/2010
NO_2	12.69197	632.25		**40** / ***26***	
PM_{10}	2.18296	882.94		**40** / ***20***	
Pb	0.02533	874.92		**none**	
CO	0.00411	1,688.45	mg/m^3		
TOC	0.00405	1,072.38		**no limit value**	
Dioxins and furans	0.00003	1,072.38	ng/m^3		

Not any one of the pollutants exceeds the respective average annual limit value.

Figure 5.13-1 shows the annual concentrations of nitrogen oxides in ground-level air. The area marked in orange (▬) shows the outlines of **Sofia Med AD** and the area marked in blue (▬) - the outlines of **TPP Sofia-East**. The black dots are the organised emission sources (stacks) of the two enterprises.

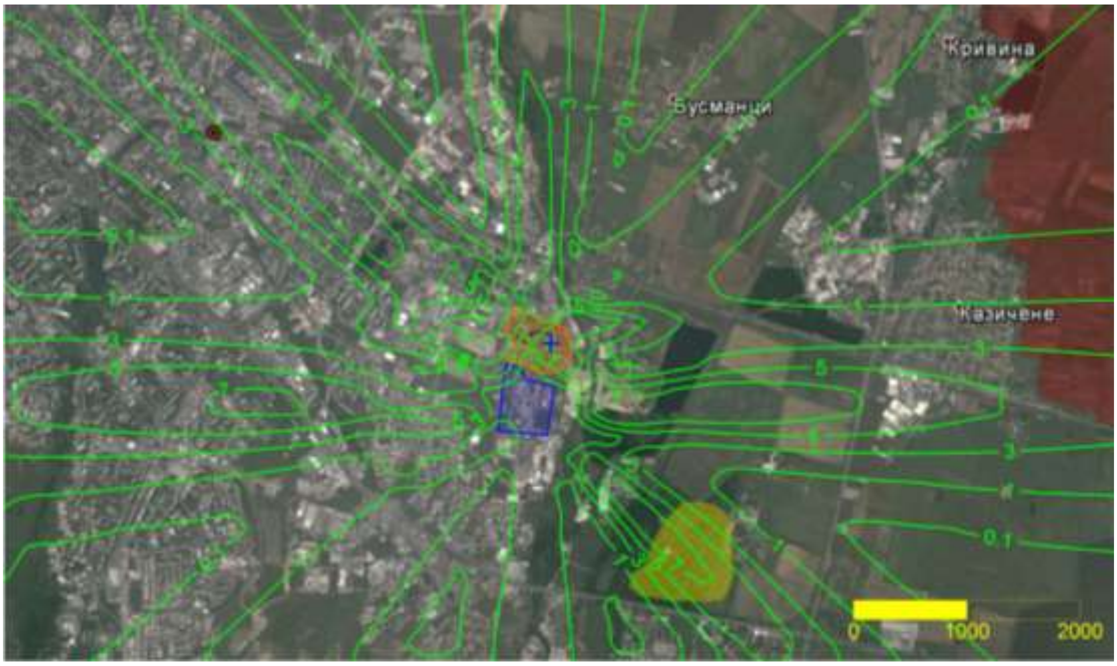


FIGURE 5.13-1 AVERAGE ANNUAL CUMULATIVE CONCENTRATIONS OF NITROGEN OXIDES (NO_X)

As seen from **Figure 5.13-1,** the concentrations of nitrogen oxides in protection area BG 0002004 **Dolni Bogrov-Kazichene** and protected site **Vrana** do not exceed the lower threshold value for protection of natural ecosystems - 19.5µg/m^3 and are within the range 0.1÷3 µg/m^3 and respectively 1÷7 µg/m^3.

Therefore we can conclude that:

The annual pollution of ambient air with Sofia Med AD and TPP Sofia-East operating simultaneously will not have a negative effect on the populated areas or the natural ecosystems.

5.13.1.2.2 MAXIMUM ONE-TIME POLLUTION

An important characteristic is the maximum possible pollution which could occur from given sources.

Table 5.13-3 shows the results from the respective section of the software **PLUME**.

TABLE 5.13-3 MAXIMUM ONE-TIME CONCENTRATIONS

Pollutant	Maximum concentration	Weather conditions		size	Average hourly value (AHV)	Standard acc. to
SO_2	37.9389	Speed Direction Stability class	4 m/s; 225°; B	**µg/m^3**	**350**	Ordinance No. 12/2010
NO_2	**221.7465**	Speed Direction Stability class	2.5 m/s; 180°; B		**200**	
PM_{10}	25.45359	Speed Direction Stability class	1 m/s; 180°; B		**none**	
Pb	0.32278	Speed Direction	2.5 m/s; 315°;		**none**	

Pollutant	Maximum concentration	Weather conditions	size	Average hourly value (AHV)	Standard acc. to
		Stability class C			
CO	0.10138	Speed 4 m/s; Direction 225°; Stability class B	mg/m^3	10	
TOC	0.04158	Speed 2.5 m/s; Direction 315°; Stability class C		**no limit value**	
Dioxins and furans	0.00033		ng/m^3		

The maximum one-time concentrations in the ground-level air, resulting from the simultaneous operation of the two enterprises, given in **Table 5.13-3**, are compared to **Table 5.1-15**. It is evident that:

- as regards the concentrations of sulphur oxides and carbon oxide the respective emissions of **TPP Sofia-East** prevail;
- as regards emissions of fine dust particles, those of **Sofa Med AD** prevail; the maximum concentrations of nitrogen oxides occur to the north of **Sofia Med AD**, at stability class **B**, wind speed 2.5 m/s, as the configuration of the location of the two enterprises stacks is in the line north- south (**Figure 5.13-2**), and that circumstance intensifies cumulation.

Figure 5.13-2 shows the area of maximum one-time concentration of nitrogen oxides in the ground-level air, resulting from the operation of **TPP Sofia-East AD** and of **Sofia Med AD**.

FIGURE 5.13-2 AREAS OF MAXIMUM ONE-TIME POLLUTION WITH NITROGEN DIOXIDE RESULTING FROM THE OPERATION OF SOFIA MED AD AND TPP SOFIA-EAST

The site can contribute to cumulative impact as regards maximum one-time concentrations of nitrogen oxides, in simultaneous operation of TPP Sofia-East and Sofia Med AD in their maximum discharge. Provided the respective emission limit values are observed concerning the flue gas of both enterprises' stacks, the impact will be low, far from populated areas, and will not have any negative effect on ecosystems.

Note:

The cumulative impact has been modelled for the maximum discharge of both enterprises according to their respective integrated permits. The annual reports of TPP Sofia-East and Sofia Med AD on the environment from the recent years show that they have not reached those discharge levels, therefore a cumulative impact is unlikely.

As seen from **Figure 5.13-2**, the area of cumulative nitrogen oxides concentrations in ground-level air, resulting from the stacks of **TPP Sofia-East** and **Sofia Med AD** spreads wider for the lower concentrations - up to 10 µg/m^3. Concentrations above the average hourly value of 200 µg/m^3 occur within the outlines of **Sofia Med AD** site, far from residential districts. According to Ordinance 12/2010 the maximum permitted number of occurrences of exceeding the limit value regarding one-time concentrations of nitrogen oxides in a calendar year is 18.

Therefore we can conclude that:

The transient pollution of ambient air from simultaneous operation of the two installations even at their maximum capacity can have a limited local temporary effect, but far from residential districts and natural ecosystems.

5.13.1.3 CUMULATIVE IMPACT OF EMISSIONS FROM THE TRAFFIC FLOWS DURING THE PLANT OPERATION

5.13.1.3.1 TPP SOFIA

Access to the site in **ТЕЦ „София“** is possible by the existing road network, namely from Nesho Bonchev St., which is a crossing of the main thoroughfare in that region - История Славянобългарска St.

The emission load in kilogram per kilometre (kg/km) of traffic in the respective section of the city road network is given in**Section 4**, **Table 4.2-5**.

Cumulative impact of gas emissions from the project-related transport flows, delivering and transporting away the necessary stuff, materials and waste during the plant operation, and the average 24-hour traffic intensity in the section from История Славянобългарска St. (**Table 5.1-4**). The assessment is given in **Table 5.13-4.**

TABLE 5.13-4 - CUMULATIVE IMPACT OF THE TRANSPORT FLOWS AND THE TRAFFIC IN ИСТОРИЯ СЛАВЯНОБЪЛГАРСКА ST.

Transport flow	CO	NMVOC	NO_X	N_2O	NH_3	Pb	$PM_{2.5}$	Ideno Pyrene	B(k)F	B(b)F	B(a)P	CO_2	SO_2	C_6H_6
Flow 1	0.04%	0.03%	0.8%	0.8%	0.1%	1.4%	0.2%	0.8%	1.1%	1.0%	0.7%	0.8%	0.5%	0.03%
Flow 2	0.01%	0.01%	0.17%	0.17%	0.03%	0.31%	0.04%	0.16%	0.24%	0.22%	0.15%	0.18%	0.11%	0.01%
Flow 3	0.002%	0.002%	0.05%	0.05%	0.01%	0.09%	0.01%	0.05%	0.07%	0.06%	0.04%	0.05%	0.49%	0.002%

The comparison is shown in percentage of the emission load (kg/km) resulting from the IP-related transportation activities and the regular traffic in История Славянобългарска St. The fields in the table given in gradations of blue show the relation of emission load from the project to the emission load from the conventional traffic. The highest impact, expectedly, is that of **Flow 1** - transport of

RDF from the MBT plant to the new plant - from 0.03 % to maximum 1.4 % (for lead[40]), i.e. the loads resulting from the project are negligible.

The expected impact **is negative, temporary and direct. The degree of impact is very low.**

5.13.1.3.2 TPP SOFIA-EAST

Access to the site of **TPP Sofia-East** is from Dimitar Peshev St. That street is part of the road infrastructure of Iskar district, Sofia municipality.

The emission load in kilogram per kilometre (kg/km) of traffic in the respective section of the city road network is given in**Section 4**, **Table 4.2-5**.

The cumulative impact of the gas emissions from the project-related transport flows, delivering and transporting away the necessary stuff, materials and waste during the plant operation, and the average 24-hour traffic intensity in that section of Dimitar Peshev St. (**Table 5.1-4**). The evaluation is given in **Table 5.13-5**.

TABLE 5.13-5 - CUMULATIVE IMPACT OF THE TRANSPORT FLOWS AND THE TRAFFIC IN DIMITAR PESHEV ST.

Transport flow	CO	NMVOC	NO_X	N_2O	NH_3	Pb	$PM_{2.5}$	Ideno Pyrene	B(k)F	B(b)F	B(a)P	CO_2	SO_2	C_6H_6
Flow 1	0.1%	0.05%	1.3%	1.3%	0.2%	2.5%	0.3%	1.3%	1.9%	1.8%	1.1%	1.4%	0.8%	0.05%
Flow 2	0.01%	0.01%	0.29%	0.29%	0.05%	0.53%	0.07%	0.28%	0.42%	0.39%	0.25%	0.31%	0.17%	0.01%
Flow 3	0.004%	0.003%	0.08%	0.08%	0.01%	0.15%	0.02%	0.08%	0.12%	0.11%	0.07%	0.09%	0.79%	0.003%

The comparison is shown in percentage of the emission load (kg/km) resulting from the IP-related transportation activities and the regular traffic in История Славянобългарска St. The fields in the table given in gradations of blue show the relation of emission load from the project to the emission load from the conventional traffic. The highest impact, expectedly, is that of **Flow 1** - transport of RDF from the MBT plant to the new plant - from 0.05 % to maximum 2.5 % (for lead), i.e. the loads resulting from the project are negligible.

The expected impact **is negative, temporary and direct. The degree of impact is very low.**

5.13.2 WATER

5.13.2.1 SURFACE WATER AND WASTE WATER

No cumulative impacts on the surface water and its ecological condition are expected. During the operation the waste water will not affect the ecological condition of the region. No irreversible negative impact on the environment is expected.

5.13.2.2 GROUNDWATER

The impact on the quantitative and chemical state of of groundwater during the construction and operation is not cumulative because of the fact that it will be limited within the investment proposal site and in its immediate vicinity, without any effect on the parameters of water abstraction from other water abstraction installations, allowed in accordance with the Water Act, and will not result in any changes in the present quality of groundwater.

[40] The percentage is based on a ratio of very low values of lead emission loads.

5.13.3 BOWELS OF THE EARTH AND GEOLOGICAL ENVIRONMENT

The impact on the bowels of the earth during construction will not be cumulative as it will be limited within the investment proposal site and in its immediate vicinity.

Provided the envisaged technical solutions and the recommendations given in this EIAR are observed, the probability of damaging/polluting the bowels of the earth during normal operation is excluded.

5.13.4 EARTH AND SOILS

Type of impact: Positive - after closing down and recultivation; Negative - during the construction, operation, and in case of emergency situations.

A potential cumulative impact is expected only if the suggested measures concerning transportation of RDF, of other materials and stuff, and waste from the technology processes are not observed; mainly in emergency situations. Such impact is expected to be temporary, of short duration, reversible and of limited scope.

5.13.5 BIODIVERSITY SPECIAL AREAS OF CONSERVATION AND PROTECTION AREAS

Not any negative impacts on biodiversity, on the special areas of conservation or protection areas are expected in the period of the IP plant construction and operation. Cumulative impact will be absent

5.13.6 WASTE

During the plant construction - A cumulative effect is expected during construction but if the waste-related operations are coordinated with the TPP, such an effect can be minimized. The impact will be of short duration, reversible and of limited scope.

During the plant operation:

The cumulative effect can be minimized if there is effective management chiefly of the process waste- the so called *technological residue, process by-waste* and strict control for coordination of the operations for waste receiving, for temporary storage and transportation of the generated waste to the designated landfills (waste accumulation at the IP site over the specified limits shall not be allowed), observing strictly the conditions and requirements regarding waste transportation and disposal, and minimizing the risk of emergency situations. The impact will be of short duration, reversible and of limited scope.

Other waste - No cumulative effect is expected during operation, provided waste is managed effectively.

5.13.7 NOISE

Noise levels higher than those currently existing in that area are expected at the new plant site. They will not exceed the limit value of 70 dBA.

In the impact areas of the two power plants no change in the current noise regime is expected after the IP project implementation because the expected levels of noise from the new plant reaching the impact areas will be much lower than those measured at present: at TPP Sofia - minimum 13 dBA lower; at TPP Sofia-East - over 25 dBA lower.

5.13.8 HEALTH RISK

The expected impacts during the IP plant construction and operation will have a limited scope - only in the area of the main building site. They will affect mostly the construction workers in the construction period and the plant employees involved in its operation - in the service period. The health risk is acceptable and controllable. No cumulative effect is expected.

5.14 SUMMARY OF THE SIGNIFICANCE OF IMPACTS (DIRECT, INDIRECT, SECONDARY, CUMULATIVE, OF SHORT AND LONG DURATION, PERMANENT AND TEMPORARY, REVERSIBLE, POSITIVE AND NEGATIVE) ON THE ASSESSED COMPONENTS AND FACTORS OF THE ENVIRONMENT

Table 5.14-1 shows the matrix of assessment of the potential impacts on each of the components of the environment and human health.

TABLE 5.14-1 POTENTIAL IMPACT ASSESSMENT MATRIX FOR THE IP IMPLEMENTATION

Impact	Impact probability [1]	Territorial scope of the impact [2]	Type of impact		Extent of impact [3]	Nature of the impact			Measures for negative impact prevention, mitigation or compensation
			Positive /negative	Direct /indirect		Frequency [4]	Duration [5]	Cumulative effect	
During construction									
1.1. Air	Expected	The IP site	Negative	Direct	Low	Temporary	Of short duration	No	Implementation of the measures under section 7.1
1.2. Water									
1.2.1 Surface water	Not expected								
1.2.2 Groundwater	Not expected								
1.3. Geological environment	Expected	The IP site	Negative	Direct	Low	Permanent	Of short duration	Yes	Implementation of the measures under section 7.1
1.4. Earth and soils	Expected	The IP site The waste transportation route	Negative	Direct	Low	Permanent	From short to long duration	Yes	Implementation of the measures under section 7.1
1.5. Landscape	Expected	The IP site	Negative	Direct	Low	Temporary	Of short duration	Yes	Implementation of the measures under section 7.1
1.6. Biodiversity									
1.6.1. Flora	Not expected								Implementation of the measures under section 7.1
1.6.2. Fauna	Not expected								Implementation of the measures under section 7.1
1.6.3. Special areas of conservation	Not expected								
1.6.4. Protection areas	Expected		Negative	Direct and indirect	Low	Temporary	Of short duration	Yes	Implementation of the measures under section 7.1
1.7. Cultural and historical heritage	Not expected	The IP site							
1.8. Staff	Expected	Route to the plant. The IP site	Negative	Direct	Low	Temporary	Of short duration	No	Implementation of the measures under section 7.1
1.9. Population	Expected	The IP site Route of construction materials, machinery and waste transportation	Negative	Direct and indirect	Low	Temporary	Of short duration	No	Implementation of the measures under section 7.1
1.10. Risk power supply sources	Expected	The discomfort area at the boundaries of the IP site. Route of construction	Negative	In the route and in the discomfort area - direct	Low	Temporary	Of short duration	No	Implementation of the measures under section 7.1

Impact	Impact probability [1]	Territorial scope of the impact [2]	Type of impact		Extent of impact [3]	Nature of the impact			Measures for negative impact prevention, mitigation or compensation
			Positive /negative	Direct /indirect		Frequency [4]	Duration [5]	Cumulative effect	
		materials, machinery and waste transportation.							
1.11. Waste generation	Expected	The IP site The waste transportation route	Negative	Direct	Low	Temporary	Of short duration	No	Implementation of the measures under section 7.1
1.12 Hazardous substances	Expected	The IP site	Negative	Direct	Low	Temporary	Of short duration	No	Implementation of the measures under section 7.1
During plant operation									
1.1. Air	Expected	The IP site. The waste transportation route.	Negative	Direct	Low	Temporary	Of short duration		Implementation of the measures under section 7.1
1.2. Water									
1.2.1 Surface water	Not expected	The IP site						No	Implementation of the measures under section 7
1.2.2 Groundwater	Expected	The IP site	Negative	Direct	Low	Temporary	Of short duration		Implementation of the measures under section 7
1.3. Geological environment	Expected	The IP site	Negative	Direct	Low	Temporary	Of long duration	Yes	Implementation of the measures under section 7.1
1.4. Earth and soils	Expected	The IP site. The waste transportation route.	Negative	Indirect	Low	Permanent	Of long duration	No	Implementation of the measures under section 7.1
1.5. Landscape	Expected	The IP site	Negative	Indirect	Low to medium	Permanent	Of long duration		Implementation of the measures under section 7.1
1.6. Biodiversity									
1.6.1. Flora	Not expected								Implementation of the measures under section 7.1
1.6.2. Fauna	Not expected								Implementation of the measures under section 7.1
1.6.3. Special areas of conservation	Not expected								
1.6.4. Protection areas	Not expected								Implementation of the measures under section 7.1
1.7. Cultural and historical heritage	Not expected								
1.8. Staff	Expected	The IP site	Negative	Direct and	Low	During	Of short duration	No	Implementation of the measures

Impact	Impact probability [1]	Territorial scope of the impact [2]	Type of impact		Extent of impact [3]	Nature of the impact			Measures for negative impact prevention, mitigation or compensation
			Positive /negative	Direct /indirect		Frequency [4]	Duration [5]	Cumulative effect	
				indirect		work			under section 7.1
1.9. Population	Expected	Area of acoustic discomfort The IP site The routes of transportation of the waste generated by the IP plant operation to the designated places of disposal	Positive (Possible negative only at noise levels above the limit values; route and adjacent installations not rendered safe)	Direct and indirect	Low	Permanent	Of long duration	No	Implementation of the measures under section 7.1
1.10. Risk power supply sources	Expected	In the areas of acoustic discomfort. The IP site. The routes of transportation of the waste generated by the IP plant operation to the designated places of disposal	Negative	Direct	Low	Permanent	Of long duration	No	Implementation of the measures under section 7.1
1.11. Waste generation	Expected	The IP site The routes of transportation of the waste generated by the IP plant operation to the designated places of disposal	Negative	Direct	Medium	Permanent	Of long duration	No	Implementation of the measures under section 7.1
1.12. Hazardous substances	Expected	The IP site	Negative	Direct	Low	Temporary	Of short duration	No	Implementation of the measures under section 7.1

[1] Expected/ not expected
[2] Route used for the IP
[3] Low, medium, high
[4] Permanent, temporary
[5] Of short, medium or long duration

In italic - positive impact elements of the matrix
Underlined - matrix elements regarding which no impact is expected, or elements of which negligible negative impact is expected
Bold - matrix elements of which considerable negative impact is expected

5.15 LOCATION-BASED GROUNDS FOR SELECTING THE OPTION

The two possible options for the IP location (TPP Sofia and TPP Sofia-East) have been pre-selected according to criteria excluding areas under regulatory prohibition or non-compliant with the environmental protection regulations.

Based on the assessment of the impact on the components and factors of the environment, made in this EIAR and shown in the matrix for assessing the potential impact of the IP implementation (**Table 5.14-1)** the site for implementing the investment proposal for **construction of a cogeneration plant utilizing RDF in Sofia** has been selected according to the lowest impact and ensuring highest safety for the staff, the population and the environment.

From the matrix we can conclude that **the suggested site of TPP Sofia is the most suitable one for the IP plant location.**

5.16 CROSS-BORDER IMPACTS

No cross-border impact is expected.

6 INFORMATION ON THE METHODS USED TO FORECAST AND ASSESS THE IMPACT ON THE ENVIRONMENT (DESIGN DOCUMENTS, REGULAITONS, OTHER SOURCES)

The main methods applied for assessing the components and factors of the environment when preparing the EIAR on the investment proposal for **a cogeneration plant utilizing RDF in Sofia** are ecology-based system analysis and synthesis of data, facts and literature on the issues.

The regulations, laws, ordinances and rules, methodology instructions, instructions, orders, decrees, strategies, plans and programmes currently in force have been applied in summarising data and drawing of conclusions. Apart from that the following have been made:

- Repeated visits on the spot and field investigation of the areas envisaged for the investment proposal implementation;
- Analysis of map schemes;
- Analysis of design documentation;
- Analysis of scientific literature;
- Comparative analysis with regulations;
- Synthesis of the results from analyses and making the expert assessment.
- All sources of information, used by the experts in preparing this EIA report, have been described - like literature, regulations (laws, ordinances, rules etc.), updated data, contemporary knowledge and assessment and forecasting the impact on the environment in conformity with art.11 (1) of the Ordinance for performing of EIA.

