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JOINT STOCK COMPANY

NAVOI TPP JSC

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"___" _____ 2019

Environmental impact assessment of the construction of two J class CCGT Units (No. 3.4) with a total capacity of 1300 MW at Navoi TPP JSC

Stage: Draft Environmental Impact Statement (draft EIS)

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JOINT STOCK COMPANY

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Contents

Introduction

The purpose of the work is to assess the environmental impact by the construction of two J class combined-cycle plants (CCGT Units No. 3, 4) with a total capacity of 1,300 MW at Navoi TPP JSC.

The basis for the draft EIA development is Order of the Deputy Minister of Energy of the Republic of Uzbekistan Sh. Khojayev No. 03–203 dated March 23, 2019 and task of Navoi Thermal Power Plant No. 9/046-PIU dated March 26, 2019.

The Navoi TPP JSC is one of the largest power plants of the Republic of Uzbekistan and is part of the Central Asian united energy system, provides electricity to the Navoi, Samarkand and Bukhara regions and heat to the Navoi region and the city of Navoi.

Construction of the thermal power plant was started in 1960. The launch of the first turbogenerator VPT–25–4 with the boiler TGM – 151 was carried out in February 1963. Construction of the station was finished in December 1981, while the capacity of the Navoi TPP was 1,250 MW.

In the early 2000s, there was a need to modernize the worn-out station equipment. The lifetime of the existing 12 power plants was 20 - 35 years, which was the cause of the continuing deterioration of the technical condition of the equipment, reducing its reliability, and as a result, low technical and economic indicators and an increase in the probability of accidents with possible negative consequences for the environment. In connection with the then current situation, a course was set for the introduction of new equipment with the use of advanced fuel combustion technologies – combined-cycle plants.

In February 2013, the first combined-cycle gas turbine unit with a capacity of 478 MW was commissioned, while the installed capacity of the plant reached 1,728 MW.

In 2014, TG-1, 2 with a capacity of 25 MW each and TG-6 with a capacity of 60 MW were decommissioned. At the end of 2014, the installed capacity of the plant was 1,618 MW.

In 2011, another 450 MW CCGT Unit was designed, the construction of which was supported by the State Ecological Expertise of the State Ecology Committee of the Republic of Uzbekistan (Conclusion No. 18/147z dated February 21, 2012), which commissioning was supposed to decommission Boilers No. 3 and 8. Construction of CCGT Unit No.2 is being completed now.

At the end of 2018, the installed capacity of the Navoi TPP was 1,618 MW.

The construction of J class CCGT Units No. 3, 4 in this project will allow increasing the total capacity of the Navoi Thermal Power Plant by another 1,300 MW, reducing operating costs,

increasing energy conversion efficiency and reliability of electricity supply to consumers, and improving the environmental situation in the station's zone of influence.

The J class 650 MW CCGT Units to be introduced have a high efficiency coefficient of electricity generation (above 60%), low specific consumption of equivalent fuel for electricity supply (215.7 g/kW·h against 381.24 g/kW·h for the Navoi TPP JSC following the results of 2018).

Project implementation will allow achieving annual natural gas savings of 587 million m³ and, as a result, reducing gross emissions of pollutants by 1,070.3209 tons/year (from 4976.6268 tons/year in the existing situation to 3906.3059 tons/year after project implementation), including nitrogen dioxide - by 787.345 tons/year (from 3483.5658 to 2696.2208 tons/year); carbon oxide - by 165.5808 tons/year (from 874.4503 to 708.8695 tons/year, as well as greenhouse gas emissions - by 1,113,950 tons of CO2 – eq/year.

The main environmental advantage of the project implementation is the reduction of maximum concentrations of pollutants in the surface layer of the atmosphere generated by emissions from the Navoi TPP JSC, by 5.2 times compared with the current situation, with the achievement of air pollution standards set by the State Ecology Committee of the Republic of Uzbekistan.

The emission of nitrogen oxides of the CCGT Unit will be 50 mg/Nm³, which is 3.5 times lower than their maximum concentrations in the flue gases of the existing TPP power units (in terms of nitrogen dioxide).

The Navoi TPP JSC belongs to the **Ist category of environmental impact** in accordance with Resolution of the Cabinet of Ministers No. 949 dated 22.11.2018 (high risk, item 35 “Thermal power plants and other power plants for burning with a thermal capacity of 300 MW or more)".

The main tasks in the development of the draft EIS were:

- to assess the degree of negative impact of the TPP on the environment before and after construction of the CCGT Unit;

- to carry out an environmental analysis of the draft decision, determining the types, objects and nature of the impact;

- to carry out an analysis of emergency risks at TPPs under the existing condition and after commissioning of two CCGT Units with a total capacity of 1,300 MW;

- to make a predictive assessment of the TPP impact on the environment after the project implementation;

- to develop an environmental management plan and an environmental quality monitoring plan for the period of construction of two CCGT Units and at the stage of operation of the TPP after the project implementation.

The environmental impact assessment of the construction of J class CCGT Units No. 3, 4 with a total capacity of 1,300 MW at the Navoi TPP JSC was based on an analysis of the current state of the environment, operating process equipment, and identification of sources of emissions, discharges and waste.

The calculation of the level of air pollution by emissions from the Navoi TPP after the implementation of the proposed technological solution was carried out and its compliance with the requirements of the State Ecology Committee of the Republic of Uzbekistan was determined.

When carrying out the work, they were guided by the "Regulations on State Ecological Expertise" approved by Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 949 dated November 22, 2018, and determining the composition and volume of the presented section of the environmental impact assessment.

1 State of the environment in the area of location of Navoi TPP JSC

1.1 Characteristics of physical and geographic and climatic features

The Navoi TPP JSC (postal address: 210600, Navoi region, Karmana district, k.f.y. "Yangi-arik") is located 6 km north-west of Navoi and 1.5 km east of nearest residential development (Appendix 1).

TPP boundaries are:

- from the north: agricultural land and garden plots;
- from the south: the integrated energy service of the Navoi MMC and Tashkent - Bukhara highway;
- from the east: “Michurin” cottage village, the Zerafshan river and Navoi – Uchkuduk highway;
- from the west: agricultural land.

The station covers an area of 100 hectares, stretching from the north-north-west to south-south-east, the height above sea level is 334.2 m.

The site for the construction of 2 new power units of CCGT Units No. 3, 4 with a total capacity of 1,300 MW is planned in the eastern part of the Navoi TPP, partly on the lands currently occupied by hydraulic structures (settlers), partly on the lands adjacent to the TPP boundary and used for garden plots and gardens, as well as occupied by the structures of the military unit and access roads. The site has planting of woody vegetation (fruit and ornamental trees), the number and location of which are discussed below in Chapter 1.7.

The boundaries of the construction site are: from the west - the territory of the Navoi TPP, from the east - the Zerafshan river, from the north - abandoned summer cottages, from the south – auxiliary TPP structures.

The area of the construction site of CCGT Units No. 3.4 is 22.9 hectares.

The distance to residential development, located in the south-east of the territory of the construction site of CCGT Units No. 3, 4, is 400 meters. The distance from the nearest residential development to chimneys of CCGT Units No. 3, 4 is 550 m, which is consistent with the requirements of SanPiN No. 0350-17 named “Sanitary standards and rules for the protection of atmospheric air in populated areas of the Republic of Uzbekistan”.

The territory of the TPP is located in the western part of the Zerafshan Valley, which is a piedmont plain, rising from west to east with a slight bias towards the Zerafshan River. From the west, the territory under consideration is bounded by sandy areas of the southeastern Kyzylkum, from the north - by spurs of the Nurata range, from the east and south - by spurs of the Turkestan and Zerafshan ranges, and from the south - the Karnabkul and Karshinsky steppes are close to it.

The position of the study area in the interior of the continent is stipulated by its climate: sharply continental, warm, very dry in summer and humid, relatively cold in winter, including significant annual and daily variations in air temperature.

The mountain systems that limit the study area from the north, east, and south affect air currents and determine local climate features, and the wind regime, in particular.

In the annual wind rose, the eastern direction is predominant, while emissions from the Navoi TPP and other large enterprises of the industrial zone spread in the direction opposite to the city, i.e. the industrial site of the station is located taking the wind rose into account.

The transfer of harmful substances towards the city is favored by the wind of the north-west direction, but the average annual frequency of such wind does not exceed 8.9%, in winter it decreases to 4.6%.

The industrial site of the Navoi TPP is located taking the wind rose into account.

Analysis of the climatic characteristics of the location of the Navoi TPP JSC was made according to observations of Uzgidromet under the Ministry of Emergency Situations of the Republic of Uzbekistan for the Navoi weather station (table 1.1., Fig. 1.1). A selection of climatic indicators was made from the meteorological observation tables (MOT) for 2018.

The average annual temperature is plus 15.9°C.

The average monthly temperature of the coldest month (January) is plus 3.0°C, the average temperature of the hottest month (July) is plus 30.9°C.

The average minimum temperature for a year is plus 9.2°C, the average maximum temperature is plus 22.8°C.

The maximum temperature for a year is plus 40.0°C, the minimum is minus 13.4°C.

Table 1.1 Main climatic characteristics

Characteristics	Unit of measurement	Value
Coefficient A, depending on the temperature stratification of the atmosphere		200
Average annual temperature	°C	+ 15,9
Average maximum temperature	°C	+ 22,8
Maximum temperature	°C	+ 40,0
Average minimum temperature	°C	+ 9,2

Minimum temperature	°C	- 13,0
Average air temperature in January	°C	+ 3,0
Average air temperature in July	°C	+ 30,9
Average surface temperature of soil	°C	+ 18,0
Minimum surface temperature of soil	°C	- 5,0
Maximum surface temperature of soil	°C	+ 69
Precipitation	mm	180,54
Average annual frequency of wind directions by rhumb lines	%	N-3,4 NNE-2,8 NE-16,8 ENE-0,9 E-23,9 ESE-3,25 SE-13,0 SSE-0,58 S-6,6 SSW-0,58 SW-6,08 WSW-0,5 W-10,5 WNW-0,75 NW-8,9 NNW-1,08 lull – 11,8
Number of cases according to grades,%	m/s	
	0-1	41,8
	2-3	27
	4-5	10,9
	6-7	8,5
	8-9	4,6
	10-11	0,16
	12-13	4,8
	>15	0,64
Average wind speed	m/s	3,6
The highest wind speed, which exceeds 5%	m/s	u*=7,0

Precipitation in Navoi falls all year round, the average annual precipitation is 180.54 mm.

Monthly maximum precipitation occurs in February, the minimum falls in July.

Fogs are very rare, 10 hours a year. Most often fogs are observed in the winter months, the average frequency of fogs does not exceed 0.5%.

The average monthly relative humidity during a year varies from 41 to 82%. The maximum values are observed in the winter months, the minimum - in June-July.

One of the meteorological factors determining the pollutant dispersion conditions in the atmosphere is a direction and speed of the wind.

During a year, eastern (23.9%) and northeastern (16.8%) winds are characteristic for the area under consideration (Figure 1.1.). Lulls or still weather occur in 11.8% of cases, which contributes to the accumulation of pollutants in the surface layer of the atmosphere.

In the study area, the average wind speeds during a year vary from 2.7 to 5.1 m/s. Their highest values fall on July, the smallest - on September, November, December. The average annual wind speed is 3.6 m/s, the maximum is 30 m/s.

The city of Navoi, in general, is characterized by small values of average monthly wind speeds. The recurrence of winds at a speed of 0-1 m/s is 41.8%, which contributes to the accumulation of pollutants in the surface layer of the atmosphere. Winds with a slightly higher speed (2–3 m/s, 27% frequency), serving as a cleansing factor, are most frequent from March to July. Strong winds (8–9 and 10–13 m/s) are quite rare (4.6 and 4.96% frequency, respectively). Squally winds with speeds of 14-15 m/s (1.16%), 16-17 m/s (0.6%) and 18-20 m/s (0.16%) are even less frequent.

The high frequency of weak winds does not lead to an increase in the pollution of the atmosphere of the city, since impurities mainly get accumulated near the Navoi TPP. Frequently repeated increased wind speeds improve the dispersion of impurities from high hot springs, and transfer them over long distances.

From the south, the wind blows much less frequently, in winter its frequency is 8%, in summer it is 5.3%. The recurrence of the northwest wind direction blowing towards the city in winter is the smallest and amounts to 4.6%, in summer it increases to 15.6%, and the average annual does not exceed 8.9%.

Annual Wind Rose of the city of Navoi

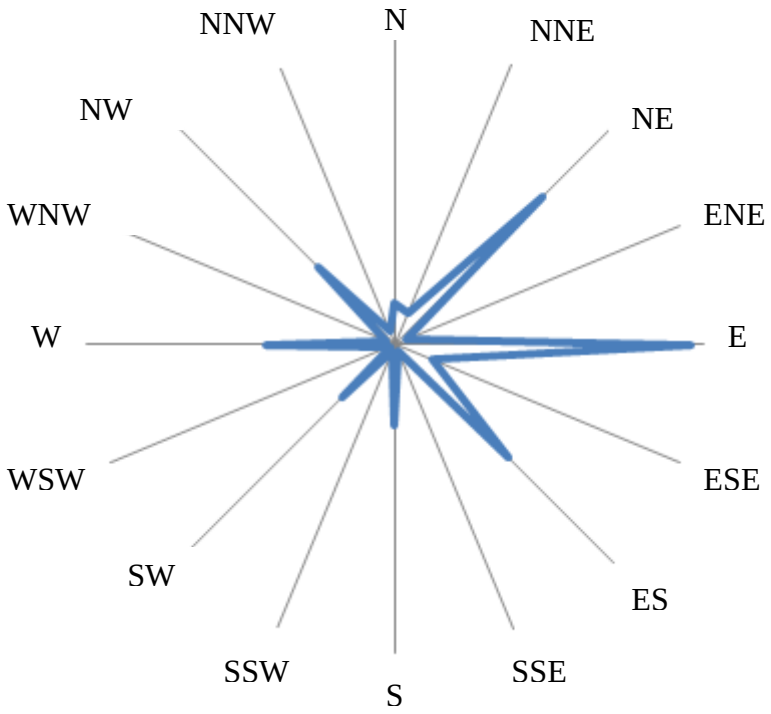

Figure 1

Thus, the analysis of the physical and geographical and climatic features of the area of the Navoi TPP location shows that high air temperatures, low precipitation, high solar radiation contribute to environmental pollution, while the presence of repeatable elevated wind speeds contributes to the dispersion of emissions from high hot springs and transporting them over considerable distances.

1.2 Existing sources of impacts

The Navoi TPP site is located on the northern edge of the Navoi industrial zone.

In the industrial zone, which occupies the territory from the western, south-western and southern sides of the city, all industrial giant enterprises are concentrated, which are the main sources of atmospheric pollution: such enterprises of Uzgosconcern as Uzstroymaterialy (Kyzylkumcement AOOT), Uzbekenergo JSC (Navoi TPP JSC), Uzkhimprom associations (Production Association Navoiazot, Navoi Electrochemical Plant), concern "Kyzylkumredmetzoloto" (Navoi Mining and Metallurgical Plant), Uzgoskhlopkopromsbyt (cotton processing plant). Along with large-scale production facilities, there are less powerful enterprises in the industrial zone: a petroleum depot, automobile companies, concrete good

production facilities, repair, construction and installation departments, rock-crushing plants, ABC, meat and dairy factories, bread products, a timber trading base, a tare repairing enterprise, including Karmana district enterprises: a winery, Khleboprodukt Trade and Production Organization, motor transport enterprises (ATP-22, ATP-2, Avtovaztekhobsluzhivanie), enterprises of the construction industry (ELUABS, PMK-2, HRU). A total of about 19 large sites with more than 450 stationary sources of emissions to the environment.

Emissions from stationary sources of the city, including industrial zone enterprises, according to the latest published data of Uzgidromet under the Ministry of Emergency Situations of the Republic of Uzbekistan, amounted to 36,261 tons of harmful substances, of which: solids - 19,802 tons, sulfur dioxide - 2,913 tons, carbon oxide – 5,002 tons , nitrogen oxides – 2,146 tons, hydrocarbons (without VOC) – 4,522 tons, volatile organic compounds - 231 tons, other gases and liquids – 1,644 tons.

The largest share of gross emissions from all stationary sources of enterprises is accounted for Navoi TPP JSC, Kyzylkumcement OJSC and Navoiazot Production Association.

In 2018, the Navoi TPP, according to the station's statistical reporting, emitted into the atmospheric air 3180.0485 tons. The station has 44 sources of pollutant emissions. 25 items of pollutants enter the atmosphere. The most powerful of the emission sources are pipes of boiler units, from which 99.37% of the total station's emissions come to the atmosphere. The leading role in the bank of pollutants belongs to nitrogen dioxide – 2,002.99 tons (62.9%).

The main harmful substances entering the city's atmosphere from the sources of Kyzylkumcement JSC are dust of cement, lime and gypsum; from Navoiazot Production Association - oxides of nitrogen, carbon, ammonium nitrate, ammonia, acrylonitrile, hydrocyanic acid, ammonium sulfate. Among the emitted harmful substances NMMC sources emit dust ore, ammonia, oxides of carbon, nitrogen, inorganic and wood dust.

In total, 78 different harmful substances are emitted into the atmosphere of the city of Navoi and its environs, among them, carbon monoxide, nitrogen oxides, sulfur dioxide, dust, hydrocarbons, nitrous oxide, ammonia, ammonium nitrate, acrylonitrile, hydrogen nitrate, ammonium sulfate are heavy-tonnage and most characteristic for the city. The main environmental pollutants of carbon monoxide and hydrocarbons are motor vehicles, all other harmful substances come mainly from industrial sources and energy facilities.

Since in the industrial zone all large enterprises are located along the perimeter, with the dominant wind directions (east and northeast), their emissions will spread in the direction opposite to the city, not reinforcing each other. With a southern wind direction, the main sources of impact in the vicinity of the Navoi TPP will be Navoiazot and NMMC. With a south-western

wind direction, emissions from Kyzylkumcement JSC and NMMC form a common field of concentrations that covers the territory of the city.

The background aggravating the state of the studied area is high and hot sources of emissions from industrial enterprises of boiler houses in the central part of the city.

Sources of impact on soil and plants in the area where the Navoi TPP is located are emissions of vehicles, industrial enterprises, energy facilities described above. Harmful impurities come to soil and plants from the atmosphere by precipitation and direct absorption.

Of all the sites under consideration, the Navoi TPP, Navoiazot Production Association, some production facilities of NMMC, Kyzylkumcement AOOT should be highlighted in terms of the scale of the environmental impact. These enterprises have powerful sources of emissions of harmful impurities, the release of industrial effluents into surface water, non-disposed solid waste.

Thus, the state of the environment in the area of the site under study is determined by emissions of high hot springs from the enterprises of Navoi, Navoi TPP, Kyzylkumcement AOOT, Navoiazot Production Association, NMMC, vehicles, as well as dusty soil surface.

The greatest anthropogenic impact on the environment in the area of the station is provided by the existing sources of this enterprise.

1.3 Analysis of sources of environmental impact from current production facilities

1.3.1 Analysis of sources of emissions of harmful substances into the atmosphere

The Navoi TPP, as one of the largest power plants in Uzbekistan, is part of the integrated energy system of Central Asia. The Navoi TPP generates electricity for consumers in the Navoi, Samarkand and Bukhara regions, steam, hot water for heating the city of Navoi and adjacent villages.

The central element of the organizational structure of management of NTES JSC is the Directorate headed by the Director General.

The Director General organizes the entire work of the enterprise and bears full responsibility for its condition and activity.

In addition to the general management of the enterprise, the Director General carries out direct management of:

- accounting;
- department of financial - economic analysis and forecasting;
- special part;
- department of information technology;
- department of corporate relations with shareholders;

- civil defense;
- legal counsel;
- personnel department.

The enterprise is managed by the Director General with the assistance of the trade union organization; through its directors and the production director, who are granted relevant rights in accordance with the Charter of the Navoi TPP JSC.

The Production Director is the First Deputy Director and is in charge of the operation, maintenance and development of the plant, and also carries out direct management of:

- head of the operation department;
- head of repair department;
- head of the new equipment under construction department;
- production and technical department;
- head of the shift of the station;
- head of the labor protection, safety and health department;
- senior operation inspector;
- senior labor and safety inspector;
- senior inspector for industrial safety of hazardous production facilities;
- fire safety inspector;
- health point;

The production director manages workshops, laboratories, subcontracted repair and adjustment organizations through his deputies.

The Director for General Affairs;

1. Manages administrative and business issues and carries management of:

- motor road transport department;
- material and technical supply department;
- administrative and economic department;
- special design bureau section;
- workers' supply department.

2. Controls on behalf of the administration over:

- provision of duty vehicles;
- improvement of internal and adjacent territory, access roads and ways;
- work of the commission on pension affairs;
- work of canteens and state of dietic treatment;
- timely unloading of wagons arriving for operational needs;

- work of the medical center and the state of recreational activities.

3. Manages the following:

- execution of contracts and acts for the supply of rail and road materials;
- assistance to agriculture and the assigned area;
- organizing public events;
- ensuring living conditions for the seconded personnel;
- visual agitation;
- control over the implementation of measures for the delivery of scrap metal.

The Security Director is responsible for managing security issues and providing guidance for:

- special part of the MOS;
- paramilitary security;
- watchman service;
- civil defense;
- material values of group II (state reserve).

The Director for Prospective Development and Investments is in charge of sales of heat and electricity:

- concludes contracts with customers and manages the work of:
- inspectors;
- accountant for sales of products.
- department of capital construction.
- department for attracting investment and implementation of investment projects.

The head of the operation department is in charge of the operation of equipment, buildings and structures, and manages the workshops of:

- boiler-turbines Nos. 1 and 2, electrical, thermal automatics and measurements, chemical, hydro structures, thermal networks, energy adjustment, as well as contractual commissioning organizations.

The head of the repair department is responsible for the repair of equipment, buildings and structures in the workshops of:

- boiler-turbines Nos. 1 and 2, electrical, thermal automatics and measurements, chemical, hydro structures, thermal networks, energy adjustment, transport and manages the work of:
- centralized repair shop;
- metal laboratories;
- all contractual repair organizations.

- RI and O.

Intrashop management is carried out on the basis of a clear distribution of rights and duties among managers and employees of the shop and control over their activities.

The placement and deployment of workplaces at the plant is carried out in accordance with the orders of Uzbekenergo JSC of the Republic of Uzbekistan.

The operational management of all personnel on duty is carried out by the shift manager of the station, who in turn is subordinate to the production director.

The installed electric capacity of the plant at the end of 2018 was 1,618 MW.

The structure of the installed electric power is given in table 1.2, thermal power - in table 1.3.

Table 1.2 Structure of electric power installed

Name of equipment	Installed power, thousand kW· h		Power as of 31.12.2018, thousand kW· h	
	as of 01.01.2017	as of 01.01.2018	operating	available
2 X P-50-130	199	100	72	72
2 X K-160-130	300	300	292	292
2 X PVK-150-130	320	320	217	217
2 X K-210-130	420	420	201	201
CCGT-478	478	4478	385	385
TOTAL:	1618	1618	1167	1167

Table 1.3 Structure of heat power installed

	Installed power, Gcal/h		***Power as of 31.12.2018, Gcal/h***	
	as of 01.01.2017	***as of 01.01.2018***	***operating***	***available***
2 X P-50-130	***376***	***376***	***246,5***	***246,5***
K-160-130	***99***	***99***	***99***	***99***
CCGT-478MW	***43***	***43***	***43***	***43***

In 2018:

- electricity generation amounted to 8,207.5 million kWh, compared to the plan of 8,584.1 million kWh;
- heat output amounted to 2,106.7 thousand Gcal, while the plan was 1,867 thousand Gcal.

For power generation, the plant mainly operates in the base mode.

The level of electricity generation increases slightly in winter and falls in summer due to power outages for repairs.

In 2018, the maximum power generation took place in December and amounted to 857,018.873 thousand kWh.

The maximum heat output in the amount of 307.0 thousand Gcal occurred in the month of December and the minimum of 95.3 thousand Gcal - in July.

The specific consumption of reference fuel amounted to 381.24 g/kWh for the electric power supplied and 185.84 kg/Gcal for the supply of thermal energy, respectively, against 379.8 g/kWh and 165.1 kg/Gcal on average for the power system.

The main technical and economic performance indicators of the Navoi TPP for 2018 are given in Table 1.4.

Table 1.4 Main technical and economic performance indicators of the Navoi TPP JSC for 2018

Item No.	*Indicators*	*Units of measurement*	*2018*			*2017*
			As planned	*In fact*	*%*	
1	*Operating power*	*MW*	*1026,7*	*1012,9*	*98,7*	*1176,1*
2	*Efficiency ratio of* *- electric power* *- heat energy*	*%*	 *61,2* *40,8*	 *57,9* *46,4*	 *94,6* *113,7*	 *59,9* *40,8*
3	*Generation of electric power*	*million kWh*	*8584,1*	*8207,5*	*96,6*	*8499,5*
4	*Heat energy supply*	*Thousand Gcal*	*1867*	*2106,7*	*112,8*	*1849,1*
5	*Sale of heat energy* *- implementation of measures on liquidation of*	*million UZS number of measures*		*192719,2*		*45471,5*

	receivables					
6	***Specific consumption of reference fuel: (normative)*** ***- for power supply*** ***- for heat supply***	 ***g/kWh n/f*** ***kg/Gcal n/f***	 ***376,00*** ***185,84***	 ***381,24*** ***185,84***		 ***369,61*** ***186,86***
7	***Consumption of power for own needs (normative)*** ***- for power generation*** ***- for heat supply***	 ***%*** ***kWh/Gcal***	 ***5,78*** ***45,0***	 ***6,04*** ***45,0***		 ***5,73*** ***45,0***
8	***Listed number of personnel***	***Person***	***1530***	***1532***	***98,9***	***1503***

Sources of harmful emissions in the production of heat and electricity are the main and auxiliary process equipment of the TPP.

The plant consists of cogeneration and condensation parts. The condensation part works according to the block principle.

The Navoi TPP has two power units of 210 MW each, two power units of 150 MW each, two power units of 160 MW each, TPP - 140 with a capacity of 100 MW, a combined-cycle plant CCGT Unit-478 MW.

Table 1.5 Characteristics of boilers of the Navoi TPP at rated load

Plant boiler No.	Boiler type	Rated steaming capacity, t/h	Fuel consumption, equivalent fuel ton/h	Heat capacity, Gcal/h	Time of commissioning
1	TGM-151	220	21,7	151,9	02.1963
2	TGM-151	220	21,2	148,4	05.1963
3	TGM-94	500	62,5	437,5	10.1964
4	TGM-94	500	62,7	438,9	10.1965
5	TGM-84	420	41,2	288,4	09.1966
6	TGM-84	420	41,4	289,8	05.1967

7	TGM-84	420	41,5	290,5	09.1967
8	TGM-94	500	62,5	437,5	07.1968
9	TGM-94	500	62,5	437,5	07.1968
10	TGM-84	420	41,2	288,4	03.1972
11	TGME-206	670	71,7	501,9	06.1980
12	TGME-206	670	71,7	501,9	07.1981
TOTAL		5460	601,8	4212,6	

Gas-oil burners of a vortex type TKZ (Taganrog Boiler Plant – manufacturer) are installed on all boilers of the TPP. On boilers of plants No 11, 12 the burners are installed in two tiers on the rear wall of the combustion chamber - six burners in each tier.

