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Environmental Impact Assessment

May 2013
Version: 1

UZB: TAKHIATASH POWER PLANT EFFICIENCY IMPROVEMENT PROJECT

This EIA is prepared by the consultants for the Uzbekenergo of the Republic of Uzbekistan and for the Asian Development Bank (ADB)

ABBREVIATIONS

ADB	Asian Development Bank
APCS	Air Filtering and Conditioning System
BAT	Best Available Technology
CAP	Corrective Action Plan
CBD	Convention on Biological Diversity
CCGT	Combined Cycle Gas Turbine
CCGU	Combined Cycle Gas Unit
CCPU	Combined Cycle Power Unit
CEAP	Construction Environmental Action Plan
CEMS	Continuous Emission Monitoring System
CITIES	Convention on International Trade of Endangered Species
CM	Cabinet of Ministers
CNR (KMK)	Construction Norms and Rules
CSES	Centre for Sanitary and Epidemiological Supervision
CWP	Chemical Water Pre-treatment
DCS	Design and Supervision Consultant
DLN	Dry Low NOx
EA	Executing Agency
EHS	Environmental Health Safety
EHSGS	Environmental Health Social and Gender Specialist
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMT	Environmental Management Team
EPA	Environmental Protection Agency (USA)
EPC	Engineering Procurement and Commissioning
ESGS	Environmental Social and Gender Specialist
FGD	Flue Gas Desulphuration
GBS	Gas Booster compression Station
GDP	Gas Distribution Plant
GDS	Gas Distribution Station
GFS	Global Forecasting System
GHS	Green House Gases
GIIP	Good International Industry Practices
GNFE	Gas Natural Fenosa Engineering
GOST	State Standards (used for USSR acronyms)
GPF	Gas Processing Facilities
GRM	Grievance Redressing Mechanism
HPP	Hydro Power Plant
HRSG	Heat Recovery Steam Generator
IFC	International Finance Corporation

ISO	International Standarization Organization
JK	Jokargy Kenes
MAC	Maximum Allowable Concentration
MAD	Maximum Allowed Discharge
MAE	Maximum Allowed Emissions
MAWR	Ministry of Agriculture and Water Resources
MHRUz	Ministry of Health
MLSW	Ministry of Labour and Social Welfare
MPC	Maximum Permissible Concentration
MSW	Municipal Solid Wastes
MVD	Ministry of Internal Affairs
NCAR	National Centre for Atmospheric Research (USA)
NCEP	National Centres for Environmental Prediction
NGO	Nongovernmental Organization
OJC	Open Joint Company
OM	Oliy Majlis
Oz	Uzbekistan
PCR	Physical Cultural Resources
PCs	Public Consultations
PDD	Project Design Document
PER	Public Environmental Review
PFS	preliminary feasibility study
PM10	Particulate Matter under 10 µg
PM2.5	Particulate Matter under 2.5 µg
PMU	Project Management Unit
PPE	Personal Protection Equipment
QA/QC	Quality Assurance/Quality Control
RD	Regulation document
RUz	Republic of Uzbekistan
SanR&N	Sanitary norms and rules
SCNP	State Committee for Nature Protection
SEE	State Environmental Expertise
SPL	Sound Pressure Level
SPZ	Sanitarian Protection Zone
SR	Safeguard Requirements
SRMT	Shuttle Radar Topography Mission
SS	Substation
STP	Sewage Treatment Plan
TPP	Thermo Power Plant
TSP	Total Solid Particulate
UE	Uzbekenergo
UES TSO	Unified Energy System Transmission System Operator
UNFCCC	United Nations Framework convention on Climate Change

WDL	Waste Disposal Limit
WDS	Waste Data Sheet
WGN	Waste Generation Norm
WHO	World Health Organization
WHO	World Health Organization
WIS	Welfare Improvement Strategy
WRF	Weather Research Forecasting
WTP	Water Treatment Plant
WWD	Waste Water Drainage
WWTP	Waste Water Treatment Plant

GLOSSARY

Glavgosexpertisa	State Department responsible for Conducting Environmental Expertise Under SNPC
Khokim	governor of administrative unit
Khokimiyat	regional government authority
Makhalla	a community of neighbors, which is based on full independence and self-governance.
Som	local currency
OVOS	National acronym for EIA assessment process
PZVOS	National acronym for Concept Statement on Environmental Impact
Uzbekenergo	managerial body in the electric power and coal industries, which are major structural components of the national economy
Uzhydromet	state governing body specially authorized for the solution of tasks in the field of hydrometeorology in the Republic of Uzbekistan and in its activities it is accountable to Cabinet of Ministers
ZVOS	National acronym for Statement on Environmental impact
ZEP	National acronym for Statement on Environmental Consequences

TABLE OF CONTENTS

TABLES

FIGURES

engineering

gasNatural fenosa

Environmental Impact Assessment
(NON-TECHNICAL EXECUTIVE SUMMARY)

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A. INTRODUCTION

A.1. Scope

1. The scope of the present document is to summarize the Environmental Impact Assessment (EIA) for the decommissioning of the inefficient existing power plants units III and IV and the construction and operation of a new combined cycle gas unit (CCPU) in the Takhiatash Thermal Power Plant (TPP), in north-western Uzbekistan, which owner is Uzbekenergo (UE).

2. This EIA was entrusted to the GAS NATURAL FENOSA ENGINEERING (GNFE) Company on behalf of the Asian Development Bank (ADB).

A.2. Project history and justification

3. Takhiatash TPP was constructed between 1961 and 1990 in six stages, as shown below. In 1980 uneconomic and obsolete equipment of the I-II lines was dismantled. Therefore, the installed capacity of Takhiatash TPP is currently 730 MW.

Units	I	II	III	IV	V	VI
Year of installation	1961	1964	1969	1974	1987	1990
Installed capacity of the line, MW	24 demounted	28 demounted	200	110	210	210
Installed capacity of TPP, MW			730			

4. The project "Construction of 230-250 MW CCGT at Takhiatash TPP" is a priority project identified by Uzbekenergo. Takhiatash TPP, with the installed capacity of 730 MW, is the main power supply source for the Karakalpakstan and Khorezm regions with over 3 million people located in the western part of Uzbekistan. The power demand outlook is strong with a number of industrial development projects envisaged for the region, exceeding currently available capacity. Furthermore, operational lifetime of the Takhiatash TPP's equipment is 22-43 years, resulting in its degradation and the increasing in the probability of accidental risk with potential negative consequences for the environment.

5. This project will allow cutting operational expenses, increasing the efficiency of energy transformation and the reliability of supply of energy to the consumers, and improving the environmental situation as a result of the replacement of the obsolete equipment of III and IV lines by the new CCPU.

A.3. Location and access

6. The existing TPP is located in the city of Takhiatash, 3 km to the south-west of the city centre, on the left bank of Amudarya river. It occupies the central part of the Republic of Karakalpakstan (Khodjeyliy region), located in north-western Uzbekistan. The capital city of the Republic, Nukus, is located 20 km to the north of TPP industrial site.

Takhiatash TPP location

7. Construction site for CCPU is planned to require the additional territory of 21 hectares on the south side of Takhtiatash TPP. The location of key project components in relation to the wider Project area is shown in the following picture.

Location of the TPP, city of Takhiatash, Amudarya River and the intake and discharge Suenly canal

Location of the existing Takhiatash TPP (blue line) and the future CCPU area (red line)

B. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK AND STANDARDS

8. In compliance with the Cabinet Ministers' Decree of the Republic of Uzbekistan (RUz) No. 491, thermal power stations with capacity of 300 MW and more belong to Category 1 and therefore must undertake national EIA procedure.

9. The „Concept Statement on Environmental Impact' (Stage I of the national EIA approval process) was developed as part of Takhiatash TPP pre-feasibility study and submitted to the State Environmental Expertise Appraisal which approved the draft environmental impact statement in November 2012 (#18/963). In this approval is mentioned that the „Statement of Environmental Impact' (Stage II of the national EIA approval process) was not needed due to the considered complete information presented in Stage I. „Statement on Environmental Consequences' (Stage III and last of the national EIA approval process) will be achieved previously to the commissioning of the project. This report will detail the modifications to the project design made from the the *Glavgosecoexpertiza/Gosecoexpertise* review at the first two stages of the EIA process, the comments received through the public consultation, the environmental norms applicable to the project and environmental monitoring requirements associated with the project and principal conclusions.

10. The Environmental Impact Assessment presents the information from the original Russian EIA and includes some additional sections required to meet ADB environmental policy requirements. With reference to ADB's Safeguard Policy Statement SR1 on Environment, this Project is considered to be a „Category A' project and therefore a complete EIA is requested.

11. Throughout the project (starting from design, construction, decommissioning and through to unit operation) all requirements in RUz environmental legislation and ADB's safeguards policy statement, including World Bank Group Environmental, Health and Safety guidelines (specific Guides concerning thermal power stations published in December 2008, and general guides published in April 2007) and international conventions were incorporated into the study.

12. It should be pointed out that limit values concerning gas emissions, noise, waste, air quality etc, were based on [whichever was] the more restrictive of the two regulation sources (national or international).

C. PROJECT DESCRIPTION

<u>Existing power plant (units III to VI)</u>

13. The existing plant currently consists of four power generation units (III-IV-V-VI) with a total installed capacity of 730 MW. It also comprises a heating water converter plant to supply not only the TPP's own hot water requirements but also Takhiatash city.

14. The main fuel for Takhiatash TPP is natural gas from Bukhara deposit that is supplied to the TPP through two aerial pipelines. Mazut, a type of residual black oil, is used as back-up fuel.

15. III and IV units, with a total installed capacity of 310 MW (boilers No. 1-6), are to be dismantled whereas V and VI units, each one with a capacity of 210 MW (boilers 7-8), will continue operating. Boilers are designed to burn both natural gas and mazut. Exhaust gases from boilers No. 1-4 are discharged into the atmosphere through the 80 m high stack whereas gases from boilers No. 5-8 are discharged through the 150 m high stack.

16. The water supply source for the existing units of the TPP is Suenly canal, which is fed by Amudarya river. The quality of this water is characterized by a high content of suspended solids, mineralization, chloride ions, sulphates and oil products so that a previous conditioning in the Water Treatment Plant (WTP) is required.

17. The TPP currently operates with an open once-through cooling system. This means that intake water from the canal passes through the condenser and, after the heat exchange, warm water is directly discharged back to the canal being the volume of water intake is almost equal to the water discharge. Apart from the thermal increase, discharge water characteristics are practically the same as the intake.

18. Power generated by the existing units of the TPP is evacuated via 35 kV, 110 kV and 220 kV.

New Combined Cycle Power Unit (CCPU)

19. The purpose of this project is the installation of a combined cycle unit with a net power of 230-250 MW. It is based on bringing a gas cycle and a steam cycle together, allowing for the thermal energy contained in the gas cycle exhaust gases to be used to generate steam with sufficient energy to be used in the steam cycle. In this way, performance is much higher (in the range of 50-60%) than that obtained by any conventional thermal power plant at present, even far above that of any newly built simple cycle, gas or steam power plant, resulting in environmental improvement, thanks to a more efficient use of the primary energy, and a reduction in generation costs.

20. Natural gas is the main and backup fuel for CCUP and it will be supplied from the existing Gas distribution plant (GDP) 2 km away from the TPP. Taking into account the decommissioning of units III and IV, the GDP will be sufficient for the natural gas CCPU needs.

21. Amudarya River will be the source of raw water at the new facilities of the CCPU through the existing intake canal of the existing facilities of Takhtiatash TPP. Just a new pump station within the existing intake canal will be needed to be constructed.

22. Circulating water system for the new CCPU is designed in closed circuit, including the installation of five mechanical draft cooling towers.

23. It is planned to build a new water treatment plant for total water desalination in order to meet the makeup water requirements of the CCPU's steam cycle.

24. A new heating-water converter plant is designed to provide heating of system water in system water heaters by extraction steam from steam turbine heat extraction, and to supply system water using line pumps in main heating system for consumers heat supply.

25. Power output of the new generator will be connected to the existing substation which will be adapted. As units III and IV are going to be decommissioned, the existing transmission line has enough capacity to evacuate power generated in the new CCPU.

C.1. Description of works

<u>Construction phase</u>

26. Due to the fact that the present project is not to build a new Thermal Power Station, but to extend an existing plant, and in view of the fact that the new CCPU will be located at the same site as the Power Station, it will not be necessary to build new access routes and certain infrastructure, since these are already in place for existing Units (for instance, no new water intake and discharge canal or transmission line are needed). Consequently, the extent and volume of the works will be less than those necessary for a new Power Station being built on a new site.

<u>Decommissioning phase</u>

27. The efficiency improvement project involves the decommissioning of the units III and IV.

28. During the commissioning of the new combined cycle unit, in order to maintain the power plant available capacity, together with the more modern units V and VI, it will be necessary to keep units III and IV in operation, complementing the power generated by the CCPU in order to cover the demanded power at all time. Once the CCPU completes all tests and it is declared in commercial operation, it will start the decommissioning of the units III and IV.

29. According to the schedule, boilers No. 1-4 shall be shut down first, in the first half of 2018 since they are the most worn out boilers connected to a relatively low stack of 80 m; during the second half of 2018, boilers No. 5 and 6 connected to the 150 m stack shall be shut down.

C.2. The project's environmental and social aspects

30. The implementation of the project for construction of the new CCPU to replace obsolete and worn-out boiler units shall help to improve environmental situation in the concerned area.

Emissions

31. The emission of pollutants into the air is caused by the exhaust gas combustion of natural gas. Natural gas is considered a clean fuel as it produces less atmospheric contamination than other liquid or solid fuels,

32. The combustion chamber of the new gas turbine will be equipped with dry type low NOx burners (Dry low NOx Hybrid Burner Ring), achieving emissions below 51 mg/Nm3 at 15% O2, dry basis (World Bank emission limit). This fact together with the efficiency improvement of the new technology will allow a reduction in emission of NOx of approximately 30% and a reduction of natural gas consumption on 321.4 mln.m3/year also.

33. Regarding CO2 emissions, Uzbekistan is a country not listed in Appendix I of Kyoto protocol, and is therefore not required to limit its emissions of CO2. The net reduction of CO2 emission gather with the project will be of 30% which will contribute to climate change mitigation.

Noise

34. After the commissioning of the CCPU, new sources of noise will be added to the existing ones. The level of noise must not exceed 80 dB(A) in operational zone one meter apart from equipment on rigid foundation according to Uzbek legislation. Nevertheless, after the decommissioning of existing units III and IV, It is expected that global background noise will decrease due to the replacement of old and noisy equipment by a new and less noisy one.