A detailed data basis for the EIAR preparation has been given as well as the methodological basis of the forecasts and assessment in this EIAR, the used project documents, regulations of Bulgarian and European legislation, and other available sources, the basic and specific approach applied in developing the report.

6.1 LIST OF BULGARIAN AND INTERNATIONAL REGULATIONS

6.1.1 DIRECTIVES

→ Directive 2001/27/EU of the European Parliament and of the Council on energy efficiency, 25.10.2012

- → Directive 2004/8/EC of the European Parliament and of the Council (notified under document number C(2008) 7294) (2008/952/EC)
- → Commission Decision of 19 November 2008 establishing detailed guidelines for the implementation and application of Annex II to Directive 2004/8/EC of the European Parliament and of the Council (notified under document number C(2008) 7294) (2008/952/EC)
- → Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment, June 2001
- → Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codified text)
- → Directive 92/43/EEC of the Council on the conservation of natural habitats and of wild fauna and flora
- → Council Directive 79/4409/EEC on the conservation of wild birds
- → Directive 78/659/EEC of 18 July 1978 on the quality of fresh waters needing protection or improvement in order to support fish life.
- → Council Directive 1999/31/EC on the landfill of waste (amended by 2003/33/EC); 91/689/EEC on controlled management of hazardous waste (amended by 94/31/EEC)
- → Directive 1999/13/EC on the limitation of emissions of volatile organic compounds
- → Directive 2001/80/EC
- → Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

6.1.2 CONVENTIONS

- → Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, Aarhus (Denmark), 25 June 1998
- → Convention on Biological Diversity, 1993
- → Convention on Environmental Impact Assessment in a Transboundary Context, Espoo (Finland), 25 February 1991; ratified by a law passed by the 37-th Bulgarian parliament on 16.03.1995, SG No. 28 /1995, prepared by the Ministry of Environment and Water, promulgated in SG No. 85/1.10.1999, effective 10.09.1997, amended No. 89 of 12.10.1999
- → Convention on the Conservation of European Wildlife and Natural Habitats, ratified by the Grand National Assembly with Decision adopted on 25.01.1991 - SG No. 13 of 1991, effective for the Republic of Bulgaria as of 01.05.1991
- → European Landscape Convention of 20.04.2000, ratified by a law passed by the 39-th Parliament, SG No.94 of 22.10.2004

6.1.3 LAWS

- → Environmental Protection Act, promulgated SG No. 91/25.09.2002, amended No.98/18.10.2002, as last amended No. 22/ 16.04.2013
- → Biological Diversity Act, promulgated in SG No. 77/2002, as last amended No. 66 of 26.07.2013

→ Protected Areas Act, promulgated in SG No. 133/1998, as last amended SG No.66 of 26.07.2013

→ Medicinal Plants Act, promulgated in SG No. 29 of 07.04.2000, as last amended SG No.66/2013);

→ Clean Ambient Air Act, promulgated SG No. 45/28.05.1996, corrected 49/7.06.1996, amended 85/26.09.1997, amended and supplemented 27/31.03.2000, 102/27.11.2001, amended.91/25.09.2002, as last amended SG No. 102 of 21.12.2012

→ Water Act, promulgated SG No. 67/27.07.99, as last amended and supplemented SG No. 49 of 13.06.2014

→ Soils Act, promulgated SG No.89 of 06.11.2007

→ Waste Management Act (WMA), promulgated SG No. 53 of 13.07.2012 2013, effective 13.07.2012, amended SG No. 66 of 26.07.2013, effective 26.07.2013, amended by Decision No.11 of 10.07.2014 of the Constitutional Court of the Republic of Bulgaria - SG No. 61 of 25.07.2014

→ Law of Protection from the Harmful Impact of the Chemical Substances and Mixtures promulgated SG No. 10 of 04.02.2000, effective 05.02.2002, as last amended SG 1 / 03.01.2014

→ Law on the Health and Safety at Work, promulgated SG No. 124/1997, as last amended No. 27 / 25.03.2014

→ Disaster Protection Act, promulgated SG No.102 of 19.12.2006, as last amended and supplemented SG No.53 of 27.06.2014

→ Protection From Environmental Noise Act, promulgated SG No. 74 of 13.09.2005, effective 01.01.2006, as last amended SG No. 66/ 26.07.2013

→ Spatial Development Act promulgated in SG No.1 of 02.01.2001, amended and supplemented SG No.53 of 27.06.2014 ;

→ Cultural Heritage Act, promulgated SG No.19 of 13.03.2009, as last amended SG No.45 of 12.06.2012

→ Climate Change Mitigation Act, effective 11.03.2014, promulgated SG No.22 of 11.03.2014 Waste Management Act, promulgated SG No.86 of 30.09.2003, as last amended SG No.26 of 30.03.2012

→ Limitation of the Harmful Impact of Waste upon the Environment Act (SG No.86/1997, No.56/1999, No.27 and 28/2000, No.86/2003)

6.1.4 ORDINANCES

→ Ordinance on the conditions and procedures for performance of environmental impact assessment, promulgated SG No. 25/18.03.2003,as last amended SG No.94 of 30.11.2012

→ Ordinance on the conditions and procedures for carrying out assessment of the compatibility of plans, programmes, projects and investment proposals with the conservation objectives of the protection areas, promulgated SG No. 73 of 11.09.2007, effective 11.09.2007, as last amended SG No.94 of 30.11.2012

→ Ordinance on the conditions and procedures for issuing of integrated permits, adopted by CMD No.238, promulgated in SG No. 80/09.10.2009 , amended SG No.69/11.09.2012

→ Ordinance No.RD-02-20-2/ 14.02.2012 on designing of buildings and installations in seismic-risk areas.

→ Ordinance No.7/22.12.2003 laying down rules and norms for different types of spatial and territorial development zones, effective as of 13.01.2004, issued by the Ministry of Regional Development and Public Works, promulgated in SG No.3 of 13.01.2004, amended SG No.10 of 28.01.2005, amended SG No.11 of 01.02.2005, amended SG No.51 of 21.06.2005, amended SG Mo.63 of 02.08.2005, amended SG No.41 of 22.04.2008, amended SG No.76 of 05.10.2012, amended SG No.21 of 01.03.2013.

→ Ordinance on the limit values of sulphur dioxide, nitrogen dioxide and dust emissions released into the air by big incineration installations,, promulgated in SG No. 2 of 08.01.2013, as last amended and supplemented SG No.76 of 30.08.2013.

→ Ordinance No.1 of 27.06.2005 on the emission limit values of harmful substances (pollutants) released into the ambient air by objects and operations which are fixed sources of emissions, promulgated SG No. 64 of 05.08.2005, effective as of 06.08.2006

→ Ordinance No. 6/26.03.1999 on the procedure and the methods for measurement of emissions of harmful substances released into the ambient air by fixed sources of emissions, promulgated SG No.31.06.04.1999, as last amended SG No. 102/ 21.12.2012

→ Ordinance No.7 of 03.05.1999 on ambient air quality assessment and management, promulgated SG No.45/14.05.1999, effective 01.01.2000

→ Ordinance No.7 of 21.10.2003 on the limit values of emissions of organic compounds, released into the environment, chiefly into the ambient air, resulting from the use of solvents in certain installations, promulgated SG No. 96 of 31.10.2003, effective 01.01.2004, as last amended SG 24/12.03.2013

→ Ordinance No.10 of 06.10.2003 on the emission limit values (concentration in exhaust gases) of sulphur dioxide, nitrogen dioxide and total dust, released into the air by big incineration installations, promulgated in SG No. 93 of 21.10.2003, as last amended and supplemented SG No. 19 of 08.03.2011

→ Ordinance No.11 of 14.05.2007 on the limit values of arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons in ambient air, promulgated SG No.42 of 29.05.2007

→ Ordinance No.12 of 15.07.2010 on the limit values of sulphur dioxide, nitrogen dioxide, fine dust particles, lead, benzene, carbon oxide and ozone content in the ambient air., promulgated SG No. 58 of 30.07.2010

→ Ordinance No.14 of 23.09.97 on the limit values of concentrations of harmful substances in the ambient air of populated areas, promulgated SG No.88/03.10.1997, as last amended 43 of 01.01.2008

→ Ordinance No.16 of 12.08.1999 limiting the emissions of volatile organic substances during storage, loading/unloading and transportation of petrol, promulgated SG No. 75 of 24.0899, effective 25.05.2000, as last amended SG No. 14/ 18.02.2014

→ Ordinance on establishing measures for applying Regulation (EC) 1005/2009 on substances that deplete the ozone layer, adopted by CMD No.326 of 28.12.2010

→ Ordinance on establishing measures for applying Regulation (EC) No.842/2006 on certain fluorinated greenhouse gases

→ Ordinance No.1 of 11.04.2011 on water monitoring, as last amended SG No. 44 of 17.05.2013

→ Ordinance No.H-4 of 14.09.2012 on surface water characteristics, SG No. 22 of 05.03.2013, effective as of 05.03.2013

→ Ordinance No.2 of 08.06.2011 on the issuing of permits for discharging waste water into water bodies, setting individual limit values for point sources of pollution, promulgated in SG No. 14 of 17.02.2012, as last amended and supplemented SG No.44 of 17.05.2013

→ Ordinance No.3 on the conditions and procedure for research, design, approval and operation of the sanitary protection zones around water sources and installations for potable and household water supply and around mineral water sources used for treatment, preventive, potable and hygiene needs, SG No. 88 of 27.10.2000

→ Ordinance No.6 specifying emission limit values of the content of harmful and hazardous substances in waste waters discharged in water bodies, promulgated in SG No. 97/28.11.2000, as last amended SG No. 24/23.03.2004

→ Ordinance No.7/14.11.2000 on the conditions and procedures for discharging of industrial waste water into the sewerage systems of settlements, promulgated SG No. 98/01.12.2000

→ Ordinance No.9 /16.03.2001 on the quality of potable water, promulgated SG No. 30/28.03.2001 as last amended SG No. 15/01.02.2012

→ Ordinance No.12/18.06.2002 specifying the requirements regarding the quality of surface water used for drinking and household water supply, promulgated SG No. 63/28.06.2002, as last amended SG No.15 of 21.02.2012, effective 21.02.2012

→ Ordinance specifying the requirements regarding the quality of liquid fuels, the conditions and procedures for their control, adopted by CMD No.156 of 15.07.2003, promulgated DG No. 66 of 25.07.2003, effective as of 01.10.2003, as last amended and supplemented SG No.36 of 10.05.2011. effective 10.05.2011.

→ Ordinance on standards for environmental quality for priority substances and certain other pollutants, promulgated SG No. 88/ 09.11.2010

→ Council of Ministers Decree (CMD) No.225 of 02.10.2013 amending the Ordinance on standards for environmental quality for priority substances and certain other pollutants adopted by CMD No.256 of 2010 (SG No. 88 of 2010) promulgated SG No. 88 of 08.10.2013

→ River basin management plan (RBMP) of the Republic of Bulgaria for Danube region

→ Ordinance No.1/07.07.2007 on groundwater studying, utilisation and protection, promulgated SG No.57/14.07.2000, amended No. 64/04.08.2000, as last amended No. 28/19.03.2013

→ DRBWMD, 2014 Condition of groundwater within the area of Danube region basin management in 2013

→ Ordinance No.3 of 01.08.2008 specifying limit values of the content of harmful substances in soils published by the Ministry of Environment and Water, Ministry of Health and Ministry of Agriculture and Food promulgated in SG No-71 of 12.08.2008

→ Ordinance No.4 of 12.01.2009 on monitoring of soils (promulgated SG No.19 of 13.03.2009)

→ Ordinance No.26 of 02.10.1996 on recultivation of damaged areas, improvement of low-productive lands, removal and utilization of the humus layer (promulgated SG No. 89/22.10.1996, amended and supplemented SG No. 30 of 2002)

→ Ordinance on the type and amount, and the procedure for imposing, of sanctions for damaging or polluting the environment above the limit values and/or for failure to observe certain emission limit values and restrictions (promulgated SG No. 70/09.09.2011).

→ Ordinance No.1 of 04.06.2016specifying the procedures and standard forms for providing information on waste-related activities, and for keeping of public registers (promulgated SG No. 51 of 20.06.2014)

→ Ordinance No.2/ 23.07.2014 on wastes classification (by the minister of environment and water and the minister of health, promulgated SG No. 66 of 08.08.2014)

→ Ordinance on discarded electrical and electronic equipment (adopted by CMD No.256 of 13.11.2013, promulgated SG No. 100 of 19.11.2013, effective as of 01.01.2014

→ Ordinance specifying requirements regarding treatment of end-of-life tyres (adopted by CMD No.221 of 14.09.2012, promulgated SG No.73 of 25.09.2012)

→ Ordinance on the terms and conditions for calculation of the amount of the financial guarantee or equivalent insurance and for the provision of annual reference declarations for cross-border transport of waste (adopted by CMD No.195 of 10.07.2014, promulgated SG No. 59 of 18.07.2014)

→ Ordinance No. 4 on the conditions and requirements for construction and operation of waste incineration and waste co-incineration installations promulgated SG No. 36 of 2013)

→ Ordinance No. 6 on the conditions and requirements for the construction and operation of waste landfills and other installation for recovery and disposal of waste, (issued by the minister of environment and water, promulgated SG No. 80 of 13.09.2013, effective as of 13.09.2013)

→ Ordinance No. 7 on the requirements regarding waste treatment facility sites (issued by the minister of environment and water, the minister of regional development and public works, the minister of agriculture and forestry and the minister of health, promulgated SG No. 81 of 17.09.2004)

→ Ordinance on packaging and waste packaging (promulgated SG No. 85/06.11.2012, amended and supplemented SG No. 76/30.08.2013)

→ Ordinance on construction waste management and utilization of recycled construction materials, adopted by CMD No.277 of 05.11.2012 (promulgated SG No. 89 of 13.11.2012, effective 13.11.2012)

→ Ordinance on the separate collection of biological waste, adopted by CMD No.275 of 06.12.2013 (promulgated SG No. 107 of 13.12.2013)

→ Ordinance on the treatment of biological waste, adopted by CMD No.235 of 15.10.2013 (promulgated SG No. 92 of 22.10.2013)

→ Ordinance on the utilization of sediments from waste water treatment by using them in agriculture(adopted by CMD No.339 of 14.12.2004, promulgated SG No. 112 of 23.12.2004)

→ Ordinance on accumulators and batteries (serviceable and discarded) (adopted by CMD No.351 of 27.12.2012, promulgated in SG No.2 of 08.01.2013)

→ Ordinance on spent oils and waste oil products (adopted by CMD No.352 of 27.12.2012, promulgated SG No.2 of 08.01.2013)

→ Ordinance on the classification, packaging and labelling of chemical substances and mixtures,, SG No. 68 of 31.08.2010, effective 31.08.2010; shall be applied until 31.05.2015

→ Ordinance on prevention of large-scale accidents involving hazardous substances and localizing the consequences of such accidents**,** promulgated SG No. 39/12.05.2006, as last amended SG No. 25 of 30.03.2010

→ Ordinance on the procedure and manner of storage of dangerous chemical substances and mixtures, adopted by CMD No.152/30.05.2011, promulgated SG No. 43 of 07.06.2011

→ Ordinance on the procedure and manner for restricting the manufacture, placing on the market and use of certain dangerous substances and preparations and certain dangerous articles listed under Annex XVII of the REACH Regulation, adopted by CMD No. 376/30.12.2011, promulgated SG No. 1 of 03.01.2012

→ Ordinance No.2 on the prevention of accidents from activities involving dangerous chemical substances, SG No.100/1990,

→ CMD No.53/1999 and Ordinance on the requirements regarding treatment and transportation of hazardous industrial waste (SG 29/1999)

→ CMD No.18/23.01.1998 and Rules for the organisation of prevention activities and elimination of the consequences of disasters, accidents and calamities (SG No.13/1998)

→ CMD No.319/2002 Rules for organisation and operation of the Enterprise for Management of Environmental Protection Activities (SG No.3/2003)

→ CMD No.61/2003 Ordinance on the national scheme for environmental management (SG No.26/2003)

→ Ordinance No.6 on the parameters of noise in the environment, taking into consideration the discomfort level in different times of the day and night, the limit values of noise parameters in the environment, methods for evaluating the noise parameters and the harmful effects of noise on people's health (MH, MEW, SG No. 58/2006).

→ Ordinance No.54 of 13.12.2010 on the activities of the national system for environmental noise monitoring, and the requirements that industrial sources of noise emissions into the environment conduct their own monitoring and provide information, promulgated. SG No. 3 of 11.01.2011, effective as of 12.02.2011

6.1.5 METHODS

The main methods applied for assessing the factors of the environment are ecology-based system analysis and synthesis of data, facts and literature on the issues. The regulations, laws, ordinances and rules, methodologies, instructions, orders, decrees, strategies, plans and programmes currently in force have been applied in summarising data and drawing of conclusions.

6.1.5.1 AMBIENT AIR

1. Methodology for calculating the height of stacks, dispersion, and the expected concentrations of pollutants in the ground-level air - PLUME software
2. EMEP/EEA air pollutant emission inventory guidebook 2013.

6.1.5.2 GROUNDWATER AND BOWELS OF THE EARTH

1. Yanev Sl. et al, 1992. Geological map of Bulgaria Map sheet Sofia, scale 1 : 100,000
2. Zagorchev Iv. et al, 1991 Geological map of Bulgaria Map sheet Pernik, scale 1 : 100,000
3. DRBWMD, 2014 Condition of groundwater within the area of Danube region basin management in 2013
4. Ananiev, B., 2006 Explanatory note for the construction of four monitoring points and on performed filtration tests.

5. Angelov, L., V. Metodiev, Zl. Ushev, 2013 Conceptual design for Cogeneration Plant Utilizing RDF in Sofia at the site of TPP Sofia, Geology part
6. Angelov L., 2013. Conceptual design for Cogeneration Plant Utilizing RDF in Sofia
7. at the site of TPP Sofia-East, Geology part
8. Antonov Hr., D. danchev, 1980 Groundwaters of the Republic of Bulgaria
9. Nikolova, R., 1983 Hydrogeological study of Sofia valley for establishing a system for optimum groundwater abstraction and conservation.
10. Integrated permit No.42/2005 issued to Toplofikatsia Sofia EAD, site TPP Sofia, Sofia city
11. Integrated permit No.30/2005 issued to Toplofikatsia Sofia EAD, site TPP Sofia-East, Sofia city, updated by Decision No. 30-NO-EO-A1/22.04.2013.
12. Letter No. P-24-14/21.05.014 addressed to EcoEnergoproekt - Sofia providing information about performing of EIA of the investment proposal for construction of a cogeneration plant utilizing RDF in Sofia.

6.1.5.3 NOISE

1. Methodology for determining the level of road traffic noise in road design (General Road Administration, 1995)

6.1.5.4 LANDSCAPE

1. Bulgarian landscapes classification system. Geography of Bulgaria, BAS, Sofia. 1997
2. Landscape regioning of Bulgaria. Geography of Bulgaria, A monograph, BAS, Sofia, 1997
3. Petrov, P. 1990. Landscape science. Publishing House of St. Kliment Ohridski University.

6.1.5.5 SOILS

The main methods applied for assessing the land and soils are ecology-based system analysis and synthesis of data, facts and literature on the issue. Data summary and conclusions have been made based on the regulations, laws, ordinances and rules currently in force. Apart from that the following have been made:

– a visit and a field investigation with taking of soil samples;

– Analysis of maps and schemes;

– Analysis of the documentation;

– Analysis of scientific literature;

– Chemical and physical analysis of soil samples;

– Comparative analysis with regulations;

– Synthesis of the results from analyses and making the expert assessment.

- A comparative analysis of the breaches and pollutions that would result from the implementation of each of the options suggested by the investor and their impact on the environment;

- Assessment of the impact of each IP implementation option on the land and soils, and based on that - proposal for a site selection;

- Recommendations and measures aiming to prevent, mitigate, or where possible - eliminate considerable negative effects on the land and soils from the IP implementation;

- A suggested plan for applying the measures for mitigating the impact on the land and soils.

Apart from the methodological approach described above we have to mention also the literature and the legal basis for the data analysis and forecasts of the impacts of the investment proposal on the soils and land use:

1. Soil atlas of Bulgaria. Zemizdat. Sofia. 1998
2. Geography of Bulgaria, academic publishing house "Prof. M. Drinov", Sofia, 1997
3. Gyurov, G and N. Artinova, 2001, Soil science. "Macros" publishing house, Plovdiv
4. Data of Metropoliten EAD
5. Donov, V., 19993, Forest soil science "Martilen" publishing house, Sofia.
6. Zheleva, E., 1974. The pollution of soils in Sofia and its influence on the ornamental vegetation. Gorsko Stopanstvo (Forestry) magazine, issue 4, page 12-16.
7. Kabata-Pendias, A. and H. Pendias. 1989. Microelements in the soils and in the plants Moscow, "Mir", page 435
8. Raykov L., H. Chuldzhiyan, L. Faytondzhiev, 1983. Mapping and diagnostics of soil contamination with heavy metals - Soil science and agricultural chemistry., issue 1, p.42-49
9. Raykov L., H. Chuldzhiyan, L. Faytondzhiev et al, 1984 Soil pollution problems. S.
10. A collection of Bulgarian state standards. Preservation of the natural environment, volume two, section 3 - "Soils". 1989. Committee on quality, S.
11. International standard ISO 11047. Fomin, G.S. and A.G. Fomin. 2001. Soils. Quality control and environmental safety according to international standards. A reference book. GOSSTANDART of Russia. VNII standard.
12. BDS 17.4.1.04-88 – General requirements regarding soil classification according to the impact of chemical pollutants on them.
13. BDS 17.4.3.01-86 - General requirements regarding the methods of pollutant determination.

