EIA Report

For the investment proposal
for the National Waste Treatment Center

Executive Summary

Prepared by:

POVVIK Ltd

Manager: Ivo Popov

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1 GENERAL INFORMATION

The purpose of this EIA statement is to make an assessment of the environmental impact of the Investment proposal for construction and operation of a National Waste Treatment Center on a site in Gledachevo.

This EIA statement was made by POVVIK Ltd pursuant to a contract with the MOEW and to Terms of Reference by the MOEW.

2 ANNOTATION OF THE PROJECT

The National Waste Treatment Center will be a complex of facilities with a physico-chemical treatment plant, waste incinerator, solidification facilities, landfilling of waste, landfilling of asbestos-containing waste and other auxiliary buildings and facilities.

The activities at the NWTC will be conducted in compliance with the Bulgarian legislation which has been harmonized with the European legislation. This will meet the conditions required for protection of the environmental media such as air, surface and ground water, soil, the plant and animal worlds, the cultural heritage, and human health against harmful impacts and pollution.

In September 2001 the Ministry of Environment and Water (MOEW) submitted an ISPA-Annex for the construction of a National Hazardous Waste Center. For various reasons, the European Union did not accept the proposal. The member states, however, considered the urgent need for treatment of hazardous waste and have given their support for the MOEW's efforts to prepare an alternative proposal.

The approach here is based on the need for a center to receive all hazardous waste (except radioactive, explosive and infectious waste), and is rated in accordance with the quantities of waste generated over 20 years.

The current studies underlie a new proposal for the construction and commissioning of a National Waste Treatment Center (NWTC) in stages. The NWTC location is at the Gledachevo site in the lands of Gledachevo village, at 3,120 m north-west from Kovachevo village, 3,050 m south from Pet Mogili village, and 3,700 south-west from Novoselets village. The sites to the south and west of the proposed location are used as dumps for the Troyanovo mines, and the Northern Dumpsites are to the west. A railway track serving the Maritsa East thermal power plant lies to the north from the site.

The expected quantities of collected waste mean that the NWTC should be constructed in stages. The gradual introduction of facilities will optimize the investment required for the construction of the National Hazardous Waste Center.

The EIA statement is concerned with the construction and operation of the facilities from the first stage of the NWTC. Stage I is divided into two sub-stages, 1-A and 1-B, planned for the years 2004 and 2007 and the following treatment facilities and capacities are envisioned:

Treatment Method	Design Quantities (tons/year)
Stage 1-A	
Hazardous Waste Landfill at the NWTC	150,000
Asbestos-containing waste landfill (on the NWTC site)	250
Solidification	5,000
Incinerator	15,000
Physico-chemical treatment	1,000
Recycling (mercury)	200
Stage 1-B	
NWTC landfill (full capacity)	150,000

2.1 GENERAL PROCEDURES AT THE NWTC

Benchmark samples – The receiving of certain waste in the Center must be preceded by submission of one sample to its laboratory for analysis. The benchmark sample should be representative for the entire batch of waste intended for delivery.

Collection of waste – No waste of uncertain origin and properties, without container identification or with improperly filled registration forms will be admitted into the NWTC. All received waste must be properly packaged and accompanied by a registration form signed by the waste generator. The registration form must comply with the Bulgarian rules and must describe the nature of the waste, its physical and chemical properties and the quantity.

Receiving, sampling and analysis – The benchmark sample analysis results will be used as the basis for unloading the waste into the inorganic-waste storage zone, in the organic waste storage zone, or in the reception area for the landfill.

Storage – There are various storage locations in the NWTC:

- Organic waste storage
- Inorganic waste storage
- Special waste storage

Information about the location of every batch of waste is entered on the computer.

Organic waste storage tanks

Liquid organic waste will be pumped into a receiving tank. The liquid wastes from the pre-treatment stage are also sent into this tank. Depending on the composition of waste, the storage area staff will prepare mixtures suitable for use in the incinerator. The main criteria are calorific value and halogen content.

Preliminary treatment – The pre-treatment facilities will be used for operations such as:

- separation of the waste for incineration into smaller quantities meeting the charging requirements for the incinerator (weight, energy or chemical composition),
- transferring of the liquid waste into the storage area etc.

2.2 DESCRIPTION OF THE NWTC

Administrative Building

The administrative building contains the offices and rooms required for the management of the NWTC. The administrative building includes the laboratory, premises for the staff, a canteen with a kitchen, bathrooms and sanitary facilities.

Checkpoint – Its purpose is to allow control and registration at the entry of the center. Waste delivery vehicles without the proper registration forms will not be admitted to the Center. A platform scale will be installed in front of the check-point for weighing of the incoming waste.

Laboratory – Serves the NWTC and will be equipped to allow all the necessary analyses.

- analysis of the incoming hazardous waste;
- analyses required for selection of the optimal disposal methods;
- analyses required for the operation of the waste disposal plants;
- analyses required for control and management of the environmental impacts of the Center.

Repair Shop

The repair shop building will include a general mechanical and electrical equipment maintenance shop.

Quarantine Area/Area for Unloading of Waste in Drums

All waste in drums and in other smaller containers will be stored temporarily into the quarantine area, during the time needed for analysis of a sample and for a decision to be made by the waste assessment specialist about the proper treatment and disposal method.

Inorganic Waste Storage Area

Liquid waste – It is assumed that liquid inorganic waste will be delivered in drums or in bulk. The liquid waste delivered in tank trucks will be unloaded in the tanks in the storage area.

The inorganic liquid waste and sludge tanks will be located in an area surrounded by a containment bund on the site of the physico-chemical treatment plant in order to prevent pollution during accidental spills.

Solid Inorganic Waste. After being tested, the solid inorganic waste unloaded in the receiving area will be transferred into the storage area. The location of the waste will be noted.

The storage area will be located on a chemically resistant concrete floor and will be covered for protection from precipitation. The area will be surrounded by a bund to prevent spilling of waste.

The storage capacity must allow for storage of waste collected over 3 weeks at the least.

Organic Waste Storage Area

Liquid Waste – The liquid waste delivered in drums will be analyzed prior to their placing into the relevant storage area tanks.

Solid Waste – The solid organic waste storage areas have the same structure and general layout as that of the solid inorganic waste storage areas.

The solid organic waste storage facilities will be equipped with a system of fire-extinguishing sprinklers.

Temporary Storage

Waste in quantities in excess of the storage capacity will be kept in a temporary storage area.

Solidification

Solidification is a method for mixing of cement, fly ash from the incinerator and waste filter cake from the physico-chemical treatment to form a virtually insoluble mass. The advantages of this method are in the use of simple equipment and the very inexpensive and flexible operation. This method allows for a high degree of inertness of the waste.

The solidification process is based on the chemistry of silicates. The amorphous silicates formed during the treatment of waste will, in time, become silicates with crystal structure, which will create inertness and minimize the leaching potential.

Hazardous Waste Landfill

The landfill will be designed in compliance with Regulation 13/06.11.1998 and Directive 1999/31/EC setting forth the hazardous waste disposal requirements.

A **bottom-laid insulation layer** is envisioned for protection of the geological base, the soil and water against pollution and collection of leachates and will consist of:

- a mineral layer, 0.75 m deep, with a filtration rate of 10^{-10} m/s (permeability of less than 10^{-10}m/s)
- a containing layer with a drain system for leachates
- insulating geoweb membrane made of high-density polyethylene (HDPE), 2 mm thick
- protected area drainage layer 0.5 m deep, of washed gravel ballast with a filtration rate of K ≥ lxl0-^{3} (permeability higher than 10 m/s) A network of drainage pipes will be installed in this layer. The minimum diameter is 300 mm, two thirds of their surface is perforated or cut.(300 mm) to take the leachates away from the landfill.

After each individual cell is filled, it will be capped by means of an upper insulation layer consisting of:

- a mineral capping layer 0.75 m thick, with a permeability of less than 5 x 10 m/sec
- insulating geoweb membrane made of high-density polyethylene (HDPE), 2 mm thick flexible with coarse surface. 2 mm
- Protective and drainage layer 0.5 m thick (permeability higher than 10^{-3} m/s) with drainage pipes. The protective area drainage layer must be made of washed gravel ballast.
- Upper reclamation layer, 1 m thick, for planting of low-stem vegetation

Leachate treatment – The drainage pipes will transfer the leachate into a leachate collection tank. The collected water will be pumped into a collection tank and will be analyzed prior to being lead into a technological water tank or into the polluted water tank from where it will be incinerated into the incineration plant.

The water drained from the inoperative part of the landfill will not be polluted and will be pumped into the technological water tank.

Physico-chemical treatment plant (PCT)

The physico-chemical treatment plant will neutralize inorganic hazardous waste, including:

- cyanides
- chromium waste
- waste acids
- waste alkalis
- heavy-metal containing waste

The main methods used will be:

- Cyanide oxidation
- Chromium reduction with subsequent settling
- Settling of heavy metals
- Neutralization of acids and alkalis

The design capacity of the PCT plant is 1 000 t/year for one-shift operation, eight hours daily.

Reagent Storage Tanks

These tanks will be equipped with stirrers, various fixtures and safety valves. They will be placed in a fenced area together with the inorganic waste storage tanks.

Incinerator

The incinerator consists of:

- *A charging system*
- *Rotary kiln*
- *Secondary incineration chamber*
- *Damping chamber*
- *Heat utilizing system*
- *Flue gas precipitator*
- *Automated incinerator process control and management system*

Charging system – designed for maximum flexibility ensuring constant charging of waste. Equipment is envisioned for charging of the following:

- bulk solid waste fed using a crane and a hopper
- solid substances by means of a bucket elevator and a feeding screw
- drums by means of a sluice
- liquid waste by means of injection systems
- pumpable sludges by means of injection systems

The charging system will ensure the feeding into the rotary kiln of organic waste, including:

- used oils/emulsions

- organic solvents
- paint and lacquer sludge
- plastics and synthetic material
- halogenated waste
- pesticides

Rotary kiln – the rotary kiln is the main part of the plant. The kiln is designed for burning 2.14 tons of waste per hour in normal operation, with a capacity of the incinerator amounting to 15 000 tons of waste/hour. The incinerator will operate on a special schedule designed to optimize the incineration and to minimize the emitting of pollutants in the atmosphere.

Secondary incineration chamber - the secondary incineration chamber allows for a staying time of 2 sec at a temperature of 1100°C - 1200°C allowing for a complete disintegration of the compounds. The secondary incineration chamber is constructed and equipped to allow extraction of the incineration residues in the form of melted slag. The slag removed from the rotary kiln will collect below the exit of the kiln and will be directed toward the slag chute.

Damping chamber – it will be located after the secondary incineration chamber and will not be used in normal operation.

Waste heat boiler – the flue gas from the secondary incineration chamber is directed toward the waste heat boiler.

Combustion air supply – the combustion air required for the incineration of waste is supplied along two flows. The first air flow fed through the solid waste charging chute is also used for the incineration of solid and paste waste.. The second air flow is introduced as burner air through the liquid waste burners in the rotary kiln and in the secondary incineration chamber.

Steam air heater – provisions are made for heating of the combustion air to the required degree to ensure good combustion even of low calorific value waste.

Slag removal system – placed below the secondary incineration chamber it consists of a water bath and a system for lifting and squeezing of the slag prior its loading into the transportation container. The boiler ash is landfilled with the slag.

Flue gas precipitator – it will secure average daily values defined as 24-hour average values for harmful substances emitted with the residual gasses into the atmosphere below the regulated emission levels set out in the Bulgarian legislation, namely Decree No.53/ 19.03.1999 and Directive 2000/76 of the EU.

The system will consist of the following units:

- Absorber with equipment for preparation of lime putty. Slaked lime will be used as an absorbent. Its purpose is to remove mainly hydrochloric acid (HCl) and sulfur dioxide (SO_2) from the flue gas.
- *Bag filter, including activated carbon metering* – for removal of lime, salts and fly ash from the flue gas and guarantees compliance with the Bulgarian and EU standards for dust content in gasses.
- *Electrostatic precipitator* – for removal of sulfur dioxide (SO_2) from the flue gas. Sodium hydroxide is used to control the pH of the water in the electrostatic precipitator. The treated flue gas is emitted into the atmosphere and is subject to constant automated quality control.
- *Forced draft fan* – equipped with a silencer
- *Smoke stack* – the smoke stack is 35 m high

Automated combustion control system – the incinerator systems, the secondary combustion chamber and the flue gas precipitator are operated by an automatic control and management system. In the event of system malfunction an emergency is signaled and this is followed by automatic shutting down of the flue exhaust system.