On the remaining boilers (plants No. 3–10), the burners are located along the front wall of the furnace evenly in three tiers. The flue gas recirculation scheme incorporated in the projects of block boilers TGME-206, TGM-94, is periodically restored by performance and commissioning works carried out by Uzenergosozlash UE.

The Navoi TPP uses gas from the Zevardy and Kultak fields with a calorific value of 8150 Gcal/nm³ and below as the main fuel, with a hydrogen sulfide content of 0.06 to 0.1 vol.%. Fuel oil is used as emergency fuel.

In 2018, gas consumption at the TPP amounted to 2,830,665.482 thousand nm3.

According to TPP data, CCGT Unit-478 burns sulfur-free gas.

Gas is supplied to the TPP through three pipelines, two of them have a diameter of 700 mm, one - 500 mm.

The presence of gas condensate in the fuel leads to a significant distortion of the true gas flow. In addition, the combustion of this gas causes corrosion and contamination of the cold layer of RAH stuffing, low-temperature sections of gas ducts, clogging of gas distributing burner nozzles, which causes deterioration of technical and economic indicators, stopping for preventive measures to clean the heating surfaces and restore corroded elements.

Fuel oil is supplied mainly of M-100 grade with a sulfur content of 2.5% and a lower working heat of combustion of 9,365 kcal/kg.

Nitrogen dioxide, nitrous oxide, sulfur dioxide, carbon monoxide, benzo(a)pyrene, the main of which are nitrogen oxides, come to the atmosphere during the operation of the equipment at the plant, and additional fuel oil ash is burned when fuel oil is burned.

Currently, flue gases from the existing boilers are emitted into the atmosphere through four chimneys from the five existing pipes. Boilers № 3-10 are connected to three pipes of 56 m high, № 11, 12 - to the pipe of 180 m high, CCGT Unit № 1 - to the pipe 60 m high.

Characteristics of chimneys at rated operation of boilers are given in table 1.6.

Table 1.6 Characteristics of chimneys for rated boiler operation

No of emission source	Height, m	Diameter, m	Plant No. of boilers	t of exhaust gases, °C	Air excess ratio, αex
2	56	9,18	3, 4	149	1,55
3	56	9,18	5, 6, 7	117	1,63
4	56	9,18	8, 9, 10	140	1,55
5	180	6	11, 12	154	1,47
44	60	8,5	CCGT Unit-478	126	2,0

Flue gas cleaning at the Navoi TPP is not provided. On all TPP boilers, according to the Atmosphere NIPTI's project, the technology of staged gas combustion was introduced through its redistribution among burner tiers, which shall ensure a reduction in nitrogen oxide emissions for up to 30 percent or more. However, the design effect of reducing emissions of nitrogen oxides is not achieved.

The amount of power output for each boiler depends on the amount and type of fuel used, the design of the boiler, the state of the boiler equipment.

In addition to the main sources of emissions into the atmosphere, at the TPP there are emissions from the operation of auxiliary units and equipment.

On the territory of the TPP in the repair departments there are two forge furnaces connected to two pipes. Furnaces operate on gaseous fuel, while they emit nitrogen dioxide, carbon monoxide.

Emissions of fuel oil facilities are carried out through the breathing valves of the tanks for long-term storage of fuel oil, consumable tanks and receiving trays. The fuel facilities of the TPP include four tanks of 3,750 m³ and three of 15,000 m³ each. The receiving-drain device of liquid fuel is designed to receive rail tank cars with a capacity of 120 tons. The maximum number of discharge tanks is 21 with 60 tons of the average amount of fuel oil in 1 tank. Marginal and aromatic hydrocarbons, hydrogen sulfide are emitted into the atmosphere.

When storing fuels and lubricants in a TPP garage in the amount of 164 tons/year (125 tons - gasoline, 25 tons - diesel fuel and 14.4 tons - engine oil) through the breathing valves of eight tanks (3×25 m³ - for gasoline, 1×25 m³3 , 1×60 m³ - for diesel fuel, 1×3.5 m³, 1×5 m³ - for engine oil), as well as when storing turbine (118 tons/year) and transformer (228 m³) oils in ground metal tanks (9 pcs.) hydrocarbon vapors are emitted at the oil facilities of the electrical workshop.

Unorganized emissions of pollutants include:

- emissions during unloading-loading and storage in storage facilities of table salt, anthracite, lime, cement, inorganic dust, quicklime, sulfuric acid, caustic soda, hydrazine hydrate, sulfur dioxide, polyacrylamide, anion and cation resin, ammonia, used as reagents in the chemical workshop;

- emissions from the production of electric welding and gas welding. Nitrogen dioxide, carbon monoxide, welding fumes, iron oxides, manganese, fluoride compounds come to the atmosphere. There are 57 mobile and stationary welding stations at the plant, but their simultaneous operation is excluded. The ratio of simultaneity is 0.3-0.4. The consumption of electrodes at the station is 15 tons.

During gas pipeline purging before firing boilers, salvo emissions of natural gas through purge plugs take place. The duration of purging is 10 minutes.

The characteristics and parameters of the sources of atmospheric pollution of the Navoi TPP JSC for the existing situation are given in Table 3.1 of Appendix 3.

The gross emission of pollutants in 2018 according to the statistics of the TPP amounted to 3,180.8893 tons, including:

- nitrogen dioxide - 2002.99 tons;
- carbon monoxide - 748.20 t;
- carbon monoxide - 325.349 tons.

1.3.2 Water consumption and waste disposal

Water at the Navoi Thermal Power Plant is used for technical and utility purposes.

Water for technical and utility purposes is used for drinking and for feeding the heating network, and is fed to the TPP from the city pipeline.

For the production needs of the plant water is taken from the river Zeravshan and is spent on:

- cooling of turbine condensers;
- cooling of auxiliary equipment of turbines and power units;

- needs of a water treatment plant (own needs and make-up of steam cycle boilers);

- production needs (irrigation of the territory, fire-fighting water supply pipeline, washing of industrial premises, etc.);

- supply of steam to industrial consumers;

- condensate return.

The scheme of cooling water supply to plants № 11, 12 is reverse block-type. The design capacity of the circulating water supply is 335,456.0 thousand m³ per year, in fact, the circulating water supply was 193031.0 thousand m³ per year.

According to the project, the capacity of cooling towers No. 1, 2 is 48,968.0 m³/h, through cooling tower No. 1, water consumption was 26,875.70 thousand m³/year, through cooling tower No. 2 – 86,307.19 thousand m³/year.

In 2018 for industrial needs from 577,868,644 thousand m³ was collected from the river Zeravshan. The water use limit is 860.0 million m³. There was no over-limited water consumption in 2018.

The design capacity of the re-supply (mix channel) is 28,500.0 thousand m³/year. The actual capacity of the repeated water supply is 1,452.60 thousand m³/year.

The main source of pollution of surface watercourses is the equipment of water treatment plants.

Water treatment and chemical regime

Replenishment of steam and water losses in the plant cycle is provided by the distillate of the evaporators and desalinated water from the ion exchange unit equipped with pre-treatment.

The feed water of the evaporators is produced by the ion-exchange softening unit also with pre-treatment in clarifiers. A small part of the softened water with a lack of desalted water and distillate is sent to the steam generator deaerators.

The source water for the water treatment plant is taken from the Zarafshan River and is characterized by high mineralization, the presence of seasonal fluctuations and tendencies for the steady growth of the qualitative characteristics of the chemical composition.

1. Desalting unit.

Design capacity - 600 m³/h.

The actual capacity is 660 t/h due to the lack of filtering materials.

Since May 1997, the desalting unit has been working on a mixture of waters: from the Zeravshan River and the waters of the Damkhoja water conduit.

The average annual amount of strong acid anions in the source water of the Zeravshan River was 12.43 mg-eq/dm³, in a mixture of water - 5.188 mg-eq/dm³.

Produced over a year – 3,739,742 m³ (426.9 m³/h) of desalinated water.

2. Sodium hydroxide treatment scheme.

Design capacity is 300 m³/h, actual - 250 m³/h.

The decrease in the capacity of the plant is due to the deterioration of the water quality of the Zerafshan River with regard to the designed by 2 times due to the physical deterioration of equipment that has developed an estimated service life, part of which has been dismantled.

Produced over a year – 1,537,217 m³ (175.48 m³/h) of Na-cationized water.

3. Condensate purification scheme.

Design capacity is 250 m³/h, the actual capacity is 250 m³/h, due to the physical wear of the equipment and the replacement of stage II filters with filters of a smaller diameter.

Purified over a year - 1,135,614 m³ (129.64 m³/h).

4. Installation of water treatment for feeding heating networks at water purification plants-1, 2.

Design capacity is 570 m³/h.

The actual capacity is up to 700 m³/h due to an increase in the number of filters and calcinators.

Due to equipment aging, a large number of defects are formed on the connection and in the filter housings.

The actual output per year at water purification plants-1, 2, 3 is 8,675,191 m³ (990.32 m³/h) of softened water to feed the heating network.

In 2018 filters were repaired in the amount of 20 pieces. At all water treatment plants for feeding the heating network in the filters, there is underload of filtering material (sulfo coal) due to non-delivery, which leads to a decrease in plant performance, its reliability and efficiency.

Due to the periodic absence of chemical reagents of hydrazine hydrate and trisodium phosphate, ulcer and oxygen corrosion and scale deposits appear in the composition in which calcium and magnesium deposits are present.

The decrease in the performance of the existing listed water treatment plants compared to the design one is explained by the following reasons: deterioration of the water quality of the Zerafshan River, physical deterioration of equipment that has developed an estimated service life (the main defects of water treatment plants are corrosive wear of N-cationite filters, a large number of defects on filter connection, mass violation chemical protection).

The operation of ion-exchange plants with the use of water of increased mineralization requires a large amount of reagents, which in the form of used regenerative and washed streams flow into surface water. Due to the non-delivery of filter materials, the lack of reagent dosing at

the automation station, disruptions in the operation of dosing pumps, there are deviations in pH, the content of iron oxides, copper, hydrazine in the feeding water. At the same time, with increased salinity of the source water, underload of filter materials leads to a decrease in the performance of the water treatment plant.

The consumption of reagents at the station is: H2SO4 - 27.5 tons/day, caustic - 12.5 tons/day, lime - 13.0 tons/day, table salt - 9.0 tons/day, coagulant - 0.165 tons/day. Wastewater of treatment installations is contaminated with salts, bases and acids.

There are also industrial waste streams polluted with oil products, wastewater from water-chemical flushing of boilers and equipment conservation, effluents from RAH washing (acid and alkaline), from cooling tower blowing, industrial drains. Domestic discharges are sent to wastewater treatment plants of the city sewage system, industrial effluents through certain outlets are sent to the river Zeravshan and "Sanitary" collector.

According to the project, the complex of treatment facilities for industrial effluents of the TPP (CTIE) includes:

- a building with a cleaning installation (neutralization, sedimentation) of waste water from flushing boilers and RAH;

- filter room of the plant for cleaning oiled and fuel oiled waste and condensate purification;

- pretreatment of oiled and fuel oiled waste, which includes receiving tanks, an oil trap, floaters, an oil and sludge pumping station;

- the room of the settling tanks for condensate purification;

- pumping station for sewage pumping;

- pipeline racks: from the main building, reagent warehouse to hydraulic structures;

- hydraulic structures - sludge dumps, evaporator pond, pumping stations.

Out of CTIE installations the following ones operate:

UOZZS is an installation for cleaning oiled and fuel oiled waste with a capacity of 100 m^3/h with an oil product content of not more than 100 mg/dm^3 in the incoming water.

UOZK is a purification plant for fuel oiled condensate with a capacity of 45 m^3/h with an oil product content in the incoming condensate of not more than 10 mg/dm^3. The circuit is in reserve due to the absence of fuel oiled condensate.

UOVK and RAH is an installation for purification of wastewater from washing of boilers and RAH with evaporation ponds of neutralized effluents with an area of 18,050 m^2.

The volume of normatively treated effluents at the treatment plants, after which the effluents are discharged into the Zeravshan River, amounted to 2,182 thousand m³ for 2018, of which:

- physical and chemical treatment - 1,832.0 thousand m³ per year (sludge disposal tank of the CTIE);

- mechanical treatment - 350.4 thousand m³ per year (oil trap No. 1, 2).

The volume of normatively treated effluents received by the river Zerafshan in 2018 without purification amounted to 577,868,644 thousand m³.

There are seven wastewater discharges at the plant, the characteristics of which are given below.

Discharge № 1. The warmed (heated) waters after cooling of condensers and coolers of auxiliary mechanisms. Discharge to the river Zerafshan. Actual consumption: 67360.927 m³/h, approved flow rate – 106,365 m³/h. Waters are normatively treated. The salt composition of the waste water does not differ from the initial one, the temperature increase is due to reheating in I-II turn heat exchangers of the TPP, operating on a direct-flow system of water supply.

Discharge № 2. Waste water drain, drainage from blocks 8-12 through oil trap No. 2 into the river Zerafshan. Discharges are polluted with oil products, suspended particles, high mineralization. The actual discharge is at the approved level and is 35 m³/h.

Discharge № 3. Blowdown water from cooling towers is regulatory clean. The content of calcium and magnesium salts is increased. Discharge is into the "Sanitary" collector. The actual discharge is at the approved level and is 254.5 m³/h.

Discharge № 4. Industrial drainage, main building, drainage from units of plants No. 1-7. Discharge into the river Zerafshan after settling in the well. The drains are normatively purified. Approved and actual discharge - 5.0 m³/h.

Discharge № 5. Discharge of regulatory purified effluents into the river Zerafshan after the integrated treatment of industrial wastwater (from the sludge collector of effluents from all water treatment plants, purification of contaminated condensates associated with ion exchange, where, after exchange reactions, the hardness salts to be removed from the make-up water accumulate in the filtering material. In the process of recovery of ion-exchange filters, the trapped ions pass into the waste water, contaminating them with hardness salts, iron impurities, silicic acid, sulfates, chlorides, etc.). The amount of actually discharged water is 209.13 m³/h, the approved wastewater flow is 344.0 m³/h.

Discharge № 6. Discharge of regulatory clean water from pumping for interception of water treatment plant drains in case of failure of pumps for sewage pumping interception

(regeneration, washing of filters) onto the terrain. The actual discharge is at the approved level and is 785 m³/h.

In 2018, a discharge was made only into discharges No. 1, 2.4.5.

Table 1.7 provides the quantitative and qualitative characteristics of each discharge in comparison with the allowed and maximum allowable concentrations for fishery watercourses, table 1.8 - according to the measurements of the plant compared to MACf.w.

The background concentrations in the source water exceed the standards in terms of the content of suspended substances, salts, sulfates, nitrite nitrogen, iron and petroleum products. A similar excess for the listed pollutants is available in the case of discharge No. 1. Iron salts, in the case of other discharges, except discharge No. 1, are not detected.

For all the discharges, the concentration of salts introduced into the surface watercourse with wastewater is 1.4 - 1.7 times higher than the standard values for water reservoirs of fishery importance, mainly due to sulphates and hardness salts accumulated in chemical filters.

The main source of the river Zeravshan pollution with salts is discharge No. 5 - wastewater after water treatment plants, including those settled in a sludge collector.

For discharge No. 4, the excesses in suspended substances and oil products can be observed, the content of other pollutants has not been identified.

Thus, chemical pollution of the river Zerafshan is mainly caused by the existing condition of the water treatment plant equipment, in which the plant's production effluents exceed the permitted and standard values of pollutant concentrations for fishery watercourses.

Table 1.7 Permissible concentrations of pollutants in waste waters of the Navoi TPP, mg/dm³

No.	Indicator	MACf.w.	Discharge 1	Discharge 2	Discharge 3	Discharge 4	Discharge 5	Discharge 6
1	Suspended substances	15	487	487	487	487	487	487
2	Mineralization	1000	1500	1500	1500	1500	1500	1500
3	Nitrites	0,08	3,3	3,3	3,3	3,3	3,3	3,3
4	Nitrates	40	45	45	45	45	45	45
5	Sulphates	100	500	500	500	500	1000	1000
6	Chlorides	300	350	350	350	350	350	350
7	Calcium	190	280,5	280,5	280,5	280,5	280,5	280,5
8	Magnesium	40	170,1	170,1	170,1	170,1	170,1	170,1
9	Oil products	0,05	0,234	0,1	0,1	0,1		
10	Total iron	0,05	4,62	4,62	4,62	4,62	4,62	4,62

Table 1.8 Composition of discharge water of the Navoi TPP JSC, mg/dm³

No.	Indicator	Feed Channel (Background)	Discharge No.1	Discharge No.2	Discharge No.4	Discharge No.5	MACf.w.

1	Suspended substances	791	759	192	181	183	15
2	Mineralization	1516	1516	1410	none	1671	1000
3	Chlorides	91	90,3	86	none	94,2	300
4	Sulphates	545	545	496	none	634	100
5	Oil products	0,24	0,24	0,29	none	none	0,05
6	Nitrite nitrogen	0,156	0,186	0,124	none	none	0,02
7	Nitrate nitrogen	7,6	7,8	6,25	none	none	9,1
8	Iron	5,0	5,1		0,27	none	0,05
9	pH	8,25	8,23	8,1	7,9	8,15	6,5-8,5
10	Temperature, °C	19,0	20,0	21,1	17,3	20,3	Not more than by 3°C

1.3.3 Solid waste generation and storage

Waste generated at the TPP differs in morphology, genesis, and hazard class.

Some types of waste are generated continuously, the generation of others is periodic.

Production wastes are generated at the TPP during the operation of the chemical, electrical, boiler-turbine, fuel and transport workshops, an auto garage, and the repair and construction site.

When preparing feed water for power boilers in a desalting plant, during the process of coagulation with iron sulfate and filtration, mechanical sludge is formed on the mechanical filters, which is sent to the sludge dumps and contains 85% of suspended substances, 13% of iron hydroxide, and 2% of silicic acid.

When cleaning water for making up the heating network, on cationic filters of the water treatment plant, when they are restored, sodium chloride is used, which comes as solid waste to the sludge collectors.

Liquid sludge, in addition to industrial wastewater treatment effluents, contains boiler equipment acid cleaning, drains after cooling of auxiliary equipment of power units and stormwater drainage. For the purpose of sedimentation of a solid phase, liquid sludge enters 5 sludge collecting sedimentation tanks:

A two-section sludge dump for wastewater of water purification plant and lime green coke with sludge pipelines and discharge ports for clarified runoff into the river Zerafshan;

The sludge dump for fuel oiled sludge and sediment with sludge pipelines and reverse water conduit for clarified water and a pump station for clarified water;

Evaporation ponds for acidic water washing of boiler equipment and washing water of the RAH.

The two-section sludge dump of wastewater of the water purification plant was designed as unfiltered, the building height is 4.5 m, the slope ratio is m = 2.5.

The area along the bottom of one section is 11,800 m² (sludge dump No. 1), of the other one - 8,000 m² (sludge dump No. 2). The sludge dump is designed for a volume of 83,000 m³ of solid sediment. The water clarified in the sludge collector enters the mine water intake wells, the height of which is increased by installing dam beams as the sludge dump is filled with solid fractions. From the water intake wells, water flows by gravity through a pipe with a diameter of 350 mm into the discharge channel. At the moment, both sections are on the verge of exhaustion. The discharge technology is often violated. In view of the failure of the integrated treatment of industrial wastewater (neutralization device of the water purification plant), alkaline and acid waste flows separately into the dump. The environment is aggressive. There is an uneven interaction reaction at the discharge sites with a negative effect on the impervious screen. Actually, the sludge dump is partially filtered. In the asphalt concrete surface there are cracks and breaks. Section cladding does not meet specifications. The dam coating is destroyed, it is cobbled with lime green coke discharges after the clarifiers.

Periodically, work is carried out on scooping up the sludge and shipping it to the sites allocated in the area of city dumps. For the full disposal of the water purification plant waste, allocation of about 40,000 m² of space is required. Given the presence of chemicals in the composition of waste, their migration into soils and groundwater is possible. Periodically, settlers No. 1, 2 are cleaned from reeds and plants. Currently, sludge dump No. 1 is closed for sludge cleaning, 20% of the total sludge has been removed. 50% filled sludge dump No. 2 is in progress.

Condensed waste enters the sludge dump foe fuel oiled mud and sediment after the installation of cleaning oiled and fuel oiled wastewater. The sludge dump is designed to be unfiltered with two sections. The height is 14.5 m, the area of each section is 1000 m2. The accommodating volume is 9600 m³. At the moment, the filling of the sludge collector is about 70%.

According to the project, the impervious screen of the ZIO (manufacturer ZIO-Podolsk) sludge dumper is made of fine-grained asphalt concrete. The surface of the bottom and slopes of the evaporation pond before facing with asphalt concrete in order to avoid germination of vegetation is treated with long-acting herbicides (douran, monuran). The solid fraction is to be incinerated in the boiler furnaces. The water clarified in the sludge dump enters the mine water intake wells, the height of which increases as the sludge dump is filled with solid fractions. From there, through the overflow pipe with a diameter of 200 mm, the clarified water returns to the integrated treatment of industrial wastewater cycle through the pumping station.

Sludge containing metals (iron, nickel, copper, chromium, vanadium), as well as sulfuric, hydrochloric acids, ammonium compounds, which are formed periodically during chemical cleaning of heating equipment (steam generators) and cleaning of RAH surfaces.

Two sections of the evaporation pond under the project are provided unfiltered with a design similar to the sludge dump for fuel oiled sludge. The evaporation ponds are located on the site, which has a slope to the floodplain of the river Zerafshan. The area of one section is 11000 m², the other one - trapezoidal - 6000 m². The building height is 1.5 m. The sections of the pond fit into the terraced terrain with 1.5 m elevation of the bottom of one section below the other one. According to the project, flushing water to be collected in acid washing tanks to neutralize acidic and alkaline drains. At the end of neutralization, to precipitate heavy metal ions, decompose hydrazine, ammonium compounds, the solution shall be treated with lime cream, and then discharged into the pond. Due to the toxicity of the sludge, the water component is subject to complete evaporation (estimated at 101 cm per year), the sludge is deposited and compressed.

The estimated amount of washing water is ≈43000 m³/year. Of these, the solid component is ≈2000 tons/year.

The water purification plant sludge is characterized by increased mineralization of aqueous solution of the water purification plant sludge, total salt content is about 6000 mg/dm³, pH - 7.8, sulfates (3939.759 mg/dm³) prevail among anions, magnesium (657.598 mg/dm³) prevail among cations.

The sludge from the evaporation pond after chemical cleaning of the equipment contains less soluble substances. The total mineralization of the aqueous extract is in the range of 300-2500 mg/dm³, pH - 7.8, sulfates prevail among anions, their content is 5 times less than in the sludge from the settling tanks of the water purification plant (783.750 mg/dm³), among cations - magnesium cations (141.866 mg/dm³).

Spectral analysis showed an increased content of magnesium, calcium, iron, sodium, and potassium in the sludge from the water purification plant ponds. Iron, copper, vanadium, chromium, and zinc dominate in the sediment of evaporation ponds.

Thus, the analyzes confirm the addition of salts and metals generated in the process of water softening and chemical equipment cleaning.

Solid waste is also generated during the regeneration of waste (transformer, turbine and other) oils.

The waste oils are cleaned at the plant's oil facilities. Contaminated oil is collected in a special tank with up to 30 ton volume.

Regeneration is performed by passing the oil through a centrifuge and silica gel filters. Refined oil is collected in another tank and returned to the process cycle. After the centrifuge, the dirt is collected in a bucket and manually transported to the fuel oil facilities, from there all the waste goes to the integrated treatment of industrial wastewater with fuel oiled drains.

The used silica gel is folded in a bucket, it is dried in an oven, and then returned to the process.

Non-ferrous metal wastes are generated in the electrical shop, auto garage, while repairing turbine and electrical equipment. The total amount of waste of non-ferrous scrap reaches 3 tons/year.

The used fluorescent lamps are generated as waste from production workshops and office premises in the amount of up to 500 pieces/year, they are stored locked up in corrugated boxes, and as they accumulate, they are transferred to a specialized organization for de-mercuration.

Waste ferrous metals are generated during the repair and maintenance of vehicles, during the repair of the plant (replacement of sections of screen tubes, superheaters, water economizers as a result of corrosion), their amount is estimated at 513 tons/year, ferrous scrap is delivered to Vtorchermet.

When carrying out welding, residues of electrodes are formed.

In the auto garage, used tires, used brake pads, waste batteries and electrolyte are generated.

At all production sites, oiled rags generated as a result of cleaning equipment and hands of personnel are formed as waste.

During construction, construction waste is generated as solid waste. Construction waste is transported to designated areas of the household waste landfill, allocated by sanitary and epidemiological authorities.

Waste from the dining room is food waste, which is temporarily stored in a metal container and then transferred as feed to personnel pets.

The TPP has a first-aid post which waste is: waste dressings, used medical syringes and needles from them.

The TPP also has its own ancillary farm, the waste of which is manure as the product of animal life.

Household waste is generated in all divisions of the TPP and consists of 47% paper, 1% wood, 1.8% leather and rubber, 0.5% bones, 4.5% metal, 29% food waste, 5% textiles, 4.9% glass and stones, 2% plastics. Household waste is transported to the city landfill in coordination with the Central State Sanitary Epidemiological Service.

A total of 37 items of waste are generated at the TPP. Temporary storage facilities are provided for all wastes.

Some of these wastes are regenerated or reused at the enterprise, some are exported under contracts to specialized organizations for recycling and disposal.

Information on production and consumption waste of the Navoi TPP JSC is given in table 1.9.

Table 1.9 Information on production and consumption waste

No.	Waste description	Amount of waste, t/year		Hazard class
		Norm	Limit	
1.	Oiled rugs	0,097686	0,048	3
2.	Waste paper	1,5	0,74	4
3.	Ferrous metal scrap	513,05	253	4
4.	Remains of welding electrodes	2,795	1,378	5
5.	Non-ferrous metal scrap	3,0	1,479	3
6.	Oil sludge	0,1006	0,1006 0,0496	3
7.	Lead waste batteries	0,374	0,184	1
8.	Electrolyte	0,144	0,071	2
9.	Used plastic battery boxes	0,057	0,028	4
10.	Used PPE	10,716	5,284	4
11.	Used fluorescent lamps	6,829055	5,5926	1
12.	Used turbine oil	1,556	0,767	2
13.	Used tires	3,52	1,736	4
14.	Used oiled filters	0,057	0,028	4
15.	Used brake pads	0,09	0,044	5
16.	Metal shavings	18,0	8,877	5
17.	Used lining material	119,0	58,685	4
18.	Construction waste	257,4375	126,956	5
19.	Containers from under paints and varnishes	16,0	7,89	3
20.	Used dressings of medical station	0,05	0,025	4
21.	Used medical syringes	0,0336	0,017	4
22.	Used medical syringe needles	0,0044	0,002	4
23.	Used transformer oil	45,0	22,192	2
24.	Waste of thermal insulation materials	21,9	10,8	3
25.	Fuel oiled mud	21,75	10,726	3
26.	Turbine oil cleaning sludge	12,85	6,337	3
27.	Oiled waste sludge	1,4016	0,691	3
28.	Sludge from wastewater treatment plant	5002,244	2466,86	3

	(WTP)			
29.	Sludge from raw water pre-treatment	4264,508	2103,045	3
30.	Mud from river water clarification	4500	2219,1781	4
31.	Sediment from chemical cleaning of condensers and tubes of the screen system	18,0	8,877	3
32.	Used lime	667,8	329,326	5
33.	Technical salt waste	89,84	44,305	4
34.	Isolator crushing	0,1	0,049	4
35.	Manure	2299,5	1134	4
36.	Food waste	56,43		5
37.	Household waste	265,75		5
	TOTAL	18221,4854	8827,0547	

Total 1 hazard class waste generation is 7.203055 tons/year, 2 hazard class - 46.7 tons/year, 3 hazard class - 9361.90889 tons/year, 4 hazard class - 7,537.371 tons/year, 5 hazard class 5 - 1268.3025 tons/year.