6.1.5.6 BIODIVERSITY

1. Geography of Bulgaria, 2002, Institute of Geography under Bulgarian Academy of Science (BAS) Physical geography and socio-economic geography;
2. Biogeography of bulgaria - Asen Asenov, 2006,
3. Atlas of endemic plants in Bulgaria. BAS, Sofia. Velchev, Vl., St. Kozhuharov, M. Anchev (ed.). 1992;
4. Places of ornithological importance in Bulgaria. Bulgarian society for protection of birds, 1997;
5. Hunting birds and mammals in Bulgaria. Mihaylov Hr., St. Stoyanov, 2001, PENSOFT, Sofia - Moscow.
6. The mammals in Bulgaria - a guide. Popov V., Vitosha library, 2003;
7. D. Boychev, Zoology, Sofia, Zemizdat, 1978;
8. Beshkov Vl., Kr. Nanev, 2002. Amphibians and reptiles in Bulgaria, PENSOFT. Sofia - Moscow;
9. Biserkov, V., (ed.) 2007. A guide to Amphibia and Reptilia in Bulgaria Sofia, Zeleni Balkani; 196 p.;
10. Ts. Peshev et al, Training practice in zoology of vertebrates, Publishinh House "Nauka i Iskustvo", Sofia, 1964;
11. Nankinov, D., 2000. Animals in Bulgaria threatened with extinction. Academic Publishing House "Prof. Marin Drinov",
12. Naumov, B., M. Stanchev, 2004/2008. Amphibians and reptiles in Bulgaria,and in the Balkan Peninsula. An electronic format publication of Bulgarian Herpetological Society;
13. Popov. V., At. Sedefchev, 2003. The mammals in Bulgaria, Geosoft EOOD, 2003;
14. Red Data Book of the Republic of Bulgaria, published by BAS and MOEW, 2011, Volume 1 - Plants and fungi; Volume 2 - Animals; Volume 3 - Habitats;
15. General ecology and bases of environment protection. Kamenov, D., 1986, Sofia;

16. Field investigations in the summer of 2014 (June) assessing biodiversity, presence of rare and endangered taxa and habitats, for assessment of the project impact on the flora and fauna: investigations of areas, routes and places.

6.1.5.7 WASTE

1. Using the regulations. Wastes classification according to Ordinance 2 and EWC. Design of section SOFRGF-34-002 By-products - May 2013

6.1.5.8 HAZARDOUS SUBSTANCES

1. Guidelines for applying the criteria of the CLP Regulation Guidance to Regulation (EC) No 1272/2008 on classification, labelling and packaging (CLP) of substances and mixtures.

6.1.6 MATERIALS PROVIDED BY THE INVESTOR

Those are listed in **Annex 12.3**

7 DESCRIPTION OF THE ENVISAGED MEASURES AIMING TO PREVENT, MITIGATE, OR WHERE POSSIBLE - ELIMINATE CONSIDERABLE HARMFIL IMPACTS ON THE ENVIRONMENT, AND A PLAN FOR IMPLEMENTING THE MEASURES

Based on the information, analyses and evaluations given in the EIA report, and taking into consideration the results from the consultations during the EIA procedure, appropriate measures are suggested for prevention, mitigation, or where possible - elimination of any considerable harmful impacts on the environment, including a plan for the implementation of those measures. The envisaged measures cover the plant design, construction, operation and decommissioning periods. The measures are described by components. Recommendations regarding the plant's own monitoring plan have also been given.

To prevent, mitigate or compensate the negative impacts on the environment resulting from the IP project implementation and plant operation, it is necessary that a programme is developed with short-term and long-term undertakings for bringing the activities at the site in compliance with the regulations on natural and work environment.

The suggested measures have been developed in accordance with the requirements of the Ordinance on the conditions and procedures for performance of environmental impact assessment.

The suggested plan for the measures implementation has been developed by components and factors of the environment.

The measures (**Table 7.10-1**) aiming to prevent, mitigate, or where possible - eliminate the considerable harmful impacts on the environment, are described in the plan; the manner for applying those measures is suggested. They concern: **D** - design; **C** - construction; **O** - operation; **DC** -decommissioning of the plant.

7.1 AMBIENT AIR

The measures which have to be applied in the IP implementation in order to guarantee ambient air quality, reduce the negative effects resulting from the implementation, and protect human health, are presented in *Plan for the measures application* **Table 7.10-1**.

7.2 WATER

7.2.1 SURFACE WATER

The suggested measures are in line with the existing programmes of measures for preventing and reducing the anthropogenic pressure (point pollution sources and diffuse pollution sources) and effects on water resources; monitoring and control measures, including measures for the water protection zones under Programme 7.1.5.1, Programme 7.1.5.2, Programme 7.1.6. in accordance with letter No.1552/15.11.2013 of DRBWMD - Pleven.

According to letter No.1552/15.11.213 of the Danube River Basin Water Management Directorate (DRBWMD)- Pleven, the main goal of the River Basin Management Plan is to achieve and maintain good condition of waters in the Danube region as well as improve it in the management period until 2015.

7.1.5.2 Measures for emission control through prohibiting the discharge of pollutants from point sources, or requirements for issuing of permits and regular review and updating of those permits as regards surface waters:

BG1MB052 – Review of the integrated permit and changing the emission limits set in it, or including of new emission limits in the conditions of the permit if the environment is polluted above the quality standards;

BG1MB070 – Prohibition on the disposal of waste, materials and substances which hamper the operation of the sewerage networks and of the local waste water treatment plants;

BG1MB071 – Control of the persons operating the sewerage networks of cities and villages and the users for observing the permits for discharging of waste water in the sewerage networks.

7.2.1.1 MEASURES PROHIBITING THE INTRODUCTION OF POLLUTANTS FROM DIFFUSE SOURCES OF POLLUTION AND MEASURES FOR POLLUTION PREVENTION OR CONTROL:

BG1MB098 – Prohibition on waste abandoning, non-regulated dumping and burning out, or any other form of uncontrolled waste disposal;

BG1MS033 – Applying of industry standards for environmental management and protection.

The investment proposal is in implementation of measure BG1MS014, which requires optimisation of water abstraction for industrial needs by means of introducing circulation cycles.

7.2.2 GROUNDWATER

According to letter No.1552/15.11.213 of the Danube River Basin Water Management Directorate (DRBWMD)- Pleven:

the main goal of the River Basin Management Plan is to achieve and maintain good condition of waters in the Danube region as well as improve it in the management period until 2015. The environmental goals concerning groundwater body "Pore water in the Neogene-Quaternary layer - Sofia valley", code BG1G00000NQ030, follow from that goal: "Preserve the good condition of groundwater"; and as regards the the sanitary protected areas for drinking water - "Reduce the need for water treatment before its use". With a view to attaining those goals, in the IP implementation it is necessary to observe the measures under programmes:

MEASURES FOR EMISSION CONTROL THROUGH PROHIBITING THE DISCHARGE OF POLLUTANTS FROM POINT SOURCES, OR REQUIREMENTS FOR ISSUING OF PERMITS AND REGULAR REVIEW AND UPDATING OF THOSE PERMITS AS REGARDS GROUNDWATER:

- BG1MS016 - Prohibition on the disposal of certain priority substances, and on other activities on and in a groundwater site, which could result in indirect leading of those substances into the groundwater;

- BG1MS017 – Prohibition on the use of priority-substances-containing materials in building of structures, engineering constructions and installations where there is contact with groundwater or such contact is possible, which could result in polluting the groundwater.

MEASURES FOR EMISSION CONTROL THROUGH PROHIBITING THE DISCHARGE OF POLLUTANTS FROM POINT SOURCES, OR REQUIREMENTS FOR ISSUING OF PERMITS AND REGULAR REVIEW AND UPDATING OF THOSE PERMITS AS REGARDS SURFACE WATERS;

BG1MB052 – Review of the integrated permit and changing the emission limits set in it, or including of new emission limits in the conditions of the permit if the environment is polluted above the quality standards;

BG1MB070 – Prohibition on the disposal of waste, materials and substances which hamper the operation of the sewerage networks and of the local waste water treatment plants;

BG1MB071 – Control of the persons operating the sewerage networks of cities and villages and the users for observing the permits for discharging of waste water in the sewerage networks;

- BG1MS014 – Optimisation of water abstraction for industrial needs by means of introducing circulation cycles.

MEASURES PROHIBITING THE INTRODUCTION OF POLLUTANTS FROM DIFFUSE SOURCES OF POLLUTION AND MEASURES FOR POLLUTION PREVENTION OR CONTROL:

BG1MB098 – Prohibition on waste abandoning, non-regulated dumping and burning out, or any other form of uncontrolled waste disposal;

BG1MS033 – Applying of industry standards for environmental management and protection.

The investment proposal is in implementation of measure BG1MS014, which requires optimisation of water abstraction for industrial needs by means of introducing circulation cycles.

Besides the measures specified in the RBMP, the project solutions and the IP implementation shall conform also to the prohibitions stipulated in art.118a, paragraph 1, it.2, 3 and 4 of the Water Act and aimed at protecting groundwater from pollution: Prohibition on the disposal, including in landfills, of certain priority substances, which could result in indirect leading of pollutants into the groundwater; other activities on the ground and in the groundwater body, which could result in indirect leading of priority substances into groundwater; use of materials containing priority substances in building of structures, engineering constructions and installations where there is contact with groundwater or such contact is possible.

In the Geology section of the conceptual design of the plant under consideration at TPP Sofia site it is recommended that "the foundations of the RDF bunker shall be made through draining the foundation pit. Making a drill well for water abstraction and monitoring (piezometric) purpose shall be envisaged in the work design phase, and a filtration-test examination shall be performed to find out the hydrodynamic parameters of the sandy Pliocene sediments." Although this recommendation is appropriate, it is not sufficient for reducing the expected impacts on groundwater and the bowels of the earth. For that reason, apart from the measures specified in the RBMP of DRBD and in the Water Act, the following mitigation measures are suggested also:

→ The results from the additional hydro-geological investigation of the site shall be taken into consideration in the next design phases. Such an additional hydro-geological investigation has to be made according to the recommendation given in the conceptual design, and besides determining the hydro-dynamic parameters of aquifer collectors, it shall include an examination of the chemical condition of groundwater according to the indicators specified in Annex No.1 with art.10, paragraph 2, it.1 of Ordinance No.1/2007 on groundwater studying, utilisation and protection.

→ The expected water influx from groundwater into the construction pits shall be forecast and draining the pits shall be planned, reducing water by pumping it out to the possible minimum.

→ Unauthorised storage of fuels, oils, waste and chemicals, waste incineration or any other form of uncontrolled waste disposal shall not be allowed;

→ A plan for own monitoring of groundwater shall be developed in line with the requirements of Ordinance No.1/11.04.2011 on water monitoring and of Ordinance No.1/2007 on groundwater studying, utilisation and preservation; the own monitoring plan shall include:

→ Designing and construction of minimum two monitoring tube wells (piezometric) of depth not less than 20 m and structure similar to that of the piezometric wells already built.

→ The monitoring shall consist in checking the following parameters once a year: water level, water temperature, general hardness, active reaction, electric conductivity, permanganate oxidation, ammonium ion, nitrates, nitrites, sulphates, chlorides, phosphates, sodium, iron, manganese, and oil products. The own monitoring plan shall be agreed with Danube River Basin Directorate and ExEA.

→ If necessary, the parameters of the currently applied integrated permit shall be amended;

→ In case of emergency situations (earthquakes, accidental spillage of oil products or other hazardous substances and materials) actions shall be undertaken for mitigating and eliminating the negative consequences, including: immediate notification of the services directly responsible for fighting disasters and accidents; enclosing the areas of the accident and ensuring that its is guarded; suitable treatment of spilt substances with absorption materials; elimination of the consequences.

7.3 BOWELS OF THE EARTH

→ Additional engineering, geological and geophysical investigations shall be conducted. They shall include mainly studying the physical and mechanical properties of levelling materials, in the section where the layer of levelling materials is over 4-5 m thick - that is the place where the flue gas treatment hall and the stack will be located;

→ Develop separate projects for the earthworks, including forecasts about the expected suffosion processes, and where necessary - about the stability of slopes, of reinforcement works and the technology for making them, and mainly about the envisaged deep construction pits.

→ High-quality construction shall be ensured as well as high-quality recultivation of damaged areas.

7.4 BIODIVERSITY

→ A forest shelterbelt shall be made around the site.

7.5 CULTURAL HERITAGE

7.5.1 ART.160 AND ART.72 OF THE CULTURAL HERITAGE ACT SHALL BE OBSERVED WHILE CARRYING OUT THE CONSTRUCTION WORKS:

Art. 160. (1) (Supplemented - SG No. 54 of 2011). For movable archaeological objects and anthropological remains, found by chance articles 93 - 95 shall be applied respectively.

(2) (amended SG No. 54 of 2011). In cases of performing construction or public works or agriculture activities, in research or extraction of ores and minerals and other activities, related with impact on the earth surface, subsoil, bowels of the earth and under water, structure and finds are found, which have signs of cultural valuables, the activity shall be immediately stopped and art.72. shall be applied.

(3) (New paragraph - SG No. 54 of 2011) Within 14 days of the notification under art. 72, paragraph 5 the minister of culture shall appoint a commission, which shall suggest following actions. Approving the report of that commission, the minister of culture shall prescribe the necessary activities for examining and preservation of the structures and finds.

The measures envisaged for preventing considerable harmful impacts of the IP implementation on the cultural and historical heritage shall be applied during the construction and assemblage works.

7.6 LANDSCAPE

– Develop a project for recultivation of terrains damaged by the construction, and recovery of the damaged landscape components - soil and vegetation.
– The neighbouring landscapes shall be protected through observing strictly the regulated boundaries of the areas of removal, loading and transportation of earth, waste and other materials.
– Besides the recultivation project a project for landscaping the area shall be developed and implemented in accordance with the planned future use of that area.
– The work programme and the health and hygiene requirements regarding such sites shall be strictly observed.

– Applying appropriate anti-erosion measures, recultivation of the top layer, maximum protection of neighbouring areas, and appropriate planting will mitigate the landscape change and the artificial introduction of such a dominant feature in the local industrial landscape.
– Suitable architectural arrangement of the visible part of installations.
– After the construction completion measures shall be undertaken for mitigating the impact - recovery of damaged land and planting where necessary - the free areas around the installations, in order to integrate the site into the environment.

7.7 WASTE

Strict control and effective management of waste for minimizing it.

Recommendations: Additional investigations should be made regarding following treatment and eventual use of the waste generated by the production activities: slag, scrap, etc.

As the plant envisaged by the IP is a component of the plan for Sofia city municipal waste treatment, after the waste is utilized as an energy resource, the process waste and technological residues will be managed also within that plan. We recommend that additional investigations are made in future, connected with solution versions, technical and economic justification, in order to adopt the most rational waste treatment solution.

7.8 HAZARDOUS SUBSTANCES

All safety requirements for working with hazardous substances shall be observed.

7.9 NOISE

The investment proposal envisages measures for reducing the noise emissions from the new equipment.

→ The space design and construction solution of the plant building restricts the spreading of noise from the various sources (main and ancillary) both from/to different departments and into the environment.

→ According to the design the equipment in the new plant's building shall comply with the requirement regarding the level of equipment-generated noise - up to 80 dBA, and those units generating the loudest noise (the turbine, some pumps, fan with the stack, compressors, slag conveyor belts, air coolers and steam condensers) - up to 85 dBA. To meet that requirement it is envisaged that the units of the equipment, generating loudest noise, will be located in enclosed and noise-insulated areas (rooms), or within noise-insulating casings. We recommend that the walls of such a casing are made of standard acoustic screens, lined with noise-absorbing material on the noise source side.

→ To meet the project requirement of 70 dBA noise limit value within the industrial site, of the noise emissions from the new plant, it is necessary to envisage silencing means for the outdoor sources (fan silencers, etc.)

→ A requirement to measure the noise level within the industrial site in accordance with the integrated permit conditions, including also the new plant, shall be included in the own monitoring plan under "noise" factor.

7.10 HEALTH PROTECTION AND RISK MANAGEMENT MEASURES

7.10.1 REGARDING EMPLOYEES

- The newly employed persons shall be acquainted with the basic rules and requirements for workplace health and safety and fire safety at the site territory.

- It is obligatory that the employees are acquainted with the specific risks to human health, connected with the concrete technologies and materials used, and with the protection methods and equipment; personal and collective protective equipment; special workwear - importance, way of using it and storing it. Regular instructions aim to maintain and update the employees' WHSFS knowledge and skills.
- Provision of information about dangerous agents at work, health risks, training an information on respective protection measures and actions, which shall be undertaken for self-protection and protection and protection of the other workers, and access to the safety data sheets of the used chemical agents.
- Provision of appropriate information and training the employees for using correctly and safely the operation equipment so as to minimize the their exposure to noise. Use of technical means for noise control; noise reduction by enclosing the noise sources within protective screens; noise-absorbing lining; false noise-insulating ceilings; maintenance of the equipment and the workplace and work organisation aimed at reducing the noise impact (limiting the duration of exposure and the noise intensity; appropriate work time organisation with sufficient breaks).
- For the persons working with video displays - provide training and information on the requirements concerning the specific equipment, work environment, software used, and potential risks of impairing one's eyesight and muscle-skeletal system; risk of mental stress, etc.
- For work with machines and installations, observing the requirements specified in the respective machine's documents and in the technological instructions shall be ensured.
- Special and protective workwear and personal protection equipment,
- corresponding to the work conditions for each position, shall be ensured
- and there should be control for using them.

7.10.2 IN CARRYING OUT CONSTRUCTION AND REPAIR WORKS

All construction and repair works will conform to Ordinance No.2 of 22.03.2004 on occupational health and safety in construction and installation works - annexes No.1 to No.5 under art.2(2), and Ordinance No.4 of 27.12.2006 on limiting harmful noise by envisaging noise insulation of buildings in their design and on the noise control rules and norms applied in construction.

- Reduction of dust emissions by sprinkling of water in the places where dust is formed (in dry and windy weather). Use of concrete and solutions prepared in a special concrete-preparation plant, and machine laying of concrete.
- Prevent spillage of oil products. In case of spillage - undertake immediate measures for its localization, removal and transportation of the oil products to suitable places of disposal.
- After the completion of construction and assemblage works the places of temporary outdoor storage of construction materials shall be cleaned. That will prevent dust emissions into the ambient air in dry and windy weather.
- Keep the construction machinery in good repair and use them under optimum load; that will reduce the quantity of exhaust gases on one hand, and on the other - the noise and vibrations.
- The work and rest regimes for positions exposed to vibrations shall be developed in such a way that the total exposition (contact with vibrations) per shift does not exceed 90-120 min.
- Carrying out of construction and assemblage works at night shall not be allowed.
- In all professional activities it is obligatory to use clothes suitable for the season, and personal protective equipment (dust masks, hearing protectors, anti-vibration gloves) if there are harmful factors of the work environment and to apply a rational work and rest regime.

7.10.3 IN THE OPERATION OF THE IP FACILITIES

- All workplace health and safety and fire safety instructions shall be observed in the operation of the installations
- In all professional activities it is obligatory to use clothes suitable for the season, and personal protective equipment (dust masks, hearing protectors, anti-vibration gloves) if there are harmful factors of the work environment and to apply a rational work and rest regime.

The plan for implementation of the measures envisaged for prevention and mitigation of harmful effects on the environment and human health, which is a part of the EIA report, is given in the form of a table, and is divided into the following implementation phases:

- During the design phase
- During construction
- During plant operation

TABLE 7.10-1 PLAN FOR APPLICATION OF MEASURES

No.	Measures	Implementation period (phase)	Results
1. Ambient air and atmosphere			
	Basic measures		
1.1.	Design all installations in compliance with BAT	D	Gas emissions not exceeding the limit values
1.2.	Observe the ELVs in the flue gas from the stack	O - constantly during operation	Gas emissions not exceeding the limit values
	Additional measures		
1.3.	Maintain the surface of internal roads and the areas around bulk materials sites clean from dust particles, and comply with the requirements of art.70 of Ordinance No.1/2005.	C, O, DC - constantly during operation	Reduction of dust emissions
1.4.	Apply internal rules of safety and rules for checking the equipment, preventive repairs of the equipment.	O - constantly during operation	Limited probability of emissions of toxic substances in case of accidents
	Emergency measures		
1.5	Develop a plan for response in emergency situations, and procedures for its mastering and implementation by the staff.	O - constantly during operation	Exclude volley emissions of toxic substances
1.6	The emergency response plan shall be agreed with the local fire fighting teams and implemented together with them	O - constantly during operation	Exclude volley emissions of toxic substances
2 Water			
2.1	**Surface water**		
2.1.1	Blackwater/sewage shall be led to chemical toilets until connection with the sewerage system is ensured.	D, C	Protect waters and soils from pollution
2.1.2	Polluting waters in the periods of plant construction, operation and decommissioning shall not be allowed.	C, O, DC	Minimized impact of the site on the water and biodiversity in the region
2.1.3	The current integrated permits issued under the Environmental Protection Act shall be amended or new integrated permits shall be issued	D, C, O, DC	Compliance with all regulations regarding surface water and groundwater protection
2.1.4	The sewerage system shall be made of materials ensuring high water-resistance.	D, C	Protection of groundwater and the bowels of the earth from penetration of pollutants into them.
2.1.5	The concrete installations shall be designed and made of water-resistant concrete	D, C	Exclude leakage. Protect the soils and groundwater from pollution
2.1.6	A special ground shall be envisaged for the construction machinery used, designed so as to exclude pollution of surface water and groundwater with oil products.	D, C	Exclude pollution of soils, groundwater and surface water with oil products.
2.1.7	Build separate sewerage systems for blackwater/sewage and for rainwater.	D, C	Prevent pollution of surface water and soils
2.1.8	Design a groundwater and surface water monitoring system as a component of the TPP's monitoring system, to function during the plant operation and decommissioning.	D, C, O, DC	Ensured effective control of the waters condition Prevent pollution
2.2	**Groundwater**		
2.1.2	Additional hydro-geological investigation and examination shall be conducted for determining the hydro-dynamic parameters of aquifer collectors, and examination of the chemical condition of groundwater according to the indicators specified in Annex No.1 with art.10, paragraph 2, it.1 of Ordinance No.1/2007 on	Feasibility study	Obtain data for the purpose of ecological design