Effluents

35. The effluent treatment system will be design to fulfill discharge national and international standards. The effluent treatment system consists of:

- **Domestic effluents**

Domestic wastewater or sanitary effluents is discharged though a pipe line to the Takhiatash Municipal Waste Water Treatment Plant.

- **Rainfall effluents**

Rainwater will be collected along the territory and discharged into existing storm water sewer system.

- **Oil and Chemical effluents**

A new treatment of effluents will be provided for the new CCPU without using the existing effluent treatment installation. From the effluent treatment effluents are driven to the chemical treatment plant slime lagoons and then into the TPP effluent channel.

- **Circulation system blowdown**

Cooling tower blowdown water, as it is similar to the intake water, is discharged into the TPP effluent channel without treatment. TPP effluent channel discharges into Suenly canal.

36. The change from the open cooling system of units III and IV towards a closed circuit of the CCPU will lead to:

- 40% reduction of water intake
- Almost a 50% reduction of thermal effluent returned to the canal which will allow a better and faster dispersion. This fact would probably improve the environmental condition of the aquatic ecosystem.
- Increase of 225m^3/h of water consumption to replace evaporated water and blow down in the cooling towers. This is a negative impact but the magnitude is insignificant as it would represent less than 1% of Suenly canal flow rate.

Waste

37. The list of waste materials expected to be generated in the decommissioning of units III and IV includes asbestos cement plaster, basalt extra-thin fibre, wire netting, fire resistant concrete and thermo-isolated concrete. For the decommissioning phase a specific plan must be undertaken including an Environmental, Health and Safety Plan. For the construction of the CCPU, asbestos will be not permitted as it use is forbidden by good international practices. Therefore, waste asbestos will not be produced in the operation of the new unit.

38. The current management of wastes of the TPP can be used but some of the procedures should be corrected to fulfill international good practices. Classification of hazardous or non hazardous wastes will be based on the international Basilea Convention signed by Uzbekistan:

39. Non-hazardous wastes:
-Reuse:
Solid precipitation of the settling tank and pulp dump will be use in agricultural needs as fertilizer only if analyses of the pulp characteristics conclude that there will not be rendered harmless or may constitute a health or environmental risk.
-Recycled:
Iron, metal debris, stubs, wool debris, waste rubber and tires, waste paper and other recyclable waste fractions can be selling to the enterprises currently being used in the operation of the existing units.
-Recover:
Only non-hazardous wastes can be burned in existing boiler furnaces.
-Disposed:
Rest of non-hazardous wastes that are not being recycled as household and similar waste should be transported to a properly designed, permitted and operated landfill. As an option, the municipal landfill could include the following improvement measurements that are recommended:

- Location of the municipal landfill further than 250 meters to residential areas and following location recommendations of the IFC guidelines.
- Soil cover material, with base and side slopes designed to minimize infiltration and facilitate collection of leachate.
- Low-permeability landfill liners to prevent migration of leachate.
- Drainage and collection system and landfill cover (daily, intermediate, and final) to minimize infiltration.
- Leachate treatment on site and/or discharge to municipal wastewater treatment.

- Perimeter drains and landfill cell compaction, slopes and daily cover materials to reduce infiltration of rainfall into the deposited waste.
- Prevention system of the run-on precipitation into the active area of the landfill and a collection and control run-off system.
- Quantity and quality of leachate generated measured and recorded.
- Groundwater monitoring wells

40. Hazardous: Hazardous waste storage, transfer, disposal and treatment will be done by an authorized waste management facility. The contractors handling, treating and disposing hazardous waste should be reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled (ensuring compliance with applicable local and international regulations).
-Recycled:
Fluorescent lights shall be delivered to a specialized organization on lamp utilization as it is being doing up to now.
-Recover:
Hazardous wastes cannot be burned at existing boiler furnaces as they are not provided with exhaust gas treatment. Hazardous wastes can be burned or incinerated just in approved installations with the proper treatment for exhaust gases in order not to introduce hazardous compounds into the atmosphere.
-Disposed:
If there is not a hazardous waste landfill or storage which have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment neither the permits, certifications, and approvals of applicable government authorities, an specific facility must be constructed or adapted to provide sound long-term storage of wastes on-site or at an alternative appropriate location up until external commercial options become available. Mazut storage located at 35 km of the TPP can be adapted as hazardous wastes storage for the construction, decommissioning and operation phases if the following recommendations are undertaken:
    - Remaining mazut should be completely removed or stabilizated in such a way to avoid potential mixture with the hazardous waste to storage
    - Reparation of the potential cracks and fissures that concrete wall, floor and roof could have.
    - Divide the tanks into different cells to separate wastes with different properties
    - Cement should have low-permeability and be chemically resistant. Otherwise a liner gathering these characteristics should be installed.
    - Install a leachate collection and removal system if needed
    - Install a groundwater monitoring wells network

41. In any case, direct discharge of wastes will be never allowed on the ground.

Jobs

42. At present, the number of employees of Takhiatash TPP amounts to 1082 people. The project will promote industrial development projects envisaged for the region. Consequently, this will promote socio-economic development in the region and indirectly in whole Uzbekistan.

43. The construction phase will constitute the highest levels of activity with up to 1.000 construction workers concentrated onto the project site. During operation phase, about 110 people will be required for long term operation of the plant (81 production workers and 29 administrative-management staff) but they will be covered with current workers from the TPP. Dismissal of the current workers is not expected.

D. ALTERNATIVE SOLUTIONS EXAMINED AND JUSTIFICATION FOR THE SELECTED SOLUTION

44. This section will explain why and how certain decisions were made and analysed concerning the project under study.

D.1. "No project" alternative

45. The main goals of the Takhiatash TPP's CCPU project are to cut operational expenses, to increase the efficiency and the reliability of the energy supply to consumers, as well as to improve the environmental quality within its area of influence.

46. The "No project" alternative means that Uzbekenergo decides not to construct the CCPU at Takhiatash TPP and continues operating the technically obsolete and physically worn-out equipment of III and IV units. As a result, the reliability and technical condition of the equipment would decrease and this option would result in even lower technical and economic indicators. Furthermore, accidental risks with potential negative consequences for the environment would increase.

47. On the one hand, the power demand outlook in Karakalpakstan region is strong and, furthermore, Takhiatash TPP not only provides the North-West region of the country with electricity but also heats water for consumers supply in Takhiatash town and for covering its own needs.

48. On the other hand, operational lifetime of Takhiatash TPP's equipment ranges from 22 to 43 years, which is the main reason for the equipment reliability degradation and increases the probability of accidental risks with potential negative consequences for the environment.

49. Not carrying out the project would mean potentially reducing the planned coverage of the energy demand in Uzbekistan in case of failure of the worn-out equipment, with the resulting parallel reduction in both economic development (delay in the development or investment in Takhiatash area and the supplied cities due to a lack of infrastructure, etc.) as well as the quality of life of its inhabitants (limited access to electricity and poor environmental conditions).

50. Given the consequences indicated and the social impact produced if the "no project" alternative is considered, the most appropriate alternative is believed to be going ahead with the construction of the CCPU at Takhiatash TPP.

D.2. “With project” alternative: location and technology alternatives

51. The implementation of the Takhiatash CCGT is a priority project within the development program in Uzbekistan. The “with project” alternative will result in a quantitative improvement of the environmental quality in the area of the TPP and an increased economic development in the region and country.

52. Alternatives chosen for the project are the best option on location and technology, both combustion and cooling system. As locate the project in an existing industrial area with part of the existing facilities to be used for the new CCPU (transmission line, water intake and discharge canals, gas supply) the environmental potential impacts are going to be minimized. By other hand, combined cycle technology based on natural gas and refrigerated with a closed cooling water systems gather the most environmental friendly power generation among those fuel combustion technologies (normally used to produce base load energy). This technology achieves the highest rate of power generation with the lowest rate of air emission pollutants. The closed refrigeration system has the advantage to decrease the amount of water intake and discharge reducing the temperature increase of the effluent compared to those open systems.

53. Karakalpakstan is an area of ecological disaster. The drying out of Aral Sea and ecological crisis in the region has caused huge economic losses, affected living standards and health of population in the Karakalpakstan and broader Aral sea area.

D.3. Physical environment

Climate

54. Climate in the Takhiatash TPP region – sharp continental is characterized by wide annual and daily temperature fluctuation range. Annual air temperature is 13.64 ºC. Maximal temperature 45 ºC, minimal - 26.80 ºC. Annual precipitation level is 110.6 mm. Winds of north-east, north and east directions prevail. Annual wind speed is 2.26 m/s. On rare occasions the speed of winds reaches 15 m/s and higher, because of the proximity of desert and dryness of underlying terrain which is accompanied by significant dust transfer.

Air quality

55. Air quality in the Takhiatash TPP region is determined by the emissions of industrial centers as Nukus, Urgench and Khodjeyli and depends on the conditions of spread of the dust from the bottom of Aral Sea.

56. In order to determine air quality baseline, data over of approximately 2 years (2011-2012) from two existing air quality stations in Nukus and Kizketken settlement area conducted by the Main Hydrometcenter was analyzed. Results show that neither national nor international standards are exceeded for NO, NO_2 and CO.

Noise

57. With the purpose of knowing the currently background level noise in the surrounding areas of Takhiatash TPP, a background noise level measuring campaign was carried out on 4th and 5th March 2013 during the day and at night time.

58. From the eight measuring points, the half of them are located bounding the TPP and the other half are located at residential areas, outside the plot of the power plant, in order to be representative of the noise perceived by the population of the nearby settlements.

59. Measurements show that the background noise levels comply with what requirements of the standards except for two points at night and one of them daytime. This point is a residential settlement of a former army unit and the houses are located in close proximity to the southwest area TPP fence.

Geology and soil

60. The territory of Takhiatash TPP is composed of quaternary sediments, which are sandy loam, clay loam, clay and sand. According to the results of laboratory data and hydrochloric acid extracts, the sands are considered saline. Sandy loam, clay loam and clay are non-saline.

61. 4 samples near the Takhiatash TPP's fuel tanks are analyzed in a twice-a-year basis. In addition, a comprehensive soil study has been carried out in March 2013 in order to study the potential soil contamination with hazardous substances or petroleum products within the area of the future CCPU.

62. Soil samples within this study have been analyzed for organochlorine pesticides, heavy metals, dry residue, moisture, phenol, humus, pH and oil products. All pollutant concentrations measured are much below their international reference standards for industrial soil quality class (Soil Quality Regulation of the Netherlands).

Hydrogeology

63. At the TPP site ground water appear at the depth of 0.3-2.2 m. The water is saline and has strong sulfate aggressive to concrete in ordinary cement and high corrosivity to metals.

64. Takhiatash is located in the area of high level phenol contamination of groundwater, which is toxic to humans and biota, and means a high-risk area of adverse impact on human health when using groundwater for human consumption.

Surface hydrology

65. The closest large surface watercourse to the Takhiatash TPP is Amudarya river which feeds Suenly canal in where Takhiatash TPP intake and discharge is located. Chemical composition of the river water is formed to a large degree under the impact of contaminants coming to the river on the territory of Turkmenistan, agricultural flows and waste waters of factories. Water of Amudarya river is characterized by high turbidity.

66. In order to reflect the water quality conditions of Suenly canal, a number of parameters are measured in both Takhiatash TPP intake and discharge points in a bimonthly basis. These analyses reflect that, except for temperature for what the operation of the TPP clearly causes an important increase, the parameters that exceed standards are being already exceeded by the water quality in the Suenly canal previously to the intake for the TPP.

D.4. Biological environment

Flora

67. The natural conditions of the area under study have defined the development of arid vegetation communities. The presence of halophytic species is and indicator. High soil and water salinity, high insolation, dust storms as well as insufficient irrigation system cause to the paucity of vegetation. Thus, the region has scanty vegetation.

Fauna

68. Fauna of the territory is varied. The most notable of the mass of desert animals are the many and various reptiles, rodents and small insects crawling on the ground. There is an exceptional diversity of species of rodents and an abundance of a group of original prancing animals, the jerboas. There are more than 50 types of fish in Aral Sea basin, 10 of them included into Uzbekistan book as a rare species. There are some fishes into the Suenly as well. However, in most of the cases these fishes flow in Suenly canal from the closest lakes over the high water level in Amudarya river.

Natural protected areas

69. The closest protected area to the project is Low Amydarya biospheric reserve which locates on the territory of Amudarya, Beruniy district of Republics Karakalpakstan around 75 km on the east-south from Takhiatash city.

D.5. Socio-economic environment.

Socio-economic conditions

70. Takhiatash TPP is located in Takhiatash city, in Khodjeyliy region of the Republic of Karakalpakstan. The total population in Khodjeyli district is 134.4 thousand people, and 47.5 thousand people in Takhiatash city. From them 49% are males and 51% are females. From total population around 25 % is under 16 years old. Average monthly income per family at Takhiatash city is 507 USD.

Infrastructure facilities and transportation

71. 99.8% of total population of Takhiatash city is connected to centralized water supply system, 19.5% of houses are connected to municipal sewage network and 99.9% of them are connected to centralized gas supply system.

72. Takhiatash city has a municipal waste water treatment plant with a biological treatment. Communal wastes and most part of the industrial wastes are disposed at the municipal landfill, located 2 km to the south from Takhiatash city. The landfill is not sited, designed and operated to isolate the wastes from the surrounding as wastes are dumped directly into the soil surface.

73. There is the Nukus-Khodjeyli highway at 4km to the north of TPP. The closest airport is at Nukus, around 20 km away from the TPP.

Power sources of transmission

74. The only power supply source in the area is the Takhiatash TPP, which supplies with energy to all Karakalpakstan, Khorezm province and some districts in Central part of Uzbekistan. Some pilot projects founded through various national and international organizations are being implemented in Karakalpakstan region such as a pilot solar PV station (100 W).

Planned development activities

75. There are several development activities currently taken place in the Karakalpakstan: chemical, gas-refining and construction materials industries are been developed, a number of big gas production and treatment companies are operating and there is an increasing production in textile goods. There is also a special investment program for the development of rural area supported with credit from ADB

Public Health

76. Statistical data analysis showed that the level of overall sickness rate and the majority of clinical entities in the Republic of Karakalpakstan is higher than the average rate for Uzbekistan.

77. The main health problems include decreased kidney and liver function, arthritis, chronic bronchitis, typhoid, hepatitis, genetic disorders and acute respiratory infections, especially among children. There is a high rate of maternal and infant mortality and children's diseases, typhoid, tetanus, intestinal diseases caused by the lack of purified water and poor sewage treatment in many settlements. Takhiatash city has one hospital for 200 beds and two more clinics designed for 500 patients.