Asbestos Landfill

Asbestos waste that do not contain hazardous pollutants other than asbestos will be disposed of in the asbestos landfill. There the waste will be unloaded and immediately covered with soil to prevent the migration of asbestos fibers into the environment. Not unlike the hazardous waste landfill, this landfill will also be constructed in accordance with the regulations.

3 POSSIBLE WAYS TO ACHIEVE THE OBJECTIVES OF THE PROJECT

The activities at the NWTC will be conducted in compliance with the Bulgarian and EU legislation.

Analysis of alternative site locations

Site selection is very important for such a project of national significance. There are two possibilities in setting the location of the NWTC:

- Building the NWTC on natural, agricultural or virgin land will have substantial impact on the environment on the site.
- Building the NWTC on land severely changed by human activities (mines, for example) could have a positive effect resulting from vertical planning measures, infrastructural changes etc.

After the preliminary selection of several possible sites in the year of 2000, the Ministry of Environment and Water selected five potential NWTC construction sites. Following a similar study and analysis of the potential sites, comparison of locations and conducting a public campaign with public hearings, the Ministry of Environment and Water decided on January 03, 2001 that a project should be developed and that environmental impact assessment should be made for the Gledachevo and Beglezh sites. The analysis was conducted using criteria such as: geographic location, available infrastructure, transport connections, geological base etc. The submission and evaluation of the preliminary environmental impact assessment report, the public campaign with public hearings of the report held on May 22 and 23, 2001, the reading of the preliminary report by the Supreme Council of Experts of the Ministry of Environment and Water and other competent authorities lead to the decision that the NWTC should be constructed on the Gledachevo site. An engineering design and a Final EIA statement were developed and reviewed by the Supreme Council of Experts, and received a positive EIA decision. For this reason only the Gledachevo site is reviewed in this report.

No-action analysis

If the NWTC is not constructed, there will be no positive change of the situation as regards generation and storage of hazardous waste in the Republic of Bulgaria. There will be no suitable alternatives for treatment of the generated hazardous waste.

We believe that the no-action alternative should be rejected, i.e. a National Waste Treatment Center must be constructed in all cases.

Analysis of alternative solutions of hazardous waste treatment in the NWTC

The analysis and assessment of the investment proposal involved many studies and reviewing of a number of documents and papers related to environment protection in general and the hazardous waste treatment methods, technologies and practices used in Europe and throughout the world in particular.

Special attention was paid to alternative methods related to waste incineration. Methods allowing implementation on an industrial scale were reviewed. Techniques such as the following were reviewed:

Plasma Techniques for Waste Incineration

The following possible alternative technologies and techniques for plasma treatment of hazardous waste were reviewed:

- Argon plasma arc
- Carbon dioxide plasma arc (CO_2)
- Microwave plasma
- Inductive radiofrequency plasma
- Alternating current plasma

In comparison to incineration, the main overall disadvantages of plasma methods for waste incineration are: High energy requirement, insufficient emission and efficiency data, no possibility to compare to the construction of incineration facilities.

Waste Gasification

The analyses and comparisons for the main pollutants have shown the following:

- As compared to incinerators, gasifier chambers emit approximately 28% more nitric oxides.
- Gasifiers emit 83% more furans and dioxins than incinerators
- Mercury emissions in air are the same for both gasifiers and incinerators.

4 DESCRIPTION AND ANALYSIS OF ENVIRONMENTAL MEDIA AND FACTORS AND OF THE MATERIAL AND CULTURAL HERITAGE THAT WILL BE AFFECTED IN RESULT OF THE IMPLEMENTATION OF THE INVESTMENT PROPOSAL, AND THEIR INTERACTION

4.1 ATMOSPHERIC AIR

4.1.1. Characteristics of Media and Factors of the Environment in which the Investment Proposal will be Implemented and Prediction of the Impact

According to the investment proposal, the NWTC site will be located in Stara Zagora area, in the Maritsa East mining and thermal energy complex.

The following statements and conclusions concerning the atmospheric air quality in the region are possible:

- exceeding the allowable average annual concentration of SO_2 at the following locations:
  - Polski Gradets – 2,2 times

- Mednikarovo – 1,2 times
- Galabovo – 1,8 times

The atmospheric air quality assessment for the region is based on 2002 data, and the allowable average annual concentration of SO_2 aimed at protecting natural ecosystems became effective on 01.01.04.

The atmospheric air quality in the NWTC site does not meet the requirements of Regulation No 9 dated May 3, 1999 on the Standards for Sulfur Dioxide, Nitric Dioxide, Fine Dust Particulates and Lead in the Atmospheric Air.

- Exceeding the allowable average annual concentration for fine particulates 10 by 1.5 times at the Stara Zagora RIEW. The high fine particle 10 levels measured as average annual concentrations in the Stara Zagora RIEW are probably caused by the specific conditions of the town environment and do not apply to the NWTC site because of the remoteness of the latter.
- Exceeding of the maximum one-time allowable concentrations of SO_2 is observed in Polski Gradets, but the percentage of samples exceeding the limit is very low. The low percentage of high SO_2 levels measured as maximum one-time allowable concentrations in Polski Gradets leads to the assumption that these high levels are caused by various weather factors, the most likely being: temperature inversions, fog, strong winds etc.
- Exceeding of the maximum one-time allowable concentrations of H_2S is observed in Stara Zagora – Kazanski and Stara Zagora – RIEW, but the percentage of exceeding samples is very low. The high levels of H_2S measured as maximum one-time concentrations in Stara Zagora – RIEW and Kazanski are likely to be caused by the specific conditions in the town in synergy with unfavorable weather.

The atmospheric air quality in the NWTC site meets the requirements of Regulation No 14 dated September 23, 1997 on the Standards for Admissible Concentrations or Harmful Substances in the Atmospheric Air in Urban Centers.

In view of the specifics of the Maritsa East area – Bulgaria's largest coal mining and thermal energy complex (Thermal Power Plant 1, Thermal Power Plant 2 and Thermal Power Plant 3 in Maritsa East) – and the three constantly operating National Environmental Monitoring System points (Polski Gradets, Mednikarovo and Galabovo), the condition of the atmospheric air in the region and around Thermal Power Plant Maritsa East 2 is monitored at two other points, ECO 1 and ECO 2, along 1000-2000 m segments, using differential optic-absorption systems.

The results from the SO_2, NO_2, phenol, O_3 and dust measurements made in the two monitoring stations during the fourth quarter of 2003 allow the following conclusions:

During the IVth quarter, which is the winter season, the average monthly concentrations of SO_2 at ECO1 are within the norm. It has been noted that the average hour concentrations for this period show irregular excessive SO_2 levels. The highest average hourly concentration in October 07, at 12:00 is 1.28 times higher. The average hourly concentrations in November have been exceeded on the 16th at 12:00 by a factor of 1.8. The average hourly concentration has not been overtopped in December. The dates with excessive values at the ECO2 station in October are: 01.10. at 11:00, 1.77 times higher, 02.10 at 13:00 until 18:00 with a highest factor of 2.38 at 17:00, 03.10. at 17:00 and 18:00, values of 1.68 and, respectively, 2.01 times higher, 07.10. at 12:00 and 13:00 with factors of 1.22 and 1.09, at 10:00 with a factor of 1.59, and on 31.10. at 13:00 by a factor of 1.10. On November 12, at 14:00 by a factor of 1.8, on November 13 at 13:00, 16:00 and 17:00 – 1.39, 1.32. and 1.33, respectively, on 14.11. at 13:00 by a factor of 1.09 and at 16:00. In December higher values have been measured only on 20. 12. at 16:00 by a factor of 1.35. The

average monthly concentrations and the average hourly concentrations of NO_2 have not been exceeded at both stations.

Concerning all other parameters, the allowable average daily and hourly concentrations have not been exceeded for one day.

4.1.2. Main sources of dust and gas pollutants in the region

The main sources of dust and gas emissions and atmospheric air pollutants in this region are Thermal Power Plant-1, Thermal Power Plant-2 and Thermal Power Plant-3 located closely to the NWTC. The dust and gas emissions from Thermal Power Plant 1, Thermal Power Plant 2 and Thermal Power Plant 3 are as follows:

Pollutants	**TPP1**	**TPP 2**	**TPP 3**
SO_2 t/y	60139,1	484286	156938,4
NOx t/y	1722,165	13492,14	4395,361
NMVOC t/y	14,3514	112,8331	50,7155
CH_4 t/y	4,3514	2,8331	0,7155
CO t/y	11,4812	94,5693	404,0161
CO_2 t/y	1082504	7379316	3534738
N_2O t/y	287,0274	2240,95	1005,576
Cd t/y	0,0039	0,0382	0,025
Hg t/y	0,042	0,3299	0,5071
Pb t/y	0,0374	0,3021	0,3076
PAH t/y	0,0547	0,3512	0,1641
PCB's kg/y	3,0753	19,4329	9,0436
DIOX g/y	7,4661	47,3279	21,9545

Forecasted annual quantities of dust and gas pollutants emitted from the NWTC

Pollutants	**Unit**	**Quantity**
SO_2	t/y	14,66424
Total hydrocarbons	t/y	2,932848
HCl	t/y	2,932848
HF	t/y	0,2932848
Dust	t/y	2,932848
Hg	kg/y	14,66424
Cd, Tl	kg/y	14,66424
Other heavy metals	kg/y	146,6424
DIOX	g/y	0,02932848

4.2 SURFACE AND GROUND WATER

4.2.1. Hydrogeological and hydrological conditions and factors

The Gledachevo site belongs to the northern periphery of the Maritsa East coal basin, a hydrogeological part of the southern Bulgarian artesian basin in the intermediary hydrogeological area.

The hydrogeological characteristics of the region are ground water accumulated in the underlying rock, deposits from the upper Eocene and from the Myocene, and sediments from the Quaternary.

The rock base and the tectonic fault lines that have formed its block structure contain fracture and karst-fracture water. These are fed by precipitation and by surface water within the reach of the rock outcrops where the ground water is confined. The water below the Middle Eocene and Myocene deposits acquires different head levels between 20-50 and 100-400 m.

The ground water in the Upper Eocene is limited and with a high hydrostatic head level of 140 to 240-360 t. The rocks have changing filtration capacity with relative flow rates between 0.02 and 0.03 l/s.m.

Ground water in the Myocene is contained in sand layers and stratifications among dust and sand powder clay. The coal basin contour features well differentiated sub-coal and above-coal aquifers and a common aquifer exists outside it.

Subterranean streams have formed in the alluvial sand and gravel Quaternary deposits along the floodplains of Ovcharitsa, Sazliika, Sokolitsa and other rivers.

They are unconfined and with bilateral hydraulic connection to surface water. Their filtration properties are comparatively high. The filtration ratio varies between 15 and 145 m/d.

Hydrological conditions

The studied region is located between the villages Kovachevo, Pet Mogili and Novoseltsi. It is within the transitional continental climate sub-area. The climate is made milder by frequent inflows of warm Mediterranean air masses along the valleys of Maritsa and Tundzha rivers. The air temperature in January is around 0°C. The hottest weather is during July and August when the dry winds causing high rates of evaporation occur. The average annual precipitation reaches 500 mm, with a main minimum in February and August. The snow cover is non-persistent and lasts approximately 10-15 days.

The surface runoff from the built-up area of the Center will be collected and depending on their properties will be reused for various technological purposes.

The surface water falling onto the capped and closed cells and sections of the landfill will flow onto the adjacent areas.

4.2.2 Characteristics of water resources and receiving waters

Surface water

The nearest recipient of the treated household waste water generated from the operation of the NWTC is the corrected Ovcharitsa river located approximately 1.8 m north from the site. Ovcharitsa river is second category receiving water.