No.	Measures	Implementation period (phase)	Results
	groundwater studying, utilisation and preservation.		
2.2.2	The expected water influx from groundwater into the construction pits shall be forecast and draining the pits shall be planned, reducing water by pumping it out to the possible minimum.	D, C	Preserved quantity of groundwater
2.2.3	The project solutions shall take into consideration the prohibitions stipulated under art.118 of the Water Act and the prohibitions and restrictions regarding belts I and II of the safeguard zones listed in Annex No.2 of Ordinance No.3/ 16.10.2000 on the conditions and procedure for research, design, approval and operation of the safeguard zones around water sources and installations for potable and household water supply and around mineral water sources used for treatment, preventive, potable and hygiene need; those are: Prohibition on the disposal, including in landfills, of certain priority substances, which could result in indirect leading of pollutants into the groundwater; other activities on the ground and in the groundwater body, which could result in indirect leading of priority substances into groundwater; use of materials containing priority substances in building of structures, engineering constructions and installations where there is contact with groundwater or such contact is possible.	D	Protection of groundwater from pollution
2.2.4	Designing and construction of minimum two monitoring points (piezometric) of depth not less than 20 m and structure similar to that of the piezometric wells already built.	D, C	Ensure conditions for groundwater monitoring
2.2.5	Develop an own monitoring plan, and monitor grounder checking once a year the following parameters: water level, water temperature, general hardness, active reaction, electric conductivity, permanganate oxidation, ammonium ion, nitrates, nitrites, sulphates, chlorides, phosphates, sodium, iron, manganese, and oil products.	C, O	Control of groundwater quantity and chemical content
2.2.6	• Unauthorised storage of fuels, oils, waste and chemicals, waste incineration or any other form of uncontrolled waste disposal shall not be allowed	C, O	Preserved chemical content of groundwater
2.2.7	• If necessary, the parameters of the currently applied integrated permit shall be amended.	D	Preserved quantity and chemical content of groundwater
2.2.8	In case of emergency situations (earthquakes, accidental spillage of oil products or other hazardous substances and materials) such actions shall be undertaken for mitigating and eliminating the negative consequences as stipulated in the laws and regulations; the services directly responsible for fighting disasters and accidents shall be notified immediately.	C, O	Preserved chemical content of groundwater
3. Bowels of the earth			
3.1	Engineering, geological and geophysical investigations and examinations shall be conducted, mainly studying the physical and mechanical properties of levelling materials, in the section where the layer of levelling materials is over 4-5 m thick - that is the place where the flue gas treatment hall and the stack will be located.	Feasibility study	Obtain data for the purpose of ecological design
3.2	Develop separate projects for the earthworks, including forecasts about the expected suffosion processes, and where necessary - about the stability of slopes, of reinforcement works and the technology for making them, and mainly about the envisaged deep construction pits.	D, C	Protect the geological environment from deformation
3.3	High-quality construction and high-quality recultivation of damaged areas.	C	Protect the geological environment from deformation

No.	Measures	Implementation period (phase)	Results
4. Land and soils			
4.1	The location of installations within the site shall be such as to reduce the amount of excavated earth, and minimize the additional technical measures aimed to ensure geo-technical stability of the system.	D, Construction and assemblage works	Minimize the impact on the environment and preserve the land.
4.2.	Exclude spillage of oils and oil products	C, O, DC	Protect the soils from pollution
5. Biodiversity Special areas of conservation and protection areas			
5.1.	During the construction works care shall be taken to ensure that construction machinery and transport vehicles do not enter the neighbouring green areas or the green areas within the TPP site, beyond the designated roads..	C	Prevention of affecting the vegetation in the green areas and the animal species inhabiting it
6. Landscape			
6.1.	Develop a project for recultivation of terrains damaged by the construction, and recovery of the damaged landscape components - soil and vegetation.	D	Preserve the landscapes
6.2.	The neighbouring landscapes shall be protected through observing strictly the regulated boundaries of the areas of removal, loading and transportation of earth, waste and other materials.	C	Preserve the landscapes
6.3.	Besides the recultivation project a project for landscaping the area shall be developed and implemented in accordance with the planned future use of that area.	Closing down and recultivation	Preserve the landscapes
6.4	The work programme and the health and hygiene requirements regarding such sites shall be strictly observed.	D, Construction and assemblage works (CAW), O, DC	Integration into the surrounding landscape
6.5	Applying appropriate anti-erosion measures, recultivation of the top layer, maximum protection of neighbouring areas, and appropriate planting will mitigate the landscape change and the artificial introduction of such a dominant feature in the local industrial landscape.	D, CAW, O, DC	Integration into the surrounding landscape
6.6	Suitable architectural arrangement of the visible part of installations.	D, CAW, O, DC	Integration into the surrounding landscape
6.7	After the construction completion measures shall be undertaken for mitigating the impact - recovery of damaged land and planting where necessary - on the free areas around the installations, in order to integrate the site into the environment.	D, CAW, DC	Integration into the surrounding landscape
7. Waste			
7.1	There shall be strict control and effective management of the generated waste	D, CAW, O, DC	Comply with the regulatory requirements Reduce the waste generated as a result of the plant operation
7.2	Regular and timely removal of the waste generated during construction	O	Protect the soils from pollution
7.3	The construction waste shall be regularly transported to a landfill for construction waste	CAW	Preservation of the soils Waste management
7.4	Areas shall be designated for temporary storage of municipal waste, industrial waste and hazardous waste before it is transported by specialized companies The temporary storage of waste shall comply with the regulatory requirements	D, CAW, O, DC	Protection of the area and the neighbouring areas from pollution. Waste management
7.5	When transporting the waste from technological processes, so called by-waste, from the plant site to the respective places of	D, O	Protection of the area and the neighbouring areas from

No.	Measures	Implementation period (phase)	Results
	disposal: → inert non-hazardous waste - slag, to Vrazhdebna inert waste landfill; → hazardous waste - fly ash, boiler dust and waste from flue gas cleaning, to the respective places of disposal, appropriate measures shall be envisaged for elimination of conditions for polluting the site, the roads used and the adjacent terrains. The waste shall be transported in covered trucks.		pollution.
7.6.	It is recommended that in future, after process waste generation, additional investigation is made for the following: - explore in details the possibility for using non-hazardous inert waste (slag) as a component of road-pavement materials and other construction materials; - explore in details the possibility for separation of the hazardous process waste (fly ash, boiler dust and waste from flue gas cleaning) in order to separate a mass, which will be disposed at less strict conditions.	D, O	
7.7	A plan for construction waste management shall be drawn up under the terms of art.11 (1) of the Waste Management Act	D	Protection of the environment from pollution
7.8	Select areas and equipment for collecting and temporary storage of hazardous waste	C	Reduced harmful effect of waste on the environment
8. Dangerous substances			
8.1	Prepare instructions for safe operation and use of personal protective equipment	D, CAW, O, DC	
8.2	All instructions for safe work with dangerous substances shall be observed. It is necessary to observe strictly all WHSFS requirements during construction and especially when laying the asphalt pavement.	D, CAW, O, DC	
8.3	Ensure compliance with the requirements regarding storehouses for storage of input materials and waste. To reduce the potential adverse effects of dangerous substances it is necessary to ensure compliance with the requirements regarding loading/ unloading of materials in powder, delivered in paper bags or polymer bags; dangerous substances shall be stored in appropriate manner.	D, CAW, O, DC	
8.4	The input materials and other materials supplied for using in the plant operation shall be accompanied by certificates of analysis, safety data sheets, and instructions for working safely with them, including measures to be applied in case of spillage, dust spreading and damage to the health of staff. Each original package shall have a label, indicating the risks to the health and to the environment, and respective safety measures. Hazardous/ dangerous substances and products are controlled by the Ministry of Health authorities.	D, CAW, O, DC	
9. Harmful physical factors - noise, vibrations, etc.			
9.1	It is necessary that the workers use personal hearing protectors during the plant construction and operation, for their personal safety and protection from acoustic load.	CAW, O, DC	Protection of the health of workers and local residents
9.2	The machinery used shall be in good working order and shall conform to all contemporary technical requirements, specifications and norms, mandatory in EU	CAW, DC	Protection of the health of workers and local residents
9.3	The investment proposal envisages using modern machinery and equipment - of good technical and acoustic characteristics - in the plant construction and operation. Appropriate silencers have been envisaged for the ventilation systems. It is necessary to keep those silencers in good repair.	D, CAW, O, DC	Protection of the health of workers and local residents

No.	Measures	Implementation period (phase)	Results
9.4	The machinery used outdoors must correspond to the requirements of the Ordinance on the essential requirements and compliance assessment of machines and equipment operating outdoors, as regards the noise which they emit. The ordinance is harmonized with Directive 2002/88/EC.	CAW, O, DC	Protection of the health of workers and local residents
9.5	The routes which the service vehicles use during the plant construction and operation shall be agreed with Sofia Municipality and with the municipalities of other places through which transportation flows will pass.	D, CAW, O, DC	Protection of the health of workers and local residents
10. Material and cultural heritage			
10.1	According to art. 160 (1) and (2) of the Cultural Heritage Act, where structures and finds, showing signs of cultural values, are discovered in the course of construction or public works, the activities shall be discontinued immediately and Art. 72 and 73 shall be applied.	D, CAW, O, DC	
	If finds having signs of monuments of culture are discovered in the course of construction works, the work shall be discontinued temporarily and the municipal authorities of the municipality in which the find is shall be informed immediately in accordance with art.93, 94 and 97 of the Cultural Heritage Act.		
11. Health protection and risk management			
11.1	All WHSFS instructions shall be observed.		
11.2	All construction and repair works will conform to Ordinance No.2 specifying the minimum requirements for occupational health and safety in construction and installation works, and Ordinance No.4 on limiting harmful noise by envisaging noise insulation of buildings in their design and on the noise control rules and norms applied in construction.	C, O, CD	
11.3	All requirements related to safety at work, envisaged on the design according to the Law on the Health and Safety at Work, shall be strictly observed during the plant construction and operation.	C, O, CD	Reduction of the risk to the health of staff involved in the construction and operation.
11.4	It is necessary to observe all prevention requirements connected with health, with physiological regimes of work and rest, and physiological norms for manual work with heavy items, specified in MH ordinances.	C, O	Reduction of the risk to the health of staff involved in the construction and operation.
11.5	Use strictly the envisaged personal and collective protective equipment.	C, O, CD	Risk prevention
11.6	It is obligatory that the workers receive instructions by competent specialists.	C, O, CD	Risk prevention
11.7	Reduction of dust emissions by sprinkling of water in the places where dust is formed (in dry and windy weather). Use of concrete and solutions prepared in a special concrete-preparation plant, and machine laying of concrete.	C, O, CD	Risk prevention
11.8	Prevent spillage of oil products. In case of spillage - undertake immediate measures for its localization, removal and delivery of the resulting hazardous waste for disposal.	C, O, CD	Prevention of risks to the environment - preservation of soils and water.
11.9	After the completion of construction and assemblage works the places of temporary outdoor storage of construction materials shall be cleaned. That will prevent dust emissions into the ambient air in dry and windy weather.	C, O, CD	Risk prevention
11.10	Keep the construction machinery in good repair and use it under optimum load; that will reduce the quantity of exhaust gases on one hand, and on the other - the noise and vibrations.	C, O, CD	Risk prevention
11.11	The work and rest regimes for positions exposed to vibrations shall be developed in such a way that the total exposition (contact with vibrations) per shift does not exceed 90-120 min.	C, O, CD	Risk prevention

No.	Measures	Implementation period (phase)	Results
11.12	In all professional activities it is obligatory to use clothes suitable for the season, and personal protective equipment (dust masks, hearing protectors, anti-vibration gloves) if there are harmful factors of the work environment, and to apply a rational work and rest regime.	C, O, CD	Risk prevention
11.13	Regular maintenance of construction machinery and transport vehicles No emissions from the engines in breach of regulations shall be allowed. Fuels complying with the standard shall be used.	C	Air pollution above the limit values shall not be allowed.
11.14	The heaps of sand and inert materials shall be covered with a polyethylene sheet in order to prevent dust spreading.	C	Prevention of dust spreading in the IP route and around it. Prevention of harm to the health of residents.
11.15	After completion of construction and assemblage works the places for temporary storage of inert materials shall be cleaned.	C	Prevention of dust spreading in the IP route and around it.
11.16	Sand and inert materials shall be transported in covered trucks or covered with tarpaulin.	During construction	Prevention of dust spreading in the IP route and around it.
11.17	A first-aid kit shall be kept in good condition.	C, O, CD	First aid shall be rendered to injured people in a timely manner.
12. Social and economic aspects			
12.1	Jobs will be created in the plant construction and operation periods, and the positions shall be occupied by specialists having appropriate experience in the respective activity.	C, O, CD	Ensure high-quality operation of the plant, optimum conditions for the technological processes; not allow for risks to the environment; ensure good working and natural environment.
12.2	Activities raising the awareness of citizens aimed at increasing their participation in decision-making and their competence in sustainable development and environmental protection issues.	D, C, O, CD	Prevent the health risk for employees
12.3	Training courses aimed at preparing staff that meets all requirements for establishing of optimum conditions for the technology processes and good quality of the work environment and natural environment.	C, O, CD	Prevent the health risk for employees Protect employees' health.
13. Other recommendations			
13.1.	All recommendations and suggestions made in the EIAR by the experts shall be taken into consideration in the following design phases; there shall be strict control and management for applying them in the operation of the IP installations.	D, C, O	Prevent risks to the natural environment and work environment.
13.2	The following documents shall be prepared in the next design phases, and regularly updated during operation and at closing down: - A monitoring plan - A plan for response to emergency situations	D, C, O	Prevent risks to the natural environment and work environment.
13.3.	Appropriate measures shall be envisaged for the RDF transportation to the plant site so as to eliminate any conditions for polluting the site, the areas of the roads used and the land nearest to them.	D, CAW, O	Protection of the area and the neighbouring areas from pollution of air, soils and water.
134	A Traffic Management Plan shall be developed for the organisation of transport during construction and for waste transportation during the plant operation; that plan shall be agreed with the respective competent authorities and applied in the plant construction and operation.	D, C	Reduced noise levels in populated areas

D - design; C - construction; CAW - construction and assemblage works; O - operation; DC - decommissioning; CD - closing down

8 STANDS AND OPINIONS OF THE PUBLIC CONCERNED, THE AUTHORITIES COMPETENT FOR MAKUNG EIA DECISIONS, AND OTHER SPECIALIZED OR CONCERNED INSTITUTIONS, ORGANISATIONS ETC., RESULTING FROM THE CONDUCTED CONSULTATIONS

Institution, company, organisation, public etc., with which consultations have been conducted on the assignment concerning the EIAR scope and content	Declared stands (quoted)	Taking into consideration manner / Reasons for acceptance/ non-acceptance of remarks and stands
1.	Notices under art.4 of the Ordinance on the Conditions and Order for Performance of EIA, for: „Construction of a cogeneration plant utilizing RDF in Sofia”. The client - Toplofikatsia Sofia EAD - has informed the following authorities about its IP: 1. RIEW Sofia - by letter of incoming No.26-00-8305/09.08.2013 2. Sofia Municipality (SM) - by letter of Ref. No. SM-7000-1099/09.08.2013 SO stand: ref. No.SM-0500-1658/11.09.2013 and written statement dated 14.08.2013 3. Sofia Municipality - Iskar district: by letter of Ref. No. SM7000-648/09.08.2013 Stand of Sofia Municipality - Iskar district: Ref.No.7000-648 (6)/21.11.2013 on the investment proposal 4. Sofia Municipality - Serdika district: by letter of Ref. No. AC-26-00-429/09.08.2013 5. A copy of the announcement 6. A copy of the announcement published in Monitor newspaper on 07.08.2013 7. Publishing in the website of Toplofikatsia Sofia - http: toplo.bg	The client for the IP has informed the competent authorities and the public concerned about his investment intent at the earliest stage, by announcing it in writing, and the municipal authorities (the districts) have placed notices and have published the notices about the IP in internet, in the website of the respective municipality (evidence enclosed in Annex 1, item 2 of the Terms of Reference), in accordance with the requirements under art. 95 of EPA (promulgated SG No.91 of 25. 09.2002, amended SG No.27 of 15.03.2013) and the Ordinance on the Conditions and Order for Performance of EIA (SG No.25/2003, amended and supplemented SG No.94 of 30.11.2012) No objections to the investment proposal have been received.
1.1 RIEW Sofia, Ref. No.26-00-8305/09.10.2013	I. In relation to the applicable procedure under chapter six of the Environmental Protection Act (EPA) The investment proposal falls within the scope of section 2.1 of Appendix of EPA and is subject to mandatory environmental impact assessment (EIA). According to art.94, paragraph 2 of EPA the authority competent to deliver a decision is the director of RIEW - Sofia. I. In relation to the stipulations of art.31 of the Biological Diversity Act (BDA) On the authority of art.2 (1), it.1 of the Ordinance on the conditions and procedures for carrying out assessment of the compatibility of plans, programmes, projects and investment proposals with the conservation objectives of the protection areas (CA Ordinance, SG No.73/2007, as last amended and supplemented) this investment proposal is subject to a compatibility assessment procedure, which according to	RIEW letter Ref.No.26-00-8305/09.10.2013 specifies the applicable procedure under chapter six of EPA and the required procedure under the Ordinance on the Conditions and Order for Performance of EIA (SG No.25/ 2003, amended and supplemented SG No.94 of 30.11.2012)

	art.31 (4) of BDA and art.38 of the same ordinance shall be performed through the EIA procedure. The provided information gives reasons for concluding that the investment proposal, both in itself and in interaction with other plans, programmes and investment proposals is not likely to have a considerable negative impact on protection areas or natural habitats, populations and habitats of species which are subject to preservation in a protection area, and in relation with art.39 (4) of the CA ordinance no assessment of the compatibility of plans, programmes, projects and investment proposals with the conservation subject and goals of the protection areas is necessary because of the following: 1. The investment proposal is not within the territory of any protection areas in the meaning of BDA. The protection area nearest to IP is PA BG 0002004 Dolni Bogrov - Kazichane for conservation of wild birds, announced with order No.RD-573/08.09.2008 of the minister of environment and water, SG No. 84/2008. The boundary of that area is at a distance over 4.1 km to the east of TPP Sofia-East site. 2. The sites envisaged in the investment proposal are within the plan of Sofia city and in the territory of existing facilities of Toplofikatsia Sofia. 3. The implementation of the project envisaged by the IP will not affect directly the natural habitats and habitats of flora or fauna species, which are subject of conservation in the protection areas. 4. The landed estate considered in the IP does not affect any special areas of conservation in the meaning of the Protected Areas Act. II. In relation to the next actions for conducting the procedure under chapter six of EPA With a view to conducting the determination procedure the following documents and information shall be provided to RIEW Sofia:	
	1. On the grounds of art.95 (2) of EPA and art.10 (1) of the Ordinance on the Conditions and Order for Performance of EIA, (the EIA Ordinance, SG No.25/2003, as amended and supplemented), you **should assign preparation of terms of reference for the scope and content of the EIA report**, containing such information as specified under art.10 (3) of the same ordinance. It should be pointed out that, taking into consideration the stipulations of art.10 (6) of the EIA Ordinance, in the consultations under paragraph 6 the client declares in writing his intent of enclosing with the EIA report an assessment under art.99 (1) of the EPA; such assessment shall be made separately for the respective installations according to Annex 4 of EPA.	Preparation of terms of reference for the scope and content of the EIA, in accordance with the EIA Ordinance, has been assigned and fulfilled. A written statement by the client Toplofikatsia Sofia EAD is enclosed - outgoing Ref. No. P-5449/16.12.13 (Annex 2, item 2.2)
	2. Consultations with specialised institutions and representatives of the public concerned should be organised and conducted, according to the requirements	Consultations on the scope and content of the EIAR have been conducted (enclosed evidence - in Annex

	of of art.95 (3) of EPA and art.9 of the EIA Ordinance.	1, it.4 of the terms of reference).
	3. The assignment concerning the EIAR scope and content should be presented to RIEW Sofia, and a report about the consultations carried out and about the reasons for accepting/rejecting remarks and recommendations should be enclosed with it.	Presented.
	I. In relation to the requirements of chapter seven, section two of EPA The described independent combustion installation is within the scope of Annex No.4 with art.117 (1) of EPA, item 1.1. Combustion installations with a rated thermal input equal to or exceeding 50 MW. For implementing the investment proposal, the two sites are within the scope of the respective integrated permit, namely: permit No.30/2005 for TPP Sofia-East, updated by Decision No.30-HO-ИО-A1/2013 of the Executive Director of ExEA, and permit No.43/2005 for TPP Sofia. After completing the procedure under Chapter Sic of EPA it is required that Toplofikatsia Sofia EAD submits to the competent authority under art.120 of the same Act information, required under art.16 (1) of the Ordinance on the conditions and procedures for issuing of integrated permits (SG No. 80/2009, as amended and supplemented)	Taken into consideration. After the procedure under chapter six of EPA is completed, the necessary information will be provided for amendment of the current integrated permit or issuing a new one. Subject to a separate procedure with information according to art.120 of EPA, art.16 (1) of the Ordinance on the conditions and procedures for issuing of integrated permits (SG No. 80/2009, as amended and supplemented)
2	Consultations have been conducted on the EIAR scope and content (in conformity with art.9 and art.10 of the EIA Ordinance) for the following site: „Construction of a cogeneration plant utilizing RDF in Sofia”.	
	Toplofikatsia Sofia EAD informed about the EIAR scope and content: 1. Publishing in the website of Toplofikatsia Sofia - http:toplo.bg with enclosed documents - information on the consultations: Terms of reference for the scope and content of the EIAR - in pdf and doc format (Annex 1 - section 4.2.16) 2. **An information report in writing** has been sent to institutions and organisations, with enclosed terms of reference for the scope and content of the EIAR**.**	The client has informed the public concerned about the EIAR scope and content in accordance with EPA requirements (promulgated SG No.91 of 25. 09.2002, amended SG No.27 of 15.03.2013) and the Ordinance on the Conditions and Order for Performance of EIA (SG No.25/2003, as amended and supplemented SG No.94 of 30.11.2013) Information about *the sent information report in writing* with enclosed terms of reference for the scope and content of the EIAR, and Annex 2 - Assessment of the applied BAT - is enclosed in Annex 1, item 4 of the terms of reference.
2.1 Danube River Basin Water Management Directorate, Pleven, ref. No. 1552/15. 11.2013	In connection with letter incoming ref.No.1552/01.11.2012, received in Danube River Basin Water Management Directorate (DRBWMD) - Pleven, requesting consultations regarding the scope and content of EIAR for the IP for	

	construction of a cogeneration plant utilizing RDF in Sofia, DRBWMD declares its stand as follows: I. The description and analysis of the components of the environment where the IP will be implemented shall be made taking into consideration the information on waters and water bodies in the RBMP of Danube region, approved by order No. RD-293/ 22.03.2010 of the minister of environment and water. The investment proposal terrains are within the area of the following surface water and groundwater bodies and in areas of their protection: 1. Surface water *The main site - TPP Sofia (site B)* is within the surface water body of a river in Iskar river valley, under the name Vladayska and code BG1IS500R010. The ecological status of the water body is very poor. The chemical status of the water body is very good. *The alternative site - TPP Sofia-East (site B)* is within the surface water body in Iskar river valley, under the name Iskar and code BG1IS500R010. The ecological status of the water body is very poor. The chemical status of the water body is very good. 2. Groundwater Groundwater body "Pore water in the Neogene-Quaternary layer - Sofia valley" , code BG1G00000NQ030 The quantitative and chemical condition of that groundwater body is good. 3. Water protection zones, according to art.119a of the Water Act (promulgated SG No.67/27.07.1999) 3.1. **Neither of the sites is** within sanitary protection areas for drinking water from surface water bodies, according to art.119, paragraph 1, item 1 of the Water Act. 3.2. Areas of protection of drinking water from groundwater bodies, according to art.119, paragraph 1, item 1 of the Water Act - an area under code BG1DGW00000NQ030, which covers groundwater body BG1G00000NQ030. The condition of the area is very good. 3.3. **Neither of the sites** is within protected areas according to art.119a, paragraph 1, item 5 of the Water Act - protected areas and zones designated for the protection of habitats and biological species where the maintenance or improvement of the condition of waters is an important factor in the protection thereof. 3.4. **Neither of the sites** is within a safeguard zone specified under Ordinance No.3 of 16.10.2000 on the conditions and procedure for research, design, approval and operation of the safeguard zones around water sources and installations for potable water supply and around mineral water sources used for treatment,	Reflected in the terms of reference, section 4.2 - Water The requirements of the basin directorate will be taken into consideration and analysed in detail in the EIA report.