Education

78. There are 4 Universities on the territory of Karakalpakstan and in Takhiatash city there are 2 colleges and 645 pupils enrolled in 9 secondary schools.

Vulnerable groups and gender issues

79. There are no vulnerable groups or ethnic minorities defined on the project area and gender issues are not objet of special investigation either as inequality has not been observed.

Cultural properties & cultural heritage

80. The closest historical monuments to the Takhiatash TPP are remains of Mizdakhan city and the Mausoleum Mazlumhon Suluv. Mizdahkan remains as a major medieval town, located 8 km west of the city Khodjeyli.

E. IDENTIFICATION AND ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS

81. In order to identify the impact of the construction and operation of the new CCPU as well as the decommissioning of the existing III and IV units, a cross-reference was made between the project activities that might have an effect on the environment and the environmental factors that might be affected by those activities. A two-dimensional matrix (see next table) was used for this purpose, where the potential impacts were presented in a synthetic and visual form.

82. The assessment was performed separately for the construction, decommissioning and operation phases, to clearly distinguish the impacts generated by each phase and to be able to efficiently devise a series of preventive and corrective actions specific to each phase (see below a table with the potential impacts identified in the matrix).

83. After the identification of the potential impacts, assessment is carried out. Methodology for this assessment gathers the following parameters: incidence (between 0 and 1), magnitude (assigning high, medium, and low values) and final value and assessment (compatible, moderate, severe, critical). See below two tables (1: construction and decommissioning; 2: operation) in where the summary of the evaluation of those impacts are shown.

IMPACT IDENTIFICATION MATRIX – WORKS PHASE																										
ENVIRONMENTAL FACTORS																										
PROJECT ACTIVITIES		NATURAL PHYSICAL SUBSYSTEM															POPULATION AND ACTIVITIES SUBSYSTEM									
		PHYSICAL ENVIRONMENT									BIOTIC ENVIRONMENT				PERCEPTUAL ENVIRONMENT		LAND USE			CULTURE HERITAGE		POPULATION				INFRA ST.
		Atmosphere		Geomorphology	Soil		Hydrology / Hydrogeology		Process		Flora		Fauna		Landscape		Rural	Productive	Nature Conservation	Resources		Occupation		Welfare		Infracts.
COMBINED CYCLE CONSTRUCTION	Land and vegetation clearing					■			■		■	■	■		■	■	■			■						
	Earthmoving	■	■	■		■	■		■	■				■						■						
	Trench digging	■	■	■		■	■		■	■				■						■						
	Occupation of land														■	■	■	■	■		■					
	Construction	■	■							■					■	■	■	■	■				■	■		
	Presence of equipment and stocks				■		■	■							■	■										
	Equipment operation	■	■			■								■									■	■		■
	Hiring personnel its activity	■					■							■								■	■	■	■	
	Waste generation				■			■															■			
EXISTING FACILITIES AND DECOMMISSIONING	Earthmoving	■	■			■																				
	Decommissioning	■	■		■		■	■							■	■		■					■	■	■	
	Presence of equipment and stocks				■		■	■																		
	Equipment operation	■	■			■																		■		■
	Hiring personnel and its activity	■					■															■	■	■	■	
	Waste generation				■			■															■			

Impact identification matrix – Works phase

IMPACT IDENTIFICATION MATRIX - OPERATION PHASE																						
ENVIRONMENTAL FACTORS																						
PROJECT ACTIVITIES		NATURAL PHYSICAL SUBSYSTEM													POPULATION AND ACTIVITIES SUBSYSTEM							
		PHYSICAL ENVIRONMENT							BIOTIC ENVIRONMENT				PERCEPTUAL ENVIRONMENT		LAND USE			POPULATION				COMM. / INFRASTR.
		Atmosphere			Soil	Hydrology			Flora		Fauna		Landscape		Rural	Product.	Nature Cons.	Occup.		Welfare		Infrast.
		Climate	Noise comfort	Air quality	Soil and subsoil quality	Resource quantity	Water quality	Groundwater quality	Natural Vegetation	Anthropic Vegetation	Fauna habitats	Behavior patterns	Landscape quality	Visual Intrusion	Agriculture and livestock use	Industrial Use	Protected land	Employment	Health & Safety	Population welfare	Development of local economy	Energy infrastructure
CYCLE COMBINED	Flue gas emissions to the atmosphere	■		■													■			■		
	Noise emissions		■									■					■		■	■		
	Water consumption					■			■		■				■		■					
	Effluent discharge						■	■									■					
	Waste generation, transportation & management.				■		■	■											■	■		
	Steam plume from the cooling towers	■			■				■	■				■		■			■	■		
	Physical presence of the Power Plant												■	■								
	Hiring personnel and its activity																	■	■	■	■	
	Maintenance activities																	■	■		■	
	Electricity generation															■		■	■	■	■	■

Impact identification matrix – Operation phase

IMPACTS IDENTIFIED	
CONSTRUCTION AND DECOMMISSIONING PHASES	**OPERATING PHASE**
- Potential discrete and local increase in particulate matter suspended in air. - Potential degradation of air quality due to exhaust emission from construction equipment. - Potential increase in the noise level of the construction sites. - Potential degradation of the local geomorphology. (*) - Potential soil compaction. - Potential increase of suspended solids in water, as a result of construction work. (*) - Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste. - Potential contamination of surface water by sanitary water from workers. - Potential increase of erosion risk due to construction work. (*) - Potential modification of natural drainage in the work area. (*) - Potential elimination of vegetation (*) - Potential reduction in the total area of fauna habitats in the work area. (*) - Impact on and potential discomfort to terrestrial fauna. - Potential modification of landscape during the construction and decommissioning - Potential impact on natural areas. - Potential impact on agriculture, livestock, etc, which take place in the work area due to changes in land use. (*) - Potential impact on historical and archaeological heritage. (*) - Hiring of personnel and reactivation of the local economy during construction and decommissioning phases. - Potential hazards for the health of the personnel and the population. - Increase in traffic. - Potential damage to road infrastructure owing to heavy duty construction traffic.	- Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology. - Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology. - Potential increase in noise levels. - Potential increase of soil salinity due to the cooling towers steam plume deposition - Potential soil and groundwater pollution by accidental spillages or improper waste management. - Water resources intake reduction - Potential effects on water resources due to the increase of water consumed for the new Unit. - Potential alteration of the water quality as a consequence of effluent discharge. - Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one. - Potential impact on the landscape due to the physical presence of the new unit - Potential impact on the landscape caused by the cooling water steam plume. - Potential impact on natural areas. - Potential hiring of personnel for operation of the new unit - Development of the local and regional economy. - Potential health risk for the operation of the cooling towers - Potential hygienic risks for the health and safety of personnel and the surrounding population. - Increase in installed electrical power.

(*) Only in construction phase

Impacts identified

IMPACT ASSESSMENT SUMMARY - CONSTRUCTION/DECOMMISSIONING PHASES				
IMPACT	SIGN	NORMALIZED INCIDENCE (BETWEEN 0 AND 1)	MAGNITUDE	FINAL IMPACT VALUE
Potential discrete and local increase in particulate matter suspended in air.	-	INSIGNIFICANT		
Potential degradation of air quality due to exhaust emissions from construction and decommissioning equipment.	-	INSIGNIFICANT		
Potential increase in the noise level of the construction and decommissioning sites	-	0.43	Medium	MODERATE
Potential degradation of the local geomorphology	-	INSIGNIFICANT		
Potential soil compaction	-	INSIGNIFICANT		
Potential increase of suspended solids in water, as a result of construction work	-	INSIGNIFICANT		
Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste	-	0.57	Medium	MODERATE
Potential contamination of surface water by sanitary water from workers	-	INSIGNIFICANT		
Potential increase of erosion risk due to construction work	-	INSIGNIFICANT		
Potential modification of natural drainage in the work area	-	INSIGNIFICANT		
Potential elimination of vegetation	-	INSIGNIFICANT		
Potential reduction in the total area of fauna habitats in the work area	-	INSIGNIFICANT		
Impact on and potential discomfort to terrestrial fauna	-	INSIGNIFICANT		
Potential modification of landscape during the construction and decommissioning	-	INSIGNIFICANT		
Potential impact on natural areas	-	INSIGNIFICANT		
Potential impacts on agriculture, livestock, etc, which take place in the work area due to changes in land use	-	INSIGNIFICANT		
Potential impact on the historical and archaeological heritage	-	INSIGNIFICANT		
Hiring of personnel and reactivation of the local economy during the construction and decommissioning phase	+	0.50	Medium	---
Potential hazards for the health of the personnel and the population	-	INSIGNIFICANT		
Increase in traffic	-	0.43	Medium	MODERATE
Potential damage to road infrastructure owing to heavy duty construction and decommissioning traffic	-	INSIGNIFICANT		

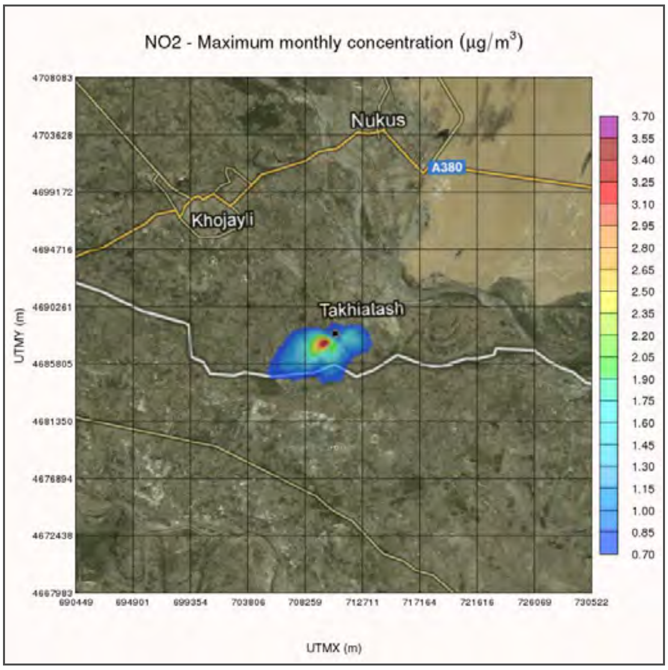
Impact assessment summary-construction/decommissioning phases

IMPACT ASSESSMENT SUMMARY - OPERATION PHASE				
IMPACT	SIGN	NORMALIZED INCIDENCE (BETWEEN 0 AND 1)	MAGNITUDE	FINAL IMPACT VALUE
Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology.	+	1	Low	---
Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology.	+	0.71	Medium	---
Potential increase in noise levels.	-	INSIGNIFICANT		
Potential increase of soil salinity due to the cooling towers steam plume deposition	-	INSIGNIFICANT		
Potential soil and groundwater pollution by accidental spillages or improper waste management.	-	INSIGNIFICANT		
Water resources intake reduction	+	0.5	High	---
Potential effects on water resources due to the increase of water consumed for the new Unit.	-	INSIGNIFICANT		
Potential alteration of the water quality as a consequence of effluent discharge.	-	INSIGNIFICANT		
Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one.	+	0.5	Medium	---
Potential impact on the landscape due to the physical presence of the new unit	-	INSIGNIFICANT		
Potential impact on the landscape caused by the cooling water steam plume.	-	0.36	Medium	COMPATIBLE
Potential impact on natural areas.	-	INSIGNIFICANT		
Potential hiring of personnel for operation of the new unit	+	INSIGNIFICANT		
Development of the local and regional economy.	+	0.5	Medium	---
Potential health risk for the operation of the cooling towers	-	INSIGNIFICANT		
Potential hygienic risks for the health and safety of personnel and the surrounding population	-	INSIGNIFICANT		
Increase in installed electrical power	+	0.5	Medium	---

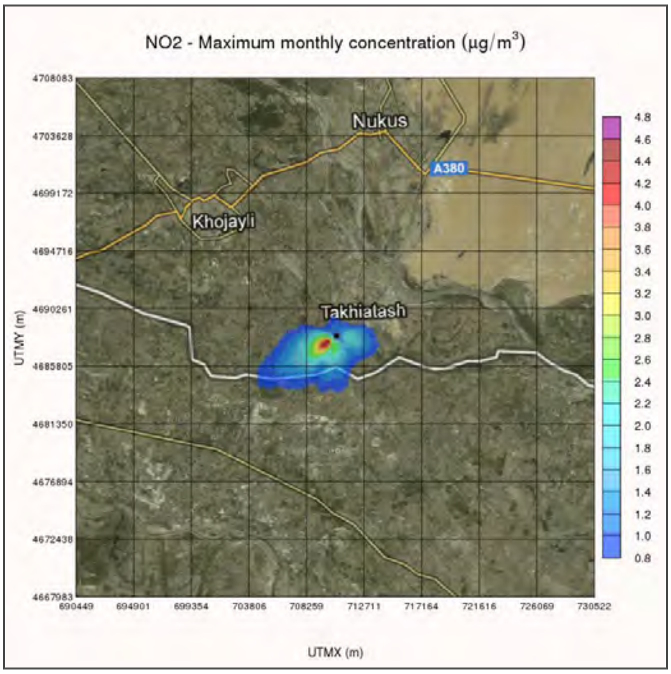
Impact Assessment Summary - Operation Phase

84. It should be point out that, for the assessment of specific impacts, specific studies and environmental simulations need to be undertaken. For instance:

85. For the assessment of the impact on air quality, modeling of the dispersion of pollutants by AERMOD model has allowed study the contribution of different emissions of the combustion of natural gas on current and future scenario on levels of air quality in the region. Ultimately, the contribution brought by the operation of the new CCPP to the background pollution will decrease in around 40% for NO2, and both national and international air quality standards are fulfilled.