Thus, in the production of power and heat, thermal power plant has sources of pollutants entering the environment in the form of emissions, discharges and solid waste.

1.4 Atmospheric air condition

The qualitative and quantitative input of polluting chemicals entering the atmosphere along with the flue gases of the Navoi TPP depends on the type of fuel used. When hydrogen-containing gas is burned, nitrogen oxide and dioxide, sulfur dioxide, carbon monoxide, benzo(a)pyrene enter the atmosphere. When burning fuel oil - fuel oil ash additionally.

22 items of pollutants come to the atmosphere from 46 emission sources.

The gross emission of pollutants during the operation of TPP equipment at maximum load, according to the calculations, is 4976.6268 tons/year. The main air pollutants are nitrogen dioxide (3483.5658 tons/year), accounting for 70.0% of the total emissions into the atmosphere, carbon oxide (874.4503 tons/year) - 17.57% and nitrogen oxide (577.9607 tons/year) - 11.61%. The share of other pollutants in the amount of 19 ingredients is 0.82% (Appendix 3, Table 3.1).

The list of substances polluting the atmosphere with emissions from the Navoi TPP in accordance with the current state is given below in Table 1.10.

To study the state of the atmospheric air, to identify the contribution by the Navoi TPP to the level of atmospheric pollution in the current state, the concentrations of pollutants produced by the enterprise emissions were calculated.

The calculation made out according to the program “Ecologist” on the area of 8×5 km with a step of 0.5 km, taking into account parameters of the sources of emissions of harmful substances (Appendix 3, Table 3.1), meteorological characteristics and coefficients determining the pollutant dispersion conditions and described in section 1.1.

The analysis of air pollution in the studied area showed that the highest concentrations outside the industrial site of Navoi TPP JSC had been formed by nitrogen dioxide emissions (Appendix 4, Fig. 4.1) and amounted to 1.03 MPC, which exceeded the quota for 2 hazard class substances and enterprises located in the Navoi region by 4.12 times.

Table 1.10 List of substances polluting the atmosphere with emissions from Navoi TPP JSC (current state)

No.	Pollutant	MAC or SRLI, mg/m3	Hazard class (SRLI)	Established quota (MAC shares)	Maximum concentration in MAC shares	Compliance with the established quota (+,-)	Pollutant emission, tons/year	%
1	Ammonia	0,2	4	0,5	0,004	+	0,1490	0,003
2	Oil aerosol	0,05	4	0,5	0,04		0,0002	0,000004
3	Sulfuric acid aerosol	0,3	2	0,25	0,16		9,9944	0,20
4	Alkali aerosol	0,01	3	0,33	0,01		0,0081	0,0002
5	Benz(a)pyrene	0,000001	1	0,2	0,14		0,0393	0,0008
6	Nitrogen dioxide	0,085	2	0,25	1,03	-	3483,5658	70,00
7	Sulphur dioxide	0,5	3	0,33	0,01		21,1547	0,43
8	Limestone	0,03	3	0,33	0,24		0,0142	0,0003
9	Fuel oil ash	0,002	2	0,25	Cm<0,1*		0,0031	0,0001
10	Manganese and compounds	0,005	2	0,25	0,05		0,0075	0,0002
11	Nitrogen oxide	0,6	3	0,33	0,03		577,9607	11,61
12	Iron oxide	0,2	3	0,33	0,03		0,1583	0,003
13	Silicon oxide	0,02	3	0,33	0,01		0,0196	0,0004
14	Carbon	5	4	0,5	0,005		874,4503	17,57

	monoxide							
15	Gasoline vapor	5	4	0,5	0,13		1,0347	0,02
16	Abrasive dust	0,04	3	0,33	0,08		0,0007	0,00001
17	Metal dust	0,2	3	0,33	0,23		0,0011	0,00002
18	Hydrocarbons	1	4	0,5	0,13		5,9609	0,12
19	Fluorides	0,2	2	0,25	0,001		0,0196	0,0004
20	Hydrogen fluoride	0,012	3	0,33	0,02		0,0140	0,0003
21	Hydrogen chloride	0,2	2	0,25	0,04		2,0563	0,04
22	Sodium chloride	0,5	3	0,33	0,02		0,0142	0,0003
	Total						**4976,6268**	**100,00**
*- The total maximum concentration created by the emissions of this substance is less than the coefficient of expediency of calculations E3 = 0.1 (no emission calculation was made for this substance)								

Concentrations of all other pollutants meet the established requirements for the level of air pollution and do not exceed the quotas for pollutants of the relevant hazard class and enterprises located in the Navoi region (Appendix 4, Fig. 4.2 - 4.21).

Thus, the state of atmospheric air in the zone of influence of Navoi TPP JSC in accordance with the “Methodological guidelines on ecological and hygienic zoning of the territory of the Republic of Uzbekistan by the degree of hazard to public health” shall be classified as moderately polluted, causing concern for public health.

1.5 Surface water

Navoi TPP JSC is located on the bank of the river Zerafshan.

In the past, the Zerafshan River was a tributary of the river Amu-Darya. Currently - Zerafshan is a drainless river. Its waters are used entirely for national economic needs.

In the area of Duguli village, the river overlooks a desert-sandy plain. Water collection of the mountainous part of the river is 11722 km².

The Zerafshan River basin extends in the latitudinal direction from east to west and is bounded by the Turkestan and Zerafshan ranges. The river has a length of 750 km.

After leaving the mountains, the river is divided into two branches: the northern - Akdarya and the southern - Karadarya. When entering the Zerafshan valley, the branches again merge into one channel, 60 km downstream from the confluence of the branches, the water intake of the Navoi TPP is located.

The Zerafshan River is fed by glaciers and snow. It is formed by the confluence of the rivers Matchi and Fandarya.

The waters of the Zerafshan River are used entirely to irrigate the land of Tajikistan, the and Samarkand and Bukhara regions of Uzbekistan.

The flow of the Zerafshan River is largely regulated by the Katta-Kurgan Reservoir, built in 1947, with a capacity of 500 million m^3.

Four irrigation canals take water from the Zarafshan River in the section from Zaatdin to Navoi: Kanimekh, Kalkon-Ata, Kasoba and Khanym with a maximum total withdrawal of up to 20 m^3/h. The residual flow of the river of Zaravshan is used to fill the Kuymazar reservoir located below the thermal power plant. In its lower reaches the Zerafshan river belongs to low rivers. Throughout the length of the river to the city of Navoi, an intensive water intake takes place. The river flow, as in all glacier-fed rivers, depends on the season. Low flow (minimum flow) occurs from October to May. In June and July there is a flood, and in August-September there is a slow decline in the water level.

To date, the river's water balance in the annual course of time is close to long-term observations, and specifically depends on the amount of precipitation during a year.

There is a tendency to a decrease in the value of the minimum flow, which is associated with increased water intake for agricultural needs during the low-flow periods.

The chemical composition of Zerafshan river water is formed under the influence of pollutants coming with sewage water from industrial enterprises of the cities of Samarkand, Kattakurgan, Navoi and farmland. The qualitative composition of surface water also depends on the meteorological, hydrogeological and morphological characteristics of water. In recent decades, the intensive growth of industry in the region of the Zerafshan river valley, the development of desert lands has led to a change in the flow of the river. Long-term observations of the chemical composition of river water indicate a tendency to increase mineralization (the content of sulphates, chlorides, hardness salts), which contributes to the development of salt-like organisms in aquatic biocenoses that affect the periphyton values.

The maximum water flow occurs in July - August. The maximum temperature of 24 ° C at the approach to the city was observed in June, July. The minimum flow of water is observed in November, December, and October. The minimum water temperature falls in January, February. With a decrease in the flow of the river, the mineralization and, accordingly, the content of sulphates, chlorides, carbonates, the content of hardness salts (magnesium, calcium, sodium) increase sharply. Chemical pollution of water increases in the autumn-winter period. When approaching the city, water contains above the permissible values of ions of magnesium, calcium,

sulfates, phenol, chromates, and iron. In some months, there is an increase in nitrites, metals (copper, zinc, etc.).

A water quality criterion is the water pollution index (WPI). When the WPI value is up to 1.0, water is considered clean. With 4>WPI> 2.5, water belongs to moderately polluted water of the third class of quality. At the gauging station before the city of Navoi, WPI is 8.5. This is due to the industrial indicators of industrial enterprises. Despite the pollution, water of the river Zerafshan is used for potable purposes of the city of Navoi and the region, since the quality of groundwater does not meet the potable water standards. Water quality after the city of Navoi is deteriorating. The concentration of suspended solids, magnesium, chlorides, sulphates, total hardness, total nitrogen increases, the content of oil products, iron, copper, zinc, chromium, surfactants, phenols increases slightly, the water temperature increases by 2-4°C with an average and maximum drain and up to 8 -9°C with a minimum flow (table 1.11).

Table 1.11 Chemical composition of the river Zerafshan

Indicators	Unit of measurement	Section above Navoiazot	Section lower Navoiazot
Oxygen	mgO2/dm3	10,2	10,55
BOD	mgO2/dm3	1,86	2,36
COD	mgO2/dm3	12,59	14,32
Ammonia nitrogen	mg/dm3	0,05	0,14
Nitrite nitrogen	mg/dm3	0,019	0,037
Nitrate nitrogen	mg/dm3	1,9	2,1
Iron	mg/dm3	0,02	0,04
Copper	mkg/dm3	1,1	1,0
Zinc	mkg/dm3	1,6	2,2
Chrome VI	mkg/dm3	1,0	1,0
Phenols	mg/dm3	0,004	0,004
Oil products	mg/dm3	0,02	0,02
Synthetic surfactants	mg/dm3	0,0	0,0
Suspended solids	mg/dm3	388,5	325,4
Mineralization	mg/dm3	1234,5	1234,5
* According to the Surface Water Quality Yearbook on the territory of Uzgidromet activities for 2012. Tashkent, 2013 (average values)			

In their lower course, the waters of the Zerafshan River are characterized by a high content of suspended solids, especially during the flood period, a large mass of garbage passes along the river, the formation of which occurs due to rainwater flushing of rhizomes of cotton, bushes and other garbage from ploughed up river slopes developed for agricultural fields.

The highest turbidity reaches 11,000 to 13,000 g/m³ in the spring and summer period. The smallest is 32 g/m³ in the autumn-winter period.

Thus, the quality of the water flow of the Zerafshan River indicates a change in its chemical composition, temperature and hydrological regimes under the influence of effluents from industrial enterprises. The river waters in the area of the city of Navoi in terms of the content of petroleum products, phenol, heavy metal elements, and nitrites exceed the MAC. The salt content increases from year to year. The temperature rises and water flow somewhat decreases. The Navoi TPP is one of the main contributors to chemical pollution, the temperature and hydrological characteristics of the Zerafshan river flow are described above in section 1.3.2.

1.6 Ground, groundwater

Navoi TPP JSC is located on the third right bank above flood-plain terrace of the Zerafshan river. This is a flat plain with a slight bias towards the river, refers to the Golodnostep sedimentation cycle.

The widespread valley of the river Zerafshan along the axial part is cut by the modern riverbed, which banks are morphologically well expressed by the ledges of the first and third above flood-plain terraces.

Absolute elevations range from 328.27 to 335.0. The height of the terrace ledge above the low-water horizon in the river is 6–7 m.

Within the area from the surface, a stratum of quaternary deposits is developed, underlain everywhere by continental tertiary deposits — a layer of interbedded sand, argillite clay, sandstones, and conglomerates. More ancient Paleozoic and Cretaceous rocks spread far beyond the industrial site.

Quaternary deposits of the Golodnostep complex are represented by alluvial-proluvial loams and sandy-brownish sandy loams, moist, dense, plastic, macroporous, imbedding as a layer with a thickness of 5-6 to 10 m and more, which decreases with distance from the river. Sandy cobbles with gravel and clay filler, with interlayers and lenses of sand, rotted rock and less often conglomerates, lie below. Pebbles are small, mostly flat, from shale, sandstone, limestone, etc. The gravel-pebble layer reaches 20-25 m and more.

Soil mineralization on average is 0.12 - 0.22%, in horizons of high salinity - 0.5 - 0.6% of dry matter.

From the surface, the relief of the site is complicated by ground dumps, crossed by small sprinklers, and excavations for various hydraulic structures (settlers for various purposes).

Analysis of archive materials on the chemical composition of water extracts of soils has not revealed sharp fluctuations in their pH values (7.4-7.6), the total content of easily and moderately soluble salts in the hydrochloric acid extract ranges from 1.461 to 3.3%, gypsum - from 1,401 to 2,799%, therefore the soils are non-saline.

Hydrogeological conditions of the area are complex due to geological, climatic and agricultural factors.

The water-bearing complex of Cretaceous-Paleogene (Upper Cretaceous-Paleocene) sediments is represented by sandstones and limestones with clay and siltstone interlayers. The group of streams of proluvial-alluvial deposits of foothill plains with a depression curve of a structural-lithological backwater. The area is with a positive salt balance.

Hydrogeological conditions are characterized by the development of groundwater, confined to the quaternary sediments of the Zerafshan river valley. Within the study area, the type of feeding is snow and rain, and in addition, groundwater receives additional feeding due to infiltration of irrigation water. A genetic type of groundwater regime is irrigation-hydrological, riverine, and drainage.

Since the area of the plant is in the field of intensive development for irrigated agriculture, the fluctuation of the groundwater level is seasonal and depends on the frequency of irrigation of agricultural crops. The maximum level is observed in the summer period and is 3–5 m, increasing as it approaches the river.

Groundwater salinity is increased and varies from 3.4 to 9.2 g/dm³. The type of mineralization is sodium sulphate.

The filtration ratio of clay rocks varies from 0.0045 to 0.2 m/day, for pebble rocks - from 1.09 to 6.84 m/day.

The surface of the groundwater mirror has slight slopes, and is generally identical with the general slope of the relief. During the period of intensive irrigation, the groundwater level rises, water flows into the river and are drained everywhere in the riverbed. When the groundwater level drops, the reverse process takes place, so groundwater in the study area has a hydraulic connection with the surface water of the river, the groundwater flow varies depending on seasonal conditions, or it pinches into the river or is fed from it.

The lithological structure of the plant area is as follows: bulk soil with a thickness of 1 to 7 m lies on the surface and represents an disorderly mixture of loam, pebble, construction debris. Bulk soils are underlain by loams with rare inclusions of sand lenses with fragments of rotted rock. The thickness of the layer ranges from 4 to 9 m. In this layer there are also sandy loam and sands with rare inclusions of gravel. Clay soils, as a rule, lie above the groundwater level.

They are underlain by gravel-pebble sediments that form the aquifer. The revealed thickness of these deposits varies from 1.9 to 9 m. This layer contains conglomerate lenses.

The groundwater in the area of the plant has a high salinity. Dense residue ranges from 1190 to 2808 mg/dm³, rarely 3602 mg/dm³. The type of mineralization is sulphate-sodium with SO_4^{2-} content of up to 2164 mg/dm³. The depth of groundwater varies depending on the nature of the relief and the season of the year.

On the plant area there is a network of piezometric wells installed in 1975. The groundwater level and its composition are monitored. These observations are made irregularly for a number of reasons. The location of piezometric plants on the territory of the Navoi TPP and their condition are presented in Table 1.12.

Table 1.12 Location of piezometric wells on the territory of Navoi TPP JSC

Item No.	Location	Condition
1	Behind checkpoint-2	Operating
2	On the corner of Switchyard-110, in the area of oil facilities	Operating
3a	Near the boiler inspection greenhouse	Clogged
4	Start of the main building, next to the railway	Operating
4a	Between settling tanks of the integrated treatment of industrial wastewater	Operating
5a	In the area of the integrated treatment of industrial wastewater, on the corner of the sludge dump	Clogged
10	Behind unit No. 8 and T-8 on the axis "A"	Operating
12a	Behind the store	Operating
14	In the central are of Switchyard-220	Operating
14a	On the corner of the building of integrated treatment of industrial wastewater	Operating

15	Behind unit No.9	Operating
15a	Near the diversion channel in the area of integrated treatment of industrial wastewater	Operating
22	At the fence of the switchyard	Operating
22a	On the corner of the building of water purification plant-2 near the road to the RTS	Operating
23	At the back of No. 8	Operating
23a	On the corner of a solid caustic warehouse near the road	Operating
24	In front of boiler No. 5	Operating
24a	At the fence in the area of fuel of lubricants	Operating
27	At the daytime laboratory of water purification plant-1 and railway	Clogged
29	At the old building of the capital building department	Clogged
31	In front of the water purification plant-3 building near the road	Clogged
32	Behind the peak boiler room	Clogged
36	Behind dining room No. 23 near the open area	Clogged
37	In from of acid and salt warehouse	Clogged
39	Near accumulator tanks of the heating system	Clogged
51	Near the site for the collection of scrap metal	Clogged
53	Behind the materials warehouse of the Navoi TPP	Clogged
55	Near the channel from cooling tower No. 1	Clogged
58	Behind the cooling towers near the perimeter	Clogged
59	Near the second settler of the cooling tower	Clogged

Thus, today there are15 working wells at the plant.

The available data indicate that groundwater level fluctuations are not the same under different technological units of the plant.

The foundations of the cooling towers, pumping room and main buildings are constantly exposed to aggressive groundwater. The drainage system is not functioning enough and flooding of the foundations is not compensated.

In the area of the integrated treatment of industrial wastewater and sludge collectors, the groundwater flow is directed from the Zerafshan river. An increase in the level of groundwater is observed along the banks of the discharge channel. This is explained by the fact that the concrete

banks of the channel create a barrier to the groundwater flow. The feed channel is not such an obstacle.

In the rest of the territory, the groundwater flow goes to the river, and in the area of the cooling towers, the groundwater is drained into the Sanitary collector.

In the central part of the station, an increase in the level of groundwater is observed, especially noticeable under the main building, presumably associated with the balance and flow disturbance by the plant structures.

he chemical composition of groundwater on the basis of archival data is presented in tables 1.13 and 1.14 and indicates a high salinity of groundwater and its assignment to sulphate. A significant addition of petroleum products to the groundwater should be noted.

Thus, according to the results of the analysis of groundwater and the data of piezometric observations, it can be concluded on the filtration from sludge collectors, settlers and cooling tower pallets.

Table 1.13 Chemical composition of groundwater in the area of location of Navoi TPP JSC

Place of sampling, sample No.	Depth, m	pH	Mineralization, g/dm^3	Hardness, mg-eq./dm^3	Content of ions, mg/l					
					$Na^+ + K^+$	Mg^{2+}	Ca^{2+}	SO_4^{2-}	Cl^-	HCO_3^-
Cooling towers, 1	3,7	7,0	4000	49,415	324	288	516	2325	252	488
Cooling towers, 2	4,5	7,2	1920	22,417	191	156	192	1017	140	342
Chimney	5,8	6,9	3164	32,210	366,3	103	476	1604,8	312,4	361,1
Switchyard, 1	5,2	7,5	1432	9,182	306	-	164	276,5	142	775,9
Switchyard, 2	6,0	7,5	7,5	20,277	335,8	118	316	1288,8	136,3	256,2
Switchyard, 3	6,0	6,9	3164	32,219	366,3	103	476	1604,8	312,4	361,1

Table 1.14 Results of measurements of groundwater level and its chemical composition in piezometers at Navoi TPP JSC

Item No.	Absolute water level elevation	Maximum allowable water level	Exceeded allowable water level	Chemical composition							
				pH	Alkali	Hardness	Ca^{2+}	Cl^-	SO_4^{2-}	Mineralization	Oil products, m/l
1	330,77	330,4	0,37	8,60	0,4/4,5	13,8	7,2	110	652	1536	0,44
3	329,68	329,2	0,48	6,95	-/6,5	6,8	4,1	130	864	1278	1,5
4	329,46	328,6	0,86	7,1	-/2,1	4,5	2,2	180	441	1094	1,1
4a	327,73	328,2		7,6	-/6,5	16,8	9,1	115	748	1684	0,76
10	329,83	329,2	0,63	7,4	-/4,8	38,8	10,0	130	921	3006	1,8
12a	328,44	328,80		9,6	0,3/0,8	9,4	4,6	135	614	1944	0,35
14	331,08	331,00	0,08	8,9	0,4/1,0	17,6	6,4	190	1228	1980	0,35
14a	327,82	327,9		8,3	0,2/5,2	17,6	9,4	96	460	1430	0,68
16	329,87	329,55	0,32	7,6	-/4,4	28,5	20,0	140	979	2425	1,2
16a	327,41	330,3		8,4	0,4/1,6	23,6	13,6	180	3840	5600	0,33
22	330,23	330,45		7,2	-/0,9	17,1	9,8	170	864	1610	1,2
22a	325,40	328,1		8,35	0,2/4,2	22,5	7,8	95	1478	3291	0,7
23	329,71	329,00	0,71	8,9	-/2,2	12,2	6,6	80	700	2048	0,54
2	3	4	5	6	7	8	9	10	11	12	13

Item No.	Absolute water level elevation	Maximum allowable water level	Exceeded allowable water level	Chemical composition							
				p H	Alkali	Hardness	Ca^{2+}	Cl^-	SO_4^{2-}	Mineralization	Oil products, m/l
23a	327,6	327,7		7,5	-/9,0	42,5	30,7	480	14,01	3912	0,42
24	327,13	328,95		8,1	-/1,2	13,9	6,8	130	748	2188	1,2
24a	327,11	327,80		7,8	-/6,8	36,2	9,8	155	1305	3072	0,95
29	328,2	327,9	0,30	8,1	-/4,6	14,8	8,2	100	1056	1186	0,9
31	327,41	327,3	0,11	7,75	-/5,4	18,2	9,4	145	806	1684	0,45
32	325,91	327,5		6,95	-/5,2	17,3	8,3	110	787	1750	0,4
36	328,63	327,8	0,03	7,45	-/4,8	25,8	16,0	115	1824	2129	0,9
37	327,25	327,8		7,7	-/4,5	24,6	6,1	250	1240	2500	0,78
39	326,21	327,3		8,4	0,7/5,7	22,8	12,0	800	960	2428	0,37
51	328,76	327,3	1,46	7,3	-/5,0	30,2	19,4	170	1612	2351	0,69
53	327,02	327,1		7,75	-/4,7	22,4	6,7	140	1050	2203	1,9
55	329,88	327,5	2,38	7,25	-/4,3	34,8	19,6	110	1036	2277	1,9
58	326,23	326,9		7,6	-/5,1	23,5	7,8	160	1324	2351	0,36

1.7 Soil, vegetation and wildlife

The territory of Navoi TPP JSC is located on light sierozem soils. Sierozem soils are gypsum-bearing, as they develop on the gypsum-bearing weathering crust. There are sierozems on loess-like loams and alluvial-meadow soils near the TPP. The soils of the study area are characterized by a neutral and slightly alkaline medium with a pH value of 7.1–7.6, and a low content of humus (1–2%).

Soil solutions are characterized by an excess of calcium ions, sulfates and carbonates, the latter accumulate in the long dry season and increase due to emissions and discharges of enterprises of the Navoi industrial zone. In the elemental composition of the soil, not only an increased content of calcium, sulfur, but also iron is found. These elements can bind toxic substances present in the emissions of enterprises.

In the soils around the Navoi TPP, there is a high content of calcium, sulfur, iron, arsenic, lead, strontium and barium in comparison with the regional background - the Central Asian sierozems.

The geochemical anomalous nature of the listed microelements is confirmed by an increase in concentrations with depth and not towards the surface, as happens in the case of man-made pollution. In addition, the increased content of strontium and barium (from 330 to 1300 mg/kg) go along with an increase in calcium content in the horizons enriched with carbonates and sulphates at a depth of 10-30 and 20-50 cm. Thus, the concentration of many elements can be associated with a carbonate alkaline barrier.

The phosphorus content in soils is low (0.15 - 0.2%), moreover, due to the high carbonate content, it is contained mainly in the form of sparingly soluble and insoluble calcium phosphates. In the soil there is a lack of nitrogen (0.02 -0.07%). But the gross amount of calcium in irrigated sierozem reaches significant values - 2% or more. The main part of it is silicates, and exchangeable and water-soluble potassium is less than 1%. The upper soil layers are enriched with water-soluble calcium and magnesium salts.

In the study area there is no clear distinction between soil horizons due to the frequent displacement of the upper horizons during planning operations in the construction of communications and roads.

The mechanical impact on the soil cover in the vicinity of the TPP is expressed in shallow recesses, which either overgrow or serve as a waste deposit for various garbage. The greatest deformation of the soil cover is observed on unorganized crossings, which contributes to the violation of integrity and dusting of the underlying surface.

The vegetation cover in the area of the Navoi TPP location is represented by ephemeroid-absinthic communities and agricultural crops in the territory of the plant.

Natural full-member communities of ephemeroid-absinthic communities with significant participation of bluegrass, awn, annual astragalus, foxtail, and iris are preserved in areas near limestone quarries. However, being used for unorganized grazing of livestock, they are largely enriched with weed species: harmel peganum, cousinia.

Ephemeroid-weed-absinthic communities dominate around access roads. Cutting is overgrown with grass-meadow groups with patches of wormwood.

Exclusively weedy groups with the participation of herbaceous saltworms are formed around the TPP itself.

Halophytic and meadow coenoses with tamarisk and Alhagi are noted in the depressions; instances of reed are found singly. The rest of the space is occupied by a rarefied group of annual saltworts, indicating superficial salinization of the soil.

On the territory of the TPP, as well as along the roads, along numerous fields and vineyards near the TPP, plantings of mulberries, poplars, and plane trees are observed. Among the tree species there is a variety of gas-resistant species: white mulberry, Siberian elm, Bollé poplar and Canadian poplar, oleaster. From among the mid-gas-resistant ones, box-elder and white willow are planted, from gas-resistant ones - Pennsylvanian ash, sycamore tree, English oak, and stone fruit trees - peaches, cherry, apricot. In addition, there is artificial planting of grapes, roses and other decorative flowers. Regular watering and care favorably affect the condition of the plants, although, according to evidence of archive materials, insignificant focal necrosis was found on the leaves of trees growing on the territory of the TPP in visual inspection, and considerable amount of necrotic sites indicating exposure to atmospheric pollutants was found in plant samples selected near the Navoi TPP.