	preventive, drinking and hygiene needs.	
	II. The main goal of RBMP is to achieve and maintain good condition of water in the Danube river basin under basing management until 2015. The goals for protecting the environment of water bodies, and the areas under protection within which the IP is, which the measures specified in EIAR need to take into consideration, and which have been envisaged for preventing and reducing the significant harmful effects on the environment (water) in the design and operation of the IP plant are as follows: - For the surface water body under code BG1IS5000R010 the environmental goal is "Prevent deterioration of the ecological status, improvement to achieve good ecological status by 2027, maintain and improve the good chemical status". - For the surface water body under code BG1IS135R026 the environmental goal is "Prevent deterioration of the ecological status, improvement to achieve moderate ecological status by 2021, maintain and improve the chemical status". - For the groundwater body BG1G00000NQ030 the environmental goal is "preservation of the good condition of groundwater". - As regards the the sanitary protection areas for drinking water the goal is: "Reduce the need for water treatment before its use, and ensuring availability of planned quantity of water in the water abstraction installations until 2015."	Included in the terms of reference, item 4.2. "Water" The requirements of the basin directorate will be analysed in detail and taken into consideration in the EIA report.
	III. For attaining those environmental goals the RBMP includes sets of measures for prevention or reduction of anthropogenic pressure (point pollution sources and diffuse pollution sources) and impact on water resources; monitoring and control measures, including measures for the water protection zones. In the IP implementation it is necessary to observe the following measures under programmes: 7.1.5.1. Measures for emission control through prohibiting the discharge of pollutants from point sources, or requirements for issuing of permits and regular review and updating of those permits as regards groundwater: - - BG1MS016 - Prohibition on the disposal of certain priority substances, and on other activities on and in a groundwater site, which could result in indirect leading of those substances into the groundwater; - - BG1MS017 – Prohibition on the use of priority-substances-containing materials in building of structures, engineering constructions and installations where there is contact with groundwater or such contact is possible, which could result in polluting the groundwater. - **7.1.5.2.** Measures for emission control through prohibiting the discharge of pollutants from point sources, or requirements for issuing of permits and regular	Reflected in the terms of reference, section 4.2 - "Water" The requirements of the basin directorate will be analysed in detail and taken into consideration in the EIA report.

	review and updating of those permits as regards surface waters: - BG1MB052 – Review of the integrated permit and changing the emission limits set in it, or including of new emission limits in the conditions of the permit if the environment is polluted above the quality standards; - BG1MB070 – Prohibition on the disposal of waste, materials and substances which hamper the operation of the sewerage networks and of the local waste water treatment plants; - BG1MB071 – Control of the persons operating the sewerage networks of cities and villages and the users for observing the permits for discharging of waste water in the sewerage networks; - **7.1.6.** Measures prohibiting the introduction of pollutants from diffuse sources of pollution and measures for pollution prevention or control: - BG1MB098 – Prohibition on waste abandoning, non-regulated dumping and burning out, or any other form of uncontrolled waste disposal; - BG1MS033 – Applying of industry standards for environmental management and protection. - The investment proposal is in implementation of measure BG1MS014, which requires optimisation of water abstraction for industrial needs by means of introducing circulation cycles.	
	III. In its scope, content and format the EIAR should consider the water sites, regulations, and the water-preservation goals and measures of RBMP, as follows: - During construction for the IP implementation, measures for protection of groundwater from pollution shall be applied, observing the prohibitions stipulated in art.118a, paragraph 1, items 2,3 and 4 of the Water Act. - The set of measures envisaged for prevention and mitigation of the negative impact on surface water and groundwater during the IP implementation, resulting from temporary or permanent effects on it, should take into consideration the measures envisaged in RBMP concerning the water bodies and water protection zones affected by the IP.	Envisaged in the Terms of Reference - section 5.4 "Expected impact on water" The analyses and assessment have been reflected in the "Water"section of EIAR.
	IV. Other conditions which have to be taken into consideration in the EIAR scope, content and format: - The need for changing the parameters in the current integrated permits: permit No.30/2005 for TPP Sofia-East, updated by Decision No.30-НО-ИО-A1/2013 of the Executive Director of ExEA, and permit No.43/2005 for TPP Sofia.	After the procedure under chapter six of EPA is completed, the necessary information will be provided for amendment of the current integrated permit or issuing a new one, according to art. 120 of EPA, art.16 (1) of the Ordinance on the conditions and procedures for issuing of integrated permits (SG No. 80/2009, as amended and supplemented).
	- The plant's own water source mentioned in the information - a tube well in	

	the territory of TPP Sofia-East - can not be considered existing and can not be used, because according to the data available at DRBWMD that installation was liquidated; the liquidation was verified by statement of findings No.2-BM-66/21.07.2008. The water abstraction permit under No.1264/28.10.2002 issued to TPP Sofia EAD was cancelled by decision No.106/01.08.2008. The given information is not true and it should be corrected in the EIAR. This stand does not cancel your obligations to observe the provisions of the Water Act and the other laws and regulations in the Republic of Bulgaria, and can not be used as grounds for cancelling your responsibility for complying with the regulations currently in force.	Corrected in the Terms of Reference, section 3.3. "Location options" - section 3.3.2. "TPP Sofia-East site (site "B")"
2.2. Executive Environment Agency, outgoing ref. No.26-00-11451/27.11.2013	Regarding the terms of reference for the EIAR scope and content: I. The characterisation of the environment does not give an assessment of the ambient air quality; it is also necessary to forecast the impact of the IP on the ambient air quality.	This has been reflected in the terms of reference for the EIA scope and content: - section 4.1. "Condition of the ambient air and atmosphere" and section 5.3. "Expected impact on the ambient air" A detailed assessment is given in the supplement to the terms of reference - Evaluation of the use of BAT (Annex 2 - Modelling by means of Plume software) - page 84-130. Analysed and assessed in details in the EIAR.
	II. As regards groundwater: 1. The terms of reference for EIAR consider two possible sites for implementation of the investment proposal, namely: - TPP Sofia - the site envisaged for the plant is located in the western part of TPP Sofia site. - TPP Sofia-East - the site envisaged for the plant is located in the southern part of TPP Sofia-East site. Section **4 - Characteristics of the environment** in which the IP will be implemented, and impact forecast, includes s.4.3. Bowels of the earth and mineral diversity, where four layers of lithological varieties are discussed, but it is not stated to the territory of which site those varieties refer. It is clear neither where the six investigation drill wells have been made nor the depth of each of them, geographic coordinates and lithologic columns. 1. The actual hydro-geological conditions of the two sites should be described separately. From the geological map it is evident that the two sites have different hydro-geological conditions - both lithology and geological age, revealed at the earth surface.	This has been discussed in detail, analysed and assessed in the EIAR - in section 4.3. Bowels of the earth and mineral diversity - separately for each of the two sites. Corrected in section 4.3. "Bowels of the earth and mineral diversity" - TPP Sofia-East site of the terms of reference for the EIAR scope and content.

	2. Indicate the location of the groundwater monitoring points (wells) -their geographic coordinates and depth, and the existing investigation drill wells. Enclose lithological columns of the monitoring points and investigation drill wells. Indicate the depth of static water level in each of the wells.	This has been discussed in detail, analysed and assessed in the EIAR, separately for each of the two sites.
	3. Enclose available data from own groundwater monitoring of the two TPPs. Present the data separately for each of the sites, in accordance with the integrated permits in force.	Presented in the EIAR. This has been discussed in detail, analysed and assessed in the EIAR, separately for each of the two sites.
	4. Considering the depth of groundwater and its expected annual fluctuation, estimate the potential impact of the 12 m deep underground bunkers where RDF will be stored. Indicate whether the bunkers will be located below the level of groundwater.	The groundwater levels for the two sites and the bunker location are given in section 4.3. "Bowels of the earth and mineral diversity". Analysed and discussed in details in EIAR.
	5. The hazardous waste from the incineration - ash containing heavy metals - will be stored within the TPP territory, at sites for temporary storage of waste; storage duration: 8 days. In that relation detailed information should be provided on the impact of the investment proposal on the condition (quantitative and chemical) of groundwater.	All areas free from process buildings will be covered with concrete and there will be no direct access to the groundwater (it.4.4. of the Scope Statement). The temporary storage of waste at the site and the impact on the groundwater condition will be analysed and discussed in the EIAR.
	6. The IP will be implemented in the territory of the two TPPs. The power plants have been issued integrated permits: permit No.43/2005 issued to Toplofikatsia Sofia EAD for TPP Sofia, and permit No.30/2005 issued to Toplofikatsia Sofia EAD for TPP Sofia-East, updated by Decision No.30-НО-ИО-А1/2013 of ExEA. In connection with the new plant it is necessary to update the conditions for own monitoring of groundwater - monitoring points, monitoring parameters and frequency.	This has been reflected in the EIAR as measures for groundwater protection. The need to update the provisions regarding own monitoring of groundwater has been assessed. After the procedure under chapter six of EPA is completed, the necessary information will be provided for amendment of the current integrated permit or issuing a new one. That is subject to a separate procedure (information according to art.120 of EPA, art.16 (1) of the Ordinance on the conditions and procedures for issuing of integrated permits (SG No. 80/2009, as amended and supplemented).
	7. In relation to the activities of the RDF incineration plant measures should be suggested for establishing of new groundwater monitoring points in the IP area.	Measures will be suggested after an analysis and assessment, and they will be included in the EIAR.
	8. A plan for own monitoring of groundwater shall be developed in line with the requirements of Ordinance No.1/11.04.2011 on water monitoring and of Ordinance No.1/2007 on groundwater studying, utilisation and preservation; the	Measures and recommendations regarding the own monitoring plan have been given in the EIAR. A plan for own monitoring of groundwater will be

	own monitoring plan shall bee agreed with the basin directorate and ExEA. Indicators of heavy metals should be included.	developed as a separate document for the selected site after the EIA decision and under the integrated permits procedure.
	III. According to the text of the EIA terms of reference - page 87, section 5.7.2: "The EIAR shall specify measures for limiting the impact on the flora and fauna during the plant construction and operation". At the same time the section "Description of measures aimed at preventing, reducing or eliminating considerable harmful impacts on the environment" does not include a "Biodiversity" part. Such part should be added and the measures mentioned above should be described in it. A description of measures aimed at limiting the plant's impact on the flora and fauna, and a plan for applying those measures shall be included in the EIAR - section VII, according to the description of expected content (page 100-1004).	This has been reflected and shortly added in section 10 "Description of measures aimed to prevent, reduce or eliminate considerable harmful impacts on the environment" of the assignment regarding EIAR scope and content. Specific measures, a plan for their implementation and detailed analyses will be given in the EIAR.
2.3. Ministry of Regional Development - Road Infrastructure Agency Ref.No.P-4516 of 18.11.2013	Regarding terms of reference for the scope and content of EIAR of IP for building a cogeneration plant utilizing RDF in Sofia, in accordance with our competence please be informed of the following: The Road Infrastructure Agency (RIA) accepts the terms of reference for the EIA scope and content, making the following suggestions and remarks: 1. When preparing the EIAR it is necessary that you take into consideration and respectively assess the roads of the national road network, which would be used for transporting the RDF from the supplier to the site of the company and back to the landfill for disposal of the hazardous waste generated in RDF incineration.	The requirements will be taken into consideration for the EIAR. (as provided by section 2.2. "Description of the physical parameters of the IP ..." of the terms of reference for the EIAR scope and content)
	2. An assessment should be made of the waste that is to be transported - in what condition it would be: d-RDF (treated fuel) or c-RDF (non-treated fuel).	The type and condition of the RDF depends on the technological parameters of the MBT plant operation. The expected composition of the RDF has been given by SM (depending on the parameters of the planned MBT) - reflected in section 2.3.3. of the terms of reference - "Planned capacity".
	3. The cumulative effect of the implementation of your investment proposal and the existing production facilities of Toplofikatsia Sofia EAD should be discussed in the EIAR and the additional increase in the traffic flow intensity, the load on the environment as regards air, noise, waste from RDF transportation, assessing the following: additional noise load, emission of odours and dust from the site to the adjacent areas in its neighbourhood in the plant construction and operation periods. That is necessary with view of assessing the risk to human health, considering the plant's vicinity to industrial and residential sites.	This has been considered in the terms of reference for the EIAR as a cumulative effect of the IP and the existing installations at the two sites, as regards ambient air and noise. The cumulative effect has been analysed and described in details and by components in the EIA report. Envisaged by components in section 5 "Significance

		of the impact on the environment..." of the terms of reference for the scope and content.
	4. In the EIAR, in the IP characterisation it is necessary to state unambiguously whether only waste from Sofia Municipality will be used or utilization also of waste from other places is envisaged; that would necessitate using roads of the national road network, which will have to be in conformity with the requirements of the Roads Act and the Road Traffic Act.	RDF will be supplied to Toplofikatsia Sofia by SM and the new plant for mechanical-biological treatment of waste (MBT) (section 2.1. "Investment proposal summary") - discussed in details in EIAR. According to the feasibility study the plant will be used only by SM. It is envisaged that RDF will be supplied chiefly from the MBT installation and potential quantities of low-calorie RDF will be added from other sources.
	5. It is necessary to include block diagrams and other texts in the EIAR, to observe art.3 of the Constitution of the Republic of Bulgaria, and those shall be legible so that they serve their purpose.	This has been taken into consideration in the EIAR in accordance with Bulgarian legislation. Appropriate graphic materials and sources have been included in the EIAR.
2.4. NEK EAD **Outgoing ref. No.85-09-102 of 06.11.2013**	Regarding terms of reference for the scope and content of EIAR of IP for building a cogeneration plant utilizing RDF in Sofia: As stipulated by art.10 (5) of the Ordinance on the Conditions and Order for Performance of EIA, the client shall conduct consultations with the authority competent on the environment, on the prepared terms of reference. According to art.94 of EPA competent authorities for making decisions regarding EIA of investment proposals are MEW and the respective RIEW, in this case - RIEW Sofia. Please be informed that the competence of the commercial company NEK EAD covers the issues of connecting the expected generator capacity and of purchasing (at a later stage) the produced electricity.	They accept the terms of reference on the scope. The stand of NEK EAD does not include any recommendations regarding the terms of reference for the EIAR scope and content. Connecting shall be accomplished according to a contract between Toplofikatsia Sofia EAD and NEK EAD, which they are to conclude.
2.5. Ministry of Investment Planning **Outgoing ref.No.V-1124/18.11.2013**	The Ministry of Investment Planning hereby expresses its stand as follows: The terms of reference for the scope and content of EIAR of IP for building a cogeneration plant utilizing RDF in Sofia have been developed with the necessary scope and in compliance with the regulations in force. The annexes provide data on the parameters of the existing environment with its components, the scale of expected impacts, investigations made for EIA purposes, alternative suggestions, sources of financing, and measures for mitigating the expected negative impacts on the environment. In our opinion the investment proposal includes all appropriate measures for preventing environmental pollution. The IP implementation will result in	They accept the terms of reference on the scope. The stand of the Ministry of Investment Planning does not include any recommendations regarding the terms of reference for the EIAR scope and content.

	considerable reduction of greenhouse gas emissions, improvement of the efficiency of energy production in TPP Sofia or TPP Sofia-East through RDF utilization, and fulfilment of the government's commitment for transition to a safe and sustainable economy with low carbon emissions by 2020.	
2.6. Ministry of Economy and Energy (MEE), outgoing ref.No.26, it.408 of 12.11.2013	MEE informs of the following: 1. Regarding the investment intent for Construction of a cogeneration plant utilizing RDF in Sofia Toplofikatsia Sofia intends to use RDF aiming to replace expensive natural gas by cheaper primary fuel for energy production. RDF will be supplied from the new MBT plant currently under construction near Sofia, and considered to be a renewable energy source, which will contribute to the efficiency of production. The main process of the suggested plant utilizing modified solid fuels is cogeneration of thermal energy and electricity. The installation deriving energy from RDF will be based on a technology for grate incineration of fuel in the combustion chamber of a horizontal steam boiler; the generated steam of pressure 60 bar and temperature 425°C will be led to and utilized in a back-pressure turbine with a condensing boiler and a generator generating electricity for the electricity transmission grid. The expected nominal electricity generating capacity of the turbine is $20MW_e$. The exhaust steam from the turbine will be led to the incorporated condensing boiler where thermal energy will be generated for the district heating system of Sofia. The expected thermal power is 50 MW_t. In addition, in the end of the line of purification installations, utilisation of energy from flue gas into the heating water is envisaged, amounting to another 5-8 MW_t, or total 58 MW_t. The selected technology - an independent RDF installation with a steam turbine of its own - corresponds completely to the framework of Directive 2004/8/EC of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market, currently in force, and meets the requirements of Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency. 2. Suggestions and additions to the terms of reference for the EIAR scope and content. High-efficiency cogeneration is one of the main priorities of Directive 2001/27/EU on energy efficiency and has significant potential for saving primary energy. That type of technology results in considerable improvement of energy efficiency as well as reducing the harmful impact on the environment. Apart from that the suggested investment proposal envisages utilization of waste, and that will result in sustainable management of waste and provide possibility for its reduction.	They accept the terms of reference on the scope.

		Analysed and assessed in the EIAR. (as provided by section 2.6. "Connection with other existing facilities, approved through site development plans" of the terms of reference for the EIA scope and content). The content of the EIAR envisages that this shall be discussed in detail in the report.
2.7. Regional Health Care Inspectorate of Sofia city, outgoing ref.No. 26-00-1112 of 14.11.2013	Regarding terms of reference for the scope and content of EIAR of IP for building a cogeneration plant utilizing RDF in Sofia, please provide detailed and exhaustive information about: 1. The location and exact distances (with appropriate hard-copy illustrations) from the nearest residential buildings, drinking water supply sources, and other sites and zones under protection for human health reasons, to all the component sites of the investment proposal, which are potential sources of harmful effects: sites of the plant, waste water and industrial water treatment plants, etc.	That has been analysed and discussed in details in the EIAR (envisaged under section 5 - "Significance of impacts on the environment ..." of the scope ToR)
	2. The present condition of the different factors of environment in the area (ambient air, surface water, groundwater and soils).	That has been indicated in section 4. "Characteristics of the environment in which the IP will be implemented" of the scope ToR. It will be discussed in details in EIAR.
	3. Identification of the risk factors of the natural environment and the work environment for harming human health during the construction and operation of all units and installations related to the investment intent.	It will be discussed in details in EIAR. It has been envisaged on the ToR under section 5 "Significance of the impact on the environment ..."
	4. The level of expected adverse impact on the components and factors of environment, based on mathematical modelling, analyses and forecasts like: - Ambient air - model the expected pollution from organised (point) sources and non-organised sources (areas). Forecast the emissions of pollutants into the ambient air and their concentrations in the nearest residential areas and areas subject to health-related protection. - As regards the expected noise pollution, provide calculations of the expected noise levels for the nearest residential buildings and residential areas, when the plant is functioning and its ancillary activities are in progress..	Taken into consideration. Discussed in details in EIAR (envisaged under section 5 "Significance of impacts on the environment ..." of the scope ToR) A detailed consideration is given in Annex 2 (Evaluation of BAT) to the terms of reference for EIAR scope and content. A short consideration is given in section 5.10 "Impact from sources of hazardous energy - noise, vibrations and radiation"of the ToR for the scope of EIAR.

		Analysed and discussed in details in EIAR.
	5. The transportation routes serving the needs of the site, indicating the residential areas which those routes cross, or the shortest distance to such areas.	It will be discussed in details in EIAR.
	Based on the forecast impact on the factors and components of the environment, determine the number of people, the territories and areas under protection for human health reasons, which are potentially at risk, depending on the expected territorial scope of the impact. Assess the potential combined, general, cumulative and remote effects of the risk factors both for the employees and the residents exposed. An analysis of the health and demographic state of population in the nearest residential areas should be provided in the report, based on updated demographic data (birth rate, death rate, natural population growth, infant mortality rate etc.) and morbidity data (by level and structure). That data should be compared to the data referring to the city, the district and Bulgaria in general. A forecast should be made of the impact on the health state and demographic state of the population, resulting from the IP implementation. Based on the information on the above issues the health risk should be assessed and health protection and risk management measures should be suggested.	Taken into consideration. Included in the ToR - section 5 "Significance of the impact on the environment..." It will be discussed in details in EIAR. Included in the ToR - section 5 "Significance of the impact on the environment..." Analysed and discussed in details in EIAR. The health risk has been taken into consideration and analysed in the EIAR; appropriate health protection and risk management measures have been suggested.
2.8. Sofia Municipality	No stand of Sofia Municipality on the EIAR scope and content was received within the legal time limit.	
2.9. Bulgarian Energy Holding EAD	No stand of Bulgarian Energy Holding EAD on the EIAR scope and content was received within the legal time limit.	
2.10. Bulgargaz EAD	No stand of Bulgargaz EAD on the EIAR scope and content was received within the legal time limit.	
2.11. Sofiyska Voda AD	No stand of Sofiyska Voda AD on the EIAR scope and content was received within the legal time limit.	