The river is corrected between Kovachevo village and its confluence with Sazlika river upstream of Galabovo village.

The water from its tributaries flow outward from the mining areas and is directed by means of facilities to the water reservoirs Kovachevo, Pet Mogili and Bogdanovo. These water reservoirs are hydraulically connected. Until 1990, the Pet Mogili water reservoir discharged directly into Sazlika river downstream of Beli Briag village.

The Kovachevo water reservoir is category two surface receiving water.

The Pet Mogili water reservoir is category two surface receiving water.

Following the construction of Ovcharitsa water reservoir in 1966, Ovcharitsa river has been used to drain the mining water and part of the surface water forming in the area.

The hydrological regime of the rivers in the area forms in a continental climate area, and the southern disposition and the warm and humid air reaching from the Mediterranean melt the winter snow quickly.

The rivers lose much water in the summer through infiltration and evaporation.

Ovcharitsa river exhibits low levels of organic pollution and of ammonia nitrogen and nitric nitrogen.

The high sulfate levels in the surface water on the site is caused by the transition of water through clay substrate in the coal-mines where the sulfur content is high.

4.2.3. Characterization of water sources and use of water from the site

Water supply and sewerage for the National Hazardous Waste Center (NWTC)

The water supply of the NWTC will be provided through the use of three main water sources:

- Drinking water supply from a drinking water main line near Pet Mogili village;
- Production water supply from collected surface runoff, leachates and waste water from various processes;
- Water supply from the facility's own water source, a borehole, required as an additional source of water for the Center.

Water from the drinking water mains

Drinking water supply is envisioned both for drinking purposes and as an addition to the steam and warm water generation system.

Drinking water can be supplied via a pipeline branching from the 530 mm steel pipe running 2.2 km north from the site, near Pet Mogili village. The free head at the water abstraction point is 20 m. The water quality in this point meets the requirements of the Bulgarian State Standard 2-23/1983, 'Drinking Water'.

A closed water cycle is envisioned for the steam and warm water generation system. The additional water will be used to compensate for losses in the system.

A drinking water supply reservoir will be constructed for the needs of the Center and will be equipped with a pumped hydrophore system.

The fire extinguishing water in adequate quantities and 6 bar pressure can be provided in the Center by means of an on-site fire-extinguishing tank with the necessary volume and a pump and hydrophore system.

There are no sewerage networks and collectors near the NWTC site.

The sewerage in the Center will be divided for the different waste water flows.

A pipeline should be constructed to lead the effluent from the household waste water treatment plant to the receiving water body, Ovcharitsa river.

Production and technical water

The main philosophy of water resource management in the Center is that the waste water should be used in the technological processes.

In keeping with the investment proposal the following sources of production water are envisioned:

- Collected surface runoff including from the surfaced areas on the site, surface runoff from roofs and sheds, surface runoff from the landfill
- Leachate from the landfill
- Water entering the physico-chemical treatment plant with the waste
- Water from a local water source, a borehole

Most of the production water will be provided from the surface runoff collected on the site. This water is formed by:

Surface runoff from the surfaced areas

The precipitation water from the surfaced areas will be collected in a buffer tank doubling as a fire extinguishing water tank. Following analysis by the automated analytical control system and satisfying the quality requirements, the water will be sent to a process water tank.

The water that fails to meet the quality requirements will be fed into the polluted water tank and will be re-circulated in the secondary combustion chamber.

Surface runoff from roofs and sheds

This water will be collected by a separate system into a tank from which it will be pumped into a precipitation water tank. The precipitation water tank will be used in the operation of the

electrostatic precipitator, for topping of the process water tank, for topping of the fire extinguishing water tank and for other purposes.

Surface runoff from the landfill

This water will be collected by a separate sewerage system into the precipitation water tank.

The surface runoff from the landfill will be used in various processes in the Center.

Leachate from the landfill

The leachate from the landfill will be collected by a system of pipes and following analysis by the automatic control system will be fed into the process water tank for re-use of into the polluted water tank.

Water entering the physico-chemical treatment plant with the waste

This is expected to be polluted water entering the physico-chemical treatment plant with the waste.

Water from a local water source, a borehole

A local water source, a borehole, is envisioned for additional water supply as needed. The water from this source will be needed to top the precipitation water tank, when necessary. No use of precipitation water from the borehole is envisioned if the precipitation tank is filled on a regular basis.

4.3 BOWELS OF THE EARTH

The immediate geological environment down the studied depth of 18.7 m at Gledachevo site, envisioned for the construction of the National Waste Treatment Center (NWTC), is made up mainly by shallow clay layers that include three small clayey-sand lenses of limited distribution by area. These sediments are underlied by clayey-sand materials with shallow coal benches comprising the top, the coal bearing and the nether-coal layers of the East Maritsa basin, and a cracked rock base.

The sandy lenses established in the interval of 9,0-13,25 m contain low-pressure water that is highly mineralized because of the high concentration of sulfates produced by gypsum present in the clay layers. This ground water resource is negligible and is not of interest for water supply.

A more substantial resource of head ground water is contained at a significant depth below the water impermeable clay materials of the top and coal bearing horizon, in the sandy layers of the nether coal layer and in the rock base.

4.4 LANDS AND SOILS

Three main genetic soil types have formed on, and have been influenced by, the main geological base described above in the Eastern Maritsa coal basin under the influence of the main soil formation factors – climate, terrain, vegetation and human activity: smolnitzes in plain areas; cinnamon forest soils in hilly areas and alluvial (diluvial) meadow soils in lowlands and river

floodplains. Cinnamon-podzolic (pseudopodzolic) soils occur in the hilly parts of the area. Typical, of the soils in the region is their relatively high fertility.

Very few of the natural soils have remained in the landfill construction site. The most significant distribution is that of smolnitzes covering approximately 50% of the soil resources in the region, with leached soils prevailing, but carbonaceous and typical soils occur also. If not removed prior to the backfilling of the United northern spoil heap sites and the Mogilata spoil heap site, soils of this soil type will be affected during the construction of the waste center.

The spoil heaps are denser in depth. The data allows us the assumption of higher relative density as well. The data of substrate fertility studies show that all soils are alkaline to very alkaline with minimal levels of organic substances and of the main nutrients nitrogen and phosphorous, and with high potash reserves. These soils are not polluted with heavy metals. With reference to the chemical pollution stability of the soils, their relatively good buffering capacity is due to their high clay and silt content.

4.5 PLANT AND ANIMAL WORLD, PROTECTED NATURE AREAS

4.5.1. Plant world

Characteristics of the condition and prediction and assessment of the impact on vegetation

From geobotanical perspective the Gledachevo site belongs to the *European deciduous forest area* (Lavrenko, 1968 etc.), *Macedonian-Thracian province, Sakar-Dervent district* (Geography of Bulgaria, 2002). It includes Sakar with the adjacent part of Marichina lowlands and the Dervent heights, as well as the southernmost part of the Middle Tundzha plains. The *Sakar region* is characterized by:

- agricultural lands;
- residual mixed cerris oak (*Q.cerris L.*), Quercus frainetto, and pubescent oak (*Q.pubescens.Willd.*);

pubescent oak forests occasionally mixed with Oriental hornbeam (*C.orientalis Mill.*). The degraded forests have been replaced by:

- secondary forests of oriental hornbeam;
- frequently, Christ's thorn (*Ap.aculeatus.Lam.*);
- grass xerothermal ecosystems dominated by beard grass, poa bulbosa etc.

The composition of flora has changed over time. Based on information from Bulgaria's Red Data Book from 1981, the endangered species in this geographic region are categorized as endangered (2 species) and rare (12).

The studies and site visit have not shown any protected plant species present on the NWTC site. The changes in agricultural production are caused by the current socio-economic factors and conditions and not by the future operation of the landfill.

4.5.2 The animal world

Characterization of the condition, prediction and evaluation of the impact on the fauna

From zoogeographical perspective, the site belongs to the southern region, the Thracian region (Geography of Bulgaria, 2002). Tundzha and Maritsa river valleys are natural entryways for the

Mediterranean fauna from the south, and the endemic species (certain centipedes and grasshoppers as representatives of the terrestrial fauna; and 3 Balkan and 6 Bulgarian endemic species as representatives of the underground fauna) are concentrated predominantly in the Eastern Rhodopes. The typical underground fauna resembles only that of the Rhodopides to some extent.

The ten kilometer zone approved with a letter from Radnevo Municipality includes the following water reservoirs: Beliat Kamak (town of Radnevo), Kunchev Vir (town of Radnevo), Gipsovo, village of Polski Gradets (property 23-29), village of Kovachevo, Ovcharitsa, village of Matsa, village of Gledachevo (property No. 9).

The animal species quoted above do not exhaust the diversity of species observed in the area.

Profirov, Yankov, Kutsarov, 1997 have established that up to 45 799 waterfowl of approximately 29 species congregate around Ovcharitsa water reservoir which does not freeze during the winter (and which has been awarded a CORINE site status and issued a protected area designation proposal). This water reservoir is one of the globally important areas for cormorants (*Phalacrocorax carbo, L. Phalacrocorax crispus*)., and white-fronted geese (*Ans.albifrons*) which winter there in large numbers. One wintering species (although rarely seen) is also the red-breasted goose (*Br.ruficolis*).

By geographic distribution, the fresh water fish fauna (Bulgaria's Atlas, 1973) belongs to the Northern Aegean section, which is the area of carp. This line (marked by the urban centers of Yambol, Nova Zagora, Harmanli and Kardzhali) lies close to the northernmost distribution boundary of the Balkan grass snake (Ophisaurus apodus Pall). The Mongolian pheasant (*Phasianus colchicus*) occurs along the Tundzha river (on a line between Yambol and the border between Bulgaria and Greece). Maritsa and Tundzha rivers toward Yambol and Burgas are migration routes for waterfowl (*Anseres*) and shore birds (*Limicolae*). Also, white storks use this route during the fall migration and congregate mainly around Tundzha river (below the town of Yambol and as far as the border between Bulgaria and Greece).

The composition of the fauna has changed over time. According to Bulgaria's Red Data Book, vol.2, 1985, 2 rare and 22 endangered species are registered in this geographic area.

The activities on the site are expected to impact the existing populations (as has been the case so far, although of limited impact).

The studies and site visit have not shown any protected animal species present on the NWTC site.

4.5.3 Protected areas

Characterization of the condition, prediction and evaluation of the impact on the protected areas

According to Geography of Bulgaria, 2000, (including the MOEW reference, 2004) there are certain geographically close (more than 10 km) sites such as 1 reserve, 1 nature park, 3 protected areas and 1 natural landmark.

Yankov, Profirov, Kutsarov, 1997 (BSPB, 1997) describe Ovcharitsa water reservoir (630 ha) as part of a CORINE site for which a proposal for designation as protected area exists. This site is a water reservoir along Ovcharitsa river, east of Radnevo village, that does not freeze in winter.

Of the total of 57 species established there 17 are included in "Bulgaria's Red Data Book" and 26 are of European significance for conservation (Tucker, Heath, 1994: SPEC 1-2 species, SPEC2-2 species, SPEC 3-11 species, SPEC4 - 8 species). This water reservoir is one of the globally important bird areas for *Phalacrocorax carbo*, *Pelecanus crispus*, *Anser albifroms*, and, rarely, for *Brantha ruficolis* as a wintering site.

The water reservoirs are protected from the operations in the hazardous waste landfill by means of technological and technical solutions, geographic features such as hills and gorges, and by the distance from the site of interest for investment.

4.6. Landscape

The operations in the Eastern Maritsa coal basin have not caused lasting changes to the structure and functioning of the landscapes in the area. The changes are dynamic and still under way and the landscapes will continue to be impacted during the operation of the site. The changes are twofold – anthropogenic degradation, and reclamation. Still, the number of landscapes that are affected by anthropogenic activities exceeds the number of improved and reclaimed landscapes.

4.7 CULTURAL HERITAGE

Initially the condition of the cultural heritage in the region is characterized briefly using the available archives. The monuments of culture are classified by type and by their significance for our national culture and history. The lists of monuments of culture in the region, presented by urban center, are used. The region where the NWTC will be constructed includes 18 registered monuments of culture, all of which are archaeological and most of which are of national significance. These monuments are marked in three separate annexes.