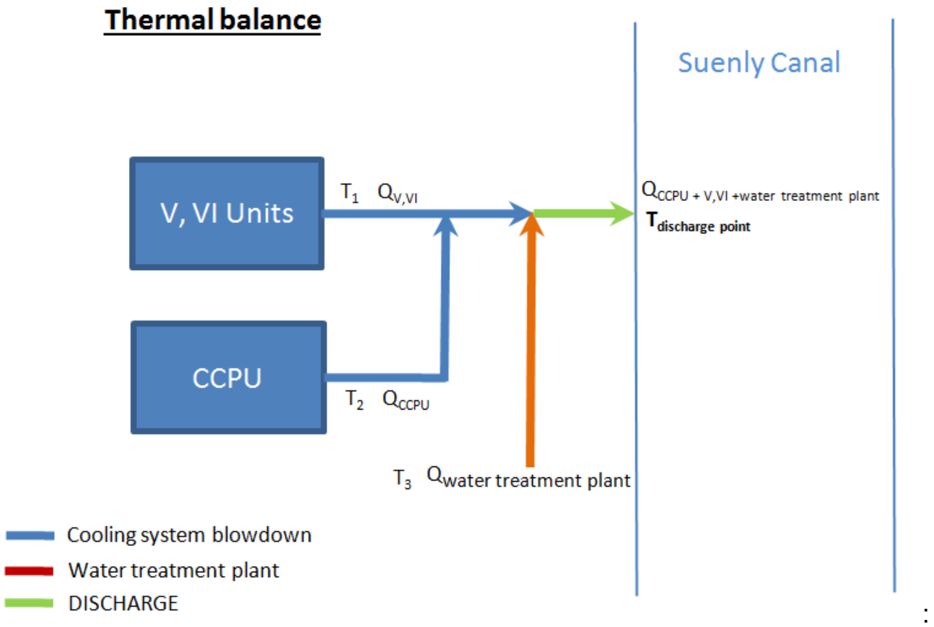


Current scenario



Future scenario

86. For the assessment on impact of the thermal discharge, a mass balance has been calculated. The influence of the decrease in temperature in the discharge point, due to partial replacement of an open cooling water system to a closed one, will not be appreciated (0.1 ºC) because the huge difference between flow rate of the closed cooling system blowdown (CCPU) and the opened cooling system effluent (V, VI units). However, the water of the effluent discharge from the open cooling water would be decreased from almost a 50%, so the thermal effluent dispersion would be faster in the Suenly canal and this will have a direct and positive impact on the aquatic ecosystem.



87. As can be observed in the above tables and assessments, the fact of replacing and old technology by a most efficient and environmental friendly one result in several positive impacts that indicate a global environmental improvement.

88. After detailed analysis of the project and environmental baseline status of the area of interest, we conclude than the environmental and social benefits from the project implementation are:

- Reduction of natural gas consumption on 321.4 mln.m3/year
- 30% emission reduction of CO2 (greenhouse gas) to the atmosphere, which will contribute to climate change mitigation
- 30% emission reduction of NOx to the atmosphere
- In accordance with the result obtained from the dispersion model of pollutants in the atmosphere using the EPA's "AERMOD" it can be stated that:
  - A 40% reduction of NO_2 in ambient air quality is achieved
  - Current and future scenarios comply with air quality standards both at national and international level
- It is expected that global background noise will decrease due to the replacement of old and noisy equipment by a new and less noisy one
- The change from the open cooling system of units III and IV towards a closed circuit of the CCPU will lead to:
  - 40% reduction of water intake

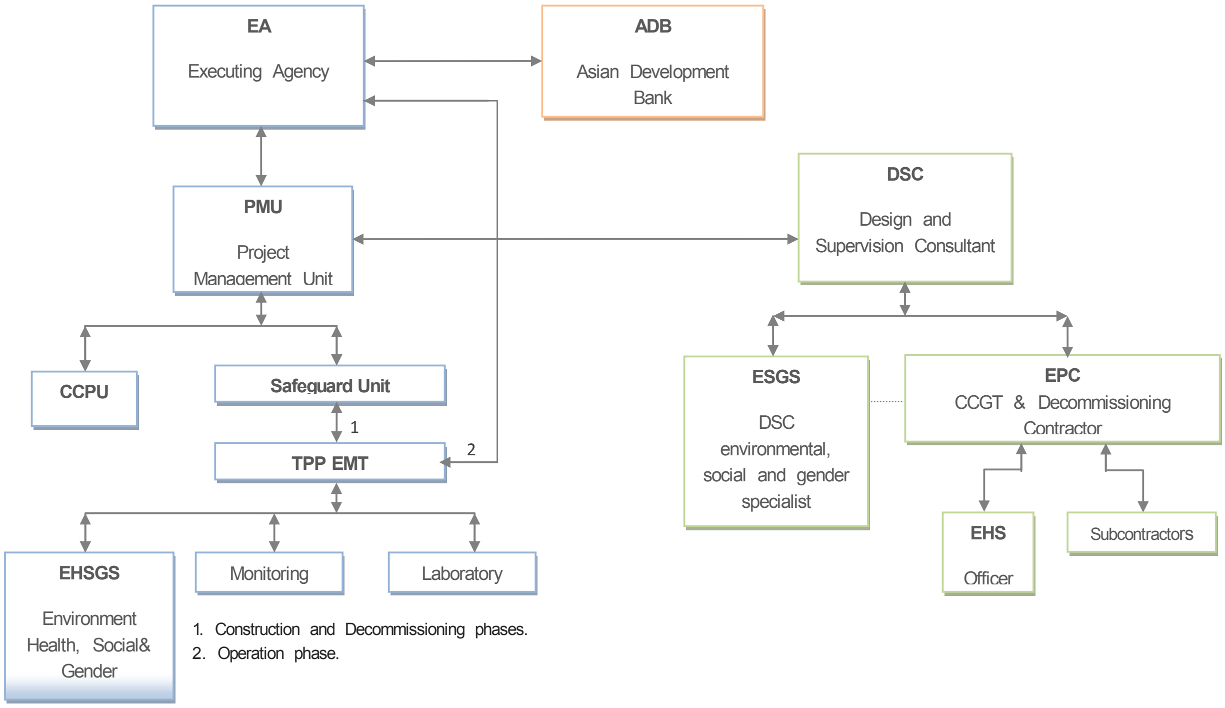
- Almost a 50% reduction of thermal effluent returned to the canal which will allow a better and faster dispersion. This fact would probably improve the environmental condition of the aquatic ecosystem.
- Increase of 225m3/h of water consumption to replace evaporated water and blow down in the cooling towers. This is a negative impact but the magnitude is insignificant as it would represent less than 1% of Suenly canal flow rate.

➢ Decrease of accidental risk by means of using Automatic Control System;
➢ Increase in power supply will promote industrial development projects envisaged for the region; Consequently this will promote socio-economic development
➢ During the construction phase workforce demand will be highly increased

F. ENVIRONMENTAL MANAGEMENT PLAN

89. The EMP compiles comprehensive information gathering together the actions required to mitigate those impacts in accordance with the laws of Uzbekistan and the ADB safeguard policy, and the monitoring activities that are to be undertaken as part of the project in order to confirm that they have been effective in reaching their objectives.

90. The EMP also details the institutional arrangements and capacities that currently exist, or that will be put in place during project implementation. The project institutional organization is shown in the following chart:



91. 58 mitigation measures have been included in the EMP and a specific monitoring plan to control the implementation and effectiveness of these mitigation measures. A summary of the most representative aspects of the EMP are presented as follows:

92. For purposes of incorporating all necessary measures so as to stay within emission limits, the following environmental elements have been taken into account for the design of the project:

- Use of low NOx emission burners so as not to exceed World Bank 51 mg/Nm^3 standard (15% O_2, dry base)
- Building a 60 m stack, in accordance with the result obtained in accordance with the Environmental Protection Agency (EPA) atmosphere pollutant dispersion "AERMOD" model.
- Installing noise attenuation devices to comply with national and international standards
- Installing an effluent treatment system (a system for separating greases, oils and chemical pollutants from effluents assuring compliance with national and international standards)
- Installing an optimized chemical dosing system for cooling water treatment and control for a minimum requirement of chemical additives, achieving a minimum concentration at discharge with consequent environmental benefits
- Safety tanks for retaining any leaks that may occur from any storage tank for hazardous materials or wastes.

93. - Development of an Environmental, Health and Safety Plan for the construction, decommissioning and operation phases.

94. - As far as possible and depending on availability, work position created by the project will be filled by local personnel.

95. - Implementation of a CEMS (Continuous Emissions Monitoring System) which will guarantee that emissions are always within legal limits, and which will analyse and record pollutants on a continuous and automatic basis: SO2, NO, NO2, CO, O2, temperature, pressure and water vapour.

96. - Yearly quantification and monitoring of Greenhouse Gases emissions in accordance with internationally recognized methodologies (IPCC, etc.)

97. - Implementation of air quality and meteorological monitoring stations on a continuous basis of SO2, NO2, NO, TSP, PM10, PM2.5, CO; wind speed and direction, atmospheric pressure, relative humidity and temperature, which ensures observance of air quality limit values in force.

98. - Yearly campaign for measuring noise levels using a sound level meter.

99. - Extension of the current monitoring system for water intake and discharge points in order to comply with national and international effluent standards:

- Continuous monitoring of: Tª, pH, conductivity, and total residual chlorine.
- By-month basis monitoring of: suspended solids, mineralization, Cl-, SO4, NO3, NO2, NH4, Fe, BOD-5 and Oil products; the project will extend monitoring to heavy metals: cadmium, cobalt, copper, chromium, lead, nickel, zinc, arsenic,

mercury (If there is no variation between intake and discharge points observed after one year, the monitoring of these new parameters could be discontinued).

100. - Extension of the current monitoring system for subterranean water: quarterly monitoring of: pH, CA2+, Mg2+, NA+, Cl, SO42,- HCO3,- Hardness, Tª; the project will extend monitoring to pH, oil products, heavy metals (cadmium, cobalt, copper, chromium, lead, nickel, zinc, arsenic, mercury), organochloride pesticides and phenols. If there is no variation for heavy metals and organochloride pesticides observed after one year, the monitoring of these new parameters could be discontinued. Wells network will be extended also to include areas which could mean risk on the quality of groundwater and soils as sludge ponds, oil and chemicals storage tanks, hazardous waste storage.

101. - Yearly campaign for measuring soil salination along the area in which deposition of steam plum from the cooling towers is more likely to occur.

102. - Soil monitoring campaign twice per year

103. - Waste management adapted to good international practices and standards: Prevention, reduction, reuse, recovery, recycling, removal and finally disposal; segregation and separate management of hazardous and non-hazardous wastes with the inclusion of a proper final landfill or storage.

104. The report monitoring results to internal (project management) and external (authorities, local people, ADB) audiences is required to verify compliance with regulatory and other requirements. For projects which category is A, semiannual reporting is required as a minimum during construction or decommission and annually during operation

G. INFORMATION DISCLOSURE, PUBLIC CONSULTATION AND PARTICIPATION. GRIEVANCE MECHANISM AND REPORTING TO THE POPULATION

105. As part of the environmental assessment process, Takhiatash TPP organised two rounds of **public consultations** on 18 and 29 of April 2013 at the Energy college of Takhiatash. These consultations were an opportunity to associate all of the parties involved and stakeholders concerned to the project: provincial and local authorities, non-central government services, NGOs and civil society, especially representatives of the local population, etc.

106. This consultation was also an opportunity to disseminate pertinent information which helped the general public understand the project risks, impacts and opportunities. In addition, the public consultation organised was a time for: (i) all of the stakeholders involved to express their opinions on the project risks, impacts and mitigation measures and (ii) Takiatash TPP to study and respond to them.

107. The public consultations meeting were mainly based on:

- prior communication of useful and pertinent information (concise, well-developed environmental assessment documents prepared up to that date) via dissemination of the EMP and EIA,

- a focus on the social and environmental risks and impacts and on the measures and actions planned to reduce and mitigate them,
- **public continued consultation and information** period throughout the duration of the project via a grievance log and via public access to the annual and the environmental monitoring report (which includes result of the Grievance Mechanism put in place) made permanently available to Takhiatash TPP at the medical services, 200 meters outside of the TPP gate.

H. FINDINGS

108. In conclusion: In view of the Environmental Impact Assessment concerning construction of 230-250 MW Combine Cycle Power unit and decommissioning of 310 MW existing units III and IV at Takhiatashs TPP, and after having analysed all the types of impact that may be generated by the project, we find that **the project will produce an overall positive environmental and social impact** that will be compatible with, controllable by, and that fits perfectly into, the sustainable development policy framework maintained by the Uzbek authorities and the ADB environmental requirements policy.

109. The entire project can therefore be considered to be **viable on condition that the Environmental Management Plan is observed** as laid out in the EIA.

A. INTRODUCTION

A.1. Scope

1. The scope of the present document is to carry out an Environmental Impact Assessment (EIA) for the decommissioning of the inefficient existing power plants units III and IV and the construction and operation of a new combined cycle gas unit (CCPU) in the Takhiatash Thermal Power Plant (TPP), located in the Republic of Karakalpakstan, in north-western Uzbekistan, which owner is Uzbekenergo (UE).

2. This EIA was entrusted to the GAS NATURAL FENOSA ENGINEERING (GNFE) company on behalf of the Asian Development Bank (ADB).

3. This EIA is developed within the framework of the Preliminary Feasibility Study of the Project ~~"C~~onstruction of 230-250 MW CCGT at Takhiatash TPP", which objective is to improve energy efficiency of the Takhiatash TPP with the adoption of an energy efficient technology that will contribute to increase reliable power supply and climate change mitigation.

4. An EIA, originally written in Russian, was prepared to meet the requirements of the Uzbekistan Environmental Legislation and approved by the relevant state authorities. This EIA present the information from the original Russian EIA and includes some additional sections required to meet ADB environment policy requirements.

A.2. History

5. Uzbekenergo (UE), which is the owner of the Takhiatash TPP, is the national company in charge of the electricity sector.

6. Takhiatash TPP was constructed between 1961 and 1990 in six stages. As shown in table 1 below.

7. In 1980 uneconomic and obsolete equipment of the I-II lines was dismantled. Therefore, the installed capacity of Takhiatash TPP is currently 730 MW.

Table 1. Commissioning of Takhiatash TPP lines

Units	I	II	III	IV	V	VI
Year of installation	1961	1964	1969	1974	1987	1990
Installed capacity of the line, MW	24 demounted	28 demounted	200	110	210	210
Installed capacity of TPP, MW			730			

8. Uzbekistan is a rich country in energy resources, so that the energy sector has substantial export potential and provides the foundation for the country's growth. Due to the economic growth, power demand has gradually increased since 2002 and it is expected to continue increasing in 2.0%–3.5% per year in the short and medium term (by 2018). The Government is seeking ways to augment its petroleum and natural gas output, increase natural gas exports, and draw direct

foreign investment to the energy sector. Natural gas production and exports have been steadily increasing.

9. Uzbekistan is also one of the most energy intensive economies in the world. It uses four times more energy than the world average (for each dollar of gross domestic product). This is mainly due to the ageing energy and industrial infrastructure, the weak operational performance of energy utilities and the lack of new investment. High losses in power generation, transmission, and distribution have led to the increase in the use of natural gas, which otherwise would have been exported delivering foreign revenues for the country. Because of infrastructure related bottlenecks, the country is beginning to face energy shortages.