The most significant violations of the leaf surface were observed in ash, sycamore, acacia in artificial plantings in close proximity to TPP. The detected areas of destruction of cell walls on both sides of the epidermis of the leaves,

The most significant violations of the leaf surface were observed in ash tree, sycamore, acacia in artificial plantings in close proximity to the TPP. The detected areas of destruction of cell walls on both sides of the leaf epidermis, gray granules between the cells indicate the effect of gas and dust pollution on the morphological and anatomical structure of leaves of trees, shrubs and herbs.

The analysis of archive materials also revealed in the samples of plants taken from four sides of the TPP near the territory (200–300 m) and at a distance of 1 km, and studied using the

spectral analysis method in the vegetative part of such species as annual saltwort and harmel peganum, the increased Cr concentration compared with the regional level by 10 times or more, and the maximum allowable – by 40 or more times. Significant Cu and Ni increased concentrations were also detected (by 2-4 times higher than permitted).

When analyzing the samples, the following pattern was revealed: from the north and east of the TPP, the metal content in plant samples is much higher near the territory than at a distance, and in the southern and western directions, on the contrary, the concentration of metals near the territory is lower than at a distance. The analysis performed allows us qualifying the state of the soil and vegetation around the TPP as characteristic of the zone with a tense environmental situation.

An earlier survey of the site proposed for the construction of CCGT Units No. 3, 4 revealed the growth of fruit (apricot) and ornamental (poplar, juniper, purple willow) tree species (Appendix 5).

The number of trees of each species growing on the construction site of CCGT Units No. 3, 4 is presented in table 1.15.

Table 1.15 List and number of trees growing on the construction site of CCGT Units No. 3, 4, at Navoi TPP JSC

Item No.	Wood species	Number
1	Juniper	22
2	Poplar	17
3	Purple willow	6
4	Apricot	33
	Total	78

The results of the surveying the construction site of CCGT Units No. 3, 4, conducted by the inspectorate of the Ecology and Environmental Protection Department of the Navoi region to identify trees to be cut down during the construction, as well as the amount of damage to be reimbursed are presented in Appendix 5.

The predominant species among the vegetation plantations to be cut down are apricot in the amount of 33 pieces, with a maximum trunk diameter of 24 to 64 cm.

The maximum diameter of the trunk of juniper trees to be cut down in the amount of 22 pieces ranges from 4.1 to 8 cm.

Poplars to be cut down in the amount of 17 pieces have a maximum trunk diameter of 8.1 to 36 cm.

Purple willow trees to be cut down have a maximum diameter of 24 to 64 cm.

There are no species of plants listed in the Red Book at the construction site.

Calculation of damage to vegetation in the preparation of the site for construction, presented by the Nature Protection Inspectorate of the Navoi region on the basis of the requirements of Resolution of the Cabinet of Ministers No. 508 dated October 28, 2004 is given in Appendix 5.

Among the animals settling near the TPP, in the area characterized by significant dust and noise, only those groups that can hide from the plant's noise impact in the soil can be mentioned, such as insects (winter-annual and cotton budworm, beet borer, red spider) and reptiles (desert lidless skink, rapid french-toed lizard, water snake, Central Asian tortoise), or the species that can quickly leave unfavorable areas, such as birds (tree sparrow, laughing dove, common starling, barn swallow, red-rumped swallow, black swift, mynah, magpie). In the areas with stagnant or running water, such amphibians as toads and frogs settle. From among the mammals, there are house mouse, mole lemming, common bat, tamarisk gerbil, eared hedgehog, and scilly shrew.

The modern composition of ichthyofauna of the river Zerafshan is represented by 30 species belonging to seven bloodlines, of which cyprinoid fishes is the most widely represented (19 species). Six species of loaches were found, and one species of catfish, livebearers, snakehead, darters and poachers. The ichthyofauna is represented mainly by local commercial species, however, there are also acclimatized commercial (white and black amur, tench, eastern bream, goldfish, silver and big-head carp, pike-perch) and accidentally imported non-commercial species (rhinogobius, Balkhash perch, Triplophysa strauchii, Korean and common sawbelly).

Thus, soil pollution in the area under consideration is moderate, flora and fauna are permissible.

1.8 Assessment of the current state of the environment

The assessment of the current state of environmental components that are in the area of influence of the Navoi TPP revealed a number of major environmental problems associated with emissions of harmful substances into the atmosphere, discharges into the river Zerafshan, and migration of chemical compounds from the solid waste storage facilities. All the identified

problems are a consequence of the deterioration and emergency state of equipment and facilities of the TPP, and, first of all, thermal and mechanical equipment, water treatment plants and wastewater treatment plants.

The concentrations formed by emissions of pollutants of Navoi TPP JSC exceed the permissible standards for nitrogen dioxide and amount to 1.03 MPC, while exceeding the quota established by the State Nature Protection Committee of the Republic of Uzbekistan is 4.12 times.

The level of air pollution in the area where the plant is located is characterized as moderate.

In the case of the using emergency liquid fuel - fuel oil, in addition to nitrogen oxides and sulfur dioxide, fuel oil ash with flue gases enters the atmosphere, on the particles of which highly toxic vanadium pentoxide, carbon oxide, and benzo(a)pyrene are adsorbed. Air pollution is intensified. The moderate level of atmospheric air pollution becomes high.

According to the condition of surface and underground water under the “Methodological guidelines on ecological and hygienic zoning of the territory of the Republic of Uzbekistan by the degree of hazard to public health”, the area of location of the Navoi TPP is classified as a zone with a tense environmental situation.

Salts of strong acids, and calcium salts, are mainly added to the Zerafshan river from the plant, and thermal addition takes place. The chemical composition of groundwater can be significantly influenced by the sludge tanks of WTS water and sludge collectors of acid washes. Due to environmental protection measures taken at the TPP for cleaning sludge dumps, cleaning the oil trap, replacing and repairing the pipeline for acid leaching of boilers, the impact on the soil, ground and groundwater in the Navoi TPP area has been reduced.

In terms of contamination of soil, ground and vegetation with heavy metals, the region can be attributed to a zone with a tense environmental situation.

The condition of the vegetative organs of plants in the area of the Navoi TPP is generally satisfactory, excluding tree crops near the plant with varying degree of leaf damage by necrosis and chlorosis.

Thus, the study of the current state of the environment has shown that the level of pollution of atmospheric air, surface and groundwater, soil, ground and vegetation is moderate and causes concern for the health of the population. According to the “Methodological guidelines on ecological and hygienic zoning of the territory of the Republic of Uzbekistan according to the degree of hazard to public health,” the ecological situation of the studied area is assessed as tense.

2 Socio-economic aspects of construction of the third CCGT Unit at the Navoi TPP

At present, Navoi TPP JSC provides electricity and heat to consumers in the Navoi, Bukhara and Samarkand regions and the population of the city of Navoi.

To ensure reliable and continuous electricity and heat supply to enterprises, as well as to improve the environmental situation in the zone of influence of the Navoi TPP, it is necessary to create their own sources of power control. This problem can be solved by building the third and fourth J class combined-cycle gas turbine plantwith a total capacity of 1,300 MW.

In comparison with steam turbine plants used at the Navoi TPP, CCGT Units have such advantages as basic simplicity, almost complete automation, which greatly simplifies the operation of the plants. In addition, they are more compact than traditional units, and have high maneuverability (load increase in 5-20 minutes, compared to several hours of steam turbines). Switching to steam-gas technologies will allow increasing the fuel efficiency, and this will lead to an improvement in the ecological situation in the studied area, since specific emissions of pollutants per unit of power are reduced.

Stable production of heat and power will improve the standards of living of people living in the Republic and directly the TPP staff. As of 01.01.2019, the number of personnel working at the TPP was 1,532 people.

Reliable and stable provision of heat as a result of the implementation of this project will contribute to reducing the level of catarrhal and other diseases of the population caused by hypothermia.

The implementation of the project will contribute to the development of gender policy in Uzbekistan by attracting women from the local population to maintain the new equipment and by improving the quality of their living conditions.

When carrying out work on the implementation of the project of construction of 2 CCGT Units No.3, 4 with a total capacity of 1,300 MW, at Navoi TPP JSC, the problem of employment of the population and training of highly qualified personnel will be partially solved. There will be a possibility of employment for unskilled labor, in particular, workers, dispatchers, drivers, etc. from among the local population.

Employment under the project is not limited to the direct presentation of jobs. There will also be indirect incomes and employment of the population associated with the purchase of goods by the contractors and payment for services. There will also be employment created at the expense of the personal expenses of the project staff, but its scale will be insignificant. The other side of the emergence of opportunities for significant local purchases and businesses based on the implementation of this project is the influx of people from other parts of the region, which

can provide a noticeable development of the local economy. It is expected that the main part of the construction staff will be attracted from among specialists of the Navoi region.

The number of personnel of CCGT Units No. 3, 4 will be about 250 people.

The project will result in economic benefits received by the state, which will be reflected in the collection of income tax from staff wages, in the development of cheaper and more reliable electricity for the growing needs of the republic. In general, the project will contribute to raising the overall level of the economy.

The work on the project will be carried out on the territory of the Navoi TPP and will not entail significant violations of the economic activities of other enterprises. Possible sources of violations include transportation of workers, transportation of construction materials, accommodation of construction personnel, as well as noise and dust during construction. These violations will be minimal and short-term: initially they can occur only during the transportation of personnel and raw materials.

Due to the fact that all the work on the project will be carried out on the territory of the Navoi TPP, the project will not have any adverse effect on the recreational potential of the region.

Thus, the main part of the socio-economic impacts associated with the construction of CCGT Units No. 3, 4 at the Navoi TPP will be positive. Mitigation measures shall be taken to reduce negative impacts to a minimum, and the positive effects need to be extended. To this end, the following measures will be taken:

- construction works will be managed so as to minimize the inevitable and short-term effects (smoke, noise, vibration, dust, dirt, delays, accidents) of construction work on local residents and other road users;

- operations will be managed so as to minimize the impact on the local residents, in particular, time limits for noisy work during the daytime hours will be introduced and a schedule of delivery of materials will be made in order to avoid traffic violations;

- local employees will be given the opportunity to learn and master new technologies;

- deliveries of the main equipment will be made from abroad.

Resettlement due to the planned construction is not expected.

3 Environmental analysis of the design solution

In accordance with Order of the Deputy Minister of Energy of the Republic of Uzbekistan Sh. Khodzhayev No. 03–203 dated March 23, 2019 and task of the Navoi TPP No. 9/046-GRP dated March 26, 2019 in order to use energy-efficient technologies with the most cost-effective modern combined-cycle plants (CCGT Units) with a power generation efficiency of over 60% at Navoi TPP JSC, this project considers the construction of two CCGT Units with a total capacity of 1,300 MW (Appendix 2).

Construction of two J class 650 MW CCGT Units is planned in the eastern part of the territory of Navoi Thermal Power Plant JSC (Appendix 1, Fig. 1).

Each of the power units of the 650 MW CCGT Unit is a monoblock combined-cycle gas turbine unit designed to produce electricity in the basic mode of operation, while simultaneously covering the heat schedule of production and heating loads.

Each 650 MW CCGT Unit includes:

- one gas turbine plant (GTP) with an electric generator;
- one waste heat boiler;
- one steam turbine plant with an electric generator;
- deaerating device;
- auxiliary equipment for the four CCGT Units:
- gas booster compressor station with three gas booster compressors;
- compressed air facility and gas-generating, electrolysis facilities with receivers, a backup diesel generator, water treatment system for unit recharge, heating systems and circulating water supply systems, industrial wastewater treatment complex, tank facilities;
- cooling towers with a pumping station for CCGT Unit water supply;
- oil warehousing in containers.

Composition of the equipment and its characteristics will be refined during detailed design.

The CCGT Units will run on natural gas as follows.

The air compressed in the GTP compressor continuously flows into the combustion chamber, where it promotes the combustion of gaseous or liquid fuel at constant pressure. The combustion products enter the gas turbine, where the kinetic energy of the gas flow is converted into mechanical work of rotation of the turbine rotor. The temperature of the gases in front of the gas turbine, depending on the turbine series, is in the range of 1100-1500°C.

After the gas turbine, the exhaust gases enter the waste heat boiler at a temperature of 530-640°C, in which steam is generated by transferring thermal energy of the gases came from

the gas turbine to feed-water and steam. The gases from the waste heat boiler are discharged into the atmosphere through a chimney at a temperature of about 110-120°C. The steam produced in the waste-heat boiler enters the steam turbine, where the kinetic energy of the steam is converted into mechanical work of rotation of the turbine shaft. The exhaust steam is sent to the condenser and is converted into condensate through heat exchange with cooling water, which is then sent back to the boiler. In order to compensate for technological losses of steam and water, the power unit is continuously fed with chemically demineralized water.

Gas will be supplied to the site of the 2 CCGT Units No. 3, 4 with a total power of 1,300 MW via the newly constructed main lines. The fuel gas enters the gas treatment center equipped with coarse filters and a commercial gas flow measuring device, and then to the gas control point (GCP), where it is cleaned for subsequent throttling before reburning (if necessary), and then to the gas-booster compressor station, where it is cleaned, compressed and supplied to the main building for combustion in the combustion chamber of the gas turbine.

It is expected that the efficiency factor of the new GT will be 42.3%, the efficiency factor of the CCGT Unit will be 62.3%, which is 1.7 times higher than the efficiency factor of the existing power plants of the power system (34-37% on average).

The maximum hourly fuel consumption per CCGT Unit is 120,323.09 m³/h, the annual consumption of natural gas per CCGT Unit is 1,564.2 million m³.

Natural gas consumption by the two CCGT Units will be 3128.4 million m³/year, while fuel savings after the project implementation will be 587 million m³.

The clear advantage of CCGT Units No. 3, 4 is the reduction in specific indicators of fuel consumption as compared with specific indicators for the Navoi TPP from 381.24 g eq.fuel /kWh for power supply (according to the results of the TPP operation in 2018) down to 215.7 g eq.fuel/kWh.

For supplying natural gas to the gas turbine combustion chambers, a gas booster compressor station (GBCS) is used.

The gas booster station is designed to compress a mixture of hydrocarbon gases, which serves as a fuel for a gas turbine, subject to continuous operation (8,000 h/year) with the necessary interruptions for maintenance work (oil refilling, filter cleaning, etc.). The gas booster station includes three gas booster compressors, two of which are operating, and one is standby, and designed to operate the GTP with maximum gas consumption. The gas is supplied to the compressor station with a pressure of at least 9 kg/cm² and is supplied from the GBCS to the GTP to the input unit of operational gas flow regulation and measurement.

Flue gases from the newly installed CCGT Units containing nitrogen oxides and carbon monoxide will be discharged through two individual chimneys with a height of 112 m each and a mouth diameter of 7.0 m. The parameters of the gas-air mixture will be: volume of flue gases – 1,047.2 m³/s, exhaust gas rate - 18.45 m/s, exhaust gas temperature - 120°C (Appendix 3, table 3.1).

From the standpoint of ecology, the main advantage of the proposed design solution is the reduction in nitrogen oxide emissions in comparison with the currently used power units, which is achieved by using combustion chambers with dry low-toxic burners when burning natural gas. This technical solution allows reducing the emission of nitrogen oxides from new installations down to 25 ppm (50 mg/Nm³), which, when compared with the concentrations in the flue gases of the power units currently operated at the TPP, is much lower (by 3.5 times in terms of nitrogen dioxide). In addition, the guaranteed by the project nitrogen dioxide concentrations in the flue gas of the CCGT Unit, comply with the requirements of GOST 29328-92 for gas turbine plants. Low NO_x concentrations are created not only due to the structural features of the combustion chamber of the CCGT Unit, but also to the combustion mode created, in which the fuel is almost completely burned.

The management of the new installation will be carried out with the help of the ACS, which, along with the operational control, will create high operational reliability and reduce the emergency risks, discussed in detail below in Chapter 7.

Water supply for CCGT Units No. 3, 4 for drinking and fire-fighting needs is provided for from the existing networks of the Navoi TPP (economic and fire-prevention water supply and production and fire-prevention water supply).

For the production needs of the CCGT Unit, technical water from the Zerafshan river and the water supply network will be used.

The estimated consumption of industrial water from the Zerafshan river for the needs of the two CCGT Units No. 3, 4 will be 1,350 m³/h or 11,705 thous.m^3/year, the expected municipal water consumption for household and drinking needs of the two CCGT Units - 15,093 thousand m^3/year, the total water consumption for the needs of CCGT Units No. 3, 4 will be 11,720,093 thousand m³/year. Discharge of blowdown water of the cooling towers in the river Zerafshan is projected at 501 m³/h (4008.0 thousand m³/year).

Adjustment of water consumption and drainage standards will be made after determining all the characteristics of the equipment at the stage of detailed design.

The design capacity of water treatment plants of the Navoi TPP is sufficient to supply the plant after the construction of the second CCGT. However, taking into account their physical

wear and tear, the increase in the number of defects in the WTP equipment, and therefore the actual performance of the desalting plant is 75%, the water treatment plant for making up heating networks - 40%, the project provides for the construction of a new WTP.

The water treatment system includes:

- water treatment equipment for deep desalination of make-up water to compensate for losses of steam and condensate of the steam-water cycle of the unit;

- installation of softening make-up water for the heating system with a heat network deaerator;

- process equipment for the installation of complex cleaning of industrial wastewater from the integrated treatment with a neutralizing unit for acidic and alkaline waters after regeneration, loosening and washing of filters of the unit's steam-water cycle feeding circuit, as well as an installation for treating oily waste water from oil products. Inside the water treatment system there is a drainage pit for collecting industrial oily water.

For CCGT Units No. 3, 4 with a total capacity of 1,300 MW, a circulating system of technical water supply is provided due to the shortage of water in the region. Fan coolers are adopted for the installation, the number and size of sections of which will be refined in detailed design.

The circulating water cooled on the cooling towers with the help of circulating pumps is supplied to the steam turbine condensers and to all auxiliary equipment of CCGT Units No. 3, 4. After heat exchangers, the waste (heated) water is directed to the cooling towers for cooling. Then the cycle repeats.

Replenishment of losses in the circulation system (water evaporation and carry-over in the cooling towers, circulating system blowdown) is provided by supplying additional river water from the river Zerafshan.

The volume of supply of additional water for CCGT Units № 3, 4 will be specified in the detailed design.

Additional water before entering the circulation system undergoes pretreatment.

To prevent biological and salt fouling of cooling tower irrigators, condensers and pipelines, additional water is treated with chemicals.

Chemical water treatment of CCGT Units No. 3, 4.

Treatment of raw process water in the water treatment system is provided for feeding CCGT Units No. 3, 4, as well as for feeding the Navoi heating network.

The total water treatment system demand (taking into account the own needs of the water treatment system) for raw process water is ~ 1200 m³/h.

Wastewater of CCGT Units No. 3,4 with a total capacity of 1300 MW

The wastewater of the CCGT Units consists of the blowing of the cooling towers and industrial effluents.

The industrial wastewater of CCGT Units No. 3, 4 is first directed to the integrated treatment of industrial wastewaters (ITIW), and then, after neutralization and clarification it is dumped into the Zarafshan river.

The discharge of drains from the water treatment system is permanent.

The drains after the chemical cleaning of the boilers from salt deposits are episodic within 2-3 days once every 2-3 years.

The oiled wastewater (industrial water) after treatment is sent to the circulating cycle of the plant.

After the construction of CCGT Units No. 3, 4 at the Navoi TPP, the number of emissions will remain the same – 7. The estimated additional amount of treated drains sent to discharge № 1 will be 5 m^3/h. The quality of the drains from the CCGT Units differs from the drains of the existing power plants with a reduced content of suspended solids.

A significant reduction in the discharge of thermal water in the river Zerafshan due to the use of the circulating system of water supply with cooling on fan cooling towers will reduce the introduction of heat into surface water.

Currently, the temperature of wastewater in the river Zerafshan, according to the measurements, ranges from 11 to 22°C and the temperature rise compared with the water taken from the river is 7 - 9°C on average. According to the existing standards, discharges shall not lead to an increase in temperature above 3°C in the control gauge (500 m) below the discharge point.

For the remaining discharges, the discharge will be practically unchanged compared with the existing state.

After commissioning of CCGT Units No. 3, 4 with a total capacity of 1,300 MW, the same types and amounts of solid waste will be generated at the Navoi TPP as in the existing state (chapter 1.3.3). The formation of new types of waste is not expected. The changes will concern an increase in the rates of such waste as ferrous scrap, used turbine and compressor oils, cleaning material contaminated with oils (with an oil content of more than 15%), used fluorescent lamps, and household waste, which will require adjustments when they are rationed.

The quantitative indicators of production waste generation and consumption during the TPP operation after commissioning of CCGT Units No. 3, 4 with a total capacity of 1,300 MW,

a plan for their temporary storage, movement, processing and disposal will be established and approved when developing standards for their generation and disposal.

At the site of CCGT Units No. 3, 4 with a total capacity of 1,300 MW, it is also assumed to perform the work on landscaping and gardening.

Stages of construction

During construction works, the environmental impact is determined by:

- air pollution by exhaust gases of motor vehicles and construction equipment used in the delivery of equipment and building materials, welding aerosol, manganese compounds during welding; vapors of organic solvents, aerosols of paints and varnishes when carrying out painting operations, inorganic dust when moving bulk materials. I.e. emissions mainly come from mobile vehicles and unorganized sources. There are no stationary organized emission sources during construction;

- noise and vibration effects of building mechanisms;

- exposure by electric and magnetic fields, electric current;

- seizure of land resources for temporary use to accommodate building structures, platforms for storing building materials and waste generated during construction operations, as well as for permanent use in the construction of TPP buildings and structures;

- impact on the soil and ground in their mechanical disturbance associated with excavation during construction;

- impact on soils and ground waters in spills of petroleum products used as a fuel for mobile vehicles and construction mechanisms.

During the construction period, pollutants can be emitted into the atmosphere, both in a solid (inorganic dust during earthworks, works on movement of soil, installation of foundations) and gaseous form (exhaust gases of mobile vehicles and construction equipment, painting works).

Emissions are temporary and have a short and inevitable nature. Technological processes that are a source of air pollution during installation, operation of construction equipment does not occur simultaneously.

The main processes during which pollutants are emitted into the atmosphere are: excavation, welding, painting, loading and unloading operations during storage of equipment and containers, operation of engines of construction machines, mechanisms and vehicles.

The amount of emissions into the atmosphere produced at the construction site is taken into account in the inventory of pollutant emissions by a subcontracting construction organization, as from mobile sources after in fact.

Emissions during construction are temporary, therefore calculation of dispersion of pollutants is not expedient.

In total, during construction works at the site of CCGT Units No. 3, 4 with a total capacity of 1,300 MW, 14 items of pollutants (iron oxide, manganese compounds, nitrogen dioxide, nitrogen oxide, soot, sulfur dioxide, carbon oxide, xylene, paint aerosol, benz/a/pyrene, formaldehyde, white spirit, saturated hydrocarbons C12-C19, inorganic dust (70-20% SiO2) will enter the atmosphere.

During the construction, local pollution of the atmospheric air with inorganic dust within the construction site is expected. Flying dust will be generated during the excavation works, during the dismantling of old foundations and installation of new ones and during the discharge operations with bulk materials. The dust resulting from excavation and transportation operations will consist mainly of large particles that quickly settle, so its distribution will be limited mainly to the construction site. Limitation of dust spread during the construction operations will be contributed by the observance of modern building standards, water moistening of roads and soil storage sites, limiting the speed of vehicles within the site.

In general, no impact on surface water is expected during construction. Contamination of the soil during construction work is possible in the spills. Contamination of the soil during construction work is possible with spills of petroleum products used as a fuel of mobile vehicles and construction equipment. However, pollution will be minor and local. Due to poor solubility, petroleum products will have a low migration capacity and will not pose a danger to groundwater. The likelihood of a fire due to fuel spills is also small. In general, during the construction period, soils and groundwater polluted with oil products will have an insignificant risk to the environment and personnel safety.

In order to further minimize the environmental impact of oil-polluted soils, it is recommended to collect contaminated soil layers into a specially provided container for subsequent disposal.

During the construction period, storage of construction materials, construction and household garbage shall be carried out in a strictly designated place within the boundaries of the construction site.

For storage of construction waste, temporary storage places are provided in standard metal containers.

Waste removal is carried out as it is accumulated (or after completion of construction operations) to a licensed company that receives, processes and disposes of this type of waste.

For household waste, it is planned to install a separate container at the construction site, with regular removal to the household waste landfill.

The wastes generated during construction works: concrete and reinforced concrete waste - 5 hazard class, sand waste - 5 hazard class, construction ballast, which has lost consumer properties - 5 hazard class, rubble dust - 3 hazard class, construction brick grits - 5 hazard class, brick dust – 3 hazard class, waste of steel electrodes (cinders and remnants of steel welding electrodes, 5 hazard class), waste of solvents, paints – 3 hazard class, waste of a mixture of heterogeneous hardened plastics (containers from paints – 3 hazard class), wiping material contaminated with oils (oil content is less than 15%, 4 hazard class), construction debris – 4 hazard class, household waste (temporary household waste is unsorted, excluding bulky, 4 hazard class).

The building contractor-organization collects and temporarily stores household waste and industrial waste generated during construction works in specially equipped places and then transported for disposal to specialized organizations, according to the contract for construction and installation work. The contractor-organization being a general contractor is fully responsible to the customer and the inspecting authorities for the sanitary-epidemiological and environmental situation.

With the organization of collection and disposal of waste during construction works the environmental impact will have a low probability.

Noise effects during construction will take place during the movement of vehicles and the operation of construction equipment.

All the most noisy construction operations, in particular, all works on soil movement, are limited to daytime hours. Therefore, this temporary noise will not have any significant adverse effects on personnel. Thus, the noise associated with construction activities will be temporary and periodic, and will not exceed noise standards.

On the site there may also be soil excavated during construction. Upon completion of construction, the excavated soil will be reused on the site for the following purposes:

- when planning the site;
- when working on the improvement of the territory of the CCGT Units.

Termination of utility services for the population during the delivery of goods shall not be without prior permission from the local authorities and the customer, and the affected population shall be informed in this case. The notice must be sent fourteen (14) days in advance.

Restoration of services is carried out within six hours (or less), or alternative connections shall be found. Temporary and permanent provision of services shall result in no less than the level that has already existed or the best level and shall be agreed with the Customer.

When carrying out the construction work, local workforce shall be attracted as much as possible for employment in the construction work, while:

Conducting training during employment.

Ensuring, whenever possible, employment of women.

All workers involved must be of working age, in accordance with the labor legislation of Uzbekistan.

Specific construction tasks will be carried out within the age limit in accordance with the labor legislation of Uzbekistan.

To exclude possible cases of human trafficking and infringe upon their rights, the Contractor shall:

As much as possible, attract local labor force for employment in the construction work, carry out a constant check of the original passports at the same time.

Develop and implement the program for prevention of and awareness on human trafficking (can be carried out simultaneously with HIV/AIDS awareness).

To exclude/minimize complaints from the public during the construction work:

To assign a Complaint Coordinator.

Through the coordinator, to be responsible for receiving, registering, transmitting complaints and taking follow-up actions on all complaints received by the Contractor.

To meet with the Customer and the Engineer regularly or as needed in order to assist the management in resolving complaints.

To maintain a register of complaints containing the names and personal data of the claimant, consideration and settlement of complaints.

To have a minutes of meeting for consideration of complaints and other grievance reports.