4.8 HARMFUL PHYSICAL FACTORS – NOISE

No background noise measurements data exist for the site. The site is located to the north-east from Troyanovo North mine. A railway line runs immediately close to the site and had been constructed to serve the open cast mines. The noise factors on the site are mainly the natural background noise, periodic noise from the mine (explosions), and trains passing by.

4.9 WASTE

Presently, the site is agricultural land, not polluted by waste, but an area of swamp and ponds of the Maritsa East mine take place near-by.

5 DESCRIPTION, ANALYSIS AND ASSESSMENT OF THE ASSUMED SIGNIFICANT IMPACTS ON THE POPULATION AND ON THE ENVIRONMENT CREATED BY THE IMPLEMENTATION OF THE INVESTMENT PROPOSAL, THE USE OF NATURAL RESOURCES AND BY HARMFUL SUBSTANCES EMITTED DURING NORMAL OPERATION AND EMERGENCIES, BY GENERATED WASTE AND BY DISTURBANCE

5.1 AIR

5.1.1. Possible dust and gas pollutants (emissions) from the operation of the NWTC's various processes

Based on the purpose of the NWTC, the quantities and types of waste to be treated there, the following emissions can be expected: SO2, SO3, SO_X, NO, NO_2, NO_X, NH_3, CH_4, C_nH_m, HMJIOC, CO, CO_2, total dust, PM_{10}, $PM_{2.5}$, HC1 and Cl, HF, , H_2S, HCN, COS, CS_2, persistent organic pollutants such as DIOX, PCB, PAH, HCB (dioxins and furans, polychlorinated byphenils, polyaromatic hydrocarbons and hexachlor benzene, greenhouse gasses (CO_2, O3, CH4, NO_X), N_2O, HFCs, PFCs, SF6, methylmercaptans, vynilchlorides, xylene, styrene, toluene, phenol, benzene, formaldehyde, Hg, Cd and Tl, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Sn. These emissions are possible and their type and quantity will depend on the type and composition of the treated hazardous waste

The assessment of the possible dust and gas emissions generated from the site has been made for the various hazardous waste treatment stages and is presented on the following diagram.

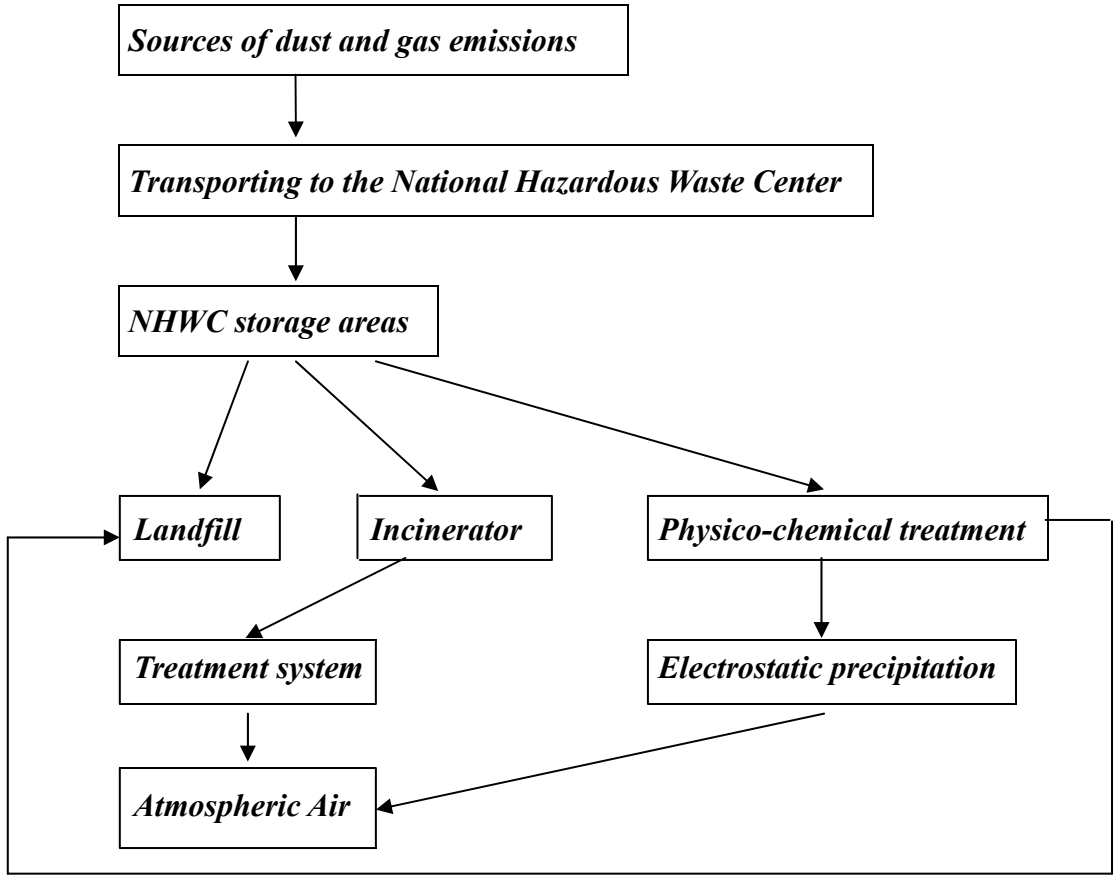


Diagram of possible sources of dust and gas emissions from the NWTC

Dust and gas pollutants generated during the transportation of the hazardous waste to the NWTC.

The mathematical modeling and simulation of air pollution during transportation of waste in the region shows that the maximum concentrations that may exist at normal load (23 heavy duty trucks per day) are many times lower and do not threaten air quality around the site.

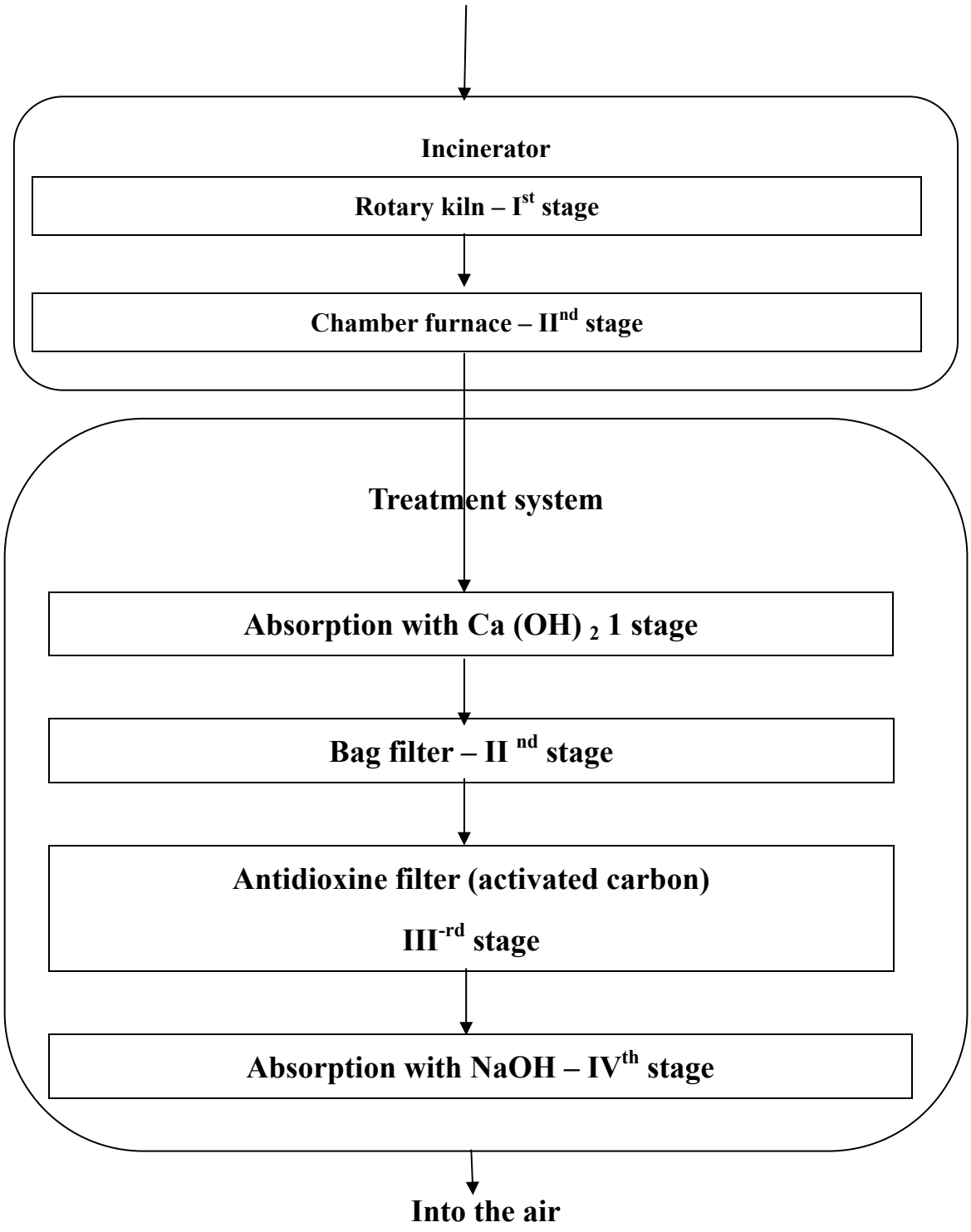
Dust and gas pollutants generated during the hazardous waste storage areas of the NWTC.

No dust and gas emissions are expected from the untreated waste storage areas, nor from the receiving facilities, tank farms, hoppers etc.

Dust and gas pollutants generated by the physico-chemical treatment of the hazardous waste.

All process units are supplied with a double system of fans, filters and cyclone filters, and with a common electrostatic precipitator for absorption treatment of the waste gases prior to their emitting into the air.

Dust and gas pollutants generated by the thermal treatment (incineration) of the hazardous waste.



Thermal treatment diagram (Incinerator)

The emissions from the incinerator stack are the only potential source of atmospheric air pollution. The flue gas concentration levels comply with the Bulgarian standards and with the standards established through the EU Hazardous Waste Incineration Directive. This is due to the following:

the proposed design includes a proven two-stage incineration system:

I stage - rotary kiln, 850°C

II stage - secondary incineration chamber, 1100 - 1300°C

- it treats (incinerates) hazardous waste that cannot be neutralized through the use of the chemical and physico-chemical treatment methods envisioned for the NWTC, and such wastes are mainly organic compounds – oils, emulsions, solvents, paints, varnishes, plastics, synthetic materials, pesticides etc.
- the incineration in the two furnaces will generate waste gasses that will be passed through a four-stage treatment system:

I stage – treatment absorber (slaked lime absorption of gas and dust pollutants (absorption, hemisorption)

II stage – solid particle bag filter (dry filtering)

III stage – antydioxine filter using activated carbon to trap dioxins, furans and mercury (adsorption)

IV stage - electrostatic precipitator for scrubbing of gas pollutants through the use of sodium hydroxide (absorption, hemisorption, chemical reactions)

This four-stage gas treatment system guarantees that the waste gasses emitted from the incinerator stack will not contain any dust and gas pollutants that will cause undesired environmental and human health related problems.

- no waste water will be emitted from the incinerator
- solid waste from the incinerator will be emitted as slag and ash that will be disposed of in the specialized NWTC landfill and, therefore, no hazardous incineration waste will be generated outside the NWTC
- the general conclusion about the hazardous waste from the incinerator is that no solid, liquid or gaseous pollutants will be emitted into the environment

5.1.2. Distribution of the emissions generated from the NWTC

The distribution of pollutants was modeled using a MOEW approved technique based on the PLUME computer software as follows:

1. Distribution of the emissions generated from the NWTC
2. Distribution of the emissions generated from the thermal power plants 1, 2 and 3, and from the NWTC The calculations of the air pollution from the NWTC incinerator are presented in this EIA statement. Each result presents the maximal concentration of the respective pollutant at the ground layer of the atmosphere and the distance from the stack where this concentration arises. In many cases the concentration values are expressed as mg/m^3, while those for dioxins and bensofurans are expressed as pg/m^3 because of their exceptionally low values. As a rule, each figure presents an outline of the concentration value that is closest to the maximum. The remaining contours represent values diminishing by an order of magnitude to negligibly low concentrations.