10. Energy security underpins all aspects of economic growth in Uzbekistan. The country relies on low priced energy as a precondition for sustained economic development. Energy efficiency options are an underlying theme in achieving energy security and mitigating the impact of climate change. The rationale for investing in clean and efficient energy technology has become even more critical for Uzbekistan for economic, social, and environmental reasons, because it is the most cost-effective way to achieve energy security and sustain low-carbon growth.

11. Expanding clean technology is a core operating area under the Asian Development Bank (ADB) Strategy 2020. ADB's *Energy Policy* also aims to help developing member countries provide reliable, adequate, and affordable energy for inclusive growth in a socially, economically, and environmentally sustainable manner.

12. Three CCGT power plants (total installed capacity of about 1,650 MW) are planned to be constructed by 2014, which will reduce the natural gas use per unit of electricity generated.

13. The project ―Construction of 230-250 MW CCGT at Takhiatash TPP" is a priority project identified by Uzbekenergo. Takhiatash TPP, with the installed capacity of 730 MW, is the main power supply source for the Karakalpakstan and Khorezm regions with over 3 million people located in the western part of Uzbekistan. The power demand outlook is strong with a number of industrial development projects envisaged for the region, exceeding currently available capacity. Furthermore, operational lifetime of the Takhiatash TPP's equipment is 22-43 years, resulting in its degradation and the increasing in the probability of accidental risk with potential negative consequences for the environment. In addition, Uzbekenergo has a plan for a second CCPU (230-250MW) and extension of high voltage transmission line to meet increasing future power demand in the region.

14. This project will allow cutting operational expenses, increasing the efficiency of energy transformation and the reliability of supply of energy to the consumers, and improving the environmental situation as a result of the replacement of the obsolete equipment of III and IV lines by the new CCPU.

A.3. Scope and methodology

15. GNFE has drawn up the Environmental Impact Assessment of the 230-250 MW CCUP analyzing the decommissioning, construction and operation phases.

16. ADB project data sheet indicates that project is category A which assessment may comprise a full-scale EIA. Nevertheless, for involuntary resettlement and indigenous peoples the project is categorized as C.

17. The methodology selected for drawing up the Assessment is as follows:

18. EIA scoping and gap analysis. The first step in the EIA process was to review the existing data and undertake a gap analysis. An EIA for the project had previously been prepared by Uzbekenergo, and this provided useful data sets. However the Uzbekenergo EIA did not meet all the ADB environmental safeguard requirements, and it was determined that a further assessment was required to ensure compliance. A site visits were undertaken by EIA team members in January, March and April 2013 as part of the scoping process. The outcome of the scoping process determined the primary data requirements and the existing secondary data that were sufficient for the assessment.

19. Policy, Legal, and Administrative Framework and Standards: Secondly, Uzbek legislation as well as ADB and World Bank legislation were reviewed with a purpose to identifying limits of the environmental protection framework, as well as the various international conventions to which Uzbekistan is a signatory. As required by the ADB safeguards, when host county regulations differ from international recognized standards, the project will achieve whichever is more stringent.

20. Description of the project: A description of the project was drawn up with data provided by UE in order to identify actions associated that might cause changes, both positive and negative, to the environment, drawing a distinction between decommissioning, construction and operation phases.

21. Description of the environment (Baseline Data): In the environmental baseline, the relevant physical, biological, and socioeconomic conditions within the study area were considered. Specifically, the most important environmental factors influencing the project's environment were described and assessed: climate, air quality, noise, geology, hydrography, water quality, vegetation, fauna, landscape, wilderness areas of interest, and in the socio-economic domain, demography, economic structure, occupational and community health and safety, vulnerable groups and gender issues, cultural heritage, urban planning programs and current and proposed development activities within the project‘s area of influence. In this stage we gathered relevant environmental data and information provided by the Administration database and complete it with primary data by means of site surveys (noise campaign, water quality analysis, soil analysis).

22. Analysis of Alternatives: Taking into account the description of the project and the environmental baseline, analysis of Alternatives was carried out after. This section examines alternatives to the proposed project site, technology, design and operation (including the ‗no project‘ alternative) in terms of their potential environmental impacts.

23. Impacts analysis and assessment: Impact identification was carried out then based on the analysis of interaction between actions of the project and environmental factors. The method consisted of creating a matrix, identifying impact where factors intersect, and determining which of those would be significant. This issue has been developed by an interdisciplinary team which gathers physical, biological and socioeconomic factors expertise with the knowledge in potential impacts of this kind of project and technology. The design of the matrix was based on the following points: project analysis and environmental baseline conclusions; project action list; environmental factors that could be affected list; panels of experts; compared scenarios application.

18. Assessment of significant impacts was carried out then. The assessment process comprised five different tasks:

- Describing potential impacts. The extent and quality of available data, key data gaps, and uncertainties associated with predictions and specifies topic that did not require further attention were identified and estimated.
- Characterising impacts by means of the attributes defining them, as follows: Signs (positive or negative), immediateness, accumulation, synergy, momentum, persistence, reversibility, recoverability, periodicity and continuity;
- Determining the incidence of each impact type;
- Determining the magnitude of each impact type in qualitative and quantitative terms;
- Finally, defining the end value of each impact type, depending on the level of incidence and magnitude previously determined.

19. In this section global, transboundary and cumulative impacts were examined as appropriate for both plants during the transition period. Opportunities for enhancement were also explored.

20. For some of the potential impacts specific assessments were carried out taking into account types of synergy that could arise with other activities (both existing and planned) in order to carry out a more in-depth analysis of the most characteristic impacts in this type of project:

- For purposes of analyzing atmospheric impact and in order to calculate stack height, modelling was carried out using AERMOD program. The Pollutants NO2, NO and CO were assessed. AERMOD was developed by AERMIC (meteorological company in the US (AMS), the Federal environmental agency (EPA), the Regulatory Model Improvement Committee), and a workgroup of scientists from the AMS and the EPA. AERMIC was created in 1991 for purposes of introducing state-of-the-art modelling concepts into the EPA's air quality modelling procedures. Thanks to the AERMIC software, the AERMOD modelling system (stationary plume modelling) was developed, incorporating air dispersion based on the Earth's outer layer structures and scale concepts, including surface source and high source processing, as well as simple and complex terrain.

  As the meteorological data required for the modellization was incomplete and not representative of the local conditions at the closest meteorological station, a meteorological simulation of 2012 was carried out with the model Weather Research and Forecasting model (WRF) at the site. WRF is a new generational non-hydrostatic and modular structure meteorological model developed by the National Center for Atmospheric Research (NCAR). WRF data provides both surface and vertical profiles of horizontal resolution on a 1km grid resolution covering the TPP area.

  In the model, topography and sensitive receptors (residential areas, air quality stations, etc) were included in order to predict the specific potential impact.

  The atmospheric impact includes the analysis of the fulfillment of the air quality standards with the future facilities in operation. The stack height was calculated to fulfill these standards.

  Analysis of the improvement of air quality due to the replacement of the old units III and IV by the new CCPU was undertaken also.

21. Environmental Management Plan: After assessing the types of impact, measures, both of a preventive and corrective nature, intended to reduce, to eliminate or to compensate significant negative impact arising from the project, were proposed. An Environmental Management Plan (EPM) was drawn up in order to verify that the proposed measures will be carried out and will be effective, and to monitor any further unforeseen environmental impact. The monitoring measures were described with technical details, including parameters to be measured, sampling locations, frequency of measurements and definition of thresholds that signalled the need for corrective actions. The monitoring and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures and document the progress and results of mitigation were also described.

22. In this section the implementation arrangements are described taking into account: implementation schedule showing phasing and coordination with overall project implementation; description of the institutional or organizational arrangements, namely, who is responsible for carrying out the mitigation and monitoring measures.

23. Information Disclosure, Consultation and Participation: After a first draft of the EIA was ready, the first information, disclosure, consultation and participation process was held on the 18th of April. In this stage the description of the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders are described; comments and concerns received from affected people and other stakeholders and how these comments were addressed in project design and mitigation measures, with special attention paid to the needs and concerns of vulnerable groups, including women and the poor were summarized; and the planned information disclosure measures (including the type of information to be disseminated and the method of dissemination) and the process for carrying out consultation with affected people and facilitating their participation during project implementation were also described. In this respect, a grievance mechanism for resolving complaints about environmental performance was included.

24. The second information disclosure, consultation and participation process was carried out on the 29th of April, before project appraisal by ADB.

25. Conclusion and recommendation: A conclusion and recommendation section provides the conclusions and recommendations drawn from the assessment.

26. Executive Summary: Finally, an Executive Summary concisely describes the critical facts, significant findings and recommended actions. The Executive Summary was redacted in a form and language understandable to affected people and other stakeholders.

27. After the completion of this EIA draft report, the document should be disclosure on the ADB´s website. This process will last 120 days prior to ADB board consideration.

B. PROJECT DESCRIPTION

28. This project description is based on the preliminary feasibility study (PFS), including a draft EIA prepared by Uzbekenergo in 2012, and modified to incorporate subsequent information obtained during further investigations and discussions.

B.1. Needs for project

26. Uzbekistan is a rich country in energy resources. It holds sizeable hydrocarbon reserves, mostly natural gas, so that the energy sector has substantial export potential and provides the foundation for the country's growth.

27. Uzbekistan's primary energy demand is expected to increase at 1.8% per year through 2030, from 47.0 MTOE in 2005 to 72.6 MTOE in 2030, as shown in **Error! Reference source not found.**.

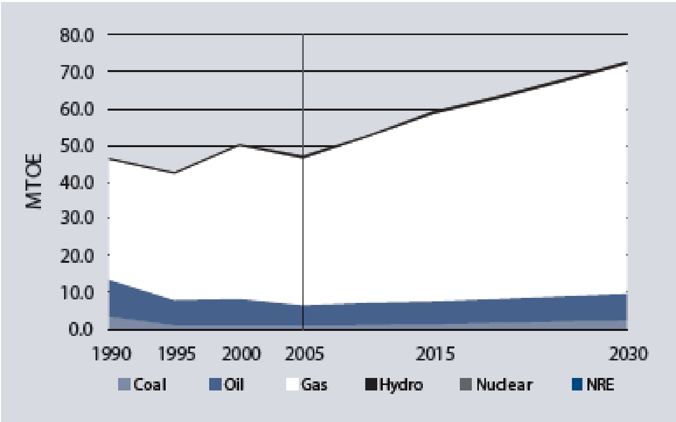


Figure 1. Primary energy demand in Uzbekistan (Source: APERC analysis, 2009)

28. After declining from 2000 to 2005, the final energy demand is likely to rebound with a faster annual growth rate of 2.4% in the near term (2005–2015) and a slower pace of 1.5% in the longer term, from 35.4 MTOE in 2005 to 56.2 MTOE in 2030 (Figure 2).

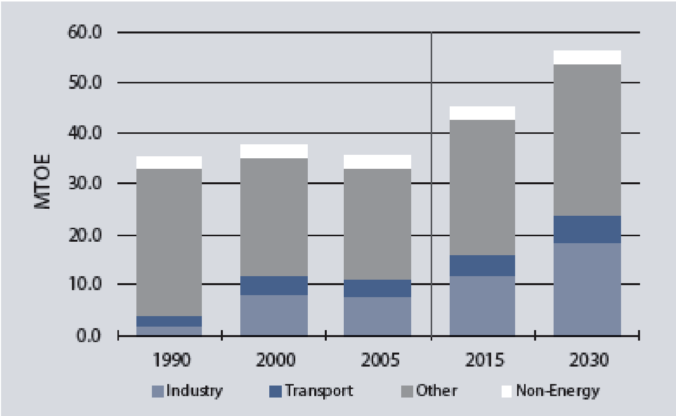


Figure 2. Final energy demand in Uzbekistan (Source: APERC analysis, 2009)

29. Due to the economic growth, power demand has gradually increased since 2002 and it is expected to continue increasing at 2.0–3.5% per year in the short and medium term and at an annual 1.1% through 2030. This trend is slower than in other countries of the same area. Industry's energy demand is expected to grow at a relatively fast pace of 3.6% per year, and this will result in substantial increases in CO_2 emissions.

30. The total installed capacity for power generation in the country is about 12,400 MW. However, the available capacity is less than 10,000 MW. In 2010, Uzbekistan generated about 51,935 GWh of electric power, out of which 2% was exported. In accordance with the electricity demand trend, total electricity generation is also likely to show moderate growth of 1.0%, increasing up to 61,200 TWh in 2030. These figures are shown in **Error! Reference source not found.**Table 2.

Table 2. Primary energy demand, electricity demand, electricity demand and generation and CO_2 emission

	Annual value					Annual growth rates	
	1990	**2000**	**2005**	**2015**	**2030**	**1990-2005**	**2005-2030**
Primary energy demand (MTOE)	46.4	50.4	47	59.2	72.6	0.10%	1.80%
Electricity demand (TWh)	42.9	39.8	39.4	45.1	52.2	-0.60%	1.10%
Electricity generation (TWh)	56.3	46.8	47.7	53.9	61.2	-1.10%	1.00%
CO_2 emission (million tons of CO_2)	110.3	101.6	96.1	120.4	149.8	-0.60%	1.80%
CO_2 per total primary energy (tons CO_2/ TOE)	2.38	2.02	2.04	2.03	2.06	-0.60%	0%

31. Uzbekenergo (UE) is the national company in charge of the electricity sector through joint-stock companies in which the State is the main shareholder. Uzbekenergo owns and operates 10 thermal power plants (TPPs) and 28 hydropower plants (HPPs), which represent 87.6% and 12.4% of the total generation capacity, respectively.

32. Uzbekistan's power generation plants are generally old and inefficient, requiring urgent replacement and/or modernization. More than 75% of the power plant units are over 30 years old, reaching or exceeding their economic life. Since 1991, only two power capacity expansion projects have been completed: (i) rehabilitation of two 300 MW steam cycle units at Syrdarya TPP, and (ii) construction of an 800 MW steam cycle unit at Talimarjan TPP.

33. Natural gas is used for 94% of thermal power generation in Uzbekistan. Conventional TPPs run with an average thermal efficiency of 31%, compared with 55% of advanced combined cycle gas turbine (CCGT) technology.

34. Energy security, affordability, and efficiency are key priorities of the government‘s energy strategy. The government has adopted policy and legal frameworks with clear goals to reduce energy intensity and losses, and enhance sector investments and institutional change. The government aims to (i) maximize savings through rational use and application of clean energy technology, (ii) integrate energy efficiency into national planning, (iii) improve sector performance through commercializing utility operations, (iv) attract private sector participation, and (v) increase energy exports on a commercial basis. Energy plans leading to 2020 and 2030 have been announced, but are not yet in the public domain.