2.12. Sofia Municipality - Iskar District, ref. No.7000-648 (6)/21.11.2013	Stand of SM - Iskar District on the terms of reference for the scope and content of EIAR of IP for building a cogeneration plant utilizing RDF in Sofia, which have been received for consultation. "... After consultations with the public concerned, in connection with the document published recently in the mass media, taking into consideration the vicinity of TPP Sofia-East site to the residential area, the concern and discontent of the local residents regarding the impact of the plant operation on people and on their health, SM - Iskar District considers that the selection of TPP Sofia-East site for implementation of the IP of Toplofikatsia Sofia EAD is unsuitable. After the notice announcement according to art.4 (2), no suggestions or objections by people or public groups concerned have been officially received in the district administration. The notice was put up in the bulletin board in the building of SM - Iskar District and published in the district website.	SM -Iskar District considers that the selection of TPP Sofia-East site is unsuitable. That will be reflected in the EIA report. Reflected in the public discussion held within the procedure for EIAR approval. After the notice announcement according to art.4 (2) of the EIA Ordinance, no suggestions or objections by people or public groups concerned have been officially received in the district administration.
2.12.1. A supplement to the stand of SM -Iskar District, citizens initiative committee "Druzhba part II"and "Druzhba 2 - Zelena" - ref. No.0500-2/15.11.2013	The supplement refers to the investment proposal **The enclosed stand is by the public concerned (citizens initiative committee "Drizhba part II"and "Druzhba 2 - Zelena**who voice their worry and concern caused by the selection of TPP Sofia-East as a possible site, and remind that the site is in the immediate vicinity to the residential part of Druzhba-2, the distance to the blocks of flats being only a few hundred meters. On the other hand, that site borders areas, which according to the urban development plan of SM are intended for building hydro-park Iskar, in combination with the river banks. Thus the over 60 thousand inhabitants of the district will be left without a recreation area. That future park has been planned years ago, and according to the plan it will be used not only by the residents of our districts but also by all inhabitants of the capital. At the same time, due to the existing buildings, the only possibilities for expansion and development of TPP Sofia-East facilities are in the direction of the residential area and/or the future park. In our opinion building the waste incineration plant, although in a revised version, in the immediate vicinity of our homes and of the future park poses a risk to the health of Druzhba-2 inhabitants. The provided information does not convince us that the noise load not only from the suggested new plat has been taken into consideration but also from all already existing industrial enterprises and from the nearby roads with heavy traffic. We have to point out that Sofia Med, Iskarsko Shose Blvd., Tsarigradsko Shose Blvd. the future Krairechen Blvd. and others are in the neighbourhood of the area. For those reasons we object to the selection of TPP Sofia-East site for	Both sites have been considered in the EIAR in detail, and the pros and cons of each of them have been indicated. Section 4 - "Characteristics of the environment in which the IP will be implemented, and impact forecast" of the ToR for the EIAR scope and content describes briefly the current noise levels at TPP Sofia-East, and section 2.4.6. "Harmful physical factors - noise and vibrations" and section 5.10. "Impact from sources of hazardous energy - noise, vibrations and radiation" indicates the noise impact during the plant construction and operation.

	implementation of the investment intent of Toplofikatsia Sofia EAD. We are not convinced that the requirements regarding protection of the health of Druzhba-2 residents have been observed.	The impact has been analysed and discussed in details in EIAR. The concerns of the inhabitants of residential district Druzhba-2 will be taken into consideration in the EIAR approval procedure.
2.13. Sofia Municipality - Serdika District, ref.No. П-5213/02.12.2013	Subject: The investment proposal for construction of a cogeneration plant utilizing RDF in Sofia. Please be informed that no public interest in the investment proposal was shown. Public access to the IP notice was provided in the period from 30.11.2013 to 14.11.2013 ??????????????? inclusive, by displaying it in the bulleting boards of Serdika District. Neither written nor oral opinions have been received.	The stand of SM - Serdika District does not include any recommendations regarding the terms of reference for the EIAR scope and content. After the notice announcement according to art.4 (2), no suggestions or objections by people or public groups concerned have been officially received in the district administration.
2.14. Environmental Association "Za Zemyata" (in English: "For the Earth"), ref. No. 298/15.11.2013	We call your attention to some statements, written in section 1.3. Investment proposal necessity and purpose It is claimed that by means of the cogeneration plant utilizing RDF Sofia Municipality "will meet the strictest requirements regarding waste management" (page 3) but those requirements have not been specified. The strictest requirements regarding waste management are not confined to just observing emission limit values, that is why we require that the EIAR specifies clearly "the strictest requirements regarding waste management" and provides assessment to what extent the suggested incinerator meets them or not. In making the assessment the waste management hierarchy has to be taken into consideration, and the effect of the new plant to attaining the short-term and long-term goals according to the priorities of that hierarchy. Such requirements are included in the waste management directive and in other strategic documents. According to Directive 2008/98/EC, art.4(1) a priority in waste management should be waste prevention; then come reuse and recycling, and only after that is energy recovery (RDF incineration), and disposal is in the last place. That hierarchy has been adopted in the programmes of Bulgarian institutions like MEW and ExEA, responsible for statistic waste management. According to art.4 (2) and art.6 (2) of the WMA, departure from the hierarchy can be tolerated for specific waste streams "where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste". Therefore those considerations based	The need for the IP and its purpose are given in the ToR just in brief. Analysed and discussed in details in EIAR. That has been envisaged in section 1.3 "Investment proposal necessity and purpose" of the ToR for the scope. In this case observing the priorities of the waste hierarchy is not required. RDF is not waste but modified solid fuel derived from waste and intended for energy recovery (Decision No. 14-8/2008 of RIEW - Sofia). It is not subject to assessment of the life-cycle of waste. The activities of the MBT plant, which is to be

	on evaluation of the life-cycle of waste have to be given and assessed in the EIA report with a view to compliance with the legislation. In that relation a life-cycle assessment should be made, and it has to conform to ISO standards, in so far as that is the minimum for such an assessment. As at this stage there is no such assessment, or it has not been made public, the selection of an RDF utilisation installation (an incinerator) violates the waste management hierarchy and art. 4 (2) of Directive 2008/98/EC and also art. 6 (2) of the WMA.	implemented, involve RDF generation, and are not the subject of this EIAR (a separate EIAR procedure has been followed for the MBT plant, and a decision has been issued - Decision No. 14-8/2008 of RIEW - Sofia).
	In page 3 we find the contention that part of the natural gas used in Toplofikatsia Sofia will be replaced with RDF and thus the dependence on imported gas will be reduced. That contention is not supported with any concrete calculations or estimates, so it is misleading. The RDF plant is a new facility within Toplofikatsia Sofia, but the terms of reference do not indicate when and which of the existing facilities would be closed down or replaced, or would operate at lower capacity - i.e. would consume less natural gas due to the energy generated by RDF. Quantitative data about the reduced gas consumption has not been provided either. - We recommend that respective data and scenarios of gas consumption reduction are added and assessed in the EIA report from environmental point of view for illustrative comparison and clarifying the eventual advantages of the RDF plant. - We suggest that data of all facilities of Toplofikatsia Sofia - installed, in use and planned for decommissioning - is included, as well as a forecast of the annual electricity and thermal energy generation and consumption after the plant is built. Thus it would be possible to illustrate and compare the contribution of the proposed RDF plant.	That has been analysed and assessed in EIAR. The decision about which of the facilities of Toplofikatsia Sofia would be closed down will be made by the company. For informing the population and the public concerned, a programme of remedial measures for improving the financial, economic and technological condition of Toplofikatsia Sofia is published in the website of the company. The programme includes short-term, medium-term and long-term measures, which will be reflected in the EIAR. Possible comment in the EIAR. The estimates and calculations are provided by Toplofikatsia Sofia AD. Will be addressed in the EIAR.
	And last in this introductory part we draw your attention to page 3 of the ToR, where there is a claim that the RDF incinerator will reduce CH4 and CO2 emissions, but again neither quantitative data is provided nor calculations how that would happen and compared to what scenario the emissions would be reduced. Also, according to the approved MBT plant project, no untreated waste will be received in Sadina landfill, and if there is any reduction of emissions connected with disposal, it would probably be due to MBT (which has been indicated in the application form submitted to EC) and to recycling. In that relation we recommend taking into consideration the effect of the MBT installation and its eventual contribution to the reduction of emissions, comparing to saved emissions if waste is recycled and not incinerated. The fact that gas would be replaced and not coal should to be taken into consideration. That information should be presented clearly so that it can be seen which components contribute to the greenhouse gas emissions and by how much.	Discussed in Annex 2 (Evaluaiton of the use of BAT) to these terms of reference. Comments in the EIAR but without MBT impact assessment. The activities of the MBT plant, which is to be implemented, are the subject of another EIAR under a separate procedure, approved by Decision No. 14-8/2008 of RIEW - Sofia. Addressed in the EIAR.
	We recommend making calculations, taking into consideration and showing the	A comment in EIAR but without precise

	RDF content - what portion the biogenic fraction is (bigenic carbon) and what - fossil carbon. Also it should be clear what methods have been used and what the input data for emission calculation was.	specification. The expected composition of the RDF has been given by SM depending on the planned MBT - (section 2.3.3. Plant capacity) of the ToR for the scope of EIAR. The exact composition - after putting into operation.
	In addition determining the biological fraction in the RDF composition is important in order to estimate to what extent the project suggested by you would use renewable energy, so as to avoid unlawful subsidizing through payment for green energy, and distortion of the inventory of national greenhouse emissions (Obermoser Fellner,& Rechberger, 2009). That should be indicated and assessed in section 5.11. Social and economic impact	The social and economic impact has been analysed and assessed in EIAR.
	Comments on section 2 Characteristics of the investment proposal We recommend adding information about the service life of the incinerator.	Addressed in the ToR in section 2.5 "IP implementation (construction, operation, decommissioning)"
	In page 4 you claim that RDF incineration produces lower emissions of pollutants into the ambient air compared to the incineration of non-separated municipal waste, but here again neither data about the quantities of pollutants is given nor reference data. We recommend that you provide data specifying the pollutants emitted from the recycling of municipal waste, what the greenhouse gas emissions (CH_4 and CO_2) are, and compare your project to the alternative of recycling for those parameters, not only to the incineration of non-separated waste. As no incineration of non-separated waste is envisaged in Sofia, but separate waste collection and recycling are envisaged, such a comparison is more relevant.	In section 4 "Characteristics of the environment in which the IP will be implemented, and impact forecast" the proposal is given in summary. Comments in the EIAR but without assessment of the impact of separation, recycling and/or disposal. Separation, recycling and disposal of MSW from SM are the subject of another EIAR under a separate procedure, approved by Decision No. 14-8/2008 of RIEW - Sofia. Comparison with functioning installations is given in Annex 2 (Evaluation of BAT) of the ToR and will be commented in the EIAR.
	2.4.1. Expected waste 2.4.4.2. Waste which will be generated in the course of operation Risks associated to the quantity and quality of the input material (RDF) In the case of the suggested investment proposal art.2 (2) of Ordinance No.3 on wastes classification is applicable. The hypothesis stated by the client that the bottom ash and slag do not contain hazardous substances (code 19 01 12) is groundless and shall be proven by regular monitoring and analysis of the properties of bottom ash and slag, as well as of the content of the input RDF, performed by an independent accredited laboratory - under the procedure of art.10 and art.11 of	The properties of the bottom ash and slag will be determined and proven in the operation process, as specified in the procedure for issuing of integrated permits. Control of the RDF produced by the MBT plant -

	Ordinance No.3 on wastes classification. The provisions of art.6 (2), item 4 of the same ordinance are also applicable here. The client takes it for granted that the RDF is produced from non-hazardous municipal waste, but considering the practice of many years and the current practice of waste management in Sofia municipality, the probability of presence of hazardous substances in the RDF should be taken into account (lack of effective large-scale awareness campaigns aimed at changing the behaviour of people regarding the need for separate collection of hazardous household waste; lack of readily accessible and clear information on how and where such waste can be delivered separately; lack of an updated analysis of the sources, composition and quantity of hazardous municipal waste and a plan/ long-term strategy for its prevention, reduction, reuse and safe disposal; lack of a regulatory framework and established practice for the safe management of pharmaceutical, medicinal and veterinary substances and products from the households.)	after the plant is put into operation. If presence of other waste, different from that envisaged in EIAR, is proven, the waste will be classified again, but after putting the plant into operation or in the procedure for issuing an integrated permit. Object of the MBT plant operation (Decision No. 14-8/2008 of RIEW - Sofia EIAR) The indicative composition has been specified according to the Decision.
	The EIAR should include description of the measures for regular control and verification of RDF parameters. The EIAR should specify what measures the client would undertake to guarantee control of the content of heavy metals and other hazardous substances.	Addressed in the EIAR. Object of the MBT plant operation (Decision No. 14-8/2008 of RIEW - Sofia EIAR) and the procedure for issuing an integrated permit for the MBT plant.
	The following is written in page 4 of the terms of reference: The calorific value of RDF depends mainly on two parameters: municipal waste content, and type of waste treatment/separation, therefore it may vary. In this situation the the requirements of art.4 (2) of Ordinance No.3 on wastes classification are applicable.	The exemplary composition of RD, given by SM - in section 2.3.3. "Capacity of the plant" of the ToR regarding scope and content. If presence of other waste, different from that envisaged in EIAR, is proven, the waste will be classified again, but after putting the plant into operation.
	The EIAR should envisage measures for constant monitoring and analysis of RDF composition and properties, so that the operator of the RDF incineration installation can verify their correct classification and treatment. - The technology and capacity have been chosen based on assumptions concerning the RDF data, but that is unreliable because it is not based on updated qualitative and quantitative analysis of the sources, composition and quantities of municipal and similar to municipal waste in the territory of Sofia municipality as the last such analysis dates back to 2008. - In that relation a full analysis has to be presented of the chemical composition of the RDF which will be used: heavy metals, chlorine, nitrogen, sulphur content; content of ashes, including the proportion of biogenic carbon and fossil carbon. Also the range shall be determined and stated, in which that composition can vary without having a material effect on the incinerator operation and on the environment.	Subject, operation and monitoring by the MBT plant. The measures on the part of the operator will be envisaged in the EIAR. That has been indicated in the EIAR regarding emissions and not as a characteristic of the RDF. The estimated composition has been indicated by SM

		and is a requirement towards the MBT plant as a composition with which the RDF installation will operate.
	- The EIAR should include detailed descriptions of the manner of transportation and the places of storage and disposal of the hazardous waste generated in the operation of the RDF incinerator.	Analysed and discussed in EIAR - addressed in section 2.2. "Description of the physical parameters of the IP ..." of the terms of reference for the EIAR scope and content.
	- The EIAR should describe the measures envisaged in case there is RDF shortage or oversupply in a given day, and also in a situation of such shortage being a constant problem.	Indicated in section 2.3.3 "Capacity of the plant" of the ToR Will be analysed and addressed in details in EIAR. Envisaged, as basic parameters in the feasibility study.
	- The EIAR should provide detailed information about the "alternative fuel" envisaged for use (page 13 of the ToR): type, properties, quantities to be used, and concrete sources of such fuel.	Those have been analysed in the EIAR. Envisaged, as basic parameters in the feasibility study. Described in section 2.3.3. of the ToR "Plant capacity"
	- A possibility for incinerating of sludge from WWTP is envisaged, without a place for temporary storage. EIAR shall provide clear data about the portion of the total quantity of sludge generated per day or per year by WWTP in Sofia. EIAR shall include information about the quantity of sludge from WWTP which the suggested installation will be able to treat. EIAR shall provide answers to the following questions: what are the properties of sludge (hazardous substances content, moisture content, calorific value etc.); in what proportion with RDF it will be and what effect it will have on the emissions and waste generated in the plant operation.	Described in section 2.3.3. "Plant capacity" of the ToR and set as input parameters for the plant That has been analysed and assessed in EIAR.
	Comments on section 2.6. "Connection with other existing facilities, approved through site development plans or other plans" As regards the contention in page 37 that the RDF incinerator project is in line with Operational Programme Environment 2007 - 2013 we contend that that is not true, because the project is neither within the objectives nor within the measures of that operational programme. If you maintain your contention, you should provide references to the concrete texts of the programme. The contention that the suggested project corresponds to Axis 2. Objective of Operational Programme Environment / National Action Plan 2006-2009, and it includes claims which are currently not true, like for example "Waste from packages and other household waste is not collected separately and recycled". As	Addressed in section 2.6. Analysed and discussed in details in EIAR.

	you know, separate collection of waste packages was introduced in the end of 2005. Also that strategy, although old, does not include goals or measures connected with building of incinerators, so the project suggested by you does not correspond to the indicated strategy.	
	Проектът, и въобще дейности по изгаряне на битови отпадъци, не фигурират в Националната програма за управление на отпадъците 2009-2013. Както става ясна „(в) инвестиционното част на НПУДО не се предвиждат финансиране на ОП „Околна среда", ПУДООС и държавен бюджет за изграждане на инсталации за изгаряне на смесени битови отпадъци" (стр.87). Доколкото в стратегията се говори за възможност за реализиране на такъв проект в София чрез публично-частно партньорство, „поради голямото количество образувани отпадъци" то е необходимо „доказана целесъобразност". В така предложеното Задание такава целесъобразност не е доказана. В тази връзка препоръчваме да докажете целесъобразността (включително екологичната) на предлагания от вас проект.	Коригирано в Задание т.2.6. „Връзка с други съществуващи и одобрени с устройствен или друг план дейности" В ДОВОС са отразени и прецизирани всички планове и програми. Настоящето ИП представлява фаза2 „на интегрирана система за третиране на отпадъците на СО". Предложението надгражда инсталацията за МБТ, като ще даде възможност за използване на остатъчния продукт от инсталацията-МБТ – полученият RDF, като гориво за производство на топлоенергия, което съответства на йерархията за управление на дейностите по управление на отпадъците, съгласно рамковата директива за отпадъците – по конкретно оползотворяване. Проектът е в пълно съответствие със изискванията за ресурсна ефективност – основен акцент в стратегическите документи на ЕС, вкл. при усвояване на средствата от ЕСИФ през програмния период 2014 -2020 г. В ДОВОС е отразено и представено.
	В крайна сметка от раздел 2.6 се създава впечатлението, че предлаганият проект съответства на всички цитирани стратегически документи. Както показахме по-горе това не е така и смятаме, че сегашният текст е подвеждащ и некоректен. Препоръчваме това да бъде коригирано, за да може екипът по ОВОС да оцени по какъв начин проектът реално допринася за изпълнението на европейските политики в областта на управлението на отпадъците, промени в климата, ресурсна ефективност. Твърдения, че проектът съответства на дадена политика или стратегия, трябва да бъдат подкрепени с факти и оценки, че това наистина е така.	Коригирана в т.2.6 „Връзка с други съществуващи и одобрени с устройствен или друг план дейности". В ДОВОС е анализирана и отразена подробно
	ДОВОС трябва да разгледа кумулативния ефект на инвестиционното предложение в комбинация с останалите елементи от „интегрираната система" за управление на отпадъците на гр. София, и да покаже как съвкупната им експлоатация ще се отрази на масовия баланс и третирането на отпадъците на София. Конкретно, как планирате капацитети от съоръженията	При желание е възможен коментар в ДОВОС от колектива изготвящ доклада, но без оценка

	от системата , и конкретно предлаганата тук RDF инсталация ще повлияят на постигането на целите за 50% рециклиране до 2010 г., както и на междинните цели, определени в ЗУО. ДОВОС трябва да приложи изчисления на база на най-актуалната налична информация относно количествата, състава и източниците на битови отпадъци, с които става ясно какво и колко ще се рециклира, компостира, предотвратява и повторно употребява, преди да бъде обезвреждано чрез изгаряне и депониране, за да се сравнят очакваните резултати от изпълнението на проекта с изискванията на ЗУО и Рамковата директива за отпадъците – както по отношение на преференциалното третиране (йерархията), така и по отношение на конкретните цели.	Интегрираната система за управление на отпадъците на гр. София е предмет на оценка в друга процедура.
	Коментари по раздел 3. Алтернативи за осъществяване на инвестиционното предложение По отношение на текста в раздел 3.1. Zero alternative В Заданието на стр.41 се твърди, че ако се избере нулева алтернатива инсталацията за механично-биологично третиране (МБТ) няма да разполага със съоръжение за оползотворяване на RDF. Доколкото в България съществуват циментови заводи, които и в момента използват RDF гориво, операторите на някои от тях бяха заявили писмено желанието си да ползват RDF от МБТ, то реализирането на нулевата алтернатива не пречи по никакъв начин RDF да отива в циментови пещи. С този пример, само поясняваме, че има налични съоръжения, в които може да се оползотвори RDF.	В ДОВОС нулева алтернатива е анализирана и оценена подробно. Циментовите заводи не разполагат, нито с предвидената система за Основно третиране чрез Комбинирана сухо-мокра система за основно пречистване с вдухване на хидратна вар и активен въглен (полу-суха), следвана от мокър скрубер с кондензация, нито с допълнителната Селективна не-каталитична редукция за NOx.
	Твърдите, че при реализирането на нулева алтернатива произведеният RDF „ ще трябва да се депонира обратно в депото", което няма да спомогне за постигането на част от целите на Столична община – „увеличено рециклиране и значително намаление на депонирането" (стр.41). Имайки предвид горния пример не смятаме, че заради реализирането на „нулева алтернатива" „ще трябва RDF да се депонира обратно в депото", тъй като за него има други възможности. Дали RDF ще бъде оползотворен в ТЕЦ „София" или другаде, няма пряко отношение към количествата отпадъци подлежащи на депониране в София. Още повече изгарянето на RDF на територията на София, ще изисква депо за опасни отпадъци, с което София не разполага към момента. По този начин де факто се увеличава депонирането чрез настоящето проектно предложение. С това искаме да подчертаваме, че представянето на проекта като единствената възможна и добра алтернатива въз основа на аргументи като липса на съоръжение за оползотворяване, необходимост RDF да се депонира и изчерпване на капацитета на депо Садина е некоректно и подвеждащо.	В Заданието е представен най-лошият сценарии. В ДОВОС е анализирано и отчетено подробно, като възможни алтернативи.