The distances of the maximum concentrations vary between 950 and 1,250 m.

The maximum concentrations arising during normal operation of the incinerator are many times lower than the admissible ambient air quality levels and will not affect the atmospheric air quality around the site.

The analysis of the distribution of pollutants from the Thermal Power Plants 1, 2 and 3 and from the NWTC shows:

Concerning sulfur dioxide, maximum concentrations in the ground layer occur only during north-eastern winds at approximately 95 km from the nearest source. This is explained by the higher wind speeds in this direction reducing the effective height of the emitters. In the case of northern and southwestern winds, the maximum concentration is defined by the size of the defined space, but is higher in reality.

The maximum dust concentration distance from the nearest source is approximately the same because the calculations were made for dust particle size of up to 10 $\mu g/m$, and this means lower settling speeds. Here too the maximum concentration at northern and south-western winds occurs outside the studied area.

As was mentioned above, dioxin and furan concentrations are presented in pg/m^3. Their maximum concentrations in all studied wind directions are observed outside the defined space.

The different shapes of isolines drawn for the various wind directions are caused by the different configuration of the sources. Also, the characteristic deformation of contours near the NWTC stack makes its influence clear on each figure of the joint impact of the power plant stacks and the NWTC stack.

The results from the study show that pollution caused by the future operation of the NWTC is far below the levels set forth in the legislation. The nominal pollution from the NWTC is a maximum concentration of 4-5 $\mu g/m$ for sulfur dioxide, 0.9-l.0 μ/m for hydrochloride, 0.9-1.0 $\mu g/m^3$ for dust and 0.9-1.0 pg/m^3 for dioxins и furans.

On the other hand, the impact of the NWTC is manifest in the sections of the studied area where the proximity and height of the power plant stacks create virtually no pollution.

5.2 WATER

5.2.1. Characterization of water sources and water use

Water supply and sewerage for the National Hazardous Waste Center (NWTC)

The water supply of the NWTC will be provided through the use of three main water sources:

- Drinking water supply from a drinking water main line near Pet Mogili village;
- Production water supply from collected surface runoff, leachates and waste water from various processes;
- Water supply from the facility's own water source, a borehole, required as an additional source of water for the Center.

Water from the drinking water mains

Drinking water supply is envisioned both for drinking purposes and as an addition to the steam and warm water generation system.

Drinking water can be supplied via a pipeline branching from the 530 mm steel pipe running 2.2 km north from the site, near Pet Mogili village.

A closed water cycle is envisioned for the steam and warm water generation system. The additional water will be used to compensate for losses in the system.

There are no sewerage networks and collectors near the NWTC site.

The sewerage in the Center will be divided for the different waste water flows.

Production and technical water

The main philosophy of water resource management in the Center is that the waste water should be used in the technological processes.

In keeping with the investment proposal the following sources of production water are envisioned:

- Collected surface runoff including from the surfaced areas on the site, surface runoff from roofs and sheds, surface runoff from the landfill
- Leachate from the landfill
- Water entering the physico-chemical treatment plant with the waste
- Water from a local water source, a borehole

Most of the production water will be provided from the surface runoff collected on the site.

Water from a local water source, a borehole

A local water source, a borehole, is envisioned for additional water supply as needed.

5.2.2 Sources of pollution

The provisions for the waste water from the NWTC site is to be reused in the process. The fecal water is an exception and will be treated and discharged into the corrected Ovcharitsa river bed.

The following waste water flows are expected from the operation of the National Hazardous Waste Center and from its site:

- production waste water
- fecal water
- Surface runoff

Production waste water

The following production waste water flows are expected:

- Leachate from the landfill
- Waste water from the physico-chemical treatment processes.
- Waste water from washing of waste delivery and storage containers.
- Waste water from washing of transport vehicles.
- Used fire extinguishing water.

Fecal water

The NWTC operation is expected to generate fecal water between 17 (during the first stage) and 20 m^3/day (in the third phase).

In the first phase (up to 2015) at a total of 101 officials and workers in the Center, the expected maximal loads and concentrations of polluted waste water are assessed as follows:

- BOD5 up to 6 kg O_2/day (up to 360 mg O_2/l)
- Non-dissolved oxygen up to 7 kg day (up to 360 mg/l)
- Total nitrogen up to 6 kg day (up to 66 mg/l)
- Total phosphorous up to 0.2 kg day (up to 11 mg/l)

Surface runoff

The surface runoff is created from precipitation on the site.

5.2.3 Treatment technology and facilities

The water management system at the NWTC is an effluent-free water use system. The surface runoff and various production water flows are to be collected and used in various processes, depending on the properties of incoming water.

The water generated in the Center will be treated as follows:

- The conditionally clean precipitation water will be collected in the process water tank and used in waste solidification, in the operation of the spray absorber, in the slag reservoir, in the physico-chemical treatment and in other activities.
- Polluted surface runoff will be incinerated in the second combustion chamber.
- Based on the level of pollution, the landfill leachate will be pumped toward the process water tank or toward the polluted water tank for treatment and subsequent use.
- During fire or emergencies, the water is collected inside the containment bunds and is incinerated in the secondary incineration chamber.

The fecal water (about 17 m^3/day during the first construction phase) will be discharged into the corrected bed of Ovcharitsa river following treatment.

Water control system in the NWTC

A provision is made for a system for automatic control of the surface runoff and precipitation water flows formed in the Center. The automatic control system will be built around the requirement for collection of the water on the site and for its use depending on its properties.

The likelihood of pollution of surface runoff is minimized because all facilities that could act as potential source of polluted rain water washing over them are protected by sheds or positioned indoors.

Also, the areas between the buildings and the facilities will be surfaced with concrete in order to prevent any spreading or penetration of polluted water into the soil or into the surrounding terrain. All water from the surfaced areas will be taken along ditches into the rain sewer and, from there, into the collection tank.

5.2.4 Prediction and assessment of expected changes in the regimes of water flows and ground water

No water flow regime changes are expected from the closed water cycle envisioned for the process.

Concerning the fecal water, no changes in the regime and quality of water flows are expected if treated water are released after the necessary treatment required to meet the necessary emission limits.

If the design in the subsequent stages meets all the requirements of Regulation 13/06.11.1998 on the conditions and requirements for construction and operation of waste landfills and if the project is implemented properly, no changes in the natural regime and quality of ground water should be expected.

5.2.5 Prediction and assessment of expected changes in the quality of receiving water resulting from the implementation of the project

No changes in the quality of surface water are expected from the realization of the design option for collection and re-use of waste water in the center. Also, no such changes are expected if the facilities are constructed in compliance with the regulatory requirements and if no waste water is allowed to flow towards the surrounding areas and receiving surface water.

The collection, treatment and discharging of fecal water in the receiving surface water will not change the quality of the receiving water provided that the treatment facilities are designed, constructed and operated in compliance with the regulations.

The assessment of the impact on the surface water in Gledachevo is as follows:

- Territorial scope of the impact: limited
- Degree of impact: low
- Duration of the impact: during the operation of the center and of the landfill
- Frequency of impact: permanent
- Cumulative and synergic environmental impacts: not expected

5.2.6 Determining the environmental components affected by waste water discharges

No substantial changes of the quality of surface water in the region are expected if all regulatory design and construction requirements are observed. No changes of the hydrogeological conditions are expected to occur from the implementation of the design solutions.

The design solutions for the site do not envision changes of the ground water hydrology under the impact of the above factors, including mining and electricity production in the region. This impact will have virtually no effect on the ground water quantities in the site and, therefore, no other environmental media will be affected.

5.3 BOWELS OF THE EARTH AND GEOLOGICAL BASE

The technical solutions for the lower and upper insulation layers of the future landfill included in the NWTC feasibility study exclude the possibility of significant impacts on the ground water and, therefore, no mitigation of such impacts are required.

The NWTC implementation will impact the geological base through disposal of hazardous waste, excavation and backfilling, construction of service buildings, communications etc. This impact is unavoidable, constant, but limited to the site and to its adjacent areas. The following is required to mitigate such impacts:

structural and operational solutions for the NWTC, including stability of the landfill slopes in compliance with Regulation No 13/06.11.1998 on the conditions and requirements for construction and operation of waste landfills, and with Decree № 53/ 19.03.1999 and consideration of the requirements concerning the high seismic rating (IX) of the region; high quality of construction work in compliance with the project solutions and, particularly, of the lower and upper insulation of the landfill according to the structural provisions made in the investment proposal.

5.4 LANDS AND SOILS

The construction of a national waste treatment center will increase the amounts of toxic elements in the air and, therefore, in the soils and reclaimed dumpsites. The threats to which the soils are subjected from the operation of the hazardous waste landfill arise also from the poor transport discipline around the Maritsa East region, the use and making of unregulated roads to shorten transporting distances, waste dumping along the roads etc.

All of this will cause decreasing fertility of the land in the region because of compaction, increased density and admixtures, increasing toxic elements from the operation of the Maritsa East mines and Thermal Power Plant - 2, and from the incinerator and hazardous waste center operations.

There are few unaffected lands in the region and the waste treatment center requires stable terrain that can be provided only by the few remaining undamaged soils. The waste treatment center is located on property owned by the mine and the municipality. The roads for its operation will be used mainly on the Maritsa East mines. This creates risk of emergencies caused by traffic situations.

No special land and soil protection measures are envisioned in the design. The measures are mainly related to air protection and this is believed to reduce or prevent pollution of land. The center itself is of compact design, as would be any industrial site, but still, it covers a large area of 20 ha. No green belt or air pollution reduction measures, other than those included in the process, are envisioned for the site. Therefore, a sanitary protection belt at least 100 m wide should be provided around the site, wherever it is located, and tree and brush vegetation should be used to insulate the site from the surrounding areas. From land protection perspective, the NWTC site should be located where good roads exist and where the transporting distances from all parts of the country are the same, allowing hazardous waste generators throughout the country to transport such waste in a manner that ensures security and safety for the lands and the population along these roads.

5.5 PLANT AND ANIMAL WORLD, PROTECTED NATURE AREAS

Implementation of the investment proposal

Flora: there will be changes caused to the geographic forms, and all the available vegetation cover on the project site will be destroyed. No protected flora has been found on the site.

Fauna: the changed geographic forms will cause disturbance and destroy the available food base, shelters and representatives of certain slow moving animal species (but not the entire population)

Protected areas: - not expected because of the large distances.

Use of Natural Resources

During the operation the components:

Flora: the site will be unusable until the design period for stage-by-stage reclamation;

Fauna: the site will be unusable until the design period for stage-by-stage reclamation;

Protected areas: - neutral because of the distance.

Emissions of harmful substances

The modeling and forecasting of the operating conditions lead to the following expectations:

Flora: the maximum pollutant concentrations are below the ELVs and do not threaten the existing vegetation

Fauna: the maximum pollutant concentrations are below the ELVs and do not threaten the existing animals

Protected areas: the maximum pollutant concentrations are below the ELVs and their effect is neutral due to the remoteness of the site and the certain protection from the ridges and gorges around the site.

Negative impact mitigation measures

The mitigation of the impacts on the animals and plants in an industrial region requires measures, additional to those envisioned in the design.

5.6 LANDSCAPE

Evaluation of the self-cleaning and self-restoration potential of landscapes.

The construction of the center and its operation are expected to impact the landscapes in the region but this will not disturb the current balance in the landscape types. The adherence to the Bulgarian and the European legislation will guarantee that the expected impact of the center will be limited to the NWTC site only. In view of the natural self-restoration potential of the ecosystems, it can be asserted that the self-restoration capacity of the landscapes in the site are good, provided that adequate technical and biological reclamation measures are taken.

Forecasts of the expected landscape damage

The impact from the NWTC on the landscapes in the region can be divided in two conditional periods – the first is during the construction of the center, and the second is during its operation. During the first stage, the period of impact is intensive and short, lasting only during the construction, and it will have a low degree of impact. Also, these activities are limited to and controlled by the requirements of the relevant construction legislation and by the manner in which the construction equipment is used.