35. The government‘s $5.2 billion power sector development plan, 2011–2015 covers physical and non-physical aspects to ensure (i) uninterrupted and reliable power supply to all customers in Uzbekistan; (ii) CAPSs‘ security and reliability; (iii) equal access to the transmission system; (iv) investment for reconstruction, modernization, and expansion of power generation, transmission, and distribution systems; (v) fuel mix diversification for power generation; and (vi) management, operations, and performance improvement of utilities based on commercial principles.

36. The government also has a $19.4 billion investment plan for the oil and gas sector to develop new production and modernization projects, 85% of which are expected to be financed through foreign direct investment and external loans.

37. Within this framework, two of the main objectives for the energy sector in Uzbekistan settled by the ADB by 2016 are:

- Thermal power generation efficiency increased from current 31 % to 50%.
- Greenhouse gas emissions reduced from 4.1 to 2.7 mtCO_2e/GDP.

38. As mentioned in the Country Partnership Strategy 2012–2016 for Uzbekistan (August 2012), ADB will provide support for energy efficiency enhancement as this is closely aligned with Uzbekistan‘s emphasis on promoting energy security and affordability, and reducing energy intensity. Uzbekistan‘s energy intensity per unit of GDP is one of the highest in the world and significantly above other middle-income countries. As a result of intensive industrial use of energy, carbon emissions per unit of GDP in Uzbekistan are among the highest in the world. Lowering energy intensity and carbon emissions will increase the economy‘s competitiveness and mitigate climate change impacts.

39. In this respect, power generation from burning gas in a CCPU is the cleanest method of generation using fossil fuels. The CCPU turbines burning natural gas produce significantly less greenhouse gases than traditional coal or oil fired thermal power stations, as a result of both the less greenhouse intensive nature of natural gas and the greater inherent energy conversion efficiency of CCPU technology. Replacing the existing power generation assets with the energy efficient CCPU technology is a key strategy for Uzbekistan in order to save energy, secure reliable power supply and mitigate climate change impacts.

40. Three CCGT power plants (total installed capacity of about 1,650 MW) are planned to be constructed by 2014, which will reduce the natural gas use per unit of electricity generated.

41. Takhiatash TPP is the main power supply source for the Karakalpakstan and Khorezm regions with over 3 million people, located in the western part of Uzbekistan. The power demand outlook is strong with a number of industrial development projects envisaged for the region, exceeding currently available capacity. Furthermore, Takhiatash TPP not only provides the North-West region of the country with electricity but also heats water to supply the consumers in Takhiatash town and for its own needs.

42. Operational lifetime of Takhiatash TPP‘s equipment ranges from 22 to 43 years, which is the main reason for the equipment reliability degradation and increases the probability of accidental risks with potential negative consequences for the environment.

43. Considering this framework, Uzbekenergo has identified Takhiatash TPP‘s project as a priority. It involves the replacement of the obsolete equipment of III and IV units by the construction of a CCPU with the capacity of 230-250 MW.

44. The implementation of this project will allow cutting operational expenses, increasing the efficiency and the reliability of the energy supply to consumers, as well as improving the environmental quality in its area of influence according with the Government and ADB strategies.

B.2. Project description

45. At the moment, power and heat production at Takhiatash TPP is based on a conventional steam power technology. In accordance with the aforementioned plans of implementing energy-efficient technologies, it is designed to construct in Takhiatash TPP a CCPU with capacity of 230 - 250 MW consisting of one gas turbine, one HRSG (heat recovery steam generator) and one steam turbine, what can significantly improve the efficiency of the plant.

46. The current installed capacity of Takhiatash TPP is 730 MW. With the commissioning of the CCPU, the decommissioning of existing units III and IV (composed of four boilers and three turbine units with a total capacity of 310 MW) will be undertaken. The installed capacity of the new combined cycle plant will be 244.4 MW, resulting in a total installed capacity of 668 MW for Takhiatash TPP. Table 3 shows an overview of both current and prospective capacities of the TPP.

Table 3. Takhiatash TPP's current and prospective units

<table>
<tr><th>Unit</th><th>I</th><th>II</th><th>III</th><th>IV</th><th>V</th><th>VI</th><th>CCPU</th></tr>
<tr><td>Year of installation</td><td>1961</td><td>1964</td><td>1969</td><td>1974</td><td>1987</td><td>1990</td><td>2016</td></tr>
<tr><td>Installed capacity of the line, MW</td><td>24</td><td>28</td><td>200</td><td>110</td><td>210</td><td>210</td><td>244.4</td></tr>
<tr><td>Current installed capacity of TPP, MW</td><td>*</td><td>*</td><td colspan="4">730</td><td>-</td></tr>
<tr><td>Prospective installed capacity of TPP, MW</td><td>*</td><td>*</td><td>**</td><td>**</td><td colspan="3">664.4</td></tr>
</table>

* Demounted

** Decommissioned

47. Both the existing facilities of the units that are currently operating at Takhiatash TPP and the new CCPU are described in detail below.

B.2.1. Description of the existing power plant (units III-VI)

48. The site of existing Takhiatash TPP is located in the city of Takhiatash, 3 km to the south-west of the city centre, on the left bank of Amudarya river. It occupies the central part of the Republic of Karakalpakstan (Khodjeyliy region), located in north-western Uzbekistan.

49. Karakalpakstan borders with the Republic of Kazakhstan in the north and west, the Navoi region in the east, the Khorezm and Bukhara regions in the south-east and with Turkmenistan to the south. The location of Karakalpakstan within Uzbekistan and the wider region is illustrated in the following figures.

Takhiatash TPP location

Figure 3. Karakalpakstan Province location

50. The capital city of the Republic, Nukus, is located 20 km to the north of TPP industrial site and Khodjeyli regional centre is 18 km to the north-east of TPP. The Nukus-Khodjeyli highway runs 4 km to the north of TPP and railway runs at the distance of 1.3 km.

Figure 4. Location of the TPP, city of Takhiatash, Amudarya River and the intake and discharge Suenly canal

Figure 5. Aerial photograph of the existing Takhiatash TPP

51. The existing plant currently consists of four power generation units (III-IV-V-VI) with a total installed capacity of 730 MW. It also comprises a heating water converter plant to supply not only the TPP's own hot water requirements but also Takhiatash city. In 2011 the TPP generated 3,276 million kWh of electricity and 3,240 GCal of heat.

52. The different facilities of the plant are explained in detail below and a layout of the existing plant is showed in Annex I.

B.2.1.1. Fuel system facilities

53. The main fuel for Takhiatash TPP is natural gas from Bukhara deposit. Natural gas from the GDP (Gas distribution plant) comes to two GDS (Gas distribution stations) through two aerial pipelines. The GDP is located at 2 km from the TPP.

54. Mazut, a type of residual black oil (type M-40), from Fergana and Bukhara oil refineries is used as back-up fuel. Mazut is stored for a power generation capacity of 15 days as there is a power supply guaranty to fulfil. Nevertheless, Mazut has not been used since 2004.

55. Fuel oil facilities consist of a mazut pumping station and a mazut storage with an overall capacity of 250,000 m^3: 6 metal tanks within the TPP terrains, with a capacity of 50,000 m^3 ((2 x 30,000 m^3) + (2 x 10,000 m^3) + (2 x 12,000 m^3)) and 20 tanks outside the TPP in Nukus city, with a capacity of 10,000 m^3 each tank. The tanks within the TPP terrains are bordered in order to prevent any fuel oil spreading but the secondary containment is not made of impervious, chemically resistant material.

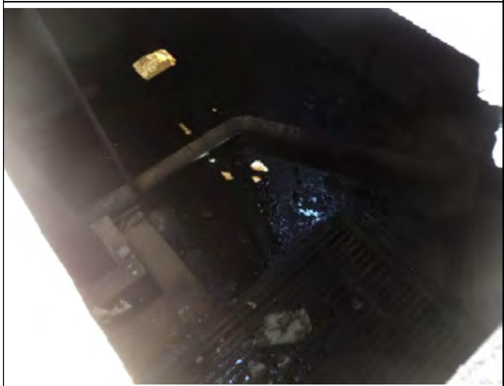
56. Fuel oil transportation from receiver tank to reservoirs and from there to the boiler units is carried out in a closed circuit to prevent overflowing. There is a mazut storage at 35 km from the TPP which capacity is 200000 m^3. The location of this storage is shown in the following picture.

Figure 6. Location of mazut storage place

57. This mazut storage has been designed in 4 groups with 5 tanks per group. Every one of the tanks has a capacity of 10000 m3 (60m x 40m basement x 5m depth). Tanks and groups are constructed in concrete (walls, basement and roof) over the ground. Disposition of the mazut storage can be seen in the following picture.

Figure 7. View of mazut storage place from satellite

58. Mazut is transported in and out of the storage by cisterns on the railway (visible at the south of the above picture). Currently, a layer of 20-40cm of mazut is remaining in the 20 tanks but maintenance operations are being undertaken in order to clean tanks. This residual mazut is being transported to Tashkent.

 View of one of the groups constructed over the ground.	 Top view of one of the groups. As it can be seen the construction material of the roof (as well as the rest of the cube) is concrete. Steam and mazut distribution pipes are disposed along the ceeling of the groups.
 Interior view of one of the tanks from the top. A layer of residual mazut can be observed.	 Cisterns on the railway are being filled with residual mazut to be transported to Taskent by train.

B.2.1.2. Power island

59. III and IV units, which include six gas and oil boilers and three steam turbines with a total installed capacity of 310 MW, are to be dismantled whereas V and VI units, each one with a capacity of 210 MW and including two boilers and two steam turbines, will continue operating.

60. **III and IV Units**

III and IV units include six drum boilers of two different types (No. 1-4 are TGM-151 model and No. 5-6 are TGM-151-B). The steam pipeline scheme provides parallel operation for the boilers No.1-6. Boilers are designed to burn both natural gas and mazut.

Exhaust gases from boilers No. 1-4 are discharged into the atmosphere through the 80 m high stack whereas gases from boilers No. 5-6 are discharged through the 150 m high stack.

III unit include two steam turbines with capacity of 100 MW each and IV unit include one steam turbine with capacity of110 MW.

61. **V and VI Units**

V and VI units consist of two 210 MW blocks with the following main and auxiliary equipment:

V and VI units include two drum boilers with natural circulation, designed to burn both natural gas and mazut.

Exhaust gases from boilers No. 7-8 are discharged into the atmosphere through the 150 m high stack.

V and VI units include two steam turbines (K-215-130) with a capacity of 210 MW.

Table 4. Main equipment of the TPP‘s power island

<table>
<tr><th>Units</th><th colspan="6">III & IV</th><th colspan="2">V & VI</th></tr>
<tr><td>Capacity</td><td colspan="6">(100 + 100 + 110) = 310 MW</td><td colspan="2">(210 + 210) = 420 MW</td></tr>
<tr><td rowspan="2">Boilers</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td colspan="4">TGM-151
220 t/h; 110 kgf/cm^2; 540°C
12 gas and oil burners frontal located</td><td colspan="2">TGM-151-B
220 t/h; 110 kgf/cm^2; 540°C
4 gas and oil burners frontal located</td><td colspan="2">TGME-206
670 t/h; 140 kgf/cm^2; 545°C
12 gas and oil burners located into the 2 tiers at the back panel</td></tr>
<tr><td>Stack</td><td colspan="4">80 m</td><td colspan="4">150 m</td></tr>
<tr><td>Turbines</td><td colspan="6">3 steam turbines
(K-100-90)
- Condensing type
- Single-shaft
- HP and LP
- 90 kgf/cm^2; 535°C</td><td colspan="2">2 steam turbines
(K-215-130)
- Condensing type
- Single-shaft
- HP, IP and LP
- 130 kgf/cm^2; 540°C</td></tr>
</table>

B.2.1.3. Water supply and water treatment systems

62. The water supply source for the existing units of the TPP is Suenly canal, which is fed by Amudarya river.

63. Figure 8 shows an image representative of the location of the TPP, Takhiatash city, Suenly canal and Amudarya River.

Figure 8. Location of Takhiatsh TPP, Takhiatash city, Suenly canal and Amudarya river

64. Raw water from Suenly canal is used for production needs of the TPP. The raw water quality is characterized by a high content of suspended solids, mineralization, chloride ions, sulphates and oil products. Water is treated in the Water Treatment Plant (WTP) for conditioning, previously to being used in the process. Water treatment process consists of the following stages:

- **Clarification -** Raw water enters the clarification tanks and is treated with lime milk, coagulant and polyacrylamide by partial decarbonization and coagulation for the removal of suspended solids. Clarified water is sent to the mechanical filtration.

- **Mechanical filtration -** Clarified water is driven to mechanical filters where there is a complete removal of suspended solids. Mechanical filters are divided into two units, four filters in each block.

- **Decarbonization -** After mechanical filters water is led to the calcinators, where the removal of dissolved carbon dioxide takes place. Decarbonized water is collected into tanks.

- **Na-cation filtration -** Decarbonized water is treated in Na-cation filters, where a complete softening takes place, and from there it is conducted to the chemically treated water tanks.

65. The poor quality of the raw water, reflected in its high indicators of turbidity and its high content of suspended matters, mineral salts and hardness salts, requires the consumption of high volumes of chemicals and a reliable operation of the water make-up filters.

66. The chemical unit provides the necessary chemical reagents for water treatment, and comprises:

- Salt: 4 working pits of salt and salt solution tanks.
- Liming: Unit for preparation of lime milk.
- Coagulation: Unit for preparation of coagulant.

67. The result of the water treatment is the reduction of hardness (from 11 to 2) by salt consumption.

68. The chemically treated water, stored in tanks, is led to the evaporation units. Replenishment of steam losses and condensate of high pressure is made by the distillate product of the evaporation units.

69. The conservation of the water in the boilers‘ circuit consists in a correction of the make-up water with hydrazine, ammonium and tri-sodium phosphate. The objective is to prevent problems of corrosion of the components due to scale deposits and impurities, etc.

B.2.1.4. Cooling water system

70. Water from Suenly canal is also used for the cooling water system. The TPP currently operates with an open once-through cooling system. This means that intake water from the canal passes through the condenser and, after the heat exchange, warm water is directly discharged back to the canal. Apart from the thermal increase, discharge water characteristics are practically the same as the intake.