4 Analysis of impact types determined by the inflow of pollutants into the environment

Analysis of the proposed process solutions has showed that the operation of two combined-cycle plants with a total capacity of 1,300 MW at Navoi TPP JSC will be accompanied by the introduction of pollutants into the environment.

This section discusses the emission sources with which the change in the environmental impact of the Navoi Thermal Power Plant will be associated upon the commissioning of two CCGT Units No 3, 4 with a total capacity of 1300 MW in addition to the already operated 475 MW CCGT Unit No.1 and completed with the construction of 450 MW CCGT Unit No 2.

Parameters of the sources of emissions of pollutants into the atmosphere are given in Table 3.1 (Appendix No. 3).

22 types of pollutants are expected to enter the atmosphere.

Compared to the current state, the amount of ingredients of pollutants will not change. The number of main emission sources will three times increase (due to an individual chimney of CCGT Unit No. 2 and two individual chimneys of CCGT Units No. 3, 4).

The parameters of emission sources generated during the operation of J class CCGT Units No. 3, 4: the height of each individual chimney is 112 m, the mouth diameter is 8.5 m, the volume, speed and temperature of the gas-air mixture is 1047.2 m^3/s, 18.45 m/s, 120°C, respectively; nitrogen dioxide emissions - 50 mg/Nm^3 (Appendix 3, Table 3.1).

The list of atmospheric pollutants from emissions of the Navoi TPP after the implementation of the project under consideration in comparison with the current state of TPP operation and the intermediate stage after the completion of the construction of CCGT Unit No. 2 with a capacity of 450 MW is given below in Table 4.1.

In total, after the implementation of the project of construction of the four CCGT Units with a total capacity of 2,600 MW, the amount of pollutants to the atmosphere at the Navoi TPP is expected to be 3,906.3059 tons/year.

The main air pollutant in the TPP operation after the commissioning of two CCGT Units No. 3, 4 with a total capacity of 1,300 MW will continue to be nitrogen dioxide (69.02% of the gross emission).

Table 4.1 List of substances polluting the atmosphere with emissions of the Navoi TPP after the project implementation

No.	Pollutants	MAC or SRLI, mg/m3	Hazard class (SRLI)	Established quota (MAC shares)	Maximum concentration, MAC shares	Compliance with the established quota (+,-)	Current state		Commissioning of CCGT Unit No.2		After project implementation (commissioning of CCGT Units No. 3,4)	
							Emission of pollutant, t/year	%	Emission of pollutant, t/year	%	Emission of pollutant, t/year	%
1	Ammonia	0,2	4	0,5	0,004	+	0,1490	0,003	0,1490	0,003	0,1490	0,004
2	Oil aerosol	0,05	4	0,5	0,04	+	0,0002	0,000004	0,0002	0,000004	0,0002	0,000005
3	Sulphuric acid aerosol	0,3	2	0,25	0,16	+	9,9944	0,20	9,9944	0,20	9,9944	0,26
4	Alkali aerosol	0,01	3	0,33	0,01	+	0,0081	0,0002	0,0081	0,0002	0,0081	0,0002
5	Benz(a)pyrene	0,000001	1	0,2	a - 0,14	+	0,0393	0,0008	0,0316	0,0006	-	-
					b - 0,09	+						
					c- abs	+						
6	Nitrogen dioxide	0,085	2	0,25	a – 1,03	-	3483,5658	70,00	3581,1376	70,09	2696,2208	69,02
					b - 0,87	-						
					c- 0,24	+						
7	Sulphur dioxide	0,5	3	0,33	a – 0,01	+	21,1547	0,43	17,9833	0,35	1,0677	0,03
					b - 0,01	+						
					c- 0,01	+						
8	Limestone	0,03	3	0,33	0,24	+	0,0142	0,0003	0,0142	0,0003	0,0142	0,0004
9	Fuel oil ash	0,002	2	0,25	a - Cm<0,1*	+	0,0031	0,0001	0,0021	0,00004	-	-

No.	Pollutants	MAC or SRLI, mg/m3	Hazard class (SRLI)	Established quota (MAC shares)	Maximum concentration, MAC shares	Compliance with the established quota (+,-)	Current state		Commissioning of CCGT Unit No.2		After project implementation (commissioning of CCGT Units No. 3,4)	
							Emission of pollutant, t/year	%	Emission of pollutant, t/year	%	Emission of pollutant, t/year	%
					b - Cm<0,1*	+						
					c - abs	+						
10	Manganese and compounds	0,005	2	0,25	0,05	+	0,0075	0,0002	0,0075	0,0001	0,0075	0,0002
11	Nitrogen oxide	0,6	3	0,33	a - 0,03	+	577,9607	11,61	581,4425	11,38	480,6951	12,31
					b - 0,03	+						
					c - 0,01	+						
12	Iron oxide	0,2	3	0,33	0,33	+	0,1583	0,003	0,1583	0,003	0,1583	0,004
13	Silicon oxide	0,02	3	0,33	0,01	+	0,0196	0,0004	0,0196	0,0004	0,0196	0,0005
14	Carbon oxide	5	4	0,5	a - 0,005	+	874,4503	17,57	909,5488	17,80	708,8695	18,15
					b - 0,005	+						
					c - 0,002	+						
15	Gasoline vapor	5	4	0,5	a - 0,13	+	1,0347	0,02	1,0347	0,02	1,0347	0,02
					b - 0,13	+						
					c- abs	+						
16	Abrasive dust	0,04	3	0,33	0,08	+	0,0007	0,00001	0,0007	0,00001	0,0007	0,00002
17	Metal dust	0,2	3	0,33	0,23	+	0,0011	0,00002	0,0011	0,00002	0,0011	0,00003
18	Hydrocarbons	1	4	0,5	0,13	+	5,9609	0,12	5,9609	0,12	5,9609	0,12
19	Fluorides	0,2	2	0,25	0,001	+	0,0196	0,0004	0,0196	0,0004	0,0196	0,0005

No.	Pollutants	MAC or SRLI, mg/m3	Hazard class (SRLI)	Established quota (MAC shares)	Maximum concentration, MAC shares	Compliance with the established quota (+,-)	Current state		Commissioning of CCGT Unit No.2		After project implementation (commissioning of CCGT Units No. 3,4)	
							Emission of pollutant, t/year	%	Emission of pollutant, t/year	%	Emission of pollutant, t/year	%
20	Hydrogen fluoride	0,012	3	0,33	0,02	+	0,0140	0,0003	0,0140	0,0003	0,0140	0,0004
21	Hydrogen chloride	0,2	2	0,25	0,04	+	2,0563	0,04	2,0563	0,04	2,0563	0,05
22	Sodium chloride	0,5	3	0,33	0,02	+	0,0142	0,0003	0,0142	0,0003	0,0142	0,0004
	Total						**4976,6268**	**100,00**	**5109,5989**	**100,00**	**3906,3059**	**100,00**

* - The total maximum concentration created by the emissions of this substance is less than the coefficient of expediency of calculations E3 = 0.1 (no emission calculation was made for this substance)

a - The current state

b - After commissioning of CCGT Unit No. 2 with shutdown of boilers No. 3, 8.

c - After commissioning of CCGT Units No. 3, 4 with disconnection of the remaining boilers.

The commissioning of two CCGT Units No. 3, 4 with a total capacity of 1,300 MW, in addition to the already operated CCGT Unit No. 1 with a capacity of 478 MW and completed with the construction of CCGT Unit No. 2 with a capacity of 450 MW, will lead to an improvement in the environmental situation in the zone of influence of the plant by reducing TPP gross emissions down to 1070.3209 tons/year.

To study the state of the atmospheric air, identify the contribution of the Navoi TPP to the level of air pollution and assess changes in the state of the atmospheric air that will occur after the project implementation, a calculation of the concentrations of harmful substances produced by the enterprise emissions was performed.

The calculation was performed according to the program "Ecologist" on an area of 8×5 km with a step of 0.5 km, taking into account the parameters of the sources of emissions of harmful substances (Appendix 3, Table 3.1), meteorological characteristics and the coefficients determining the conditions of dispersion of pollutants and described in section 1.1.

Analysis of air pollution in the studied area shows that after the project implementation the concentrations of all pollutants from emissions of the Navoi Thermal Power Plant will not exceed the quotas permitted by the State Ecology Committee of the Republic of Uzbekistan (0.2 MPC for hazard class 1 substances, 0.25 MPC for hazard class 2 substances, 0,33 MPC - for substances of hazard class 3 and 0.5 MPC - for hazard class 4 substances and enterprises located in the Navoi region).

After the project implementation, the highest concentrations outside the industrial site of the Navoi TPP are formed by nitrogen dioxide emissions (Appendix 4, Fig. 4.22) and amount to 0.24 MAC, which does not exceed the quota permitted by the State Ecology Committee of the Republic of Uzbekistan and the enterprises located in the Navoi region.

It should be noted that entry into the quota in terms of the level of air pollution is achieved only if all existing worn-out boilers of the TPP are shut off. The option of calculating the level of air pollution by emissions of the Navoi TPP after commissioning of CCGT Unit No. 2 (see table 4.1) results in a reduction in the maximum concentration of nitrogen dioxide from 1.03 MAC at the current state down to 0.87 MAC (with an excess of the approved rate by 3.48 times). A further increase in power due to the introduction of new equipment will lead to an even greater increase in the load on the atmosphere and its excessive pollution.

Emissions of 10 of 22 pollutants beyond the boundaries of the TPP industrial site will not generally spread, their concentration outside the boundaries of the TPP territory does not exceed trace quantities.

Reducing the maximum concentrations of nitrogen dioxide when commissioning CCGT Units No. 3, 4 in addition to CCGT Unit No. 1, 2. compared to the current state, will be 4.3 times (NO_2 concentrations will decrease from 1.03 to 0.24 MAC).

The emission of nitrogen oxides of the CCGT Units will be 50 mg/nm³, which, when compared with the concentrations of nitrogen oxides in the flue gases of the power units currently in operation at the TPP (in terms of nitrogen dioxide), is significantly lower (by 3.5 times on average).

Thus, the implementation of the project under consideration will not lead to a change in the state of the atmospheric air as compared with the current state for the worse: the state of atmospheric air will remain at the permissible level.

The implementation of the project of construction of two CCGT Units with a total capacity of 1,300 MW at Navoi TPP JSC will lead to a reduction in greenhouse gas emissions.

The reduction of emissions of the main greenhouse gas - carbon dioxide in the framework of the project, was determined using the data on natural gas consumption savings due to the introduction of two CCGT Units with a total capacity of 1,300 MW in the amount of 587 million m³, as well as the CO_2 emission factor for natural gas - 1897,7 tons/million m³ of fuel.

Thus, the reduction of CO_2 emissions as a result of the project implementation:

$587 \times 1897.7 = 1113{,}950$ t CO_2 – eq./year.

After commissioning of two CCGT Units No. 3, 4 from the sources of the Navoi TPP, the addition of nitrates to the soil and vegetation will decrease by means of migration from the atmosphere due to subsidence.

The addition of pollutants and heat into the Zerafshan river during the operation of CCGT Units No. 3, 4 will decrease due to the use of the circulating water supply system.

The sources of noise and vibrations at the Navoi TPP are currently blasting equipment, electrical equipment, turbines, generators, pumps, gas pipelines, compressors, noise sources of CCGT Unit No. 1 (from the exhaust of a gas turbine, the gas turbine itself, a steam turbine, a generator, chimneys, a gas boosting station).

After the project implementation, the summing acoustic impact will be made additionally from sources of CCGT Unit No. 2 and two CCGT Units No. 3, 4, mainly from the exhaust of gas turbines, the gas turbines themselves, steam turbines, generators, chimneys, gas booster stations.

After the project implementation, it is expected to ensure compliance with noise standards (no more than 45 dBA in residential buildings according to KMK 2.01.08-96) and no

more than 80 dBA at permanent workplaces according to SanPiN No. 0325-16 “Sanitary norms of permissible noise at workplaces”.

The sources of greatest noise from the CCGT Units will be emergency blowing valves. The impact of noise from them will be felt by CCGT Unit personnel at workplaces, the impact will be periodic and reversible.

In general, the acoustic noise from the CCGT Units will not have a negative impact on the health of personnel, since the noise generated will be extinguished by the plant’s buildings, facilities and green spaces.

The expected noise level will not exceed the standard values in residential buildings, but during the operation of the CCGT Units, measurements will be required to identify compliance with the standards for acoustic effects.

The expected level of vibration from CCGT Unit sources will not exceed 50 dB and will not be felt beyond the boundaries of the working site.

The analysis of the characteristics of analogue CCGT Units shows that the influence of noise beyond the TPP borders will not spread. This is due to the use of various methods of noise suppression. So, the noise from the CCGT Unit itself is supposed to be attenuated by installing a casing. It is also intended to install a silencer at the outlet of the heat recovery steam generator. At the exhaust of a gas turbine, the installation of a silencer is not foreseen because the exhaust gas enters the atmosphere through a high pipe, and the noise is attenuated both in intensity and in direction. In addition, although the gas turbine exhaust exerts a strong sound pressure in the low frequency band, it is weakened when the exhaust gas passes through the heat recovery steam generator. The noise from the suction of the gas turbine, which exerts pressure in the high frequency band, can also be relatively easily attenuated by means of sound insulation.

In order to reduce the vibrations and noise generated by air ventilation systems, the following measures are envisaged:

- installation of vibration insulators under centrifugal fans of supply, exhaust and air conditioning systems;
- installation of lamellar noise suppressors;
- fan connection to the network is carried out through flexible inserts;
- air velocity in the air ducts to prevent the appearance of aerodynamic noise are selected depending on the purpose of the premises and the presence of permanent workplaces in them;
- fencing of the design of ventilation chambers located in buildings with a low normalized noise level is performed with enhanced sound insulation.

The addition of noise from the CCGT Unit will not exceed the standard values provided that the above-mentioned methods for reducing noise are used when installing new combined-cycle plants.

During the operation of the CCGT Units, measurements will be required to identify compliance with the standards for acoustic effects.

5 Analysis of alternative design solutions

"Zero" option. In the case of refusal to build two CCGT Units No.3, 4 with a total capacity of 1,300 MW at the Navoi Thermal Power Plant and with continued operation of physically worn out equipment, its reliability and technical condition will decrease, which in turn will lead to even lower technical and economic indicators. Emergency risks will increase with possible negative consequences for the environment. The environmental situation in the zone of TPP influence in terms of atmospheric air condition will, as before, remain tense. The level of atmospheric pollution with nitrogen dioxide, as in the existing condition, will exceed the norms established by the State Ecology Committee Uzbekistan by 4 times.

6 Assessment of impact types determined by the extraction of natural resources from the environment

The operation of two CCGT Units No 3, 4 with a total capacity of 1,300 MW at Navoi TPP JSC will be accompanied by the extraction of mineral resources (natural gas), and air for burning fuel and water.

An additional land allotment for the territory of CCGT Units No. 3, 4 is assumed to be at the level of 20.8 hectares from the eastern border of the TPP territory. Part of the allotted lands is a wasteland (6.0 hectares), part is summer cottages (2.6 hectares), part is gardens (11.7 hectares), part of the land is occupied by structures of a military unit and planting of fruit and ornamental trees (0.5 hectares).

Instead of cutting down 78 units of trees 780 seedlings are planted at development-free places on the territory of the CCGT Unit construction site and around the TPP.

Operation of CCGT Units No. 3, 4 will be accompanied by withdrawal of water from the Zerafshan river and municipal water. Thanks to the adopted reverse system of water supply with cooling on cooling towers, the water consumption of the CCGT Unit from the river Zerafshan will decrease. The estimated consumption of industrial water from the Zerafshan river for the needs of two CCGT Units No. 3, 4 will be 1,350 m³/h or 11,705 thous. m³/h, the estimated municipal water consumption for household and potable needs of the two CCGT Units - 15,093 thous. m³/h, the total water consumption for the needs of CCGT Units No. 3, 4 will be 11,720,093 thousand m³/year.

The TPP water consumption from the Zerafshan river in 2018 amounted to 577,868,644 thousand m³ per year with a limit of 860,000 thousand m³ per year.

The consumption of natural gas during the operation of CCGT Units No. 3, 4 with a total capacity of 1,300 MW will amount to 3,128.4 million m³/year. Currently, gas consumption at the station is 2,830.665 million m³.

The existing capacity of natural gas supply is estimated at 11,200 million m³, i.e. it will be quite sufficient even after the commissioning of two CCGT Units No. 3, 4 with a total capacity of 1,300 MW.

7 Emergency situations

A considerable service life of the main and auxiliary equipment of the TPP, which has led to a high degree of deterioration, the emergency condition of the pipelines of heat networks and communications, and hydraulic structures, is the cause of a risk of occurrence of various types of accidents.

The prior frequency of accidents at the TPP according to [21] can be estimated as 10^{-5}.

The use of natural gas as a fuel makes it possible to predict possible scenarios of emergencies (fire) in the event of a gas pipeline rupture. The gas transported by a gas pipeline belongs to the group of fire and explosion-hazardous substances with a high degree of danger (4th grade). The affected area will be in the form of a concentric circle with a center at the point of gas leakage, with a 19 m radius of irrevocable damage area. In this case, the plant's service personnel located in this area gets the irrevocable damage area of 1,134 m^2; according to the estimations, one person will happen to be in the irrevocable damage area, and seven people in the sanitary zone. For people in the fire zone, hospitalization may be required.

During a fire, nitrogen and sulfur dioxide, carbon black, carbon monoxide will be emitted into the atmosphere, their concentration will exceed 20 MAC, which can worsen the general health of personnel, mainly, reduce respiratory functions. However, this impact will be short-lived.

Steam line ruptures can cause burns to the personnel with sharp steam.

In connection with the use of a large amount of turbine oil during the operation of the main TPP equipment, classifying the room in which steam turbines are located to category B, if an accident scenario with oil ejection develops when parts of turbines wear out with subsequent ignition from heated surfaces and sparks, irrevocable damage will hit the personnel serving the main equipment of the plant.

When the CCGT Unit is operating, the degree of these types of risks is reduced, thanks to the design features and provision of the ACS, which creates high operational reliability and ensures operational control and management of the new installation, implementation of technological protection and blocking, automatic regulation and signaling, performance of current calculations and discrete logical control in regular situations, optimization of the CCGT Unit operation according to specified criteria.

The gas turbine plants are equipped with an automatic carbon dioxide (CO_2) fire extinguishing system and are supplied complete with the M701F4 gas turbine unit.

The purpose of the fire extinguishing system is to detect and automatically extinguish every fire that may occur in one of the protected compartments: the load compartment, the turbine compartment, the bearing compartment, the lubricating oil/gas compartment.

The carbon dioxide fire protection system extinguishes the fire by increasing the CO_2 concentration inside the protected compartment, thereby reducing the oxygen concentration down to a value below which burning is impossible (8% O_2 in terms of volume). The system works automatically and does not require operator intervention.

Main components of the fire extinguishing system:

- One rack with 80 cylinders with carbon dioxide;

- CO_2 distribution tubes between the CO_2 rack and protective zones, as well as factory-assembled units with nozzles for supplying CO_2;

- Alarm devices, manual fire detectors, sensors and alarms to ensure the safety of personnel.

- Central alarm panel and fire suppression.

Each CO^2 cylinder is filled with 45 kg of liquefied carbon dioxide at an approximate pressure of 60 bar and 25°C. Twenty cylinders are used for the initial supply, and 60 cylinders are used for the prolonged supply of carbon dioxide in various fire protection zones.

To ensure fire and explosion safety, the gas supply system of the two CCGT Units 450 is equipped with a light and sound alarm system, which is output to the control panel, and signals an increase in the concentration of gas in the indoor air above 10% of the lower concentration limit of flame propagation (LCLFP).

On all gas pipelines only steel fittings (class “A”) shall be used.

In order to automate the process control, valves in the gas supply system are used with remote-controlled drives (electrical, mechanical) in an explosion-proof design. Valves are equipped with redundant manual control.

In order to prevent the spread of fire and combustion by-products, the plant is divided into fire hazardous zones. Protection of these zones from fire is carried out through the use of either passive (structural, integrated and operational measures), or active measures (portable fire extinguishers, fire protection systems) or a combination of these measures where the risk of fire is high.

Areas with an increased risk of fire are separated from each other by enclosures made of fire-resistant materials. Similar enclosures are used in the following areas:

- Thermal block (module) of the gas turbine.

- Auxiliary equipment of the gas turbine.

These parts of the casing are equipped with an automatic fire extinguishing system.

Fire hazardous zones are protected by fire walls. Fire walls are installed to protect the gas turbine from fires or explosions that may occur on an oil-filled main (boost) transformer.

Also through these walls separate the main control panel, relay room and cable floor from adjacent areas.

In order to prevent the spread of fire, openings in fire walls and fire-resistant enclosures (doors, openings for laying pipes or cables, ventilation ducts, etc.) are sealed.

Evacuation routes from all fire-hazardous areas and approaches for fire fighting are carefully planned out, are not cluttered, properly marked and lead to a safe zone or exit. At least two escape routes from fire hazardous areas of categories 1 and 2 are envisaged. Their length does not exceed the established rules.

Emergency lighting (with backup batteries for at least 60 min. of operation) is installed along the escape routes as follows:

- indicating the direction to the emergency exit;
- above the doors of the emergency exit there is a sign that indicates exit to the outside.

The design and installation of an emergency lighting system is carried out in accordance with applicable standards.

Fire prevention measures have been designed to meet the following requirements:

- preventing the occurrence of a fire source and its spread;
- protection of technical personnel;
- early fire detection, notification of personnel and fire extinguishing;
- reduction of damage caused by fire.

Fulfillment of these requirements is achieved through the optimal placement of equipment (passive measures) and by taking appropriate measures to prevent and extinguish a fire (active measures).

If for any technical reason passive measures do not meet the requirements, the corresponding active measures are applied as compensation.

8 Affected facilities

When commissioning two CCGT units with a total capacity of 1,300 MW at the Navoi TPP, taking into account commissioning of CCGT Unit No. 2, for the TPP as a whole, the impact on atmospheric air, soil, vegetation, station personnel, and population of nearby residential areas will decrease.

The impact of the enterprise on the atmospheric air will be through fewer emissions of pollutants and greenhouse gases in comparison with traditional power units, thanks to advanced fuel combustion technologies.

Surface water will experience less impact on account of reducing the discharge of thermal water and reducing the addition of pollutants into the surface watercourse, as well as by reducing water withdrawal through the use of circulating water supply system with fan cooling towers.

Soils and vegetation due to the reduction of harmful substances from the atmospheric air during precipitation, will have little impact.

The personnel employed in the production process of the Navoi TPP, the population of nearby residential areas will experience the influence in inhalation intake of fewer harmful substances, and in addition the impact by the equipment with less noise and vibrations compared to the existing equipment.

9 Nature of the impact on the environment

Commissioning of two CCGT Units No. 3, 4 with a total capacity of 1,300 MW at Navoi TPP JSC will reduce the level of impact on the atmospheric air, improve the environmental situation in the plant's area of influence by reducing total TPP emissions by 1070.3209 t/year.

The emission of nitrogen oxides of the CCGT Unit will be 50 mg/nm³, which is 3.5 times lower than their maximum concentrations in the flue gases of the existing power units of the TPP (in terms of nitrogen dioxide).

The maximum concentration of nitrogen dioxide generated in the atmospheric air by TPP emissions after commissioning of two CCGT Units No. 3, 4 will be 0.24 MPC, which corresponds to the allowed quota and meets the requirements of the State Ecology Committee of the Republic of Uzbekistan for the level of atmospheric pollution. Compared to the current state, the maximum concentrations of nitrogen dioxide in the surface layer of the atmosphere will decrease from the excess levels (1.03 MPC) by 4.3 times.

According to the nature of the impact on the human body, harmful substances from TPP emissions are irritating to the upper respiratory tract and mucous membranes of eyes, nose, and larynx.

During the operation of the CCGT Unit, the likelihood of emergency situations is practically eliminated due to the superiority of the thermodynamic data of the CCGT Unit, its design solutions and the provision of the automated control system that create high operational reliability. Therefore, the commissioning of the CCGT Unit is fully justified.

The reduction of the thermal water discharge after commissioning of the CCGT Unit due to the use of circulating water supply system with fan cooling towers for cooling the heated water will cause a reduction in the negative impact on aquatic biota. It is known that with a sharp increase in water temperature by 10°C, fish die, and the ecological regime of hydrobionts changes. After the construction of the four CCGT Units, the expected damage to the fish stocks of the Zerafshan river is much lower due to a decrease in the supply of warm water drains.

After the CCGT Unit construction changes in the environmental impact from the sites of storage and warehousing of solid waste are not expected. Formation of additional types of waste in relation to those generated under the existing situation is not expected. The changes will concern the norms of formation of such types of waste as ferrous scrap, used turbine and compressor oils, used fluorescent lamps, oiled rags, solid household waste, as well as rates of the formation of all types of waste will change.

Personnel will experience noise and vibration impacts from CCGT Unit sources, the level of which will not exceed the standard values. However, after commissioning the CCGT Units, it

will be necessary to make actual measurements of the level of noise exposure at permanent workplaces at the CCGT Unit industrial site and at the border of the nearest residential area.

Thus, the construction of two CCGT Units No 3, 4 with a total capacity of 1,300 MW at Navoi TPP JSC will not cause negative changes in the state of the environment and public health.

Data on residual environmental impacts from the operation of CCGT Units No. 3, 4 are summarized in Table 9.1.

Table 9.1 Impact conclusions

	Impact by the CCGT Units	Importance of impacts	Comparison of the CCGT Unit with the existing plant
In general	Using cleaner and more efficient technology of energy production	Positive impact	Improvement: more energy efficient
Air quality	NOx, SO2 emissions	Minor: emissions within standards	Improvement: reduced emissions compared to existing boilers
Water quality	Discharge of heated water in the river Zerafshan	Minor	Improvement: lower discharge temperature due to circulating water supply system with fan cooling towers
Soil and groundwater	Oil infiltration into soil and groundwater	Minor: measures have been taken to protect soil and groundwater	Improvement: the existing Navoi TPP pollutes soil and groundwater with oil products
Waste	Waste disposal	Minor: suitable disposal ways have been identified	Improvement: the existing Navoi TPP does not utilize the major part of industrial waste
Noise and vibration	Noise during operation	Minor: meets standards	Improvement: at the existing plant there are sections of workplaces with noise levels exceeded
Ecology	Flora/fauna	Minor: limited to the industrial site	Improvement: the existing plant has an impact on the hydrobionts of the river Zerafshan
Socio-economic	Replacement of existing units	Positive impact	More reliable and stable energy production, operation with fewer personnel

10 Recommendations for reducing the adverse effects on the environment

Operation stage

1. To reduce the likelihood of emergency situations, the installation of an improved instrumentation and automation system for monitoring the production process and equipping with fire alarm systems is provided.

2. To enter the quota permitted by the State Ecology Committee of the Republic of Uzbekistan for the level of air pollution by emissions of the Navoi TPP, it is necessary to provide for the installation of new, at least 112 m chimneys of the CCGT Unit.

3. To monitor the concentrations of pollutants (nitrogen oxides, carbon monoxide) in the flue gas of the CCGT Unit.

4. To maintain the sound pressure level from the Navoi TPP, after commissioning two CCGT Units No. 3, 4 with a total capacity of 1,300 MW at standard values in residential buildings and at permanent workplaces, it is necessary to establish noise control with the involvement of a specialized organization, as well as to make a compaction of the green zone around the perimeter of the CCGT Unit industrial site.