The impacts on the environment and landscape features during the second stage is more substantial and longer. The operation of the NWTC which is a local technological site will occur within the Maritsa East region which is affected seriously by human impacts and the construction

of the center and the provision of utilities on the site will change the degraded landscape into an industrial landscape. The construction of the NWTC on this site is a good solution because it does not disturb the natural landscape and the ecological balance of another area.

Forecast assessment:

a) territorial scope of the impact – local, corresponding to the site infrastructure;
b) degree of impact – low;
c) duration of the impact – long-term, for the entire operation of the site;
d) frequency of impact – constant;
e) evaluation (characterization) of cumulative and combined (synergic) environmental impacts – low risk from such impacts.

5.7 CULTURAL HERITAGE

The information about monuments of culture has been compared to the conditions that will arise with the implementation of the site and conclusions and predictions have been made about the degree to which they are threatened to be destroyed or their protection belts disturbed.

Measures have been recommended for the management of risk for monuments of culture, and for prevention and reduction of the expected damages to monuments of culture caused from the construction of the NWTC and of its structure.

5.8 HARMFUL PHYSICAL FACTORS

No substantial impacts on the environment and on the near-by urban centers from noise caused by the activities on the site is expected;

- noise is expected from the machinery used during the various types of construction works (trucks, loaders, concrete trucks etc.);
- No noise impacts are expected in the urban centers and in the site. If measurements prove that urban centers are significantly affected by noise from the vehicles transporting waste to the center, then adequate measures should be taken to achieve a normal noise regime.

5.9 WASTE

5.9.1. Analysis of the NWTC proposal

This EIA statement concerns the construction of the first stage of the National Hazardous Waste Center during the period between 2004 and 2007 that will involve the construction of the following hazardous waste treatment facilities:

- complete construction of the external NWTC infrastructure
- complete construction of the internal NWTC infrastructure
- additional systems (electricity, water etc) – partial
- administrative building, including laboratories, utility premises and trucks (partial)
- physico-chemical treatment and storage areas.
- solidification plant
- solid organic waste storage and pre-treatment area (partial)
- containers for bulk organic waste (partial)
- incinerator – 15,000 t/y

- boiler and steam conducting system
- gas emission treatment system
- safe NWTC landfill – 200,000 tons
- laboratories and control equipment
- repair shop
- training and management personnel

5.9.2. Expected quantities of generated waste

Generation of waste during construction

Earth and topsoil will be excavated during the construction works. These will be stored and used as capping during the operation of the landfill. Also, it is expected that the generated waste will have a code 17.00.00. *Treatment of waste during operation*

Waste generated in the Republic of Bulgaria will be received, treated and stored in the National Hazardous Waste Center. No provisions are made for processing and disposal of imported waste.

The designer of this project has conducted in-depth studies of the generation of various hazardous waste types in Bulgaria. This assessment was used to define the design capacity of the NWTC. It should be noted that there are many uncertainties about the quantities of hazardous waste that will be delivered to the center because of the effects, among many, of the general economic situation in Bulgaria. For this reason the center should be capable of very flexible operation with regard to quantities and with regard to the composition of waste processed there.

The waste types to be received and treated in the National Hazardous Waste Center are the following:

- asbestos containing waste for landfilling
- liquid organic waste for incineration
- solid organic waste for incineration
- liquid halogenated organic waste for incineration
- solid organic waste for incineration
- inorganic waste, suitable for landfilling
- liquid inorganic waste suitable for physico-chemical treatment (PCT), containing recyclable materials, including mercury waste

5.9.5. Collection, transporting and storage

Various waste receiving and treatment areas are envisioned in the Center.

Provisions are made for organic waste, inorganic waste and special waste storage areas.

The location of each waste batch will be entered into a computer system.

Provisions are made for roof structures to minimize the likelihood of scattering of waste around the storage areas. The waste receiving and storage facilities will be located in contained areas, allowing for collection and treatment of leaks.

From the collection areas, the waste will be sent to the treatment areas and its movement will be documented.

5.9.4. Processing of waste prior to their transferring for final disposal

The hazardous waste flows identified for the NWTC are subjected to various types of treatment. Several of the NWTC processes generate waste or residual material flows. All of the generated waste and residual materials are subsequently treated in other sections of the NWTC except for the recyclable materials that are sold to external companies. The waste processing residues are disposed of in the landfill.

Waste or residual material flows are generated by the following facilities in the NWTC:

- Facilities for reception, storage and treatment of pumped inorganic waste (PCT)
- Facilities for receiving, storage and treatment of inorganic waste
- Facilities for receiving, storage and treatment of containerized organic waste
- Facilities for receiving, storage and treatment of bulk organic waste (tank farm) and a hopper
- flue gas incineration and treatment
- fecal water treatment plant
- administration and auxiliary facilities

Facilities for reception, storage and treatment of pumped inorganic waste (PCT)

The inorganic waste flows are treated in batches in a reaction vessel where sludges are created. The sludge quality from every batch that is a potential environmental threat is subject to infiltration tests. Depending on quality, the sludges can be treated in one of the following ways:

- solidification of sludges in the solidification facility
- dewatering of sludges and solidification of the filter cake
- disposal of filter cake

Facilities for receiving, storage and treatment of inorganic waste

The solidification plant processes the waste by means of mixing into cement and cement-like materials. In this way the waste will be transformed into a concrete-like material and will contain most pollutants. Infiltration samples are taken to determine the quality of the material.

Facilities for receiving, storage and treatment of containerized organic waste

The generated liquid and solid waste will be stored for subsequent treatment elsewhere in the facility.

Facilities for receiving, storage and treatment of bulk organic waste (tank farm) and a hopper

The liquid wastes that will be stored in the tank farm are transferred into the incinerator.

Flue gas incineration and treatment

The flue gas incineration and treatment plant will generate the following flows of waste and residual materials:

- boiler slag and ash, from the vertical section and fly ash and lime/salts, and boiler ash from the horizontal section
- waste from washing in the electrostatic precipitator

Fecal water treatment plant

The biological treatment of fecal water form small amounts of sludge which is stabilized and will be used to fertilize some of the reclaimed landfill sections.

Administration and auxiliary facilities

Small quantities of solid waste will be generated in the administrative building such as office and kitchen waste. The laboratory manufactures small quantities of chemical waste and small quantities of non-hazardous waste.

5.9.5. Disposal

Construction of a special landfill is envisioned in the NWTC. This landfill will cater for two basic waste types:

- hazardous solid waste not subject to direct disposal
- residual hazardous materials from neutralization in the NWTC consisting of solidified waste, slag, fly ash and filter cake

The residual waste from the hazardous waste treatment facilities will be delivered to the secure landfill in bulk. The majority of the untreatable solid hazardous waste will be delivered to the special landfill in drums.

The special landfill will be designed in compliance with Regulation 13/06.11.1998 and Directive 1999/31/EC setting forth the waste disposal requirements.

A small individual landfill will be constructed next to the hazardous waste landfill to store asbestos containing waste.

The asbestos waste will be delivered in bulk or in drums; and the asbestos waste will have to be placed in adequate packing guaranteeing that no asbestos fiber will be released into the environment. Asbestos waste treatment will comply with Regulation No 5 dated April 15, 2003 on the prevention and reduction of asbestos pollution in the environment (promulgated in the State Gazette, issue 39 dated 25.04.2003).

During the first phase, between 2004 and 2015, the landfill will cover approximately 150x300 m or, approximately, 4.5 ha.

The landfill construction will involve a bottom insulation layer, waste and upper insulation layer.

The lower insulation layer will consist of:

- a mineral layer at least 0.75 m thick (permeability of less than 10^{-10} m/sec);
- a containing layer with a drain system for leachates
- insulating geoweb membrane made of high-density polyethylene (HDPE), 2 mm thick
- protected area drainage layer 0.5 m deep, of washed gravel ballast with a filtration rate of K > lxl0^{-3} (permeability higher than 10^{-3} m/s). A network of drainage pipes will be installed in this layer. *The*

minimal diameter is 300 mm, two thirds of their surface is perforated or cut. Pipes of 300 mm in diameter will be laid to take the leachates outside the landfill. The protective area drainage layer must be made of washed gravel ballast.

The upper insulation layer will consist of:

- a mineral capping layer 0.75 m thick, with a permeability of less than 5 x 10^{-10} m/sec
- insulation geoweb membrane made of HDPE, 2 mm thick, flexible and coarse;
- Protective and drainage layer 0.5 m thick (permeability higher than 10^{-3} m/s) with drainage pipes. The protective area drainage layer must be made of washed gravel ballast.
- Upper reclamation layer, 1 m thick, for planting of low-stem vegetation

Monitoring and control

The design provides for a reliable system for management, monitoring and control of the treated waste.

5.10 HAZARDOUS WASTE (UN CLASSIFICATION)

5.10.1. Hazardous waste (UN classification)

Received toxic waste:

- cyanides
- heavy metals
- polychlorinated byphenils/polychlorinated triphenils
- biocides
- halogenated substances

Toxic substances – sources, toxicological characterization

The incineration of hazardous waste (HW), irrespective of the process characteristics of the installations, the following hazardous mixtures of substances, waste and air emissions are formed:

- emissions containing suspended dust carrying particles of hazardous organic pollutants and heavy metals (ashes)
- gaseous and vaporous compounds containing nitrous, sulfur and carbon oxides, aldehydes, unsaturated hydrocarbons, halogenated and, particularly, chlorinated hydrocarbons, polycyclic aromatic hydrocarbons and polyhalogenated furans and dioxins.
- waste from the furnaces and ash from the waste gas scrubbers classified as hazardous because of their containing of persistent organic pollutants (POPs) and heavy metals(lead, copper, cadmium, cobalt, mercury, nickel, chromium, zinc). Heavy metals are also generated from dumping of waste from small metal processing sites such as jewelry, specific purpose spare parts, metal processing and metal plating practices, the waste from which are subject to incineration. The sludges from metal plating shops could also contain cyanides.
- Sludge from containers of waste water and oil products and from maintenance, treatment and repair of the POP and heavy metal containing facilities. This depends on the specifics of the industrial sites and on the permits to dispose of production waste alongside the hazardous waste.
- Small quantities of construction waste from the demolition of old buildings which could contain asbestos-cement or asbestos insulation materials. The asbestos and asbestos containing materials are landfilled separately from the other hazardous waste

The hazardous substances are classified by their properties listed in the Act on protection against the harmful impact of chemicals, preparations and products (SG, issue 10 dated 2000). A significant part of these substances may affect the health of the personnel involved in collection and disposal of waste (toxic, harmful, corrosive, irritating, sensibilizing, carcinogenic, toxic for reproduction, mutagenic), while another part is related to the risk of accidents and emergencies (explosive, oxidizing and flammable) and is considered hazardous for the environment.

Disposal of incineration waste

Incineration waste is disposed at the special landfill where no releases of environmental pollutants are expected.

5.10.2. Other hazardous substances

Substances such as those listed below can be received for treatment in the Centre:

- highly corrosive substances such as acids and bases
- combustible substances
- oxidants
- Liquid substances, except for waste water whose release into the sewer or into surface water is allowed.

Waste containing heavy-metals or toxic substances such as: Waste pesticides, waste batteries, incinerator slag etc. The hazardous waste received in the Center are neutralized, dewatered, rendered inert or incinerated, and the resulting inert residuals are landfilled.

The following will not be received in the Center:

- Household waste and production waste whose composition is close to that of household waste
- Construction waste (except for asbestos)
- Abattoir waste
- Radioactive waste
- Hospital waste

5.11. WASTE TRANSPORTATION

The expected quantities of generated hazardous wastes in the country that will have to be transported to the NHWC are presented in point 2.1.2 of the EIA report. The road transport scheme (route list and route map) from the towns, from where waste is mainly being generated and collected to the NWTC, as well as the length of the roads is given in Appendix to the EIA report. It is planned to use the existing roads, crossing the pointed towns, most of which have roundabout roads. The trucks and the tanks with hazardous wastes shall not cross the central quarters and special sanitary protection zones, because the generators of the hazardous wastes are mainly the industrial regions of the settlements, the access to which is provided by roundabout roads.