71. Annual water intake from Suenly Canal for cooling purposes is detailed in point B.4.1.3.

B.2.1.5. Drinking water system

72. Drinking water for consumption of the TPP‘s personnel is supplied from the local pipeline system of Takhiatash city.

73. Drinking water is fed for consumption of plant personnel and service water site is also used for sanitary needs (showers, eye washers, toilets…).

B.2.1.6. Heating water system

74. Heating water converter plant is designed for heating part of Tahiatash city, as well as administrative, residential and industrial buildings of Tahiastash Thermal Power Station. The water is heating in boilers as heating system water: 400 t/h in boilers πCB200-7-15 and 250 t/h in boiler πCB125-7-15. The water temperature at inlet/outlet is 70/150ºC.

75. Water is fed to the atmospheric deaerator in order to remove the oxygen and feed water is chemically softened in the water treatment plant.

B.2.1.7. Effluent treatment system

76. Description of the effluents treatment generated in the TPP is presented in the following paragraphs. Depending on their nature, the effluents are subjected to various types of processing:

77. **Oily and acid effluents.** These effluents are conducted for treatment to the Complex purification of Industrial waste water. This complex includes 2 facilities to treat industrial waste water: Greasy/oily treatment system and acid waste water neutralization system:

78. - Acid waste water neutralization system. These chemically contaminated effluents contain effluents resulting after washing regenerative air heater and acid washes of boilers. Acid waste water (up to 800 m3) is directed to the acid waste water neutralization unit. Acid solution is neutralized by lime water and up to pH 9.5-10. The neutralized effluent is discharged into evaporation sludge ponds identified as nº5 and nº6. Currently sludge pond nº5 is not being used (see picture below).

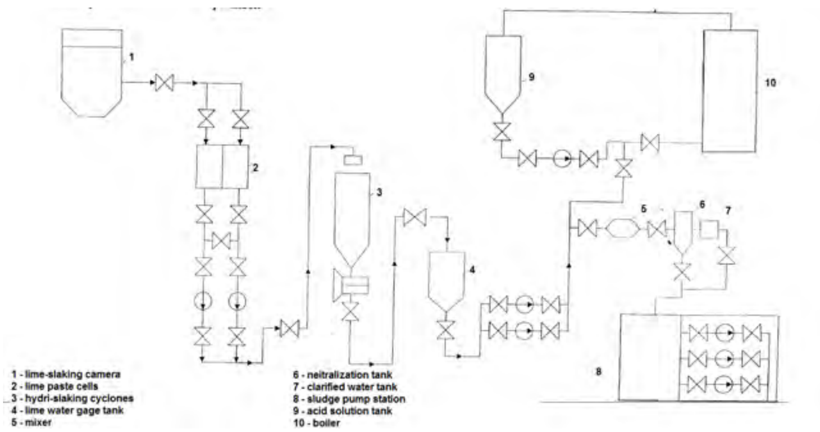


Figure 9. Water treatment scheme at the Takhiatash TPP

79. - Oily/greasy treatment system. The oily effluents are water flows from areas that may have been contaminated by oils and greases such as fuel-oil handling system, open oil warehouse, blowdowns from boiler and turbine units, cooling water coolers, cooling of bearings and seals of the rotating machinery, etc. Oily waste water is directed to the oily water treatment system, with capacity of 50 t/h.

80. Oily/greasy waste water goes through several stages of the treatment. Firstly, waste water is collected into the receiving tanks, where the largest oil fractions ascend to the surface of water due to the sedimentation process. Initially pre-cleaned water goes to an oil remover for cleaning from emulsified oil and mechanical impurities. Partly-cleaned water is conducted to an intermediate reservoir of pressure flotation. After flotation stage, cleaned water is directed to two filtration processes. In the first stage water is treated on the mechanical filter filled with anthracite. In the second stage water is cleaned in the coal or claydite filters.

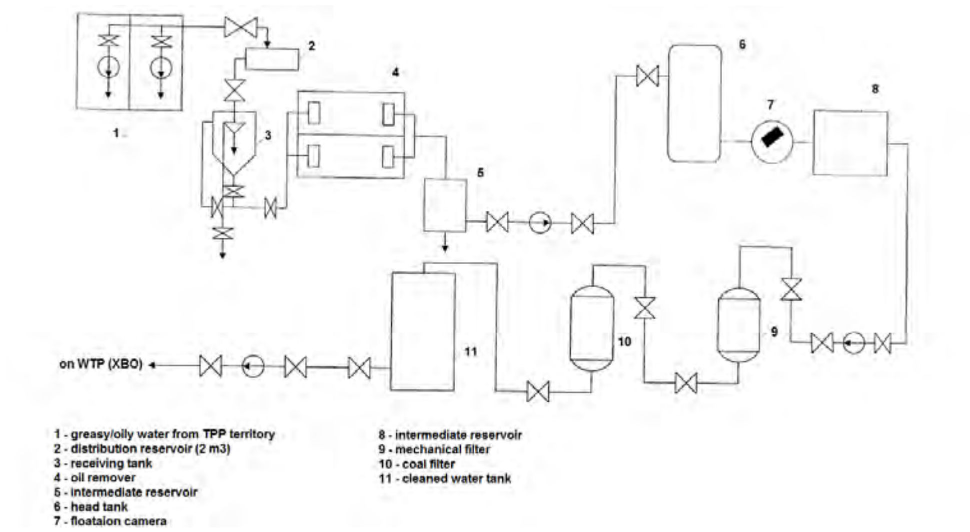


Figure 10. Scheme of comprehensive treatment of industrial sewage

81. Treated effluent is returned to the Water Treatment Plant and oiled residue is discharged to the evaporation sludge ponds identified as No 1 and No 2. Currently sludge pond No 2 is not being used (see picture below).

82. **Cooling System discharge**. As previously mentioned the cooling system is an open circuit type and therefore requires water supply from Suenly canal. After being used for cooling purposes in the condenser, cooling water increases its temperature and is discharged into the Suenly canal. Cooling system is once-through therefore the volume of water intake is almost equal to the water discharge.

83. Water used for technical water supply from intake canal is characterized by a high content of suspended solids and mineralization, including chloride ions, sulphates and oil products. Quality of discharged water is almost the same as initial water and main pollution is thermal, with an increase in temperature of 8-10 ºC. Effluent from cooling system does not contain neither poisonous nor toxic matters.

84. **Sewage effluents**. Sanitary sewage is discharged into the sewage collector, which is connected with the municipal sewage network. Municipal network ends up in the Takhiatash city municipal waste water treatment plant (WWTP). Takhiatash municipal sewage system is based on biological treatment.

85. **Water treatment plant (WTP) effluents**. Blownwater from clarification tanks and non-used water from the regeneration of the Water Treatment Plant are effluents that contain small amounts of salts. These effluents are discharged into the municipal sewage network because they do not contain neither hazardous nor toxic components. These effluents are sent to the Takhiatash city municipal waste water treatment plant (WWTP).

86. Sludge from the liming section of the Water Treatment Plant is conducted to the evaporation sludge ponds, identified as No 3 and No 4 (see picture below). This sludge is formed by incompletely burned lime.

Figure 11. Ponds for industrial sewage disposal

87. All the sludge disposal sites are nonfiltrable with impervious screens at the bottom and sides in the form of poured asphalt of 20mm width. Tiling construction – concrete lining - 30 mm, poured asphalt –20 mm, reinforced concrete protective lining of 120 mm made of portland cement concrete. Ground area of the sludge disposal site is treated with herbicides.

88. The calculated area of evaporation is 3300 m^2. The complete evaporation of flows is ensured. The capacity of the sludge collector is 1700 m^3. Currently, sludge tanks are 1/3 full.

89. On the regular base lime wastes are supplied to the specialized building organizations. According to the TPP statistical data the whole amount of accumulated wastes is 84 tons, 0.065 tons of them are of III toxic class of hazard (oil sludge).

B.2.1.8. Chemical storage

90. There is a chemical storage consisting in a closed warehouse with a basement of concrete, a ventilation valve and roofed.

B.2.1.9. Power evacuation

91. Power generated by the existing units of the TPP is evacuated via 35 kV, 110 kV and 220 kV.

B.2.2. Description of the new Combined Cycle Power Unit (CCPU)

92. A combined cycle thermal power unit brings together two cycles: a gas cycle (Brayton cycle) and a steam cycle (Rankine cycle). Its main characteristic lies in the use of the thermal energy contained in the gas cycle exhaust gases to generate steam with sufficient energy to be used in a steam turbine.

93. The CCPU that will be installed in the Takhiatash TPP will be formed by two power generation cycles, the first one represented by the gas turbine (164.5 MW) and the second by the steam cycle (87.6 MW), with a net power of 244.4 MW.

94. The CCPU comprises one gas turbine, a heat recovery steam generator (HRSG) and one steam turbine (1:1:1 concept) which operate together as a single integrated module.

95. The first cycle is represented by the gas turbine. After passing through the Air Filtering and Conditioning System (APCS) air is compressed and passed into the combustion chamber with a reciprocating compressor. Here fuel mixed with air is burned to produce a hot high pressure combustion gas which is expanded through a turbine, where the kinetic energy of the gas stream is converted into mechanical revolution of the turbine's rotor. The turbine drives both the compressor and the electrical generator to produce electricity. Gas temperature before the gas turbine, depending on the series turbine is in the range between 1100-1500º C.

96. The gas turbine generates approximately two thirds (2/3) of the electricity. The only problem arising in these systems is the formation of nitrogen oxides (hereinafter NOx) due to the high temperatures reached in the combustion chamber. The combustion chamber used has dry method low NOx burners to reduce these emissions, not requiring any water or steam consumption.

97. This technology is based on performing the natural gas combustion with air in two stages, in such a way that the fuel and the oxidizer are mixed first, allowing for a homogeneous temperature distribution to be achieved and, therefore, a stable low temperature flame that reduces NOx formation.

98. The second cycle is a steam cycle. The exhaust gas from the gas turbine is still hot (544 ºC) and is passed through a special gas pipe into a Heat Recovery Steam Generator (HRSG), where the heat energy of the flue gas is transferred to feed water to generate steam at high pressure. This steam is used to drive a steam turbine which powers a further electrical generator, generating one third (1/3) of the electricity.

99. Once expanded in the steam turbine, exhaust steam is sent to condenser where the heat exchange between the steam and the cooling water occurs. Condensate is pumped out by the condensate pump and sent to the HRSG where it is again converted into steam, closing the steam-water cycle.

100. Gases from the HRSG are discharged into the atmosphere through the stack at a temperature of 112° C.

101. Therefore, the layout of the CCPU is a two-shaft arrangement with two electric generators for gas and steam turbines.

102. A simplified process flow diagram of the CCPU of Takhiatash TPP is shown in Figure 12.

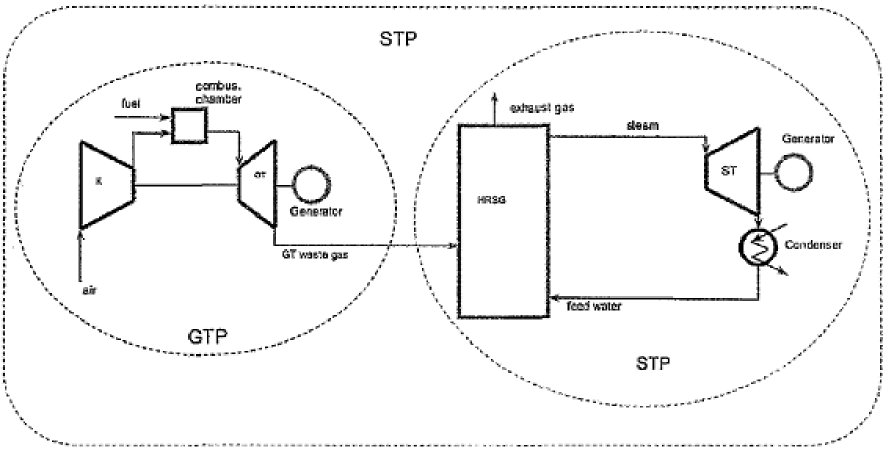


Figure 12. Simplified process flow diagram of the CCPU of Takhiatash TPP

103. The use of combined cycle power plants allows the recovery of part of the energy contained in the gas turbine exhaust gases which would be released into the atmosphere. The good global performance of this type of cycles is due precisely to the high recovery of part of this energy. The exhaust gases at the gas turbine outlet are at approximately 544 °C, being at approximately 112°C at the heat recovery steam generator (HRSG) outlet. Such a low temperature is possible thanks to using natural gas as the fuel, since the content of sulphur is very low and does not give the problem of acid condensation at low temperatures, leading to the fast corrosion of the last stages of the heat recovery steam generator (HRSG) and the stack, as in the case of other fossil fuels whose greater content of the aforementioned element harms the lifespan of the equipment and the environment.

104. Efficiency of standard gas turbine power unit (basic cycle) is 34-40%. In the combined cycle efficiency is in the range of 50-60% depending on the selected design. This represents both an environmental improvement, thanks to a more efficient use of the primary energy, and a reduction in generation costs.

105. The aforementioned power and operating parameters for the new CCPU have been calculated with the simulation software Thermoflow for the selected fuel characteristics and the specific atmospheric conditions of the TPP‘s site (average annual temperature 13.64 ° C, pressure 0.004 bar, relative humidity 49 %). This software allows selecting the gas turbine model within a rich library containing a wide range of commercial models from the main suppliers. The model used for the simulation, the Siemens SGT5-2000E, was selected according to the project‘s requirements (168 MW and being series E), which does not mean that this will be with certainty the model selected for the final design. The whole CCGU (gas turbine, HRSG and steam turbine) has been simulated.

106. The new main building is separated from the existing main building and the following auxiliary structures and equipment are located on the CCPU‘s site:

- Five forced draft cooling towers
- Gas processing point with gas booster compressors and gas-control point;
- Blow off and waste gas pipe system;

- Facility and technological equipment for boiler feed preparation of unit's water-flow cycle makeup
- Heating-water converter plant with a line-pump
- Chemicals for boiler unit metering system to support a chemical state
- Tank farm
- Emergency oil drain system
- Express laboratory
- Warehouse for oil stored in containers
- Chemicals active storage
- Materials active storage
- Nitrogen generator with receivers
- Pressurized air compressor with receivers
- Backup diesel generator in case of emergency power shutdown of unit's auxiliaries
- Technological pipe-line racks
- Pump for transfer of waste water polluted with oil products
- Engineering and domestic building

107. Gas processing point, chemicals storage, warehouse for oil stored in containers and expendables storage are planned to be located on the south side of the CCPU. Electric device's site is located on the west side of the CCPU. A new relay cabinet building is planned to be located near the existing.