5. To establish control of the chemical composition of the CCGT Unit wastewater.

6. To organize the control of the temperature of discharges at the outlet of the blowing of the cooling towers into the Zerafshan river.

7. To prevent mixing of different types of waste during their storage and transportation, to prevent unorganized accumulation of waste in the territory of two CCGT Units No. 3, 4. To provide containers for temporary storage of waste generated during repair work with subsequent delivery of ferrous scrap to Vtorchermet for disposal, non-ferrous - to Vtortsvetmet for disposal, household waste - to the landfill, and used fluorescent lamps - to a specialized organization for recycling.

8. Providing personnel at permanent workplaces with personal protective equipment. Purchasing noise protection devices (headphones, earplugs) and require their use at workplaces with elevated sound pressure levels.

9. Before putting the facility into operation, it is necessary to develop environmental standards for emissions, generation and disposal of waste.

10. In order to save water resources and reduce the impact on surface watercourses by thermal and polluted effluents, the project provides for the use of a circulating water supply system with the construction of cooling towers for cooling warm water drains.

11. In addition to the measures for reducing environmental impact provided for in the technical project, it is proposed to:

Stage of pre-construction

1. To establish control over the maximum preservation of all the green plants on the site by transplanting young trees with a clod of earth around the root system without damaging it outside the plots and partially using it for landscaping the GTP territory.

Stage of construction

1. Periodic inspection and maintenance of vehicles.

2. Turning off motor vehicles while waiting.

3. Slowdown of vehicles in a residential area and near the school territory.

4. Checking the rules of the road, installing road signs, learning to drive safely, limiting speed, inspecting vehicle equipment.

5. Using equipment with low noise/vibration level.

6. Installation of temporary rain sewers.

7. Installation of a septic tank and a temporary toilet (a dry closet) at the construction site.

8. Preventing spills of petroleum products.

9. Developing a waste management plan for the period of construction.

10. Excluding destruction of the existing green plants on the construction site in the preparation of the site for construction work and during the operation of construction equipment.

11. Exercising control over the preservation of all green plants on the site during its preparation for construction works.

12. Collection of solid wastes generated during construction and their storage on concreted sites with subsequent removal for disposal by specialized organizations and to storage landfills in accordance with the concluded agreements.

The environmental impact assessment of the construction of two CCGT Units No.3, 4 with a total capacity of 1,300 MW at Navoi TPP JSC shows that there is no negative impact on the environment if the requirements of the process regulations for the existing and newly commissioned equipment after the project are met.

The station has an approved plan of measures to protect the water basin and a plan of measures to reduce waste generation, the degree of hazard of waste storage, improve safety and efficiency of waste disposal facilities, which fully relate to the operation of the TPP after the project implementation and require constant implementation.

11 Forecast of environmental changes

The assessment of environmental changes as a result of commissioning of two CCGT Units No. 3, 4 with a total capacity of 1,300 MW at Navoi TPP JSC has showed the following results.

The state of the atmospheric air will not change and will remain permissible. During the implementation of the considered design solution, the concentration of all pollutants contained in the emissions of the enterprise (nitrogen oxides, sulfur dioxide, carbon monoxide, benzo(a)pyrene, hydrocarbons, etc.) will not exceed the quotas permitted by the Uzbekistan State Ecology Committee.

Reduction of the addition of harmful substances into the air will improve the condition of the soil and vegetation by reducing the deposition of nitrates on them compared to the power units used at the TPP.

The chemical composition of surface waters will also not change and will be characterized by class III of moderately polluted water. Due to the use of the circulating water supply system, the supply of heated wastewater to the surface waters will decrease.

The condition of soil, groundwater will not change.

Conclusion

The first stage of the environmental impact assessment procedure of the construction of two J class CCGT Units No 3, with a total capacity of 1,300 MW at Navoi TPP JSC has revealed the following results.

The Navoi TPP is located in a zone with a tense ecological situation according to the state of the atmospheric air, surface and groundwater, soils, ground and vegetation. The environmental problems of the existing plant are: increased levels of atmospheric pollution with nitrogen dioxide, pollution caused by plant discharges into the river Zerafshan, waste warehousing, including toxic waste, in sludge collectors, a high degree of wear and damage rate of the existing main and auxiliary equipment.

The construction of J class CCGT Units No. 3, 4 under the project will allow increasing the total capacity of the Navoi TPP by 1,300 MW, reducing operating costs, increasing the energy conversion efficiency and reliability of electricity supply to consumers, and improving the environmental situation in the plant's influence zone.

The introduced 650 MW J class CCGT Units have a high efficiency factor of power generation (above 60%), low specific consumption of equivalent fuel for electricity supply (215.7 versus 381.24 g/kWh for Navoi TPP JSC following the results of 2018).

The project will allow achieving annual natural gas savings in the amount of 587 million m^3 and, as a result, reducing gross emissions of pollutants by 1,070.3209 tons/year (from 4976.6268 under the existing situation down to 3906.3059 tons/year after the project implementation), including nitrogen dioxide - by 787.345 tons/year (from 3483.5658 down to 2696.2208 tons/year); carbon oxide - by 165.5808 tons/year (from 874.4503 down to 708.8695 tons/year), as well as greenhouse gas emissions by 1,113,950 tons of CO_2 – eq./year.

The main environmental advantage of the project is the reduction of maximum concentrations of pollutants in the surface layer of the atmosphere generated by emissions of Navoi TPP JSC by 4.3 times compared with the current situation, with the achievement of air pollution standards set by the State Ecology Committee of the Republic of Uzbekistan.

The emission of nitrogen oxides of the CCGT Unit will be 50 mg/nm^3, which is 3.5 times lower than their maximum concentrations in the flue gases of the existing power units of the thermal power plant (in terms of nitrogen dioxide).

Surface waters will be less affected due to reducing the discharge of thermal waters and reducing the addition of pollutants into the surface watercourse, as well as reducing the withdrawal of water through the use of circulating water supply system with fan cooling towers.

After the CCGT Unit construction changes in the environmental impact from the sites of storage and warehousing of solid waste are not expected. Formation of additional types of

waste in relation to those generated under the existing situation is not expected. The changes will concern the norms of formation of such types of waste as ferrous scrap, used turbine and compressor oils, used fluorescent lamps, oiled rags, solid household waste, as well as rates of the formation of all types of waste will change.

During the development of the draft EIS, possible emergency situations were considered and a significant decrease in the probability of their occurrence after the construction of CCGT Units No. 3,4 due to the use of the ACS was detected.

Thus, the construction of CCGT Units No. 3, 4 with a total capacity of 1,300 MW at Navoi TPP JSC will allow increasing the reliability of power supply to consumers of the Republic, reducing specific indicators of fuel consumption, gross emissions of pollutants into the atmosphere, air pollution level, greenhouse gas emissions, thermal water discharges in the river Zerafshan, emergency risks.

Implementation of the project of construction of two J class CCGT Units No.3, 4 with a total capacity of 1,300 MW at Navoi TPP JSC will not exacerbate the negative consequences for the environment and public health, subject to compliance with the environmental measures stipulated by the draft EIS.

List of sources used

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2. Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 14 dated 21.01.2014 “On Approval of the Regulations on the Procedure for Development and Coordination of Draft Environmental Standards”.

3. Annual report on the production activities of Navoi TPP JSC. Navoi city, 2019.

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5. Report on nature conservation for 2018 by Navoi Issiklik Elektrostantsiyasi.1-eko shakli.

6. Instructions for the inventory of sources of pollution and rationing of emissions of pollutants into the atmosphere for enterprises of the Republic of Uzbekistan. Resolution No. 1553 of the Ministry of Justice dated 03.01.06, Tashkent, 2006.

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8. Uzbekistan SanPiN No. 293-11 “Hygienic standards. The list of maximum allowable concentrations (MAC) of pollutants in the atmospheric air of populated areas on the territory of the Republic of Uzbekistan".

9. Uzbekistan SanPiN No. 0297-11 “Sanitary rules and standards for cleaning the territories of populated areas from solid household waste under conditions of the Republic of Uzbekistan”.

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18. Yearbook for surface water quality and effectiveness of water protection measures carried out on the territory of Glavgidromet for 2018 Tashkent: Glavgidromet of the Republic of Uzbekistan, 2019.

19. Yearbook for soil pollution in the territory of activities of Glavgidromet of Uzbekistan for 2018. Glavgidromet, Tashkent, 2019.

20. Guidelines for ecological and hygienic zoning of the territory of the Republic of Uzbekistan by the degree of hazard to public health. Ministry of Health of the Republic of Uzbekistan, Tashkent, 1995.

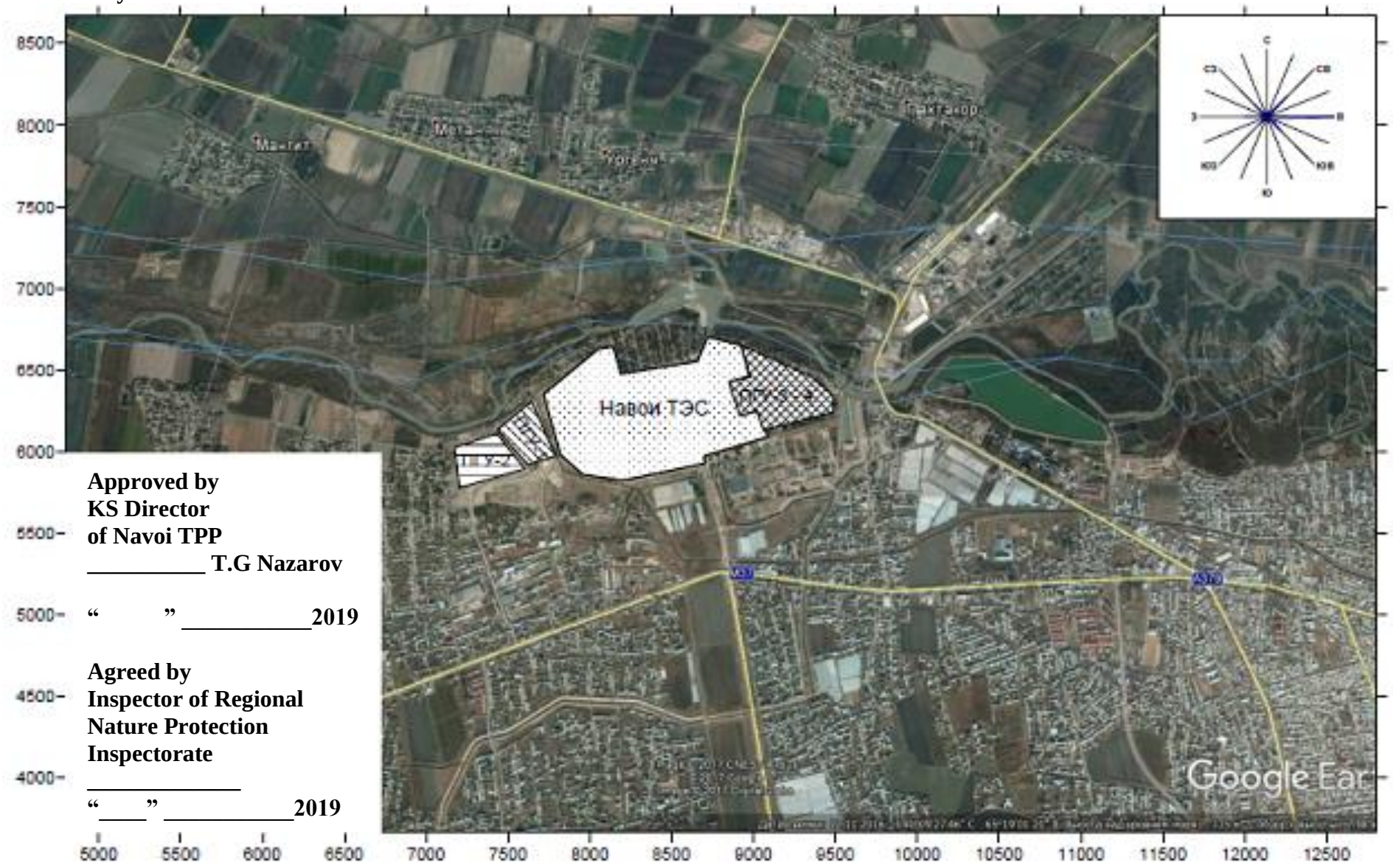
21. RD 118.0027714.24-93. "Manual on the assessment of hazards associated with possible accidents during the production, storage, use and transportation of large quantities of flammable and explosive substances."

Appendix

Appendix 1

General Layout

General Layout



Approved by
KS Director
of Navoi TPP
_____ T.G Nazarov

“ ” _____2019

Agreed by
Inspector of Regional
Nature Protection
Inspectorate
_____
“____” _____2019

Scale 1 : 30000 Fig. 1

Appendix 2

Supporting materials

Coat of Arms of the Republic of Uzbekistan

Ministry of Energy
of the Republic of Uzbekistan

"23" 03. 2019, No. 03-203

Uzbekenergo JSC,
Syrdarya TPP JSC,
Navoi TPP JSC
Teploelektroproekt JSC

In order to accelerate the project of construction of four CCGT Units with a total capacity of 2600 MW at Syrdarya TPP JSC, two CCGT Units with a total capacity of 1300 MW at Navoi TPP JSC, and examine the sources of financing for the projects due to attraction of loans from international financial institutes, hereby I request:

1. Teploproekt JSC (Shaismatov), Syrdarya TPP JSC (Shaimov) – to develop (update) the draft EIA for the thermal power plant with the construction of the four J class CCGT Units with a total capacity of 2600 MW at Syrdarya TPP, taking into account the available EIA for the F class two CCGT Units with a capacity of 900 MW. **Deadline – 30.03.2019.**
2. Teploproekt JSC (Shaismatov), Navoi TPP JSC (Ganiev) – to develop a draft EIA for the construction of two F class CCGT Units (3, 4) with a total capacity of 1300 MW at Navoi TPP JSC, taking into account the available EIA for the two CCGT Units (2, 3) with a total capacity of 900 MW. **Deadline – 30.03.2019.**
3. Syrdarya TPP JSC (Shaimov), Navoi TPP JSC (Ganiev), Teploproekt JSC (Shaismatov) – to submit the drafts developed for examination to the State Ecology and Nature Protection Committee and obtain a conclusion. **Deadline – 15.04.2019.**
4. Uzbekenergo JSC (Mubarakshin), Syrdarya TPP JSC (Shaimov), Navoi TPP JSC (Ganiev) – to submit the conclusion of the state environmental examination for the EIA to the Ministry of Energy. **Deadline – 20.04.2019.**

Deputy Minister /signed/ **Sh. Khojaev**

UKGM, (71) 236 61 17

NAVOI THERMAL POWER PLANT
JOINT STOCK COMPANY

26. 03. 2019 Ref. No. 9/046 – GRP

To Director General of
Teploproekt JSC
S.E. Shaismatov

According to letter from the Deputy Minister of Energy No. 03-203 dated 23.03.2019, it is planned to construct two J class CCGT Units (3, 4) with a total capacity of 1300 MW at Navoi TPP JSC.

In order to accelerate the implementation of the scheduled investment project at Navoi TPP JSC, we request you, taking into account the available EIA (for the third CCGT Unit-450MW), to enter into a contract for development draft EIA for the two J class CCGT Units (3, 4) with a total capacity of 1300 MW, and accelerate the development of the draft for the timely implementation of the scheduled investment project and obtain an experts' conclusion from the State Ecology and Environment Protection Committee.

KS Director of
Navoi TPP JSC /signed/ T.G. Nazarov

STATE STATISTICAL REPORTS

Violation by officials of the order of provision of state statistical reports expressed in the non-provision of reports and other data required to conduct state statistical observations, misrepresentation of reporting data or violation of deadlines for the provision of reports shall entail the responsibility as established in Article 215 of the Administrative Liability Code of the Republic of Uzbekistan.

To be submitted by means of the Internet through the automated system of collection of state statistical reports in an electronic form eStat 2.0 using an electronic digital signature.
Electronic forms of state statistical reports (patterns) available in eStat 2.0 can be obtained at the official web-site of the State Statistics Committee of the Republic of Uzbekistan www.stat.uz

Confidentiality of the information is guaranteed in accordance with article 7 of the Law of the Republic of Uzbekistan "On state statistics"

NATURE PROTECTION REPORT FOR 2018

To be submitted by	Deadline for submission	
Organizations having stationary sources of atmospheric pollution forming toxic and non-toxic waste (except for microfirms and small-scale enterprises)	not later than February 16	Annual

Time spent to fill in the statistical forms, hours (mark as necessary)					
Up to 1 hour	1-2	2-4	4-8	8-10	More than 10 hours

Name of organization	OKPO	TIN
Navoi Thermal Power Plant	00133184	200850647

Reporting period	2018	year

Code of pollutant	Line code	Pollutants	Amount of pollutants generated	Pollutants came to treatment facilities, total	of them, captured and neutralized		Pollutants emitted into the atmosphere, total (columns 2-4)
					total	of them, disposed of	
A	B	1	2	3	4	5	6
0001	101	Total (102+103)	**3180,0485**				**3180,0485**
	102	of them: solid	**0,2931**				**0,293**
x		of them:	x	x	x	x	x
0123	1401	Iron oxide	0,1583				0,1583
0143	1402	Manganese and its compounds	0,0075				0,0075
0323	1403	Silicon oxide	0,0196				0,0196
0703	1404	Benz(a)pyrene	0,0393				0,0393
0344	1405	Fluorides	0,0196				0,0196
2904	1407	Fuel oil ash	0,0031				0,0031
5555	1408	Others	0,0376				0,0376
			-				-
			-				-
			-				-
			-				-
			-				-
0004	103	Gaseous and liquid (104+105+106+107+108+109+110)	**3179,7554**				**3179,7554**
0330	104	Of them: sulphur dioxide	11,284				11,284
0337	105	carbon oxide	748,2001				748,2001
0301	106	nitrogen dioxide	2002,99				2002,99
0304	107	nitrogen oxide	325,349				325,349

Code of pollutant	Line code	Pollutants	Amount of pollutants generated	Pollutants came to treatment facilities, total	of them, captured and neutralized		Pollutants emitted into the atmosphere, total (columns 2-4)
					total	of them, disposed of	
A	**B**	**1**	**2**	**3**	**4**	**5**	**6**
0401	108	Hydrocarbons (without VOC)	**77,0792**				**77,0792**
x		Of them:	x	x	x	x	x
0410	1501	Methane	65,6183				65,6183
3027	1502	Oil aerosol	0,0002				0,0002
6666	1503	Others	11,4607				11,4607
0006	109	**Volatile organic compounds (VOC)**	**2,6398**				**2,6398**
x		Of them:	x	x	x	x	x
0402	1601	Butane	0,6600				0,6600
0403	1602	Hexane	0,2993				0,2993
0405	1603	Pentane	0,3453				0,3453
7777	1604	Others	1,3352				1,3352
0005	110	Other gaseous and liquid	12,2133				12,2133
x		Of them:	x	x	x	x	x
0303	1701	**Ammonia**	**0,1490**				**0,1490**
0342	1702	**Hydrogen fluoride**	**0,0140**				**0,0140**
0324	1703	**Sulphuric acid**	**9,9940**				**9,9940**
0316	1704	**Hydrogen chloride**	**2,0563**				**2,0563**

Appendix 3

Results of calculation of pollutant emissions

Table 3.1

Parameters of sources of emissions of pollutants into the atmosphere

Production facilities No. of shop, site, etc.	Sources of emission of pollutants	Source of atmospheric pollution	Number of map	Height of source of emission, m	Pipe diameter	Parameters of gaseous mixture			Coordinates of sources on the base map, m					Pollutant	Emissions of pollutants								
	Name					Volume, m3/s	Speed, m/s	Temperature, degrees C	One terminal, dotty, linear, plane		Second terminal, dotty, linear, plane		Width, m		Current state			Commissioning of CCGT Unit No. 2			Commissioning of CCGT Units No. 3, 4		
									X1	Y1	X2	Y2			g/s	mg/m3	t/g	g/s	mg/m3	t/g	g/s	mg/m3	t/g
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Navoi TPP																							
Boiler shop	Boilers TGM-94, plants No.3,4	pipe	2	56,0	9,18	655,908	9,91	140,4	3590	2523				Nitrogen oxide	3,89056	5,93	94,3164	1,94528	2,97	47,1582	-	-	-
	(after commissioning of CCGT Unit No.2, boiler No. 3 is put into reserve)													Nitrogen dioxide	23,94190	36,50	580,4088	11,97095	18,25	290,2044	-	-	-
	(after commissioning of CCGT Units No.3,4, boiler No. 4 is put into reserve)													Sulphur dioxide	0,14680	0,22	3,5587	0,07340	0,11	1,7794	-	-	-
														Hydrogen oxide	5,54597	8,46	134,4476	2,77299	4,23	67,2238	-	-	-
														Benz(a)pyren	0,00040	6,1E-04	0,0097	0,00020	0,00	0,0049	-	-	-
														Fuel oil ash	0,74100	1,13	0,0012	0,37050	0,56	0,0006	-	-	-
	Boilers TGM-84, plants No. 5-6	pipe	3	56,0	9,18	402,105	6,08	117	3495	2506				Nitrogen oxide	3,17979	7,91	50,3335	3,17979	7,91	50,3335	-	-	-
	(after commissioning of CCGT Unit No.3,4, boilers No.5-7 are put into reserve)													Nitrogen dioxide	12,71918	31,63	201,3344	12,71918	31,63	201,3344	-	-	-
														Sulphur dioxide	0,10979	0,27	1,7379	0,10979	0,27	1,7379	-	-	-
														Hydrogen oxide	3,74080	9,30	59,2139	3,74080	9,30	59,2139	-	-	-
														Benz(a)pyren	0,00040	9,9E-04	0,0097	4,0E-04	9,9E-04	9,7E-03	-	-	-
														Fuel oil ash	0,24375	0,61	0,0007	0,24375	0,61	0,0007	-	-	-
	Boilers No. 94 plants No. 8,9	pipe	4	56,0	9,18	664,042	10,03	140,4	8159	6101				Nitrogen oxide	5,93758	8,94	126,6699	3,95841	5,96	84,4508	-	-	-
	Boilers No. 84 plants No. 10													Nitrogen dioxide	25,83007	38,90	551,0484	17,22013	25,93	367,3840	-	-	-
	(after commissioning of CCGT Unit No.2, boilers No.8 is put into reserve)													Sulphur dioxide	0,19576	0,29	4,1764	0,13051	0,20	2,7844	-	-	-
	(after commissioning of CCGT Unit No.3,4, boilers No.9-10 are put into reserve													Hydrogen oxide	6,45752	9,72	137,7621	4,30503	6,48	91,8460	-	-	-
														Benz(a)pyren	0,00040	6,0E-04	0,0085	0,00027	0,00	0,0057	-	-	-
														Fuel oil ash	0,74100	1,12	0,0012	0,49400	0,74	0,0008	-	-	-
	Boilers TGME-206, pants No. 11, 12	pipe	5	180,0	6,00	700,861	24,79	154	8039	6134				Nitrogen oxide	7,91915	11,30	184,9945	7,91915	11,30	184,9945	-	-	-
	(after commissioning of CCGT Unit No.3,4, boilers No.11-12 are put into reserve)													Nitrogen dioxide	71,23562	101,64	1664,0926	71,23562	101,64	1664,0926	-	-	-
														Sulphur dioxide	0,45429	0,65	10,6124	0,45429	0,65	10,6124	-	-	-
														Hydrogen oxide	17,80890	25,41	416,0230	17,80890	25,41	416,0230	-	-	-
														Benz(a)pyren	0,00049	7,0E-04	0,0114	0,00049	7,0E-04	0,0114	-	-	-
	Peak boiler room	pipe	39	60,0	0,50	0,028	0,14	120						Hydrogen oxide	0,00915	0,01	0,0711	0,00915	0,01	0,0711	-	-	-
	(after commissioning of CCGT Unit No.3,4, a peak boiler room is put into reserve)													Nitrogen oxide	0,00206	2,9E-03	0,0160	0,00206	2,9E-03	0,0160	-	-	-
														Nitrogen dioxide	0,00052	7,4E-04	0,0040	0,00052	7,4E-04	0,0040	-	-	-
														Sulphur dioxide	0,00020	2,9E-04	0,0016	0,00020	2,9E-04	0,0016	-	-	-
Fuel oil facilities	Fuel oil storage tanks	breathing valve	8	6,0	0,25	0,186	3,80	25						Hydrocarbons	0,00005	0,27	0,0014	0,00005	0,27	0,0014	0,00005	0,268528464	0,0014
	Railway tank	breathing valve	9	6,0	0,25	0,186	3,80	25						Hydrocarbons	0,33460	1796,99	5,7000	0,33460	1796,99	5,7000	0,3346	1796,992481	5,7
	Fuel oil storage tank	breathing valve	45	6,0	0,25	0,186	3,80	25						Hydrocarbons	0,00005	0,27	0,0014	0,00005	0,27	0,0014	0,00005	0,268528464	0,0014
	Fuel oil storage tank	breathing valve	46	6,0	0,25	0,186	3,80	25						Hydrocarbons	0,00005	0,27	0,0014	0,00005	0,27	0,0014	0,00005	0,268528464	0,0014
	Fuel oil storage tank	breathing valve	47	6,0	0,25	0,186	3,80	25						Hydrocarbons	0,00005	0,27	0,0014	0,00005	0,27	0,0014	0,00005	0,268528464	0,0014
	Fuel oil storage tank	breathing valve	48	6,0	0,25	0,186	3,80	25						Hydrocarbons	0,00010	0,54	0,0030	0,00010	0,54	0,0030	0,0001	0,537056928	0,003
	Fuel oil storage tank	breathing valve	49	6,0	0,25	0,186	3,80	25						Hydrocarbons	0,00010	0,54	0,0030	0,00010	0,54	0,0030	0,0001	0,537056928	0,003
	Fuel oil storage tank	breathing valve	50	6,0	0,25	0,186	3,80	25						Hydrocarbons	0,00010	0,54	0,0030	0,00010	0,54	0,0030	0,0001	0,537056928	0,003
Fuel oil facilities of electrical shop	Oil tank	breathing valve	10	6,4	0,15	0.068	3,80	25						Hydrocarbons	0,00065	9,50	0,0205	0,00065	9,50	0,0205	0,00065	9,50	0,0205
	Oil tank	breathing valve	11	6,4	0,15	0.068	3,80	25						Hydrocarbons	0,00065	9,50	0,0205	0,00065	9,50	0,0205	0,00065	9,50	0,0205
	Oil tank	breathing valve	12	6,4	0,15	0.068	3,80	25						Hydrocarbons	0,00065	9,50	0,0205	0,00065	9,50	0,0205	0,00065	9,50	0,0205
	Oil tank	breathing valve	13	6,4	0,15	0.068	3,80	25						Hydrocarbons	0,00065	9,50	0,0205	0,00065	9,50	0,0205	0,00065	9,50	0,0205
	Oil tank	breathing valve	14	6,4	0,15	0.068	3,80	25						Hydrocarbons	0,00065	9,50	0,0205	0,00065	9,50	0,0205	0,00065	9,50	0,0205
	Oil tank	breathing valve	15	6,4	0,15	0.068	3,80	25						Hydrocarbons	0,00065	9,50	0,0205	0,00065	9,50	0,0205	0,00065	9,50	0,0205
	Oil tank	breathing valve	16	6,4	0,15	0.068	3,80	25						Hydrocarbons	0,00065	9,50	0,0205	0,00065	9,50	0,0205	0,00065	9,50	0,0205
	Oil tank	breathing valve	51	6,4	0,15	0.068	3,80	25						Hydrocarbons	0,00065	9,50	0,0205	0,00065	9,50	0,0205	0,00065	9,50	0,0205
Water treatment 1-3	Ammonia dilution tank	breathing valve	17	6,0	0,15	0,067	3,80	25						Ammonia	0,00470	69,73	0,1490	0,00470	69,73	0,1490	0,00470	69,73	0,1490
	Sulphur acid storage tanks	breathing valve	32	12,0	0,33	0,315	3,80	25						Sulphur dioxide	0,03433	108,98	1,0677	0,03433	108,98	1,0677	0,03433	108,98	9,9937
														Sulphur acid aerosol	0,32130	4767,06	9,9937	0,32130	4767,06	9,9937	0,32130	4767,06	2,0563
	Hydrochloric acid storage tank	breathing valve	33	12,0	0,33	0,315	3,80	25						Hydrogen chloride	0,06600	979,23	2,0563	0,06600	979,23	2,0563	0,06600	979,23	2,0563
	Alkali storage tank	pipe	34	5,0	0,10	0,030	3,80	25						Alkali aerosol	0,00026	3,86	0,0081	0,00026	3,86	0,0081	0,00026	3,86	0,0081
	Reloading unit	Non-organized	35	2,0	0,56	0,935	3,80	25						Limestone	0,00012	0,13	0,0006	0,00012	0,13	0,0006	0,00012	0,13	0,0006
	Limestone storage facilities	Non-organized	18	2,0	0,56	0,935	3,80	25						Limestone	0,00043	0,46	0,0136	0,00043	0,46	0,0136	0,00043	0,46	0,0136
	Reloading unit	Non-organized	36	2,0	0,56	0,935	3,80	25						Sodium chloride	0,00012	0,13	0,0006	0,00012	0,13	0,0006	0,00012	0,13	0,0006
	Salt storage facilities	Non-organized	19	2,0	0,56	0,935	3,80	25						Sodium chloride	0,00043	0,46	0,0136	0,00043	0,46	0,0136	0,00043	0,46	0,0136
Centralized repair shop	Forge furnace	pipe	6	6,0	0,30	0,329	4,65	200						Nitrogen dioxide	0,00720	130,70	0,3390	0,04300	130,70	0,3390	0,04300	21,88	0,0568
														Hydrogen oxide	0,04300	21,88	0,0568	0,00720	21,88	0,0568	0,00720	130,70	0,3390
	Forge furnace	pipe	7	6,0	0,30	0,329	4,65	120						Nitrogen dioxide	0,00720	21,88	0,0568	0,00720	21,88	0,0568	0,00720	21,88	0,0568
														Hydrogen oxide	0,04300	130,70	0,3390	0,04300	130,70	0,3390	0,04300	130,70	0,3390
	Cutting machines	Non-organized	28	2,0	0,56	0,935	3,80	25						Oil aerosol	0,00005	0,05	0,0002	0,00005	0,05	0,0002	0,00005	0,05	0,0002
	Grinding machines	Non-organized	29	2,0	0,56	0,935	3,80	25						Abrasive dust	0,00010	0,11	0,0004	0,00010	0,11	0,0004	0,00010	0,11	0,0004
														Metal dust	0,00010	0,11	0,0007	0,00010	0,11	0,0007	0,00010	0,11	0,0007
	Cutter-grinding machines	Non-organized	30	2,0	0,56	0,935	3,80	25						Abrasive dust	0,00010	0,11	0,0003	0,00010	0,11	0,0003	0,00010	0,11	0,0003
														Metal dust	0,00010	0,11	0,0004	0,00010	0,11	0,0004	0,00010	0,11	0,0004
	Welding post No. 1	Non-organized	26	2,0	0,56	0,935	3,80	25						Iron oxide	0,01424	15,23	0,0748	0,01424	15,23	0,0748	0,01424	15,23	0,0748
														Manganese and compounds	0,00068	0,73	0,0036	0,00068	0,73	0,0036	0,00068	0,73	0,0036
														Silicon oxide	0,00186	1,99	0,0098	0,00186	1,99	0,0098	0,00186	1,99	0,0098
														Fluorides	0,00186	1,99	0,0098	0,00186	1,99	0,0098	0,00186	1,99	0,0098