It is assumed that for phase 1A of the investment proposal the average daily number of vehicles shall be 9 coming from Sofia and 6 from the rest of the regions in the country. Under phase 1B the number of the vehicles shall be respectively 13 and 10. The owner of the half of the number of vehicles for transportation of hazardous wastes shall be the NWTC while the other half shall be in possession of the firms licensed for that activity. Covered trucks of capacity of 20t shall be used, as well as container-trucks

for transportation of the hazardous wastes loaded beforehand in closed containers and tanks for liquid hazardous wastes that shall meet the requirements for hazardous wastes transportation.

The average speed of the vehicles shall be 70 – 75 km/h fueled with diesel at average fuel consumption of 6 km/l. The average transport distances shall not be longer than 300 km.

The EIA report contains information about the emissions in the atmosphere generated by the vehicles transporting hazardous wastes, as well as their distribution in the environment. The experts' conclusion is that the maximum generated concentrations that can be achieved shall be many times lower, thereby being no threat to the atmospheric air quality in the surrounding the project site area.

The NWTC is planned to be under operation 24 hours a day, and the hazardous wastes shall be received according to previously drawn up schedule, so that the risk stream at the entrance of the site shall be regulated. It is advisable that transportation in heavy traffic roads shall be done during the night hours, so as to reduce the risk of accidents. Where the road transport scheme leads through a mountain throat (from North Bulgaria, region of the town of Smoljan), as well as narrow roads with many bends and under winter conditions, it is recommended that the hazardous waste transportation should be done during the daily hours.

The endangered settlements related to hazardous waste transportation are Radnevo, Pet Mogili and Novoselets. Radnevo town has a roundabout road, which will be rehabilitated and reconstructed. The vehicle stream with hazardous waste passes by the end part of Novoselets village and this road can be safeguarded in a way to avoid accidents and to reduce the unfavourable noise, vibration and fuel emissions impact. It is recommended to build a bypass of Pet Mogili, because at the moment the road passes through the village. The hazardous waste traffic will not pass through Kovachevo village. The vehicle with hazardous waste should not use the mine roads, because many heavy trucks use them.

Republic of Bulgaria has adopted the harmonised European legislation with the requirements for hazardous waste transportation: Council of Ministers Decree № 53 with Regulation for treatment and transportation of production and hazardous waste (SG 29/1999), Regulation № 40 regarding the conditions and order for hazardous waste transportation (SG 15/2004) and European agreement for international transportation of hazardous waste – ADR (SG 73/1995). The legislation guarantees the control for safety traffic and takes precaution measures for prevention of accidents. The hazardous waste transportation should follow strictly the legislation.

NWTC and licensed operators for hazardous waste transportation shall use special safety trucks, container and tank trucks. They will be marked with international symbols for danger, supplied with papers for repairs, maintenance and inspections. The drivers selection is based on criteria for good mental health, passed exams form additional and current instructions and training programs. Drivers will be supplied with proper clothes, personal safety equipment and mobile phones. The trucks will have appropriate equipment for prevention and neutralization of traffic accidents. Every truck run will be accompanied with the necessary papers in accordance with the legislation.

6 HEALTH AND HYGIENE ENVIRONMENTAL ASPECTS: ANALYSIS OF THE CURRENT STATUS AND FORECAST OF THE PROBABLE IMPACTS ON HUMAN HEALTH AND ON THE HYGIENIC CONDITIONS OF THE ENVIRONMENT, WHICH ARE LIKELY TO BE AFFECTED BY THE IMPLEMENTATION OF THE PROJECT

The population of Stara Zagora area by March 01, 2001 is 370,615 (the final data from the most recent census). The population is Radnevo Municipality is 24,280. The ethnic distribution is as follows: Bulgarian 85.9 %, Roma 7.2 %, Turkish 5.0 %, other groups 1.1 % and 0.9 % not defined.

The structure of income from sales by sector is as follows: 90 % from the public sector and 10% from the private sector. The production of certain types of food of importance for public health is as follows: bread without honey added, eggs, cheese or fruits – 741 t., processed meat – 16 t. The above data show that the main part of the food for the population is supplied from other areas and regions so there is no significant danger of consumption of food produced in the high risk industrial areas of Radnevo Municipality, and in the area around the NWTC site.

According to the national sector classification, only 4 % of the active companies distributed by sectors are involved in agriculture. In relation to assessment of the risk for unfavorable impacts caused by persistent organic pollutants and heavy metals after the commissioning of the NWTC, the distribution of the use and of the managed agricultural land of 2262,83 ha by data from 2000 is as follows: meadows and pastures 12,6%, arable land 87.3%, predominantly meadows and permanent plantations 0.33%. Dumpsites used over the many years of operation of the Maritsa East 2 Thermal Power Plant and Maritsa East mines exist near the NWTC site. The NWTC site borders on meadows with plantations of cereals. The number of agricultural animals bred in Radnevo Municipality is small – 2,749 cattle of which 2,110 cows; 187 buffaloes of which 122 cow buffaloes; 3467 pigs; 10,287 sheep and 2,958 goats.

Radnevo Municipality includes the municipal center of Radnevo with its residential areas and 22 villages in the region. The total number of the population of the Municipality by 32.12. 2000 is 25,158. Of these 12,657 (50.3%) are men and 501 (49.7%) are women. Unlike many other Bulgarian municipalities, the relative number of men is higher because of the employment in the coal mines and power plants. The total number of children at ages between 0 and 14 is 3,836 or 15.2% of the population. The adults over 60 years of age are 6,196 or 24.6% of the population. The known general ageing trend of Bulgaria's population is repeated here too.

In comparison to the Stara Zagora area demographics and to the data from 2000 and 2002, there is a decreasing marriages trend, decreasing birth rates, higher death rates and less favorable, negative natural growth of the population. The natural growth of the population in the entire country is 5.7‰. The 2002 natural growth data for Radnevo Municipality are not favorable. There is no statistical confidence about the differences between the remaining indicators and between those indicators and the nation wide indicators. Against this background, the diminishing child mortality data is favorable.

The villages nearest to the NWTC are Kovachevo, Novoselets, Pet Mogili and Radetski (3,735 to 5,700 m from the site). The average number of the population in each of those villages is approximately 750. The remaining 7 settlements within the 10 km zone around the NWTC are more than 9,000 m away. The literature about the unfavorable impact of the old type of household and/or hazardous waste incinerators on the population concerns the period between 1960 and 1995 and groups of the population residing between 25,000 and 75,000 m. Allsopp, M., P. Costner, P. Johnston Incineration and human health (State of knowledge of the impacts of waste incinerators on human health, Greenpeace Research Laboratories, University of Exeter, UK, 2001, 1-81).

There are no statistically reliable differences between the numbers of born girls and boys and the numbers of men and women in the age groups up to 60 or 64 years of age. The relative share of women older than 65 is larger. This demographic characteristic applies to the entire country. Studies in healthcare and social medicine show that the mortality rates for the entire country caused by cardiovascular or malignant diseases and diseases of the digestive system is higher among men over 45 years of age. The data is related to the unfavorable effects of psycho and economic stress, non-observance of occupational hygiene requirements in certain high-risk

activities (mining and energy production), lack of exercise after work shifts, the lack of sports and recreation, improper food and overweight body mass, and increased alcohol consumption.

There are 13 kindergartens in Radnevo Municipality with 844 beds and positions for 75 teachers. There are also 10 schools - 9 general education facilities and one vocational training school. The number of children and adolescents studying in those schools is 2,747 with 207 specialist teachers.

According to data from Radnevo municipality, the population is engaged in the public sector. The highest share of employment is in the production industry. Those employed in healthcare, education and construction are relatively few. The registered companies are involved mainly in the production of food, trading, services and transportation. The main production activities in Radnevo municipality are coal mining, energy production, repair and maintenance of mining and energy facilities.

There will be 101 persons involved in maintenance on the NWTC site. The exact number of employees is presented by profession and activity. The number of persons employed in construction activities at the facility will be specified in the Detailed design.

According Regulation No 7 on the hygienic requirements for health protection of the urban environment /1992 (SG issue 20/1999), the hygienic protection zone of 3,000 m applies to position 337 b: „Thermal treatment, including incineration and pyrolisis and/or other methods for disposal of hazardous waste in sites with storage areas and facilities for additional treatment of the residues (slag).” The investment proposal has been agreed with the Ministry of Healthcare, and the control on the implementation of the recommended population health-risk reduction measures will be carried out by the Stara Zagora Health and Hygiene Inspectorate. The control of compliance with the health and safety working conditions at the NWTC will be carried out by the Regional Labor Inspectorate (RLI) in Stara Zagora.

Some of the sources of pollution to the environment and to the residential environment in Radnevo municipality are the Maritsa East mines, the Trayanovo 1 and Trayanovo North mines, the Maritsa East 2 Thermal Power Plant, the Construction and Assembly Ltd. Company, Minstroi Ltd. and Zavodski Stroezhi Maritsa East Ltd.

Radnevo and Galabovo municipalities are known as hot spots in the environmental risk assessment conducted by the MOEW in the “Environment Protection Strategy and Action Plan for 2001 – 2006” (Council of Ministers, 2001). According to the “National Environmental Health Action Plan” (Council of Ministers, 2002) of the Ministry of Healthcare and the MOEW, the municipalities Radnevo and Galabovo are considered problematic in respect to human health because of the “Maritsa East” mines the “Maritsa East 2” TPP.

There are no data published about epidemiological studies of selected risk groups from the population inhabiting the area around the NWTC site (children, adults, persons with cardio-vascular or respiratory diseases) to prove the impact from the industrial pollutants. The analyses of diseases causing temporary disability of those employed in the coal mines and in the energy production enterprises have been carried out by the occupational medicine services and show an increased frequency and duration of respiratory, cardiovascular and digestive system diseases. This was confirmed by representatives of the KNSB and Support trade unions during the consultancy prior to the writing of this EIA statement.

7 IMPACT MITIGATION MEASURES

The Contractor should elaborate an integrated environmental management system (IEMS). The objective of the IEMS is to guarantee adherence to all environmental security and safety measures during the operation of the NWTC. The IEMS should be elaborated in keeping with ISO 14001 or EMAS. In accordance with the Draft Reference Document on The Best Available Techniques for the Waste Treatment Industries, January 2004, the designing for the subsequent stages, the construction and the operation of the NWTC should make provisions for the following components:

- Setting of the environment protection policy;
- Implementation and management of the of environment protection procedures;
- Control over the management of the NWTC;
- Preparation of regular reports on the condition of the individual processes and emissions;
- Regular auditing;
- Development and implementation of cleaner technologies
- Comparison to the best developed practices etc.

7.1 MEASURES FOR INDIVIDUAL MEDIA

It is recommended that the detailed design should include the following impact mitigation measures to be used also as a condition for its approval.

One important condition is the introduction of constant monitoring, the data from which should be made public in a location near the Center, which will ensure public control of the studies.

Atmospheric air

The analysis and assessment of the equipment, of the normal process and of the physico-chemical and thermochemical treatment, of the reliability of the treatment facilities, of the organization of individual processes, and of similar plants throughout the world have shown that no fugitive or controlled dust and gas emissions exceeding the standards or threatening environmental media or human health are expected.

However, the safety of plants and processes at the NWTC require a reliable, constant, automatic instrument environmental and process monitoring to be provided at the design stage and subsequently implemented.

- control of dust and gas emissions released from the stacks of the thermal and physico-chemical hazardous waste treatment plants;
- possibility for automatic management of the data base processes of the monitoring system for dust and gas emissions leaving the physico-chemical and thermal treatment plants;
- 100 % registration of data from the technological and environmental control on electronic and paper carriers, light and sound alarms, visualization of data from the environmental monitoring in the nearest urban centers, connecting the control systems to the National Environmental Monitoring System (RIEW, Executive Environment Protection Agency);
- provisions should be made for reliable, constant, automatic, instrument control of the working environment in the premises (storage areas, physico-chemical treatment and chemical treatment) of the NWTC;
- develop emergency plans in consideration of the specifics of processed waste and of the envisioned wet (hydrotechnical) and dry (thermal) processes

- all parts of the detailed design for the NWTC should comply with the best available techniques and technologies;

In keeping with Regulation No 13/05.11.1998 and Directive 1999/31 of the EU, the next design stage should present the volume, the indicators and the means to meet the requirements for monitoring during the construction, operation and post closure operations for the cells in the landfills.