	Намаляването на количествата отпадъци депонирани в Садината може да бъде постигнато с намаляване генерирането на отпадъци, повторна употреба и рециклиране, което отговаря на приоритетността на методите за управление на отпадъците установена в европейското и българското законодателство. В тази връзка не коментирате как проектът се отнася към друга част от целта на Столична община, а именно „увеличено рециклиране”. Напомняме, че изгарянето на RDF по никакъв начин не допринася към изпълнението на целта в тази и част. Инсинераторът за RDF не подпомага постигането на целта за „увеличаване на рециклирането” тъй като отнема от ресурсите, които могат да бъдат рециклирани.	Коментар в ДОВОС, но без оценка Не е предмет на ДОВОС за инсталация за оползотворяване на вече получен RDF. (Решение №14-8/2008 РИОСВ София) В инсталацията ще се изгаря остатъчен продукт (RDF)– т.е продукт, който е получен след сепариране и рециклиране на полезните компоненти.
	Във връзка с това не сте предложили да се оцени друг вид третиране на отпадъците, освен изгаряне с оползотворяване на енергия върху скара или върху кипящ слой. По този начин става невъзможно избраният подход да се съпостави и оцени от екологична гледна точка (базирана на оценка на жизнения цикъл) с други варианти като рециклиране или дори депониране. Такава оценка следва да бъде направена в ДОВОС, за да могат да се съпоставят различните възможни и подходящи за случая алтернативи, на базата на което да бъде избрана най-добрата. От информацията представена в Заданието остава впечатлението, че се опитвате да заобиколите йерархията на управление на отпадъците, без да представите необходимите анализи изисквани от Директива 2008/98/ЕО чл.4 пар.2 и без да разгледате реалните алтернативи.	Възможностите за друг вид алтернативно третиране, като сравнение на работещи инсталации (Приложение №2 Оценка на НДНТ към Заданието) ще бъде коментирано и в ДОВОС Проектът надгражда втората фаза на проекта за третиране на отпадъците на Столична Община – инсталация за МБТ. Йерархията при управление на отпадъците е съобразена напълно – затова в инсталацията ще се изгаря RDF, а не директно битови отпадъци в които присъстват компоненти за рециклиране. Йерархията на управление на отпадъците не е предмет на ДОВОС за инсталация за оползотворяване на RDF.
	При това разгледаните 2 варианта на изгаряне не са сравнени, както изисква чл.5 пар.3 точка г) от Директива 2011/92/ЕО за ОВОС, като по този начин не сте аргументирали избора с оглед въздействието върху околната среда. Също така според настоящето задание не е предвидено оценяване на ефекта от повишени нива на рециклиране в София, които могат да рефлектират, както върху състава на RDF така и върху количествата излизащи от МБТ и подавани към RDF инсталацията. Нещо повече в момента МБТ инсталацията в София предвижда производство на 154000 т/г RDF и от заданието не става ясно кое налага RDF инсталацията да е с капацитет от 180000 т/г и откъде ще дойдат тези допълнителни количества.	В ДОВОС е дадено за максимален капацитет на инсталацията. Предварителният състав на RDF е зададен от СО в предпроектните проучвания в т.2.3.3. „Капацитет на инсталацията” от Задание). Точното количество ще стане известно след пускане на МБТ в експлоатация.

	Относно аргумента, че чрез RDF инсталацията ще се намали вноса на природен газ, то той не е подкрепен с конкретни данни и разчети, както споменахме по-горе. Намаляването на консумацията на газ респективно вноса, може да се постигне и с мерки за енергийна ефективност на жилищните сгради, намаляване на загубите при топлоподаване и пренос и прочее мерки неизискващи строеж на нова мощност.	Коментар в ДОВОС, но без оценка. В случая се заменят стари неефективни, амортизирани мощности, а не се увеличава производителността на Топлофикация София – определена от броя на клиентите и тяхното потребление в гр. Sofia. Намаляване на загубите от топлопренасяне не е предмет на ДОВОС за инсталация за оползотворяване на RDF. Повдигнатите въпроси и съображения са предмет на инвестиционната политика на Топлофикация София ЕАД и в момента се изпълняват. За справка – сайта на дружеството.
	И на последно място изказваме нашето несъгласие с твърдението, че „Нулева алтернатива” е изключително неприемлива от законова, екологична, социална и икономическа гледна точка (стр.42 подчертано е в оригинала), тъй като не предоставяте конкретни факти и разчети с които да подкрепите това си твърдение.	Коригирано в т.3.1. „Нулева алтернатива” В ДОВОС „нулева алтернатива е анализирана и отразена подробно.
	Нещо повече, не предоставяте такива не само за „нулева алтернатива”, но дори за избраната от вас такава. За пример даваме раздел 5.11 Социално и социално-икономическо въздействие от Заданието, където само декларирате цели и не предоставяте конкретни оценки и разчети как тези цели ще се постигнат. В ДОВОС всички декларирани цели и твърдения следва да бъдат подкрепени с анализи, разчети с цифри и оценки иначе остават голи твърдения като: „Наред с трайно решение на съществуващите екологични проблеми на столичния град, изграждане на Инсталацията ще даде отражение за решаването на социални и икономически проблеми, свързани с гарантиране на качествено отопление на поносима цена на населението......” (стр.93). Инсталацията няма потенциала да реши трайно „съществуващите екологични проблеми на столичния град”, тъй като тези проблеми не са свързани само с отпадъците на София. Един от най-сериозните екологични проблеми в София е качеството на въздуха, което няма да се подобри вследствие на изграждането и експлоатацията на нов източник на емисии, какъвто представлява инсталацията за изгаряне на RDF. Също така е спорно доколко „изграждането на инсталация... ще окаже положително социално–икономическо въздействие върху населението на гр. София и Столична община (стр.93) имайки предвид оскъдната информация за създаването на	В Заданието в т.5.11. „ Социално и социално-икономическо въздействие” е разгледано накратко. В ДОВОС е анализирано и оценено, но без подробна финансова оценка. Конкретните разчети и цифри се изготвят от Топлофикация София ЕАД с изготвянето на „Социално икономическия анализ”. Ще се предостави информация за поносимост на тарифите, информация за цените на топло и електроенргията произведена от ТС ЕАД и тяхното влияние върху различните групи население, вкл. „децилни” групи. Инвестиционното предложение дава възможност на Топлофикация София ЕАД за реализиране на икономия от над 10% от употребявания в момента природен газ и ще покрие нуждите за обезпечаване на базовия товар в централна градска част, като в интервалите на ниска

	едва 35 постоянни и 110 временни работни места и спестената информация за разходите по управлението на отпадъците, ефектите върху такса смет и цените на топло и електроенергия от Топлофикация София.	консумация, произведената топлинна енергия ще се акумулира и ще се реализира в часовете на нарастващо потребление. Социално–икономическо въздействие върху населението на гр. София и Столична община е оценено и отразено в ДОВОС.
	Коментари по раздел 4. Характеристика на околната среда Препоръчваме в този раздел да бъдат използвани актуални данни, както и да бъдат показани тенденциите през последните години относно компонентите на околната среда. От изключителна важност е да се вземе предвид динамиката не само на основа сезони, а и как компонентите на околната среда са се променили през последните години и какви са тенденциите/сценариите за тези промени. Климатичните промени са един пример за динамичен фактор, който трябва да бъде отчетен в проекта. Наличието на горещи вълни, нарастването на емисиите на СО2 в София са част от тенденциите през годините в София и е редно да залегнат в доклада за ОВОС.	В ДОВОС е разгледано, анализирано и приложено в съответните части.
	Друг фактор е заболеваемостта и препоръчваме да бъдат представени актуални данни със съответните източници както за потенциално засегнатото население така и за работещите в Топлофикация. Препоръчваме да се ползват и доклади на СЗО, статистики, както и публикации в научни журнали. Представената към момента информация в заданието е оскъдна и без посочени източници.	В ДОВОС е разгледано подробно в съответните части и ще бъдат посочени използваните източници..
	Коментари по раздел 5. Значимост на въздействията върху околната среда При определяне на въздействието върху всеки един елемент на околната среда и върху човешкото здраве да се отчетат и тези по време на извеждане от експлоатация на съоръжението. В момента на раздел 5 от заданието въздействията от този етап не са отчетени.	Въздействието по време на извеждане на инсталацията е отразено в ДОВОС в т.6 Граници на проучването във връзка с ОВОС” на Заданието В ДОВОС е анализирано и отразено подробно въздействието върху човешкото здраве по време на извеждане от инсталацията на инсталацията.
	1. По т.5.1. Въздействие върху хората и тяхното здраве. Отчитайки, че „населението на Столична община (вече) е подложено на негативното въздействие главно на емитираните замърсители от промишлените предприятия и транспорта (стр.79 от заданието), то спазването на „емисионните норми” не може да гарантира, че RDF инсталацията няма да окаже негативно въздействие върху здравето на населението тъй като инсталацията представлява нов, допълнителен източник на замърсяване с тежки метали, диоксини и фурани, ФПЧ, ултрафини и нано частици, азотни и серни окиси и други замърсители. В тази връзка оценката на здравния риск следва да се основава не само на база емисионни норми в рамките на ТЕЦ, но и да включва оценка на база общи концентрации на отделните замърсители и	В ДОВОС е разгледано и анализирано подробно в

	приноса на новите източници към съществуващите такива извън ТЕЦ (например транспорта), т.е. да се оцени натрупването на замърсители и какъв ще е здравния риск за населението в прилежащите населени площи. Ако няма данни за конкретните места, то да се направят съответните измервания. При анализа да бъде посочена и да се има предвид възрастовата структура на населението, както и факта, че някои от замърсителите влияят по-силно определени възрастови групи.	съответните части, като информация към здравен риск за населението. Оценен е здравният риск и кумулативния ефект от дейността на инсталацията и съществуващите мощности на ТЕЦ, транспорта и др.
	- При оценяване на въздействието да се обърне допълнително внимание на особено уязвимите групи като деца, хронично болни (с дихателни и сърдечно съдови заболявания) и възрастните хора, както и на постоянно заетите в инсталацията. Да се оцени и въздействието при ремонти и дейности по почистването на инсталацията (котли, скара и т.н.) както от постоянно заетите така и от външни работници. - Също така да се оцени влиянието на нано и ултрафините частици с размер $1x10^9$м, или <100 nm като емисиите през комина, така и от летливите пепели, които ще се генерират. Това да бъде направено и за уязвимите групи посочени по-горе, като се отчете и кумулативния ефект от други източници (освен ТЕЦ и RDF инсталация). - За потенциално засегнатото население да се оцени нивото на диоксини, на което е изложено в момента и на нивото, на което ще бъде изложено в случая на реализация на проекта (годишно и като общо натрупване за периода на работа на съоръженията), и да се оцени въздействието върху здравето.	В ДОВОС е разгледано в съответните части, като информация към здравен риск за населението с отчитане ефективността на системите за пречистване на димните газове. Оценено е и въздействието при ремонти и дейности по почистването на инсталацията, както от постоянно заетите така и от външни работници. Предвидена е система за Основно третиране чрез Комбинирана сухо-мокра система за основно пречистване с вдухване на хидратна вар и активен въглен (полу-суха), следвана от мокър скрубер с кондензация и допълнителна Селективна не-каталитична редукция за NOx. В ДОВОС е разгледано в съответните части и е оценено въздействието върху здравето на хората.
	- Анализ на здравния риск на населението, което се очаква да бъде засегнато от предложената инсталация за изгаряне на RDF, отчитайки настоящите концентрации на тежки метали и бъдещите емисии.	В ДОВОС е разгледано и оценено.
	- При определяне на въздействието върху здравето да се използват актуални данни за размера и тенденциите на заболяваемостта в София и по-конкретно за потенциално засегнатото население.	В ДОВОС са разгледани и анализирани наличните актуални данни.
	- ДОВОС трябва да съдържа обоснован анализ, подкрепен с цитати от научната литература или емпирични данни, относно обхвата на засегнатото население за да се изясни дали то действително се ограничава с жителите на жилищните зони, граничещи с предложените две площадки, както посочва заданието, или включва по-широк кръг, или дори всички жители на територията на Столична община, поради свойствата на замърсителите, които ще бъдат отделяни, както и другите ефекти и рискове за човешкото здраве, вследствие на реализиране на проекта.	Представен е обоснован анализ за ефекта и рисковете за човешкото здраве, вследствие на реализиране на проекта. Заложено в т.8 „Източници на информация” от Заданието - ще бъде представена подробна информационната база с източниците на информация, използвани в ДОВОС.

	1. По т.5.3 Очаквани въздействия върху атмосферния въздух Вижте Приложение 1 Коментари към очаквани въздействия върху атмосферния въздух В представеното Задание не са отчетени текущи проблеми, свързани с качеството на атмосферния въздух (КАВ) в град София. В настоящия момент в града има наднормено замърсяване по два показателя – ФПЧ10 и NO2, което е отчетено в т.1.6 от програма за намаляване на емисии и достигане на установените норми за финни прахови частици ФПЧ10 и азотен диоксид NO2 и управление на качеството на атмосферния въздух в столична община за периода 2011-2014 г. (наричана за краткост Програмата). В документа са описани емисиите и приноса към стойностите на замърсяване с ФПЧ10 и NO2 от неподвижни източници. През периода 2007-2010 г съгласно утвърден от Министъра на околната среда и водите график за извършване на контролни измервания на емисиите от неподвижни източници, е проведен емисионен контрол на следните обекти: ОЦ „Земляне", ОЦ „Люлин", ТЕЦ „София-Изток", ТЕЦ „София", Чугунолеене", „Дружба стъкларски заводи" АД; ПУДОС – МОСВ инсталация за изгаряне на опасни отпадъци (инсинератор) към ВМА-ГОС гр.София; „Кодак Графикс Комюникашънс"АД; АБ „Враждебна" към „Пътища и съоръжения" ЕАД гр. Sofia.	Моделиране в ДОВОС, с приетите за тази цел програмни продукти (Plume) с отчитане на кумулативен ефект и фоново замърсяване. Не е предмет на ДОВОС за инсталация за оползотворяване на RDF, а на допълнително моделиране към Актуализирана програма за управление качеството на атмосферния въздух на София (AERMOD), от която може да се отчете само фоновото замърсяване за този район.
	С изграждането и експлоатацията на нова промишлена инсталация, каквато е инсинераторът за RDF, данните за емисиите на ФПЧ10 и ФПЧ2.5 и NO2 от неподвижни източници ще се променят. Програмата съдържа мерки за намаляването на общите нива в тези емисии, без да отчете приноса на новата инсталация към замърсяването на атмосферния въздух. В ДОВОС изискваме ясно да се покаже приноса на емисиите от RDF инсинератора към общите концентрации на NO2 (средночасови и годишни) и ФПЧ10 (дневни и годишни) за пунктове Дружба и Надежда, които са в най-голяма близост до двете предложени площадки за изграждане на съоръжението, във фазите на строителство, експлоатация и изваждане от употреба. Под общи концентрации разбираме тези от всички сектори, а не само от източниците разположени на предложените площадки моделирани с модела PLUME според „Методика за изчисляване височината на изпускащите устройства, разсейването и очакваните концентрации на замърсяващи вещества в приземния слой" и приложени към заданието за обхват. Освен това, изискваме чрез моделирането да се покаже как новата инсталация ще допринесе към изменения в качеството на атмосферния въздух в София град като цяло, а не само в района на посочените по-горе площадки.	Моделиране в ДОВОС, с приетите за тази цел програмни продукти (Plume) с отчитане на кумулативен ефект и фоново замърсяване Не е предмет на ДОВОС за инсталация за оползотворяване на RDF, а на допълнително моделиране към Актуализирана програма за управление качеството на атмосферния въздух на София (AERMOD)|, от която може да се отчете само фоновото замърсяване за този район.

	От предоставената информация не става ясно дали методиката за оценка на въздействието върху атмосферния въздух отчита само приземни концентрации произтичащи от емисии на ТЕЦ „София” или ТЕЦ „София-Изток” или включва и настоящите нива на замърсяване на въздуха от транспорта и други релевантни източници. Препоръчваме да се използва методика, която отчита освен изпускащите устройства и климатичните особености на района така и настоящите нива на замърсяване, като се вземе в предвид тенденцията през последните години, както и сезонните вариации и се моделира как ще се развият емисиите през жизнения цикъл на инсталацията. Така може да бъде направена оценка на кумулативното въздействие върху качеството на атмосферния въздух по отношение на NO2 и ФПЧ10. Кумулативният ефект да включва емисиите от секторите: транспорт, битово горене, промишленост за NO2; и транспорт, битово горене, промишленост, строителство, депа и кариери и земеделие за ФПЧ10. При моделирането да се използват най-новите налични емисионни данни, предвид динамичната промяна на количествата емисии по сектори от 2007 до 2010 г. При моделирането на въздействието на емисионните източници от обекта върху качеството на атмосферния въздух трябва да са обхванати всички емисионни източници и на двете алтернативни площадки на инсталацията, като освен изброените на стр.82 от Заданието, да бъде добавен и общ прах, както изисква Директива 2010/75/ЕС. Да бъда ясно посочен как е измерен общия прах и какво включва.	Моделиране в ДОВОС, с приетите за тази цел програмни продукти (Plume и Traffic Oracle) с отчитане на кумулативен ефект и фоново замърсяване от Актуализираната програма за СО. В ДОВОС е отразено подробно (в т.4 „Характеристика на околната среда......” от Заданието за обхват и съдържание на ДОВОС и Приложение №2 към него) Отразено в ДОВОС при отчитане на съществуващо състояние и фоновото ниво Не е предмет на ДОВОС за инсталация за оползотворяване на RDF, а на моделиране към Актуализирана програма за управление качеството на атмосферния въздух на София (AERMOD), от която може да се отчете само фоновото замърсяване за този район.
	София е на 15-то място сред градовете в Европа по отношение на концентрация на ФПЧ10. При разрешени 35 дни в годината с концентрация над 50 $\mu g/m^3$ в София през 2011 г. са отчетени 122 дни (EEA-Air pollution aggregated cities2011). Проблемът е посочен и в Програмата: „Във всички крайградски пунктове (с изключение на извънградския фонов пункт Копитото) има превишение на СГН повече от 35 пъти за съответната година”. Допълнително, фигура 1-4 на стр.22 от Програмата показва, че в пункт Надежда от 2003 г до 2010 г. се наблюдава тенденция към нарастване на средноденонощните стойности на ФПЧ10 за разлика от другите пунктове в общината, следователно изборът на площадка ТЕЦ „София” би повишил допълнително замърсяването в района и трябва да бъде направена специална оценка в тази посока.	Не е предмет на ДОВОС за инсталация за оползотворяване на RDF, а на допълнително моделиране към Актуализирана програма за управление качеството на атмосферния въздух на София (AERMOD), от която може да се отчете само фоновото замърсяване за този район. В ДОВОС е отразено.
	Във връзка с препоръките на Програмата да се оцени как замяната на природен газ с RDF ще допринесе за намаляване на емисиите от NO_2 и $ФПЧ_{10}$. Да се представят конкретни разчети и графики отчитащи освен	Отразено в ДОВОС при отчитане на съществуващо състояние и фоновото ниво.

	данните за 2007 и 2010 в КАВ, така и тези до момента. Отбелязваме, че за 2010 г.68% от емисиите на Nox са от промишлеността, а от тях приблизително 74.45% сумарно се дължат на ТЕЦ „София” и ТЕЦ „София-Изток”.	
	Сектор транспорт е отговорен за 63% от всички емисии на ФПЧ10 и 30% от тези на Nox за 2010 г. в София (2) (програма за намаляване на емисиите и достигане на установените норми за фини прахови частици ФПЧ10 и азотен оксид NO2 и управление на качеството на атмосферния въздух в столична община за периода 2011-2014 г.). поради това настояваме за кумулативна оценка на въздействието върху качеството на въздуха в района на площадката на RDF инсинератора от сектор транспорт, както следва: - По време на строителството на съоръжението, свързано с всички строителни дейности и доставка на материали и елементи - По време на експлоатацията, свързано с необходимия транспорт на горивото от точките, в които то се намира до съоръжението - По време на изваждане на съоръжението от употреба.	В ДОВОС кумулативната оценка на качеството на въздуха в района на двете площадки (RDF инсталация и транспорт) е анализирана и отразена, съответно по време на строителството, експлоатацията и по време на изваждане на инсталацията от употреба.
	2. По т.5.11 Социално и социално-икономическо въздействие От изключителна важност за населението на София е да знае колко ще струва цялото управление на отпадъците в София и кой ще плати за това. Имайки предвид, че интегрираната система струва около 360 млн.лв. и предлаганият инсинератор ще струва 130 млн. евро (около 255 млн.лв.), то само инвестиционните разходи надхвърлят 600 млн.лв. предвид размерът на инвестицията в ОВОС трябва да се изясни по какъв начин Топлофикация София смята „цените за отопление в София да останат без промяна в бъдеще”[6]. Препоръчваме възложителят Топлофикация София ЕАД със съдействието на Столична община да изготвят и представят на населението на град София ясна и нагледна информация за: - Формирането и размерът на цената на единица произведена топлинна енергия от RDF инсталацията съотнесена спрямо цената от инсталацията на газ; - Размерът на такса смет за домакинства и бизнеса, отчитайки влиянието на RDF инсталацията, инсталацията за МБТ, както и на останалите елементи от цялостната система за управление на отпадъците; - Цената, на която Топлофикация София ще купува и/или Столична община ще заплаща за изгарянето на RDF и базата, на която ще се определя тя; - Цената, на която генерираната електроенергия ще бъде продавана (изкупувана от НЕК); - Цената за изгаряне на един тон RDF – на база разходи;	Коментар в доклада по ОВОС. Разходите за настоящия проект касаят единствено Топлофикация София ЕАД. Стойността на гориво е 0, тъй като то вече е произведено в инсталация за МБТ. Валидна са само разходите за персонал и режийни разходи. Инвестиционните разходи ще се поемат от ОПОС 2014-2020. Конкретните разчети и цифри се изготвят от Топлофикация София АД (СО). Цените и ценовите разчети са предмет на Анализ на разходи и ползи (АРП) от изпълнението на проекта. Колективът по ДОВОС е анализирал и отразил.