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
														Hydrogen fluoride	0,00133	1,42	0,0070	0,00133	1,42	0,0070	0,00133	1,42	0,0070
	Welding post No. 2	Non-organized	27	2,0	0,56	0,935	3,80	25						Iron oxide	0,01424	15,23	0,0748	0,01424	15,23	0,0748	0,01424	15,23	0,0748
														Manganese and compounds	0,00068	0,73	0,0036	0,00068	0,73	0,0036	0,00068	0,73	0,0036
														Silicon oxide	0,00186	1,99	0,0098	0,00186	1,99	0,0098	0,00186	1,99	0,0098
														Fluorides	0,00186	1,99	0,0098	0,00186	1,99	0,0098	0,00186	1,99	0,0098
														Hydrogen fluoride	0,00133	1,42	0,0070	0,00133	1,42	0,0070	0,00133	1,42	0,0070
	Gas cutting post	Non-organized	31	2,0	0,56	0,935	3,80	25						Iron oxide	0,00166	1,78	0,0087	0,00166	1,78	0,0087	0,00166	1,78	0,0087
														Manganese and compounds	0,00005	0,05	0,0003	0,00005	0,05	0,0003	0,00005	0,05	0,0003
														Hydrogen oxide	0,00083	0,89	0,0044	0,00083	0,89	0,0044	0,00083	0,89	0,0044
														Nitrogen oxide	0,00084	0,90	0,0044	0,00084	0,90	0,0044	0,00084	0,90	0,0044
ATP	Charging device	Non-organized	20	2,0	0,56	0,935	3,80	25						Nitrogen acid aerosol	0,00013	0,14	0,0007	0,00013	0,14	0,0007	0,00013	0,14	0,0007
Warehouse of fuel and lubricants	Diesel fuel tank	breathing valve	21	4,0	0,05	0,008	3,80	25						Hydrocarbons	0,00064	0,68	0,0201	0,00064	0,68	0,0201	0,00064	0,68	0,0201
	Diesel fuel tank	breathing valve	22	4,0	0,05	0,008	3,80	25						Hydrocarbons	0,00064	0,68	0,0201	0,00064	0,68	0,0201	0,00064	0,68	0,0201
	Diesel fuel tank	breathing valve	23	4,0	0,05	0,008	3,80	25						Hydrocarbons	0,00064	0,68	0,0201	0,00064	0,68	0,0201	0,00064	0,68	0,0201
	Diesel fuel tank	breathing valve	24	4,0	0,05	0,008	3,80	25						Hydrocarbons	0,00064	0,68	0,0201	0,00064	0,68	0,0201	0,00064	0,68	0,0201
	Diesel fuel tank	breathing valve	25	4,0	0,05	0,002	4,10	25						Gasoline vapor	0,02564	12820,00	0,8087	0,02564	12820,00	0,8087	0,02564	12820,00	0,8087
	Gasoline tanks	Non-organized	37	2,0	0,56	0,935	3,80	25						Gasoline vapor	0,85300	912,30	0,2260	0,85300	912,30	0,2260	0,853	912,30	0,226
	Diesel fuel column	Non-organized	38	2,0	0,56	0,935	3,80	25						Hydrocarbons	0,00998	10,67	0,0019	0,00998	10,67	0,0019	0,00998	10,67	0,0019
CCGT Unit No.1	Gas turbine	pipe	44	60	8,50	691,232	12,18	126	2768	2436				Nitrogen dioxide	17,15362	24,82	486,5520	17,15839	24,82	486,5520	17,15839	24,82	486,5520
														Nitrogen oxide	4,28840	6,20	121,6380	4,28840	6,20	121,6380	4,28840	6,20	121,6380
														Hydrogen oxide	4,45109	6,44	126,2502	4,45109	6,44	126,2502	4,45109	6,44	126,2502
CCGT Unit No. 2	Gas turbine	pipe	51	60	8,50	752,912	13,27	126	2578	2292				Nitrogen dioxide	-	-	-	18,68947	24,82	571,4406	18,68947	24,82	571,4406
														Nitrogen oxide	-	-	-	3,03704	4,03	92,8591	3,03704	4,03	92,8591
														Hydrogen oxide	-	-	-	4,84827	6,44	148,2384	4,84827	4,03	148,2384
CCGT Unit No. 2	Gas turbine	pipe	52	112	8,50	1047,222	18,45	120	9012	6433				Nitrogen dioxide	-	-	-	-	-	-	29,09411	27,78	819,0573
														Nitrogen oxide	-	-	-	-	-	-	4,72779	4,51	133,0968
														Hydrogen oxide	-	-	-	-	-	-	7,70280	7,36	216,8492
CCGT Unit No. 3	Gas turbine	pipe	53	112	8,50	1047,2222	18,45	120	9052	6433				Nitrogen dioxide	-	-	-	-	-	-	29,09411	27,78	819,0573
														Nitrogen oxide	-	-	-	-	-	-	4,72779	4,51	133,0968
														Hydrogen oxide	-	-	-	-	-	-	7,70280	7,36	216,8492
														Total	**218,54963**		**4976,6268**	**214,94188**		**5109,5989**	**137,32552**		**3906,3059**

Nitrogen dioxide (current state)

Fig. 4.1

Nitrogen oxide (current state)

Fig. 4.2

Sulphur dioxide (current state)

Fig. 4.3

Hydrogen oxide (current state)

Fig. 4.4

Benz(a)pyren (current state)

Fig. 4.5

Metal dust (current state)

Fig. 4.6

Iron oxide (current state)

Fig. 4.7

Quicklime (current state)

Fig. 4.8

Manganese compounds (current state)

Fig. 4.9

Alkali (current state)

Fig. 4.10

Nitrogen chloride (current state)

Fig. 4.11

Chrome oxide (current state)

Fig. 4.12

Ammonia (current state)

Fig. 4.13

Hydrogen chloride (current state)

Fig. 4.14

Sulphuric acid (current state)

Fig. 4.15

Silicon oxide (current state)

Fig. 4.16

Hydrogen fluoride (current state)

Fig. 4.17

Fluorides (current state)

Fig. 4.18

Mineral oil (current state)

Fig. 4.19

Hydrocarbons (current state)

Fig. 4.20

Abrasive dust (current state)

Fig. 4.21

Nitrogen dioxide (current state)

Fig. 4.22

Nitrogen oxide (current state)

Fig. 4.23

Sulphur dioxide (current state)

Fig. 4.24

Hydrogen oxide (current state)

Fig. 4.25

Unified Air Pollution Calculation Program ECOLOGIST, version 3.00
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Serial number 12-34-5678, Teploproekt JSC

Company number 113; Navoi TPP
city of Navoi

Option of source data: 26, Navoi TPP (current state)
Option of calculation: 27, 8 to 5 km site
Calculation was made for winter
Calculation module: "OND-86 standard"
Calculation invariables: E1 = 0,01, E2 = 0,01, E3 = 0,01, S = 999999,99 sq.m.

Metrological parameters

Average outdoor temperature in the hottest month	36,48°C
Average outdoor temperature in the coldest month	-3° C
Ratio depending on temperature stratification of the atmosphere A	200
Maximum wind speed in the area (repeatability of exceedance within 5%)	7 m/s

Parameters of sources of emissions

Accounting:
"%" – the source is taken into account with exclusion from the background;
"+" – the source is taken into account without exclusion from the background;
"-" – the source is not taken into account and its contribution is excluded from the background;
Subject to absence of marks the source is not taken into account.

Types of sources:
1 - dotty;
2 – linear;
3 – non-organized;
4 - a total of dotty ones, combined to calculate in one areal;
5 – non-organized with emission power non-stationary in time;
6 - dotty, with an umbrella or horizontal direction of emission;
7 - a total of dotty ones with umbrellas or horizontal direction of emission;
8 – motorway.

Accounting in calculation	Site No.	Shop No.	Source No.	Source	Option	Type	Source height (m)	Mouth diameter (m)	Hot water supply volume (m/s)	Hot water supply rate (m/s)	Hot water supply temperature (°C)	Ratio	X1-axle ccord. (m)	Y1-axle coord. (m)	X-2 axle coord. (m)	Y2-axle coord. (m)	Source width (m)
%	0	0	2	Boilers TGM-94, plant No.4	1	1	56,0	9,18	655,908	9,90986	140,4	1,0	8425,0	6142,0	8425,0	6142,0	9,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	23,9419000	0,0000000	1		0,335	1 438,6	8,3		0,318	1 474,3 9	9
0304	Nitrogen (II) oxide (Nitrogen oxide)	3,8905600	0,0000000	1		0,008	1 438,6	8,3		0,007	1 474,3 9	9
0330	Sulphur dioxide	0,1468000	0,0000000	1		0,000	1 438,6	8,3		0,000	1 474,3 9	9
0337	Hydrogen oxide	5,5459700	0,0000000	1		0,001	1 438,6	8,3		0,001	1 474,3 9	9
0703	Benz(a)pyren (3,4-Benzpyren)	0,0004000	0,0000000	1		0,475	1 438,6	8,3		0,452	1 474,3 9	9

Accounting in calculation	Site No.	Shop No.	Source No.	Source	Option	Type	Source height (m)	Mouth diameter (m)	Hot water supply volume (m/s)	Hot water supply rate (m/s)	Hot water supply temperature (°C)	Ratio	X1-axle ccord. (m)	Y1-axle coord. (m)	X-2 axle coord. (m)	Y2-axle coord. (m)	Source width (m)
%	0	0	3	Boilers TGM-84, plant No. 7	1	1	56,0	9,18	402,105	6,07525	117	1,0	8324,0	6132,0	8324,0	6132,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	12,7191800	0,0000000	1		0,258	1 193,9	6,2		0,240	1 238,5	6,9
0304	Nitrogen (II) oxide (Nitrogen oxide)	3,1797900	0,0000000	1		0,009	1 193,9	6,2		0,008	1 238,5	6,9
0330	Sulphur dioxide	0,1097900	0,0000000	1		0,000	1 193,9	6,2		0,000	1 238,5	6,9
0337	Hydrogen oxide	3,7408000	0,0000000	1		0,001	1 193,9	6,2		0,001	1 238,5	6,9
0703	Benz(a)pyren (3,4-Benzpyren)	0,0004000	0,0000000	1		0,689	1 193,9	6,2		0,641	1 238,5	6,9

Accounting in calculation	Site No.	Shop No.	Source No.	Source	Option	Type	Source height (m)	Mouth diameter (m)	Hot water supply volume (m/s)	Hot water supply rate (m/s)	Hot water supply temperature (°C)	Ratio	X1-axle ccord. (m)	Y1-axle coord. (m)	X-2 axle coord. (m)	Y2-axle coord. (m)	Source width (m)
%	0	0	4	Boilers TGM-94, plant No.9 TGM-96 plant No.10	1	1	56,0	9,18	664,042	10,03276	135	1,0	8159,0	6101,0	8159,0	6101,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	25,8300700	0,0000000	1		0,361	1 439,4	8,3		0,343	1 476,1	9
0304	Nitrogen (II) oxide (Nitrogen oxide)	5,9375800	0,0000000	1		0,012	1 439,4	8,3		0,011	1 476,1	9
0330	Sulphur dioxide	0,1957600	0,0000000	1		0,000	1 439,4	8,3		0,000	1 476,1	9
0337	Hydrogen oxide	6,4575200	0,0000000	1		0,002	1 439,4	8,3		0,001	1 476,1	9
0703	Benz(a)pyren (3,4-Benzpyren)	0,0004000	0,0000000	1		0,475	1 439,4	8,3		0,451	1 476,1	9

Accounting in calculation	Site No.	Shop No.	Source No.	Source	Option	Type	Source height (m)	Mouth diameter (m)	Hot water supply volume (m/s)	Hot water supply rate (m/s)	Hot water supply temperature (°C)	Ratio	X1-axle ccord. (m)	Y1-axle coord. (m)	X-2 axle coord. (m)	Y2-axle coord. (m)	Source width (m)
%	0	0	5	Boilers TGME-206 plants No. 11, 12	1	1	180,0	6,00	700,861	24,78789	154	1,0	8039,0	6134,0	8039,0	6134,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	71,2356200	0,0000000	1		0,108	3 601,1	5,6		0,102	3 703,7	6,1
0304	Nitrogen (II) oxide (Nitrogen oxide)	7,9191500	0,0000000	1		0,002	3 601,1	5,6		0,002	3 703,7	6,1
0330	Sulphur dioxide	0,4542900	0,0000000	1		0,000	3 601,1	5,6		0,000	3 703,7	6,1
0337	Hydrogen oxide	17,8089000	0,0000000	1		0,000	3 601,1	5,6		0,000	3 703,7	6,1
0703	Benz(a)pyren (3,4-Benzpyren)	0,0004900	0,0000000	1		0,063	3 601,1	5,6		0,060	3 703,7	6,1

Accounting in calculation	Site No.	Shop No.	Source No.	Source	Option	Type	Source height (m)	Mouth diameter (m)	Hot water supply volume (m/s)	Hot water supply rate (m/s)	Hot water supply temperature (°C)	Ratio	X1-axle ccord. (m)	Y1-axle coord. (m)	X-2 axle coord. (m)	Y2-axle coord. (m)	Source width (m)
%	0	0	6	Forge furnace	1	1	6,0	0,30	0,329	4,65440	200	1,0	8284,0	6178,0	8284,0	6178,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	0,0072000	0,0000000	1		0,135	51,7	1,4		0,123	54,7	1,5
0337	Hydrogen oxide	0,0430000	0,0000000	1		0,014	51,7	1,4		0,013	54,7	1,5

Accounting in calculation	Site No.	Shop No.	Source No.	Source	Option	Type	Source height (m)	Mouth diameter (m)	Hot water supply volume (m/s)	Hot water supply rate (m/s)	Hot water supply temperature (°C)	Ratio	X1-axle ccord. (m)	Y1-axle coord. (m)	X-2 axle coord. (m)	Y2-axle coord. (m)	Source width (m)
%	0	0	7	Forge furnace	1	1	6,0	0,30	0,329	4,65440	120	1,0	8296,0	6180,0	8296,0	6180,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	0,0072000	0,0000000	1		0,180	43,7	1,1		0,153	48,1	1,2

		0337		Hydrogen oxide			0,0430000		0,0000000		1		0,018	43,7	1,1		0,016	48,1	1,2					
%	0	0	10	Oil tanks	1	1	6,4	0,15	0,021	1,18836		20	1,0	8324,0	6381,0	8324,0	6381,0		0,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	2754			Saturated hydrocarbons C12-C19			0,2520000		0,0000000		1		0,000	0	0		2,358	17,4	0,5					
%	0	0	17	Ammonia storage tank	1	1	6,0	0,15	0,021	1,18836		20	1,0	8569,0	6163,0	8569,0	6163,0		0,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	0303			Ammonia			0,0043000		0,0000000		1		0,000	0	0		0,231	16,4	0,5					
%	0	0	18	Limestone storage facilities	1	1	2,0	0,50	0,569	2,89789		20	1,0	8482,0	6184,0	8482,0	6184,0		5,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	0128			Calcium oxide (quicklime)			0,0225000		0,0000000		3		0,000	0	0		24,735	12	1,2					
%	0	0	19	Salt storage facilities	1	1	2,0	0,50	0,569	2,89789		20	1,0	8499,0	6187,0	8499,0	6187,0		5,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	0152			Sodium chloride (Cooking salt)			0,0225000		0,0000000		3		0,000	0	0		1,484	12	1,2					
%	0	0	26	Welding posts No.1	1	1	2,0	0,50	0,569	2,89789		20	1,0	7986,0	6022,0	7986,0	6022,0		100,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	0123			Iron oxide (in calculation into iron)			0,0128000		0,0000000		3		0,000	0	0		2,111	12	1,2					
	0143			Manganese and its compounds			0,0007000		0,0000000		3		0,000	0	0		4,617	12	1,2					
	0304			Nitrogen (II) oxide (Nitrogen oxide)			0,0007000		0,0000000		1		0,000	0	0		0,013	24,1	1,2					
	0323			Amorphous silica (Aerosil-175)			0,0007000		0,0000000		3		0,000	0	0		1,154	12	1,2					
	0337			Hydrogen oxide			0,0036000		0,0000000		1		0,000	0	0		0,008	24,1	1,2					
	0342			Gaseous fluorides (hydrogen fluoride)			0,0036000		0,0000000		1		0,000	0	0		0,550	24,1	1,2					
	0344			Poorly soluble fluorides			0,0007000		0,0000000		1		0,000	0	0		0,038	24,1	1,2					
%	0	0	28	Cutting machines	1	1	2,0	0,50	0,569	2,89789		20	1,0	8472,0	6240,0	8472,0	6240,0		0,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
%	0	0	29	Grinding machines	1	1	2,0	0,50	0,569	2,89789		20	1,0	8452,0	6252,0	8452,0	6252,0		5,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	0022			Metal dust (for iron)			0,1120000		0,0000000		3		0,000	0	0		18,469	12	1,2					
	2930			White alumina			0,0760000		0,0000000		3		0,000	0	0		62,663	12	1,2					
%	0	0	30	Cutting-grinding machines	1	1	2,0	0,50	0,569	2,89789		20	1,0	8472,0	6256,0	8472,0	6256,0		5,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	0022			Metal dust (for iron)			0,0960000		0,0000000		3		0,000	0	0		15,831	12	1,2					
	2930			White alumina			0,0640000		0,0000000		3		0,000	0	0		52,769	12	1,2					
%	0	0	31	Gas welding post	1	1	2,0	0,50	0,569	2,89789		20	1,0	8488,0	6328,0	8488,0	6328,0		5,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	0123			Iron oxide (in calculation into iron)			0,0199000		0,0000000		3		0,000	0	0		3,282	12	1,2					
	0143			Manganese and its compounds			0,0006000		0,0000000		3		0,000	0	0		3,958	12	1,2					
	0301			Nitrogen (II) oxide (Nitrogen oxide)			0,0108000		0,0000000		1		0,000	0	0		1,397	24,1	1,2					
	0337			Hydrogen oxide			0,0138000		0,0000000		1		0,000	0	0		0,030	24,1	1,2					
%	0	0	32	Sulfuric acid storage tank	1	1	12,0	0,33	0,99499	11,99395		20	1,0	8511,0	6331,0	8511,0	6331,0		5,00					
	Substance code			Substance			Emission (g,/s)		Emission (t/g)		F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um					
	0322			Sulfuric acid			0,3213000		0,0000000		3		0,000	0	0		1,480	40,1	0,8					
	0330			Sulphur dioxide			0,0343000		0,0000000		3		0,000	0	0		0,095	40,1	0,8					

%	0	0	33	Hydrochloric acid storage tank	1	1	12,0	0,33	0,99499	11,99395		20	1,0	8490,0	6304,0	8490,0	6304,0		5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um	
	0316			Hydrochloride (Hydrogen chloride, hydrochloric Acid) (for HC molecule)			0,0660000		0,0000000	1		0,000	0	0		0,152	80,3	0,8	
%	0	0	34	Alkali storage tank	1	1	5,0	0,10	0,0471	5,99696		20	1,0	8516,0	6311,0	8516,0	6311,0		5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um	
	0150			Sodium hydroxide (Sodium hydroxide, Caustic soda)			0,0003000		0,0000000	3		0,000	0	0		0,901	8,7	0,5	
%	0	0	35	Reloading unit	1	1	5,0	0,50	0,569	2,89789		20	1,0	8500,0	6273,0	8500,0	6273,0		5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um	
	0128			Calcium oxide (quicklime)			0,0187000		0,0000000	3		0,000	0	0		6,543	17,1	0,9	
%	0	0	36	Reloading unit	1	1	5,0	0,50	0,569	2,89789		20	1,0	8516,0	6278,0	8516,0	6278,0		5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um	
	0152			Sodium chloride (Cooking salt)			0,0220000		0,0000000	3		0,000	0	0		0,462	17,1	0,9	
%	0	0	39	Peak boiler room	1	1	60,0	0,50	0,0275	0,14006		120	1,0	8266,0	6113,0	8266,0	6113,0		5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um	
	0301			Nitrogen (IV) oxide (Nitrogen dioxide)			0,0020600		0,0000000	1		0,001	149,4	0,5		0,001	149,4	0,5	
	0304			Nitrogen (II) oxide (Nitrogen oxide)			0,0005200		0,0000000	1		0,000	149,4	0,5		0,000	149,4	0,5	
	0330			Sulphur dioxide			0,0002000		0,0000000	1		0,000	149,4	0,5		0,000	149,4	0,5	
	0337			Hydrogen oxide			0,0091500		0,0000000	1		0,000	149,4	0,5		0,000	149,4	0,5	
%	0	0	44	CCGT Unit-478 MW	1	1	60,0	8,50	691,232	12,18137		126	1,0	7592,0	6046,0	7592,0	6046,0		0,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC	Xm	Um	
	0301			Nitrogen (IV) oxide (Nitrogen dioxide)			17,1583900		0,0000000	1		0,202	1 551,2	8,1		0,192	1 590,8	8,9	
	0304			Nitrogen (II) oxide (Nitrogen oxide)			2,7882400		0,0000000	1		0,005	1 551,2	8,1		0,004	1 590,8	8,9	

Calculation made for substances (summation groups)

Code	Substance	Maximum Allowable Concentration			Environmental situation ratio	Background concentration	
		Type	Ref. value	Used in calculation		Acc.	Interpreted
0022	Metal dust (for iron)	MAC m/r	0,2	0,2	1	No	No
0123	Iron oxide (in recalculation to iron)	MAC m/r	0,2	0,2	1	No	No
0128	Calcium oxide (quicklime)	MAC m/r	0,03	0,03	1	No	No
0143	Manganese and its compounds	MAC m/r	0,005	0,005	1	No	No
0150	Sodium hydroxide (Sodium hydroxide, caustic soda)	SRLI	0,01	0,01	1	No	No
0152	Sodium chloride (Cooking salt)	MAC m/r	0,5	0,5	1	No	No
0203	Chrome (VI) oxide	MAC m/r	0,0075	0,0075	1	No	No
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	MAC m/r	0,085	0,085	1	No	No
0303	Ammonia	MAC m/r	0,2	0,2	1	No	No
0304	Nitrogen (II) oxide (Nitrogen oxide)	MAC m/r	0,6	0,6	1	No	No
0316	Hydrochloride (Hydrogen chloride, Hydrochloric acid) (for HC molecule)	MAC m/r	0,2	0,2	1	No	No
0322	Sulphuric acid	MAC m/r	0,3	0,3	1	No	No
0323	Amorphous silica (Aerosil-175)	SRLI	0,02	0,02	1	No	No
0330	Sulphut dioxide	MAC m/r	0,5	0,5	1	No	No
0337	Hydrogen oxide	MAC m/r	5	5	1	No	No
0342	Gaseous fluorides (hydrogen fluoride)	MAC m/r	0,012	0,012	1	No	No
0344	Poorly soluble fluorides	MAC m/r	0,2	0,2	1	No	No
0703	Benz(a)pyren (3,4-Benzapyren)	MAC s/s*10	0,000001	0,000001	1	No	No
2735	Mineral petroleum oil	MAC m/r	0,05	0,05	1	No	No
2754	Saturated hydrocarbons C12-C19	MAC m/r	1	1	1	No	No
2930	White alumni	SRLI	0,04	0,04	1	No	No