Water

The fecal water will be locally treated and discharged into the corrected Ovcharitsa river which is a category II receiving water.

The design envisions a septic tank for the treatment of the fecal water. We believe that a more adequate solution for the treatment of fecal water from the NWTC would be to construct or install a biological treatment plant using floating or fixed biomass. The water treated in this way can achieve the regulatory discharging requirements and the requirements for removal of nitrogen and phosphorus prior to discharging into sensitive areas. Also, the treatment of fecal water by means of an adequate technology can achieve a high purification effect at low energy costs, absence of unpleasant odors and a good opportunity to reuse the treated water together with the remaining water flows. This will reduce the need to construct and operate a discharging pipeline leading to the river.

It is necessary to look at the possibility to use properly treated process water instead of drinking water for the production of steam and warm water.

With a view to protecting the ground and the ground water from pollution, sewerage pipe ditches should be made. This should be done in order to ensure observation possibilities, collection and removing of any emergency leaks.

Soil

No special land and soil protection measures are envisioned in the design. The measures are mainly related to air protection and this is believed to reduce or prevent pollution of land. The center itself is of compact design, as would be any industrial site, but still, it covers a large area of 20 ha. No green belt or air pollution reduction measures, other than those included in the process, are envisioned for the site.

Therefore, a sanitary protection belt at least 100 m wide should be provided around the NWTC, wherever it is located, and tree and brush vegetation should be used to insulate the site from the surrounding areas.

The reclamation should extend to more than closing of hazardous waste landfill cells, and the next phase of the design should include a project to close and reclaim the terrain in the NWTC as required by Regulation 26.

Bowels of the Earth

The expected absence of ground water impact from the construction of the NWTC, no measures to protect ground water from pollution are required.

The unavoidable negative impact on the geological base can not be prevented. The following is required to mitigate such impacts:

- structural and operational solutions for the NWTC, including stability of the landfill slopes in compliance with Regulation No 13/06.11.1998. on the conditions and requirements for construction and operation of waste landfills, and with Decree № 53/ 19.03.1999 and consideration of the requirements concerning the high seismic rating (IX) of the region;
- high quality of construction work in compliance with the project solutions and, particularly, of the lower and upper insulation of the landfill according to the structural provisions made in the investment proposal.

Plant and animal domain and protected areas"

The mitigation of the impacts on the animals and plants in an industrial region requires measures, additional to those envisioned in the design:

3. No imported waste should be allowed for processing.
4. A protective belt, at least 100 m wide, should be established and maintained around the hazardous waste landfill.
5. A pollution control system should be established, allowing for timely termination of pollution.
6. The protective zone should represent a 100 m wide green belt of trees and brushes limiting the distribution of harmful emissions and waste in the surrounding agricultural lands and in the Ovcharitsa water reservoir.
7. Felling of trees and bushes outside the construction site and its facilities should be prohibited.
8. The design requirements for construction and for the treatment processes should be adhered to strictly.
9. The fire safety requirements should be adhered to strictly, and additional measures to protect the fuel and oil storage should be taken during the periods of increased fire-safety.
10. The grass should be cut regularly and the dry grass removed promptly to a fire safe location.
11. The grass, brush and tree species selected for the landfill site should be selected in line with the characteristic root vegetation, the soil and the weather conditions. The ecology and biology of the selected species should correspond to the conditions of the vegetation (particularly the soil conditions, that have been severely affected by human activities).
12. The excavation work during the construction should separate the topsoil layer that can be used of areas envisioned for greening.
13. No poplars should be planted near buildings and facilities, despite the rapid greening effect achieved with them. Poplars can be used, but at distances of 20-25 m. This recommendation is made to avoid damage and emergencies in the future caused by breaking and falling poplars.

Health risk

Measures to reduce human health impacts

The investment idea contains measures to reduce health risks for the employees. These will be elaborated in detail in the next design phase of the NWTC construction and operation project. The following list contains some legislative documents of significance in the management of the health risks for the employees.

- Adequate training should be provided by selected qualified specialists and responsible staff upon commissioning of the NWTC.
- Strict adherence should be imposed to Regulation No 3 on the safety, labor hygiene and fire safety instructions of workers and officials, promulgated in the State Gazette issue 44/1996. The pre-employment instructions include all possible risks from acute chronic damage, intoxication, loss of hearing, fire, explosion and emergencies.
- All the necessary signs and warnings should be placed on risk locations during the construction and operation, as required by Regulation No 4 on the signs and signals for labor and fire safety. SG, issue 77/1995. Labor Safety Bulleting, Ministry of Labor and Social Care, Sofia, 1995.
- Adherence to Decree 35 of the Council of Ministers and its Rules for technical supervision of the high-risk facilities. State Gazette 72/1983.
- Adequate seasonal working clothes should be provided, such as shoes, boots, hats, goggles, gloves, gas masks, masks with filters, helmets and ear protection according to Regulation No 3 on the minimum requirements for safety and protection of the health of workers through the use of personal protective equipment at work. SG, issue 46/2001.
- The work clothes should be washed at the NWTC. Taking clothes to the workers' homes should not be allowed. The personal protective equipment should be changed in time and cleaned regularly in the NWTC.
- Adherence should be ensured for Regulation No 3 on the compulsory preliminary and periodic medicinal inspections for the workers, SG issue. 16/1987, amended and supplemented SG, issue 65/1991, issue 102/1994.
- The Healthy and Safe Labor Conditions Act (SG issue 124/1997) and the remaining regulations related to it should be observed.
- Work in closed premises should be conducted with local and general ventilation, provision of safety with inert gasses and conditions guaranteeing concentrations of hazardous chemical agents in the working environment in keeping with Regulation No 13/2004.
- The personnel should be trained in first aid in the event of accidents, and a medical offices with the necessary medicines and dressing should be provided.
- The assessment and management of risks for the employees are the responsibility of the employer with the support of an adequate Occupational Medicine Service, as required by Regulation No 14/1998.

Measures to prevent population health impacts

- The construction of the new NWTC should comply with the feasibility study and with the documents prepared by the investor under the control of the MOEW, MH, the local administration and representatives of the public following consulting and maintenance of liaisons.
- The traffic of hazardous waste delivery vehicles should not cross urban centers or other sites with sanitary and protection status in the region.
- The investor is responsible for the safe operation of the NWTC, for the efficiency of the treatment facilities, for the good production practices, and for prevention of emergencies.
- The data about the NWTC activities and systematic environmental media monitoring results should be made available upon request.
- The hall provided for meetings with the interested population groups and NGO representatives can be used, according to the European criteria, for health promotion by specially trained public relations personnel.
- Apart from the air and water monitoring, annual samples should be taken from the emissions from the incinerator to measure dioxins. Periodic measurements should be made of the pollution of soil within the 10 km area around the NWTC, of the fish in the water reservoirs and of milk from domestic animals for POP residues. The National Center for Hygiene, Medical Ecology and Nutrition – Sofia and the Executive Environmental Agency – Sofia operate accredited laboratories that can determine PCBs and PAH in the occupational and household environment. In 2003, Dr. Hristo Yordanov

defended a doctoral thesis on the subject of Biological Markers for Exposure of Effects of Exposure to Polycyclic Hydrocarbons in Low Concentrations. A method was introduced in the NCHMEN to determine 1-hydroxyproline in urine, proving the exposure to low concentrations of PAH. This method allows real determination of the impact of these persistent organic pollutants on the population and on the employees at the NWTC.

Studies should be made on the health status, including the functional status of the respiratory system of 50-60 children between 10 and 12 years of age from villages within the 10 km zone around the site, and the data should be compared with the data for 50 children from settlements in Radnevo municipality, residing 20 -30 km from the Maritsa East 2 Thermal Power Plant.

Noise

If the noise level measurements prove that the transportation of waste from the generators' sites to the center causes acoustic discomfort to the population, measures should be taken to change the vehicles' routes or, where possible, to noise proof road sections in urban centers etc.

Landscape

To reduce the anthropogenic nature of the impact, a more detailed design should be made for the utilities, reclamation and greening of the site, and for aesthetic landscaping of the surrounding terrains to ensure their better blending into the surroundings and for better aesthetic effect. The better blending of the site into the surrounding landscape requires attention to the visual impact of the NWTC buildings and plants, of the transport infrastructure, and it requires provision of nighttime illumination on the site.

A landfill design should be prepared in observation of the regulations and of the technological requirements, in order to prevent pollution of the surrounding landscape and its components. Following the conclusion of the operations, a technical and biological landfill reclamation design should be developed for the purpose of minimizing its impact and its blending into the surrounding landscape.

The design should include reliable measures to prevent any air pollution by dust or other light fractions and waste during waste transporting, storage and landfilling, and during the operations of the Center;

For the purpose of landfill security and marking, it should be surrounded by a chain-link fence and stakes, and a green belt of tree and bush species typical of the region should be created. These measures will prevent people or animals from entering the landfill, and will limit the spreading of waste by air.

Periodic measurements should be made in air, water, soil and vegetation, the environmental quality should be monitored and no pollution of the surrounding landscape should be allowed. The quality implementation of the project should be monitored.

Cultural heritage

The cultural heritage conservation measures are provided for in laws and regulations, and in international conventions ratified by Bulgaria.

According to the legislation, the projects affecting monuments of culture and their environment, as is the case, must be agreed upon with the National Institute for Education and Culture and with the local self-government authorities.

It is recommended that to reduce the risk of irreversible destruction of significant monuments of culture without their having been studied previously by specialists and without measures for conservation being taken, and to reduce the potential risk of damage of any new archaeological finds, and to ensure the necessary measures to guard the heritage in keeping with the legal and regulatory system, it is recommended that the Investor should contract an archaeologist for a field study in order to determine the need for conservation digging.

7.2 RISK MANAGEMENT

The protective measures in most emergencies include adequate design and construction, and sufficient supervision of the construction and assembly works, as well as adequate management of the site.

It is necessary to take all required measures preventing emergencies both during the construction and the operation of the site. The selection of adequate personnel is extremely important as a guarantee of the prevention of emergencies.

7.3 MONITORING

The Bulgarian and European legislation require the implementation of Integrated Pollution Prevention and Control (IPPC) and adherence to requirements for the creation of registers for emission into the environment of polluting substances (EPER - register for releasing of pollutants into the environment, PRTR – register of the releasing and transferring of pollutants into the environment) and inclusion into the design of self monitoring for the construction and operation of the waste treatment facilities and the landfills.

The design envisions the implementation of a control and management system for the waste received for processing/disposal, control of the waste incineration or neutralization processes and control of the emitted gasses.

In order to monitor and control the NWTC operation it is necessary to establish monitoring points in compliance with the relevant legislation. The following permanent monitoring points are proposed:

- 3 monitoring points for groundwater;
- 7 monitoring points for surface water;
- 2 monitoring points for air emissions from the incinerator and physico-chemical treatment plant;
- 4 points for monitoring and visualisation of atmospheric air quality, located in the four closest villages (Pet Mogili, Novoselets, Radetski and Kovachevo);

In addition to the above, periodic air quality measurements are proposed to be carried out in the town of Radnevo by the mobile laboratory of the Executive Environmental Agency.

8 CONCLUSIONS

The project reviewed here is of crucial significance for the environmental management of hazardous waste in Bulgaria. Its successful implementation will result in significant nationwide reduction of the health and environmental risk related to hazardous waste.

The review of the design proved that this project envisions technologies for physico-chemical treatment, incineration, solidification and disposal that meet the latest and most efficient solutions used in the EU member states.

The analysis made in this EIA statement allows the conclusion that the strict adherence to the environmental regulations of the Republic of Bulgaria and the consideration of the recommendations made in this Statement allows moving towards the subsequent stages of implementation of the National Waste Treatment Center Project on the Gledachevo site.