	- Тъй като изграждането на инсталацията за изгаряне на RDF е част от управлението на отпадъците на София, към информацията по-горе да бъде добавена цената за третиране на един тон отпадък в инсталацията за МБТ; - Да се покажат разходите по събиране и депониране – включително опасните отпадъци, които ще се генерират от RDF инсталацията; - Обща цена за третиране на 1 тон отпадък в София от събиране до депониране; - Да се направи анализ на чувствителността като се отчете повишаване на рециклирането в София и евентуално повишаване на целите за рециклиране над 50% вследствие на текущата ревизия на ниво Европейски Съюз.	Конкретните разчети и цифри се изготвят от Топлофикация София АД (СО). Цените и ценовите разчети са предмет на Анализ на разходи и ползи (АРП) от изпълнението на проекта. Колективът по ДОВОС е анализирал и отразил.
	Получената информация да бъде представена нагледно и ясно и да засяга целият период на строителство, експлоатация и извеждане от експлоатация на съоръженията.	
	Исканата информация ще изясни на гражданите на София как тази инвестиция ще се изплати, какви ще са оперативните разходи и евентуалните приходи и с колко ще се увеличат разходите им. Обявеното, за пореден път от заместник кмета г-жа Мария Бояджийска, намерение за пълна прозрачност включва предоставянето на тази информация преди вземането на решение за изграждането на RDF инсталацията. Също така, настоящата задлъжнялост на Топлофикация София има пряко отношение върху евентуалните разходи и ползи за населението от реализирането на RDF инсталацията. Препоръчваме оценката на социално и социално-икономическото въздействие да отчете задлъжнялостта, размерът на инвестицията и ефектът от евентуален фалит на дружеството. Да се представи оценка с ясни количествени разчети как това ще повлияе върху размера на такса смет и цената на топлоенергията в София за крайния потребител.	Конкретните разчети и цифри се изготвят от Топлофикация София АД (СО). Цените и ценовите разчети са предмет на Анализ на разходи и ползи (АРП) от изпълнението на проекта. Колективът по ДОВОС е анализирал и отразил.
	Коментар по раздел 6. Граници на проучването във връзка с ОВОС – кумулативно въздействие В направените от нас коментари до момента на няколко пъти споменаваме, че има нужда да се извърши оценка на кумулативното въздействие, като прилагаме съответните аргументи. В тази връзка очакваме да бъде извършена такава минимум за компонентите атмосферен въздух и здраве на хората. Във връзка с генерирането на опасни отпадъци и необходимостта от тяхното обезвреждане да се оцени и тяхното въздействие.	Заложено в Заданието по компоненти В ДОВОС е анализирано и отразено по компоненти.
	Препоръчваме при оценяването да се използват методики за моделиране, които макар и по-скъпи дават възможност за количествено определяне на кумулативните ефекти, географските и времеви хоризонти са ясно	Моделиране в ДОВОС при отчитане на съществуващо състояние и фоновото ниво

	дефинирани и могат да отразят специфични причинно-следствени връзки.	
	Кратък коментар и препоръки относно оценка за използване на НДНТ Според референтния документ за НДНТ за изгаряне на отпадъци BREF Code WI стр.vii) инсталации за комбинирано производство на енергия (combined heat and power-CHP) са добре използвани само в няколко страни в Европейския съюз характеризиращи се с високи цени на отоплението и/или възприели определени политики. От показаните от вас съоръжения на стр.11 и стр.18 от „Приложение 2: Допълнение към Задание - Оценка за използване на най-добри налични техники" не става ясно кои инсталации реално са за комбинирано производство използващи RDF гориво.	Актуалните данни с брой работещи инсинератори, предоставени от консултанта (Предпроектни проучвания) са дадени в НДНТ стр 7, 10 и 15. Съдържанието, включително таблиците на Оценката за използване на НДНТ се изработват в съответствие с Актуализираната Методиката за попълване на Заявление за издаване на КР (Заповед № РД-925/13.12.2012 на Министъра на МОСВ) и т. 3.1 на Методиката за определяне на най-добри налични техники (МОСВ, декември 2012.)
	В тази връзка предлагаме да представите списък с работещи точно такива инсталации като отбележите кои съответстват на НДНТ и приложите източници, потвърждаващи съответствието. Също така искаме да представите реални и актуални данни от емисии на всички замърсители на съществуващи идентични инсталации (инсинератори за RDF със скарово горене или кипящ слой в режим на комбинирано производство), както и данни за превишаване на норми като приложите и източниците с оглед тяхната проверяемост.	Референтните НДНТ документи за инсталациите за оползотворяване на отпадъци чрез изгаряне (за който НДНТ все още се представят с утвърдения *BREF Code WI)*, са издадени през 2006 година, а новото издание, включително Решение на ЕК за формиране на заключения за НДНТ (съгласно Директива 2010/76/ЕС) предстои да бъде издадено през 2014 година. Актуалните данни ще бъдат дадени в новото издание (вероятно 2014).
	В „Таблица 1 (от Приложение 1А) Общи емисии на вредни вещества изпускани в атмосферния въздух от инсталация за комбинирано производство на енергия с оползотворяване на RDF" представените стойности в колона „Емисионна стойност съгласно заключения за НДНТ, включително приети с Решения на ЕК" представляват данни събрани от оператори и събрани в таблици 3.8 и 3.9 от BREF Code WI (стр.156-157). За нас не е ясно защо се твърди, че представените стойности а според заключенията за НДНТ, след като тези заключения са в глава 5 от BREF Code WI и в нея има други таблици например Таблица 5.2 на стр.440 от BREF Code WI. В тази връзка е необходимо допълнително да уточните в заданието кои са стойностите според, които инсталацията спада към НДНТ и да ги добавите в таблица 1 (от Приложение 1А) за по-голяма яснота. Попадането „като цяло" или „почти" на инсталацията в приетите НДНТ диапазони за емисии (Таблица 5-2 от BREF Code WI) трябва да бъде обяснено по-подробно с оглед на заключението ви, че избраната алтернатива отговаря на изискването за НДНТ. Според BREF Code WI, за да бъде една инсталация съответстваща на НДНТ тя трябва да отговаря на общите и специфичните НДНТ (Generic BAT and	Подробно анализирана и сравнена в подробности с Максимално допустимите емисионните норми т.нар. НДЕ (Приложение №2 към чл. 22, ал. 1 от Наредба № 4 / 05.04.2013) на стр. 56-57 от Оценката за използване на НДНТ. Тези НДЕ от нашето законодателството са и в основата на изчисленията в Таблица 1 (от Приложение 1А). Възможно в Оценката за използване на НДНТ към ОВОС.

	Specific BAT-chapter 5). Предлагаме за по-лесно сравняване и четимост всички елементи на предложената инсталация и кореспондиращите им стойности (описания) според НДНТ да бъдат показани в една таблица, като в отделна колона се показва ясно дали елементът съответства на НДНТ или не. Това представяне може да е направено и в отделно приложение.	
	Допълнителни коментари и препоръки - В публикуваната информация на страницата на Топлофикация София от 11.11.2013 г. както и в изпратеното копие на Задание за обхват на доклада по ОВОС се споменава, че е готов и „идейният проект на съоръжението”, но той не е представен на засегната общественост.	Представянето на идейния проект на съоръжението на засегнатата общественост не е предмет на Заданието по обхват и съдържание за ОВОС.
	- Самото задание за обхват на доклада за ОВОС и възможността да бъдат изразени становища от засегната общественост не са публикувани на страницата на Топлофикация София, нито бяха оповестени на прес конференцията на дружеството проведено в БТА на 11.11.2013 г., с което смятаме, че са нарушени изискванията на ЗООС чл. 95 ал.(3) т.4. консултирането с няколко неправителствени организации не отменя задължението на възложителя да проведе консултации със засегнатата общественост и по-специално населението в близост до предлаганите площадки.	Заданието за обхват и съдържание на ДОВОС е публикувано на уеб страницата на Топлофикация ЕАД на 11.11.2013 (Приложение 1, т.4.1.16.) Заданието за обхват и съдържание на ДОВОС е внесено за консултации със засегнатата общественост в съответните райони (Приложение 1 т.4.1.) съгласно Наредбата за ОВОС
	- В представената до момента информация не са разписани срокове за реализация и етапи на изпълнение на процедурата по ОВОС. - В представената до момента информация не са разписани срокове за реализация и етапи на изпълнение на инвестиционното предложение	Допълнено в т.13 „Етапи, фази и срокове за разработване на ДОВОС” от Заданието В ДОВОС е отразено. За стартиране на строителство е необходимо да има одобрени проекти. За целта е необходимо да има одобрено решение по ОВОС, съгласно ЗУТ.
	- В представеното задание и неговите приложения повечето таблици и графики са представени без последователна номерация, което затруднява разбирането на изложената информация и противоречи на елементарните правила за стил и форма в научната литература. ДОВОС трябва да съдържа много ясно обозначени таблици, графики и приложения, като те трябва да бъдат изнесени и в съдържанието като отделен списък.	Коригирано в текста Приложен списък на фигури и таблици (Приложение 1, т.6)
	Във връзка със системите за мониторинг и контрол – вътрешни и външни – на емисиите и замърсяванията да се предвиди предаване на информация в реално време на обществено достъпен адрес в интернет. Да се включат и основни параметри на инсталацията като производство на електроенергия и топлоенергия, количества оползотворени битови отпадъци чрез RDF и реални намаления на парниковите газове. Да бъде предвидена и система за незабавно	Разгледани в ДОВОС Предвидено е да бъде инсталиран дисплей за отчитане на емисиите в реално време (чрез мониторингова с-ма) т.2.3.2.2. „Основно третиране..........” от Заданието за обхвата на

	известяване на населението в случай на авария или инцидент в RDF инсталацията.	ДОВОС. В ДОВОС ще бъде отразена и предвидена и система за незабавно известяване на населението в случай на авария или инцидент.
	Считаме, че ДОВОС трябва да включва (освен предвидените в ЗООС и Наредбата за ОВОС) и споменатите по-горе елементи, така и следните проучвания и данни: - количествени цели в приложимите нормативни актове, свързани с управлението на определени потоци отпадъци и на отпадъците като цяло, включително (но не изчерпателно); междинните и крайните цели за подготовка за повторна употреба и рециклиране от 50% до 2020 г. заложени в ЗУО, целите за отклоняване на биоразградими отпадъци от депа за разделно събиране на биотпадъци, за рециклиране на строителни отпадъци, за оползотворяване на отпадъци от опаковки и др.	Коментар в ДОВОС Управлението на отпадъците като цяло, както и изпълнение целите на ЗУО е предмет на оценка в друга процедура.
	- оценка на емисиите на парникови газове според препоръките на стр.2 като наблягаме, че трябва да се разгледа вариант с предотвратяване, повторна употреба и рециклиране	Коментар в ДОВОС Като страна по Рамковата конвенция на Обединените нации по изменение на климата (РКОНИК), България има задължението да провежда ежегодни инвентаризации на емисиите на парникови газове по източници и поглътители, съгласно утвърдена от РКОНИК методология. Инвентаризациите обхващат емисиите на основните парникови газове: въглероден диоксид (CO2), метан (CH4), диазотен оксид (N2O), хидрофлуоркарбони (HFCs), перфлуоркарбони (PFCs) и серен хексафлуорид (SF6), както и предшественици (прекурсори) на парниковите газове (NOx, CO и NMVOC) и серен диоксид (SO2). За сравняване на различните ПГ, чрез различната им сила да ускоряват глобалното затопляне, от Междуправителствения комитет по изменение на климата (IPCC), е създаден индекс, наречен „потенциал за глобално затопляне" (ПГЗ). Въздействието на топлинната енергия на всички ПГ се сравнява с въздействието на CO2 (ПГЗ = 1) и се обозначава като CO2 еквивалент (CO2 - екв.) За наблюдение и оценка на нивата на парникови газове се използват индикатори, като в доклада за ОВОС ще бъде направена подробна оценка на

		нивата на емисиите на парниковите газове по тях.
	- да се извърши оценка на жизнения цикъл по чл.4 пар.2 от Директива 2008/98/ЕО Оценка на жизнения цикъл на отпадъците за RDF, с оглед неспазването на йеархията за управление на отпадъците или избора на обезвреждане/оползотворяване чрез изгаряне пред по-предпочитаните рециклиране, компостиране, повторна употреба и предотвратяване.	Оценката на жизнения цикъл е предмет на друга процедура
	В заключение, настояваме засегнатото население и работниците в района на площадките да бъдат задължително консултирани относно обхвата на бъдещия доклад по ОВОС на проекта, както се изисква по чл.95, ал.3 от ЗООС. Във връзка с изискването на чл.6 от Директива 2011/92/ЕО, информация за проекта, както и за процедурата по ОВОС, изготвените към момента идеен проект, задание за обхват и съдържание на доклада за ОВОС и в последствие самият ДОВОС да бъдат предоставени за свободен достъп в районните кметства, Столична община и качени в интернет. Към тази информация да бъде добавена и изискваната в чл.6, пар.2 буква д от същата директива, включително график кога ще бъдат готови и предоставени на засегната общност други документи като например: анализ разходи и ползи. Искаме цялата информация да бъде достъпна както на хартиен, така и на електронен вид от страницата на възложителя и на съответните компетентни органи и Столична община.	Изпълнено, съгласно процедурата по ОВОС (провеждане на обществено обсъждане) ОВОС се изготвя в началния етап на проектиране, въз основа на наличната информация отговаряща за етапа на самото предложение Съгласно изискванията на ЗООС и Наредба за условията и реда за извършване на ОВОС - Засегнатото население е информирано за ИП на най-ранен етап. СО и районите, както и Топлофикация София е информирала засегнатото население за обхвата и съдържанието на ДОВОС (Приложение 1 т.4) съгласно ЗООС и Наредба за условията и реда за извършване на ОВОС
2.15. Фондация за екологично образование и обучение (ФЕОО) Рег.№ П-4899 от 15.11.2013 г.	Предложение относно обхвата и съдържанието на ДОВОС В представения материал не е представена с достатъчна пълното информацията за така наречената „нулева алтернатива" – състоянието и въздействието върху околната среда при запазване на съществуващата ситуация без да се реализира разглежданото инвестиционно намерение. Предлагане, в ДОВОС: 1. Информацията за „нулева алтернатива" да се попълни и да се представят данни за въздействието върху околната среда от инсталацията за производство на енергия, която се експлоатира в момента от възложителя и която се предлага да бъде заменена (посочен е конкретен обем природен газ, който ще бъде заменен – 70 млн.$м^3$ природен газ годишно). Информацията трябва да включва най-малко данни за емисии във въздуха и във водите, количествата и вида на образуваните отпадъци, както и използваните ресурси.	Коментар в ДОВОС след решение на Топлофикация София АД . The decision about which of the facilities of Toplofikatsia Sofia would be closed down will be made by the company. То ще определи и намаление при ползването на природна газ.
	1. Да бъде разгледан и вариант за „нулева алтернатива", когато произведеният RDF се оползотворява в циментови заводи. Тази „нулева алтернатива" следва да бъде разгледана равностойно по отношение на възможното въздействие върху околната среда.	Коментар в ДОВОС Циментовите заводи не разполагат, нито с предвидената система за Основно третиране чрез Комбинирана сухо-мокра система за основно

		пречистване с вдухване на хидратна вар и активен въглен (полу-суха), следвана от мокър скрубер с кондензация, нито с допълнителната Селективна не-каталитична редукция
	Считаме, че не са разгледани равностойно възможните алтернативи на технологии от типа „отпадъци за енергия". В представеният материал възложителят се е ограничил до една технология с два варианта на техническо решение. Предлагаме в ДОВОС: 1. Да се разгледат равностойно и други алтернативи на предложената технология, например пиролиза и/или газификация; 2. Да се направи сравнителен анализ на разгледаните алтернативи на база на ясно дефинирани критерии. Резултатите от сравнителния анализ да се представят в табличен вид.	Газификацията и други подобни технологии за изгаряне (напр пиролиза) се считат в не достатъчна степен разработени или са още в етап на развитие за масово прилагане при оползотворяне на RDF. Таблица 2.5 на BREF code WI: Обобщение на успешно реализираните основни технологии за термично третиране по отношение на основните видове отпадъци стр. 7 от Оценка на НДНТ.
2.16. ПП „Зелените" от 15.11.2013 г.	Становище на ПП „Зелените" относно определянето на обхвата и съдържанието на ДОВОС: ПП „Зелените" работим за запазването на първичните ресурси на земята за идните поколения, като същевременно им завещаваме огромни сметища и замърсяващи инсталации като инсинератори за изгаряне на отпадъците или RDF ПП „Зелените" активно подкрепяме подхода за „Нулеви отпадъци", който практически се опитва да подражава на устойчивите цикли в природата, където отпадните продукти от едни процеси са ресурси за други и реалната замяна на думата „отпадъци" с ресурси. „Нулеви отпадъци" означава проектиране и управление на продуктите и процесите по начини, драстично намаляващи обема и елиминиращи токсичността на отпадъците. Този подход запазва и възстановява всички ресурси, без да ги изгаря или погребва в сметища. Изпълнението на местни инициативи за „Нулеви отпадъци" елиминира изпускането на емисии във въздуха, водата и почвата, които могат да са опасни за здравето на хората, животните и растенията. Ние оказваме политическа подкрепа и съдействие за създаването и развитието на центрове за повторна употреба и поправка, рециклиране и компостиране, паркове за възстановяване на ресурсите и еко-индустриални паркове. Подкрепяме и стимулираме също и инициативи и подходи, в които продуктите от едни процеси са ресурси за други, с цел откриването на многократно повече зелени работни места, отколкото депонирането или изгарянето на отпадъците. ПП „Зелените" категорично подкрепяме становището на ЕС „За земята" относно определянето на обхвата на ДОВОС на предложението за изграждане на инсталация за изгаряне на гориво от отпадъци (RDF) на площадката на	Подкрепят становището на ЕС „За земята" относно определянето на обхвата и съдържанието на ДОВОС Addressed in the EIAR.

	Топлофикация София	
2.17.Сдружение на дива природа „Балкани” – не е постъпило	До момента не е получено становище от Сдружение на дивата природа „Балкани” относно обхват и съдържание на ДОВОС.	

9 ОПИСАНИЕ НА ТРУДНОСТИТЕ (ТЕХНИЧЕСКИ ПРИЧИНИ, НЕДОСТИГ ИЛИ ЛИПСА НА ДАННИ) ПРИ СЪБИРАНЕТО НА ИНФОРМАЦИЯТА ЗА ИЗРАБОТВАНЕ НА ДОВОС

В хода на изготвяне на доклада по ОВОС трудности, възникнали при събирането на информацията за изработване на Доклада за ОВОС, включващи недостиг на данни от различни заинтересовани институции, бяха преодолени своевременно.

10 ЗАКЛЮЧЕНИЕ В СЪОТВЕТСТВИЕ С ИЗИСКВАНИЯТА НА ЧЛ.83, АЛ.5 НА ЗООС

Докладът за ОВОС на инвестиционно предложение за реализация на „Инсталация за комбинирано производство на енергия в София с оползотворяване на RDF отпадък“, е разработен от колектив от независими експерти по отделните компоненти и фактори на околната среда, които при изготвянето на ДОВОС са се ръководили от принципите за намаляване и преодоляване на риска за околната среда и човешкото здраве и осигуряване на устойчиво развитие, съобразно действащите в страната норми за качеството на околната среда.

Докладът по ОВОС включва подробен анализ, прогноза и оценка на въздействията върху всички компоненти и фактори на околната среда, както и здравните аспекти по време на строителство, експлоатация и извеждане от експлоатация на ИП „**Инсталация за комбинирано производство на енергия в София с оползотворяване на RDF отпадък“.** Предложени са конкретни мерки за намаляване, предотвратяване или възможно най-пълно отстраняване на идентифицираните въздействия върху околната среда и човешкото здраве.

Алтернативните варианти по местоположение са проучени и сравнени, като оценката на възможните варианти за реализиране на проекта са единствените осъществими и възможни решения за реализация на инвестиционното предложение. Въз основа на анализ и прогноза за предполагаемото въздействие и при равностойно разглеждане на вариантните решения, в ДОВОС е обоснован **предпочитания вариант реализация на ИП на площадка „В” в ТЕЦ”София”**. Площадката за изграждане на ИП е в антропогенно вече повлияна територия - площадката на ТЕЦ”София”, в промишлената зона на гр. Sofia.

Не се очаква отрицателно въздействие върху предмета и целите на опазване на защитените зони, както и върху приоритетни природни местообитания или видове.

Анализът на данните в аспект здравен риск, показват, че при строго спазване на изискванията на българското и европейското законодателство и на най-добрите налични техники в строителството и експлоатацията на ИП и защита на околната среда не се създава здравен риск за населението. Здравният риск е оценен като нисък за населението и умерен за работниците, приемлив и управляем.

The implementation of the RDF utilisation plant project is in line with the priorities of EU policy in the area of waste management, specified in the new Framework Directive 2008/98/EC, based on the principle of five-stage waste management hierarchy: минимизиране на отпадъците, повторно използване, рециклиране, друго оползотворяване (напр. оползотворяване за получаване на енергия в конкретния случай) и обезвреждане. The long-term goal of EU is to make European society a recycling society, striving to minimize waste generation and increase its utilization as a resource, and this is precisely such a case. Рециклирането и оползотворяването на отпадъците е в рамките на най-високия приоритет от йерархията на отпадъците.Към момента на европейско ниво се оценява въздействието върху околната среда, икономиката и хората.

В политиката на ЕС в областта на отпадъците за тяхното управление най-висок приоритет се дава на предотвратяване образуването на отпадъци, последвано от подготовка за повторна употреба, рециклиране, друго оползотворяване и обезвреждане. Използваните съоръжения., в които се извършва третиране трябва да се съобразят с по-високите стандарти, с оглед спазване изискванията на Директива 96/61/ЕС за комплексно предотвратяване и контрол на замърсяването. Необходимо е спазване изискванията на нормативните актове, свързани със съществуващите изисквания за депониране на отпадъци, термично третиране, както и алтернативно производство на енергия от отпадъци.

След реализацията на ИП при строго спазване на изискванията на българското и европейското законодателство и най-добрите международни стандарти и практики в областта на проектиране, експлоатация и при изпълнение на препоръчаните в ДОВОС мерки не се очаква негативно значимо въздействие върху отделните компоненти и фактори на околната среда и човешкото здраве.

Заключението на колектива от независими експерти, разработили Доклада за ОВОС на „Инсталация за комбинирано производство на енергия в София с оползотворяване на RDF отпадък“, е да се одобри от компетентния орган РИОСВ-София инвестиционното предложение за изграждане на „Инсталация за комбинирано производство на енергия в София с оползотворяване на RDF отпадък“ на площадката на ТЕЦ „София” при изпълнение на препоръчаните в ДОВОС мерки.

11 ДРУГА ИНФОРМАЦИЯ ПО ПРЕЦЕНКА НА РИОСВ-СОФИЯ

12 ПРИЛОЖЕНИЯ

12.1. Нетехническо резюме на доклада ДОВОС;

12.2. Оценка за използване на НДНТ по чл. 99а, ал. 1 от ЗООС;

12.3. Документи, графични материали, използвани при разработване на ДОВОС, предоставени от Възложителя;

12.4. Становища и консултации със специализирани ведомства и представители на засегната общественост, съгласно изискванията на чл. 95, ал. 3 от ЗООС и чл. 9 от НУРИОВОС