Results of calculation and contributions in terms of substances (reference points)

Types of points:
0 – user reference point
1 – point on the border of the secured zone
2 - point on the border of the production area
3 - point on the boundary of the SPZ
4 – point on the border of the residential area
5 - point on the border of the building

Substance: 0022 Metal dust (for iron)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,23	159	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	29			0,13	55,04	
		0	0	30			0,10	44,96	
2	9800	6167	2	0,03	274	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	29			0,02	53,16	
		0	0	30			0,02	46,84	

Substance: 0123 Iron oxide (in recalculation to iron)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,03	152	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	31			0,03	88,29	
		0	0	27			0,03	11,71	
2	9800	6167	2	0,00	275	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	31			0,00	64,89	
		0	0	27			0,00	28,87	
		0	0	26			0,00	6,26	

Substance: 0128 Calcium oxide (quicklime)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,24	156	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	35			0,13	54,73	
		0	0	18			0,13	45,27	
2	9800	6167	2	0,04	272	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	18			0,02	54,73	
		0	0	35			0,01	33,31	

Substance: 0143 Manganese and its compounds

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,05	154	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	31			0,03	66,92	
		0	0	27			0,02	33,08	
2	9800	6167	2	0,01	274	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	27			0,00	46,74	
		0	0	31			0,00	42,64	
		0	0	26			0,00	10,63	

Substance: 0150 Sodium hydroxide (Sodium hydroxide, caustic soda)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,01	149	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	34			0,01	100,00	
2	9800	6167	2	0,00	276	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	34			0,00	100,00	

Substance: 0152 Sodium chloride (Cooking salt)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,02	154	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	36			0,01	58,44	
		0	0	19			0,01	41,56	
2	9800	6167	2	0,00	272	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	19			0,00	63,67	
		0	0	36			0,00	36,33	

Substance: 0203 Chrome (VI) oxide

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,02	160	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	27			0,02	100,00	
2	9800	6167	2	0,00	273	1,63	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	27			0,00	100,00	

Substance: 0301 Nitrogen (IV) oxide (Nitrogen dioxide)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
2	9800	6167	2	1,03	268	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	4			0,30	29,13	
		0	0	2			0,28	27,30	
		0	0	3			0,23	22,06	
1	8300	6667	2	0,19	176	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	3			0,13	71,20	
		0	0	2			0,03	17,55	
		0	0	7			0,01	6,08	

Substance: 0303 Ammonia

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,00	152	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	17			0,00	100,00	
2	9800	6167	2	0,00	270	0,70	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	17			0,00	100,00	

Substance: 0304 Nitrogen (II) oxide (Nitrogen oxide)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
2	9800	6167	2	0,03	268	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	4			0,01	33,87	
		0	0	3			0,01	27,90	
		0	0	2			0,01	22,44	
1	8300	6667	2	0,01	176	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	3			0,00	85,73	
		0	0	2			0,00	13,74	
		0	0	4			0,00	0,51	

Substance: 0316 Hydrochloride (Hydrogen chloride, Hydrochloric Acid) (for HC molecule)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,04	152	1,49	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	33			0,04	100,00	
2	9800	6167	2	0,01	276	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	33			0,01	100,00	

Substance: 0322 Sulphuric acid

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,16	148	3,77	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	32			0,16	100,00	
2	9800	6167	2	0,02	277	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	32			0,02	100,00	

Substance: 0323 Amorphous silica (Aerosil-175)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,00	206	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	

		0	0	26			0,00	100,00		
2	9800	6167	2	0,02	265	7,00		0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %		
		0	0	26			0,00	100,00		

Substance: 0330 Sulphur dioxide

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,01	148	2,91	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	32			0,01	99,99	
2	9800	6167	2	0,00	273	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	32			0,00	54,13	
		0	0	3			0,00	14,65	
		0	0	4			0,00	14,65	

Substance: 0337 Hydrogen oxide

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
2	9800	6167	2	0,00	269	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	4			0,00	28,94	
		0	0	3			0,00	26,54	
		0	0	2			0,00	26,13	
1	8300	6667	2	0,01	181	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	7			0,00	42,27	
		0	0	6			0,00	40,35	
		0	0	3			0,00	15,35	

Substance: 0342 Gaseous fluorides (hydrogen fluoride)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,02	160	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	27			0,02	100,00	
2	9800	6167	2	0,01	270	1,63	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	27			0,00	60,18	
		0	0	26			0,00	39,82	

Substance: 0344 Poorly soluble fluorides

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,00	206	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	26			0,00	100,00	
2	9800	6167	2	0,00	265	1,63	0,000	0,000	0
		Site	Shop	Source	Contribution in shares		MAC	Contribution %	
		0	0	26			0,00	100,00	

Substance: 0703 Benz/a/pyren (3,4-Benzapyren)

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
2	9800	6167	2	0,14	268	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares MAC		Contribution %		
		0	0	3		0,06	42,26		
		0	0	2		0,04	27,78		
		0	0	4		0,04	27,78		
1	8300	6667	2	0,04	176	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares MAC		Contribution %		
		0	0	3		0,04	88,18		
		0	0	2		0,00	11,55		
		0	0	4		0,00	0,28		

Substance: 2735 Mineral petroleum oil

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,04	158	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares MAC		Contribution %		
		0	0	28		0,04	100,00		
2	9800	6167	2	0,01	273	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares MAC		Contribution %		
		0	0	28		0,01	100,00		

Substance: 2754 Saturated hydrocarbons C12-C19

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,13	175	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares MAC		Contribution %		
		0	0	10		0,13	100,00		
2	9800	6167	2	0,01	278	0,70	0,000	0,000	0
		Site	Shop	Source	Contribution in shares MAC		Contribution %		
		0	0	10		0,01	100,00		

Substance: 2930 White alumni

No.	X coord. (m)	Y coord. (m)	Height (m)	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before excl.	Type of point
1	8300	6667	2	0,08	159	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares MAC		Contribution %		
				29		0,04	55,47		
		0	0	28		0,04	44,53		
2	9800	6167	2	0,01	273	7,00	0,000	0,000	0
		Site	Shop	Source	Contribution in shares MAC		Contribution %		
		0	0	29		0,01	53,60		
		0	0	30		0,00	46,40		

Unified Air Pollution Calculation Program ECOLOGIST, version 3.00
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Serial number 12-34-5678, Teploproekt JSC

Company number 113; Navoi TPP
city of Navoi

Option of source data: 27, Navoi TPP (current state)
Option of calculation: 27, 8 to 5 km site
Calculation was made for winter
Calculation module: "OND-86 standard"
Calculation invariables: E1 = 0,01, E2 = 0,01, E3 = 0,01, S = 999999,99 sq.m.

Metrological parameters

Average outdoor temperature in the hottest month	36,48°C
Average outdoor temperature in the coldest month	-3° C
Ratio depending on temperature stratification of the atmosphere A	200
Maximum wind speed in the area (repeatability of exceedance within 5%)	7 m/s

Parameters of sources of emissions

Accounting:
"%" – the source is taken into account with exclusion from the background;
"+" – the source is taken into account without exclusion from the background;
"-" – the source is not taken into account and its contribution is excluded from the background;
Subject to absence of marks the source is not taken into account.

Types of sources:
1 - dotty;
2 – linear;
3 – non-organized;
4 - a total of dotty ones, combined to calculate in one areal;
5 – non-organized with emission power non-stationary in time;
6 - dotty, with an umbrella or horizontal direction of emission;
7 - a total of dotty ones with umbrellas or horizontal direction of emission;
8 – motorway.

Accounting in calculation	Site No.	Shop No.	Source No.	Source	Option	Type	Source height (m)	Mouth diameter (m)	Hot water supply volume (m/s)	Hot water supply rate (m/s)	Hot water supply temperature (°C)	Ratio	X1-axle ccord. (m)	Y1-axle coord. (m)	X-2 axle coord. (m)	Y2-axle coord. (m)	Source width (m)
	0	0	6	Forge furnace	1	1	6,0	0,30	0,329	4,65440	200	1,0	8284,0	6178,0	8284,0	6178,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer: Cm/MAC	Xm	Um	Winter: Cm/MAC	Xm	Um
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	0,0072000	0,0000000	1	0,135	51,7	1,4	0,123	54,7	1,5
0337	Hydrogen oxide	0,0430000	0,0000000	1	0,014	51,7	1,4	0,013	54,7	1,5

	0	0	7	Forge furnace	1	1	6,0	0,30	0,329	4,65440	120	1,0	8296,0	6180,0	8296,0	6180,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer: Cm/MAC	Xm	Um	Winter: Cm/MAC	Xm	Um
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	0,0072000	0,0000000	1	0,180	43,7	1,1	0,153	48,1	1,2
0337	Hydrogen oxide	0,0430000	0,0000000	1	0,018	43,7	1,1	0,016	48,1	1,2

%	0	0	10	Oil tanks	1	1	6,4	0,15	0,021	1,18836	20	1,0	8324,0	6381,0	8324,0	6381,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer: Cm/MAC	Xm	Um	Winter: Cm/MAC	Xm	Um
2754	Saturated hydrocarbons C12-C19	0,2520000	0,0000000	1	0,000	0	0	2,358	17,4	0,5

%	0	0	17	Ammonia storage tank	1	1	6,0	0,15	0,021	1,18836	20	1,0	8569,0	6163,0	8569,0	6163,0	0,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer: Cm/MAC	Xm	Um	Winter: Cm/MAC	Xm	Um
0303	Ammonia	0,0043000	0,0000000	1	0,000	0	0	0,231	16,4	0,5

%	0	0	18	Limestone storage facilities	1	1	2,0	0,50	0,569	2,89789	20	1,0	8482,0	6184,0	8482,0	6184,0	5,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer: Cm/MAC	Xm	Um	Winter: Cm/MAC	Xm	Um
0128	Calcium oxide (quicklime)	0,0225000	0,0000000	3	0,000	0	0	24,735	12	1,2

%	0	0	19	Salt storage facilities	1	1	2,0	0,50	0,569	2,89789	20	1,0	8499,0	6187,0	8499,0	6187,0	5,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer: Cm/MAC	Xm	Um	Winter: Cm/MAC	Xm	Um
0152	Nitrogen chloride (Cooking salt)	0,0225000	0,0000000	3	0,000	0	0	1,484	12	1,2

%	0	0	26	Welding posts No.1	1	1	2,0	0,50	0,569	2,89789	20	1,0	7986,0	6022,0	7986,0	6022,0	100,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer: Cm/MAC	Xm	Um	Winter: Cm/MAC	Xm	Um
0123	Iron oxide (in calculation into iron)	0,0128000	0,0000000	3	0,000	0	0	2,111	12	1,2
0143	Manganese and its compounds	0,0007000	0,0000000	3	0,000	0	0	4,617	12	1,2
0304	Nitrogen (II) oxide (Nitrogen oxide)	0,0007000	0,0000000	1	0,000	0	0	0,013	24,1	1,2
0323	Amorphous silica (Aerosil-175)	0,0007000	0,0000000	3	0,000	0	0	1,154	12	1,2
0337	Hydrogen oxide	0,0036000	0,0000000	1	0,000	0	0	0,008	24,1	1,2
0342	Gaseous fluorides (hydrogen fluoride)	0,0036000	0,0000000	1	0,000	0	0	0,550	24,1	1,2
0344	Poorly soluble fluorides	0,0007000	0,0000000	1	0,000	0	0	0,038	24,1	1,2

%	0	0	27	Welding posts No.2	1	1	2,0	0,50	0,569	2,89789	20	1,0	8458,0	6238,0	8458,0	6238,0	100,00

Substance code	Substance	Emission (g,/s)	Emission (t/g)	F	Summer: Cm/MAC	Xm	Um	Winter: Cm/MAC	Xm	Um
0123	Iron oxide (in calculation into iron)	0,0091000	0,0000000	3	0,000	0	0	1,501	12	1,2
0143	Manganese and its compounds	0,0006000	0,0000000	3	0,000	0	0	3,958	12	1,2
0203	Chrome (VI) oxide	0,0003000	0,0000000	1	0,000	0	0	0,440	24,1	1,2
0337	Hydrogen oxide	0,0001000	0,0000000	1	0,000	0	0	0,000	24,1	1,2
0342	Gaseous fluorides (hydrogen fluoride)	0,0006000	0,0000000	1	0,000	0	0	0,550	24,1	1,2

%	0	0	28	Cutting machines	1	1	2,0	0,50	0,569	2,89789		20	1,0	8472,0	6240,0	8472,0		6240,0	0,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	2735			Mineral petroleum oil			0,0094000		0,0000000	3		0,000	0	0		6,200		12	1,2
%	0	0	29	Grinding machines	1	1	2,0	0,50	0,569	2,89789		20	1,0	8452,0	6252,0	8452,0		6252,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0022			Metal dust (for iron)			0,0960000		0,0000000	3		0,000	0	0		15,831		12	1,2
	2930			White alumina			0,0640000		0,0000000	3		0,000	0	0		52,769		12	1,2
%	0	0	30	Cutting-grinding machines	1	1	2,0	0,50	0,569	2,89789		20	1,0	8472,0	6256,0	8472,0		6256,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0022			Metal dust (for iron)			0,0960000		0,0000000	3		0,000	0	0		15,831		12	1,2
	2930			White alumina			0,0640000		0,0000000	3		0,000	0	0		52,769		12	1,2
%	0	0	31	Gas cutting post	1	1	2,0	0,50	0,569	2,89789		20	1,0	8488,0	6328,0	8488,0		6328,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0123			Iron oxide (in calculation into iron)			0,0199000		0,0000000	3		0,000	0	0		3,282		12	1,2
	0143			Manganese and its compounds			0,0006000		0,0000000	3		0,000	0	0		3,958		12	1,2
	0301			Nitrogen (IV) oxide (Nitrogen dioxide)			0,0108000		0,0000000	1		0,000	0	0		1,397		24,1	1,2
	0337			Hydrogen oxide			0,0138000		0,0000000	1		0,000	0	0		0,030		24,1	1,2
%	0	0	32	Sulfuric acid storage tank	1	1	12,0	0,33	0,99499	11,99395		20	1,0	8511,0	6331,0	8511,0		6331,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0322			Sulfuric acid			0,3213000		0,0000000	3		0,000	0	0		1,480		40,1	0,8
	0330			Sulphur dioxide			0,0343000		0,0000000	3		0,000	0	0		0,095		40,1	0,8
%	0	0	33	Hydrochloric acid storage tank	1	1	12,0	0,33	0,99499	11,99395		20	1,0	8490,0	6304,0	8490,0		6304,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0316			Hydrochloride (Hydrogen chloride, hydrochloric Acid) (for HC molecule)			0,0660000		0,0000000	1		0,000	0	0		0,152		80,3	0,8
%	0	0	34	Alkali storage tank	1	1	5,0	0,10	0,0471	5,99696		20	1,0	8516,0	6311,0	8516,0		6311,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0150			Sodium hydroxide (Sodium hydroxide, Caustic soda)			0,0003000		0,0000000	3		0,000	0	0		0,901		8,7	0,5
%	0	0	35	Reloading unit	1	1	5,0	0,50	0,569	2,89789		20	1,0	8500,0	6273,0	8500,0		6273,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0128			Calcium oxide (quicklime)			0,0187000		0,0000000	3		0,000	0	0		6,543		17,1	0,9
%	0	0	36	Reloading unit	1	1	5,0	0,50	0,569	2,89789		20	1,0	8516,0	6278,0	8516,0		6278,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0152			Sodium chloride (Cooking salt)			0,0220000		0,0000000	3		0,000	0	0		0,462		17,1	0,9
%	0	0	39	Gas pipelines	1	1	18,0	0,05	0,005	2,54648		20	1,0	8266,0	6113,0	8266,0		6113,0	5,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0333			Hydrogen sulphide			0,0112000		0,0000000	1		0,000	0	0		1,344		45,7	0,5
	0410			Methane			1,4900000		0,0000000	3		0,000	0	0		0,086		22,9	0,5
%	0	0	44	CCGT Unit-478 MW	1	1	60,0	8,50	691,232	12,18137		126	1,0	7592,0	6046,0	7592,0		6046,0	0,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0301			Nitrogen (IV) oxide (Nitrogen dioxide)			17,1583900		0,0000000	1		0,202	1 551,2	8,1		0,192		1 590,8	8,9
	0304			Nitrogen (II) oxide (Nitrogen oxide)			2,7882400		0,0000000	1		0,005	1 551,2	8,1		0,004		1 590,8	8,9
	0337			Hydrogen oxide			4,4510900		0,0000000	1		0,001	1 551,2	8,1		0,001		1 590,8	8,9
%	0	0	45	CCGT Unit-450 MW	1	1	60,0	8,50	736,127	12,97254		126	1,0	8460,0	6273,0	8460,0		6273,0	0,00
	Substance code			Substance			Emission (g,/s)		Emission (t/g)	F	Summer:	Cm/MAC	Xm	Um	Winter:	Cm/MAC		Xm	Um
	0301			Nitrogen (IV) oxide (Nitrogen dioxide)			18,2728100		0,0000000	1		0,205	1 588,2	8,4		0,195		1 626,9	9,2
	0304			Nitrogen (II) oxide (Nitrogen oxide)			2,9693300		0,0000000	1		0,005	1 588,2	8,4		0,004		1 626,9	9,2
	0337			Hydrogen oxide			4,8482700		0,0000000	1		0,001	1 588,2	8,4		0,001		1 626,9	9,2
%	0	0	47	CCGT Unit-650 MW	1	1	112,0	8,50	1047,222	18,45487		120	1,0	9012,0	6433,0	9012,0		6433,0	0,00
		0301		Nitrogen (IV) oxide (Nitrogen dioxide)			29,0941100		0,0000000	1		0,094	2 671,8	7,2		0,088		2 752,5	7,9
		0304		Nitrogen (II) oxide (Nitrogen oxide)			4,7277900		0,0000000	1		0,002	2 671,8	7,2		0,002		2 752,5	7,9
		0337		Hydrogen oxide			7,7028000		0,0000000	1		0,000	2 671,8	7,2		0,000		2 752,5	7,9
%	0	0	48	CCGT Unit-650 MW	1	1	112,0	8,50	1047,222	18,45487		120	1,0	9019,0	6381,0	9019,0		6381,0	0,00
		0301		Nitrogen (IV) oxide (Nitrogen dioxide)			29,0941100		0,0000000	1		0,094	2 671,8	7,2		0,088		2 752,5	7,9
		0304		Nitrogen (II) oxide (Nitrogen oxide)			4,7277900		0,0000000	1		0,002	2 671,8	7,2		0,002		2 752,5	7,9
		0337		Hydrogen oxide			7,7028000		0,0000000	1		0,000	2 671,8	7,2		0,000		2 752,5	7,9

Calculation made for substances (summation groups)

Code	Substance	Maximum Allowable Concentration			Environmental situation ratio	Background concentration	
		Type	Ref. value	Used in calculation		Acc.	Interpreted
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	MAC m/r	0,085	0,085	1	No	No
0304	Nitrogen (II) oxide (Nitrogen oxide)	MAC m/r	0,6	0,6	1	No	No
0330	Sulphur dioxide (quicklime)	MAC m/r	0,5	0,5	1	No	No
0337	Hydrogen oxide	MAC m/r	5	5	1	No	No

Maximum concentrations and contributions in terms of substances (estimated sites)

Substance: 0301 Nitrogen (IV) oxide (Nitrogen dioxide)

Site:1
Field of maximum concentrations

X (m) coord.	Y (m) coord.	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before exclusion
6300	5667	0,24	74	7,00	0,000	0,000

Site	Shop	Source	Contribution in shares MAC	Contribution %
0	0	44	0,08	34,27
0	0	45	0,08	31,42
0	0	47	0,04	16,98
0	0	48	0,04	16,58

Substance: 0304 Nitrogen (II) oxide (Nitrogen oxide)
Site: 1
Field of maximum concentrations

X (m) coord.	Y (m) coord.	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before exclusion
6300	5667	0,01	74	7,00	0,000	0,000

Site	Shop	Source	Contribution in shares MAC	Contribution %
0	0	44	0,00	34,41
0	0	45	0,00	31,55
0	0	47	0,00	17,04
0	0	48	0,00	16,64

Substance: 0330 Sulphur dioxide
Site: 1
Field of maximum concentrations

X (m) coord.	Y (m) coord.	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before exclusion
8300	6167	0,02	52	1,49	0,000	0,000

Site	Shop	Source	Contribution in shares MAC	Contribution %
0	0	32	0,02	100,00

Substance: 0337 Hydrogen oxide
Site: 1
Field of maximum concentrations

X (m) coord.	Y (m) coord.	Concentr. (MAC)	Wind direction	Wind speed	Background (MAC)	Background before exclusion
8300	6167	0,00	49	7,00	0,000	0,000

Site	Shop	Source	Contribution in shares MAC	Contribution %
0	0	31	0,00	99,24
0	0	45	0,00	0,76

Appendix 5

Information on trees to be cut on the site of construction of CCGT Units No. 3, 4

Emblem of the Republic of Uzbekistan

STATE ECOLOGY AND ENVIRONMENT PROTECTION STATE COMMITTEE OF THE REPUBLIC OF UZBEKISTAN

NAVOI REGIONAL ECOLOGY AND ENVIRONMENT PROTECTION DEPARTMENT

210100, Navoi city. 27, S.Ayniy street, tel: (0436) 220-61-67; tel / fax 220-61-69
El.adres: navoiy@uznature.uz

15/04/2019 year **01-08 / 779**

To T.Nazarov
Capital Construction Director
"Navoi TPS" JSC

When your letter registered 9/060-Gep dated April 9, 2019 was analyzed by the Chief Specialist Sh. Utapov of the Navoiy Regional Department of Ecology and Environmental Protection of the Division for Biodiversity and Conservation of Natural Territories, the Inspector T. Khujamov of the inspection of the Navoi city Ecology and Environmental protection, and the Inspector A. Yangiboyev of the inspection of the Karmana district Ecology and Environmental protection, the followings have been determined.

When the case was studied on the site on April 11, 2019, it was determined that on the site where the Karmana district **"Navoi TPS" JSC** has two 650 megawatts of steam-and-gas equipment, there are 22 (twenty-two) spruce trees, 18 (eighteen) poplar trees, 6 (six) willow trees, 32 (twenty-two) apricot trees, a total of 78 (seventy eight) trees on the site. The trees that have not stopped growing can be chopped down in accordance with **the Appendix 4 of the regulation "On Procedures for Planting, Taking care, Cutting and Registering Trees and Shrubs on the Lands Not Included in the State Forest Fund" as confirmed by the Decree # 43 of the Cabinet of Ministers of the Republic of Uzbekistan of January 17, 2019 "On further improvement of licensing procedure in the sphere of regulation and use of trees and shrubs in non-state forest fund"**. The amount of the fines shall be paid based on **Appendix 4 (Charges for Cutting Trees and Shrubs Outside the State Forest Fund)** of the present Regulation.

Head of the department: signature Sh. Hudaykulov.

Executed by
F. Kodirov
79.220-61-68

A STATEMENT OF ACT

11.04.2019. **Karmana district**

The book of accounts regarding the trees on the site where Karmana district "Navoi TPS" JSC has two 650 megawatts of steam-and-gas equipment

We, who make and sign the present statement of act, the Chief Specialist Sh. Utapov of the Navoiy Regional Department of Ecology and Environmental Protection of the Division for Biodiversity and Conservation of Natural Territories, the Inspector T. Khujamov of the inspection of the Navoi city Ecology and Environmental protection, and the Inspector A. Yangiboyev of the inspection of the Karmana district Ecology and Environmental protection, as well as the experts on environment Sh. Hafizov, J. Mirzayev of "Navoi TPS" JSC and the leading engineer Sh. Dostov of the project implementation team.

The Content of the Statement of the Act

Identified on the site where the Karmana district "Navoi TPS" JSC has two 650 megawatts of steam-and-gas equipment, the 22 (twenty-two) spruce trees, 18 (eighteen) poplar trees, 6 (six) willow trees, 32 (twenty-two) apricot trees, a total of 78 (seventy eight) trees that have not stopped growing can be allowed to be chopped down in accordance with **the Appendix 4 of the regulation "On Procedures for Planting, Taking care, Cutting and Registering Trees and Shrubs on the Lands Not Included in the State Forest Fund" as confirmed by the Decree # 43 of the Cabinet of Ministers of the Republic of Uzbekistan of January 17, 2019 "On further improvement of licensing procedure in the sphere of regulation and use of trees and shrubs in non-state forest fund".** The amount of the fines shall be paid based on **Appendix 4 (Charges for Cutting Trees and Shrubs Outside the State Forest Fund)** of the present Regulation. The prime cost of the trees and the amount of the fine are as follows:

#	The type	The diameter of each of the trees to be cut down (см)	The coefficient at the Monthly Minimal Wage (202730 soum)	The amount determined for each of the tree (soums)	The quantity of the trees to be cut down	Total sum (soums)
1	Poplar tree	d-8.1-12 см	202730 x 0,3	60819	3	182457
		d-16.1-20 см	202730 x 1,0	202730	6	1216380
		d-24.1-28 см	202730 x 1,8	364914	7	2554398
		d-32.1-36 см	202730 x 3,3	669009	1	669009
	Total				**17**	**4622244**
2	Spruce tree	d-4.1-8 см	202730 x 0,6	121638	22	2676036
	Total				**22**	**2676036**
3	Willow tree	d-20.1-24 см	202730 x 1,5	304095	2	608190
		d-32.1-36 см	202730 x 3,3	669009	2	1338018
		d-60.1-64 см	202730 x 10,5	2128381	2	4256763
	Total				**6**	**6202971**
4	Apricot tree	d-20.1-24 см	202730 x 1,5	304095	5	1520475
		d-28.1-32 см	202730 x 2,3	466279	6	2797674
		d-36.1-40 см	202730 x 4,4	892012	4	3568048
		d-40.1-44 см	202730 x 5,2	1054196	3	3162588
		d-44.1-48 см	202730 x 6,2	1256926	3	3770778
		d-48.1-52 см	202730 x 7,2	1459656	7	10217592
		d-60.1-64 см	202730 x 10,5	2128665	5	10643325
	Total				**30**	**35680480**
	Total				**78**	**49181731**

Our account number:
Treasury of the Ministry of Finance of the Republic of Uzbekistan
Tashkent city MFO 00014 x / r: 23402000300100001010 STIR: 201122919
Navoi Regional Ecology and Environmental Protection Department
STIR: 200005905 MXV **40142186051223434222225144**

Chief specialist:	**signature**	**Sh.Utapov**
Inspector:	**signature**	**T. Khujamov**
Inspector:	**signature**	**A.Yangiboyev**

Leading engineer of the project implementation team:	**signature**	**Sh. Dostov**

Environmental protection specialists:	**signature**	**Sh. Hafizov**
	signature	**J. Mirzaev**