108. Technical water supply facilities: circulating pumping station with fire suppressing pump, water cooling towers, chemical water pre-treatment (CWP) for preliminary filtering of make-up water are planned to be located on the west side of the warehouse. Settling pit and pulp waste dump are located further to the west.

109. It is planned to allocate a new cuttings ditch for CWP preliminary filtering and evaporation pond for chemical wash of waste-heat boiler near the existing Takhiatash TPP's cuttings ditch.

110. This project also includes all necessary buildings such as administration building, the fire fighting facilities and the gate house.

111. Construction site for CCPU is planned on the south side of Takhtiatash TPP from the temporary end of the main building. CCPU's construction base and technical water supply facilities are planned to require the additional territory of 21 hectares.

112. The different facilities of the CCPU are explained in detail below and a layout of the new plant is showed in Annex I.

113. There were several weighty reasons justifying the choice to implement the Takhiatash CCPU within the Takhiatash TPP terrains (area already developed for, and having undergone the impact of, industrial use). One of the reasons is to avoid the construction of a new thermal power plant in other terrains with other uses different to the industrial one which means that:

    a) There will be no involuntary overtaking of land resulting in:
        - Relocation or loss of shelter
        - Loss of assets or access to assets
        - Loss of income sources or means of livelihood, whether or not the affected persons must move to another location

b) There will be no involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the persons

114. Due to the above reasons, regarding the ADB ~~"~~Safeguard Policy Statement (June 2009)" the project has been classified as category ~~"~~C": no involuntary resettlement impacts, no further action is required.

B.2.2.1. Fuel system facilities

115. Natural gas is the main and backup fuel for CCUP and it will be supplied from the GDP (Gas distribution plant) to the Gas Processing Facilities (GPF), located at the left part of the design site. In accordance with preliminary estimates, the gas will be done through two new gas pipelines with a diameter of 426 x 7. Logically, these pipelines will be traced in parallel to the existing ones and the length will be 2 km as this is the distance between the GDP and the TPP. Taking into account the decommissioning of units III and IV, the GDP will be sufficient for the natural gas CCPU needs.

116. The GPF includes the Gas Booster compressor Station (GBS), a gas metering unit with two pipelines (one working and one backup), system of blow off and discharge gas to vent stacks. The GBS is designed to compress gas and to stabilize its pressure before it is supplied to the GPF. Dust collectors will be installed upstream the GBS. Purging and waste gas pipe system will be provided to remove fuel gas and nitrogen from dry packing of GBS, and to provide periodic purges, as well as to ensure emergency discharge from safety devices.

B.2.2.2. Power island

117. CCPU is a one-piece combined-cycle plant designed to produce electricity in the basic mode of operation, and at the same time to cover heat schedule of heating loads and loads of hot water supply.

118. The CCPU is a combination of steam turbine and gas turbine units, connected by joint technological cycle (combined cycle). The combination of these units into one whole unit allows getting extra power and increasing the efficiency in comparison with the steam turbine and gas turbine power plants, as well as reducing the emissions of oxides of nitrogen and sulphur in the atmosphere.

119. The CCPU equipment includes one gas turbine (164.5 MW) with electric generator, a HRSG, one steam turbine (87.6 MW) with an electrical generator

120. The gas cycle performance rises as the temperature of the combustion chamber gases increases. In contrast, the temperature rise implies an increase in the NOX formation speed. The combustion chamber of the gas turbine is equipped with dry type low NOX burners, not consuming any water or steam, to counteract this harmful effect on the environment, achieving emissions below 25 ppm with 15% O_2 (approximately 51 mg/Nm3 at 15% O_2, dry basis).

121. In order to reduce the emissions of nitrogen oxides, in comparison with the units operated at the present day, dry low emission burners are used during the natural gas combustion process. This technical solution allows emission of NOx 3.5 times lower compared to concentration of flue gases in existing boilers and boilers to be dismantled. Furthermore, another design solution to decrease the emission levels of NOx is the use of structural features of the combustion chamber of the gas turbine that allows a combustion mode in which the fuel is almost completely burned.

122. The exhaust gases, at 112 ºC, will be disposed of through a 60 m high individual stack with a diameter of 6.0 m, located outside the building of the boiler room. It is metallic and it shall be equipped with a slide gate valve and a noise suppressor. Final height of the stack was determined by the atmospheric modeling results (Annex III).

B.2.2.3. Water supply and water treatment systems

123. Amudarya River will be the source of raw water at the new facilities of the CCPU through the existing intake canal of the existing facilities of Takhtiatash TPP. Just a new pump station within the existing intake canal will be needed to be constructed.

124. Water is used for the following purposes:

- Make-up water losses due to evaporation in cooling towers
- Make-up the blowdown of the circulating water system
- Steam cycle make-up
- Auxiliary needs of the chemical water treatment (CWT) of the steam cycle make-up
- Auxiliary needs of the pre-treatment plant

125. Primarily, the raw water initially settles in a settling tank to remove suspended particles. Settling tank is two-sectioned for an estimated water flow rate of 1000 m3/h, trapezoidal cross-section, performed in earthen bed with bulk embanks of clay loam. The bottom and the slopes of the settling tank are protected with cladded concrete encasement in two 120 mm layers with impervious membrane shield between the layers.

126. The clarified water is supplied to Chemical Water Pretreatment (CWP) after the settling tank for further processing with use of clarified water pumping station.

127. Due to the high content of solids and hard salts in raw water of Amudarya river, it is recommended to provide water clarification pre-treatment using clarifiers and soda lime treatment (N_2CO_3, CaO) with coagulation($FeSO_4$ coagulant) followed by mechanical filtering process. This pre-treatment allows removing the most part of calcium ions in processed water.

128. It is proposed that, within the total volume of makeup water (916 m^3/h), only 500 m^3/h will be exposed to such treatment.

129. After clarification process, this volume of treated water will be distributed as follows:

- 36 m^3/h will be used as makeup water for the Chemical Water Treatment of the CCPU's water-steam cycle.
- 110 m^3/h will be used to meet the auxiliary needs of the pretreatment plant (clarified water for the preparation of shaft turning gear reagent solutions, etc).
- 354 m^3/h will be mixed with a non-treated flow of 416 m^3/h of make-up water that will be further used as make-up water for the cooling system.

130. The following describes the main intake water uses:

a) Make-up water for circulating water system

131. Circulating water system for the new CCPU is designed in closed circuit, including the installation of five mechanical draft cooling towers and the auxiliary hydraulic engineering

structures according to the Law of the Republic of Uzbekistan –On water and water use" № 837-XII from 06.05.1993.

132. The total volume of circulating water in the cooling system of the new CCPU has been estimated at 12,862 m3/h. It is planned to install 5 mechanical draft cooling towers with an irrigation area of 16x16=256 m2 each.

133. Circulating water cooled in cooling towers will be supplied with circulation pumps to steam-turbine's condensers and to all auxiliary equipment of the CCPU. After the heat exchange in the condenser, the treated (heated) water will be supplied back to the cooling towers, for cooling. Further, the cycle repeats.

134. A water stream from the clarification process (354 ton/h) will be mixed with a non-treated water stream (416 ton/h) from the settling tank. This mixed water stream, with a total volumetric flow of 770 m3/h, will be subsequently stabilized by a correctional treatment using polyphosphonates in order to prevent the salt fouling of the equipment, pipe lines and cooling towers' sprinklers.

135. Next, the water is supplied to pumping station's water intake, where it is mixed with chilled on cooling tower circulation water is directed to the cooling mechanisms of CCPU.

136. Makeup water treated by such method will be used to makeup evaporation losses in cooling towers and to makeup blowdown losses of circulating system in amount of 770 m3/h.

137. To prevent the fouling, biocide treatment equipment is proposed, where used a sodium hypochlorite as the main component. Maintenance of working dosage of both components in the circulation water is carried out by automatic insertion of the product in proportion to the amount of make-up water. This processing will make it possible to partially soften the water sufficiently under given salt content of the source water to ensure stable operation of the circulation system.

138. The information on chemicals consumption for the clarifying treatment of circulating water system makeup water is provided in point B.4.1.2..

b) Make-up water for CCPU's steam cycle

139. The quality of the makeup water fed to the heat recovery steam generator shall comply with manufacturer requirements. To meet these strict requirements, the complete desalination of raw water is required at a previous stage. The composition of the intake water from Suenly canal is given in Table 5.

Table 5. Composition of intake water from Suenly canal

No.	Parameters	Unit of measurement	Value
1	Salt content	mg/dm^3	1360
2	Solid residual	mg/dm^3	1147
3	Suspended matter	mg/dm^3	434
4	pH	-	8.3
5	Sulfates (SO_4^{2-})	mg-eq/dm^3	8.4
		mg/dm^3	403
6	Chlorides (Cl-)	mg/dm^3	3.66
		mg/dm^3	128.1
7	Total hardness	mg-eq/dm^3	12.1

No.	Parameters	Unit of measurement	Value
8	Hardness Ca^{2+}	$mg\text{-}eq/dm^3$	6.5
		mg/dm^3	130.3
9	Hardness Mg^{2+}	$mg\text{-}eq/dm^3$	5.6
		mg/dm^3	68.1
10	Alkalinity	$mg\text{-}eq/dm^3$	sl-2.25
11	Hydrated acid (SiO_2)	mg/dm^3	8.4
12	Oxidation characteristics	mg/dm^3	1.4
13	Iron (Fe^{3+})	mg/dm^3	0.22
14	Nitrites (NO_2)	mg/dm^3	0.2
15	Nitrates (NO_3)	$mg\text{-}eq/dm^3$	0.1
		mg/dm^3	6.2
16	Sodium (Na^+)	$mg\text{-}eq/dm^3$	2.31
17	Anions	mg/dm^3	14.61
18	Cations	mg/dm^3	14.63

140. It is planned to build a new water treatment plant for total water desalination with a production rate of 36 t/h in order to meet the makeup water requirements of the CCPU‘s steam cycle. The appropriate water treatment method shall be determined by both the raw water composition and the treated water quality requirements.

141. Water in amount of 36 t/h will be supplied to Chemical Water Treatment (CWT) of desalinated water to makeup losses of basic cycle, and 30 t/h is required to makeup CCPU directly.

142. This Chemical Water Treatment (CWT) comprises a two-stage Na-cation exchange followed by a reverse osmosis process and the adjustment of chemically desalinated water‘s parameters on mixed-bed filters.

143. For highly mineralized water, the continuous operation of osmotic equipment is allowed after particular ionization (Na-cation exchange) of clarified water only. It is proposed to install 4 filters with diameter of 2.6 m on the first stage, and 2 filters on the second stage. Two tanks of soda-lime treated water and two tanks of sodium cation-exchanged water with a capacity of 40 m^3 each will be provided to ensure trouble-free operation of plant.

144. The reverse osmosis plant consists of 2 units and 2 plants with a production capacity of 20 ton/h each. In this case, 1 unit is in operation and 1 is remains as backup. The load of the plant on processing water is 30 t/h.

145. The sequence of plant operation is as follows. High-pressure pumps boost the plant inlet pressure and treated water goes to the reverse osmosis membrane elements. The water flow exposed to reverse osmosis pressure is divided into two streams on semi-permeable membranes. 1-2% of the total salt flow penetrates into the less concentrated stream; (permeate). After adjustment in MBF filters, this stream is supplied for the cycle makeup.

146. The second stream (concentrate) containing the bulk of dissolved salts is discharged to plant drainage. The portion of this water can be used for salt solution preparation for further regeneration of Na-cation filters.

147. Reverse osmosis plants shall be flushed periodically to ensure their efficiency. There are two types of flushing:

- During the operation, membranes are flushed at set intervals by the supply of permeate to the concentrate pipeline.
- Chemical flushing of membrane modules will be provided if permeate productivity of plant is reduced by 10%, or if permeate salt content increases by 10%, or if pressure difference between treated water and concentrate increase by 15% of the initial difference.

148. Further, permeate is supplied to cartridge MBF filters, and after advanced treatment and Ph adjustment, the treated water is supplied to CCPU heat recovery steam generator makeup. Two backup condensate tanks (one is in operation, one is standby) with a capacity of 1000 m^3 each will be provided to ensure trouble-free operation of plant. Preliminary data on chemicals consumption in the makeup water processing for the CCPU's steam cycle is detailed in point B.4.1.2

149. Water sent to the steam-water cycle required conservation in boilers with hydrazine and ammonia in the mode boiler stop with supply of the conservation solution into the feed water line before the economizer and the line of phosphate in the boiler drum is provided. This system is designed to maintain optimum chemical conditions in the boiler units.

c) Water for fire fighting

150. On the other hand, the fire protection system of the new CCPU draws the firewater from the cooling tower basin. This basin must store the volume of water required to meet the needs for fire suppression. The design volume of water for fire fighting purposes will be provided in power ponds and the minimum required duration of water supply is 3 hours, in accordance with regulatory requirements.

151. At this current design stage, a firewater water pump station is provided with two firewater pumps installed in parallel (one working and one standby pump), with a discharge capacity of 500 m^3/hour and a pressure of H=63 m.

152. The new CCPU site includes a pressurized water ring feeding system equipped with stop valve and fire hydrants in manholes. Firewater is supplied from the firewater pump station to the water ring surrounding the CCPU site via two pipelines.

B.2.2.4. Heating water

153. A new heating-water converter plant is designed to provide heating of system water in system water heaters by extraction steam from steam turbine heat extraction, and to supply system water using line pumps in main heating system for consumers heat supply. The heating water system uses softened water that is treated in the existing water treatment plant.

154. Condensate pumps will be also provided to ensure the pumping of heating steam condensate from the water system heaters to a steam-water cycle unit. Steam pipeline (laid from heat extraction steam removal) passes through the heating water converter plant room.

B.2.2.5. Drinking water

155. Urban water supply networks are the main source of service and drinking water. Water supplied from the municipal network to the CCPU site is used for drinking and sanitary needs (showers, eye washers, toilets, etc.).

156. Drinking water supplied from the city mains will fill the two existing tanks, with a capacity of 600 m^3. It is planned to build a new drinking and service water pumping station at the place of the existing one for the supply of the newly designed buildings and constructions of the CCPU. The design of this new pumping facility has been approved in accordance with the regulations of KMK 2.04.01-98 ―Building internal water supply and sewage system".

B.2.2.6. Effluents System

157. The expected effluents generated by operation of the new facilities of CCPU are:

Domestic effluents

158. Domestic wastewater or sanitary effluents (4,401 m3/h) from buildings and structures of the CCPU are discharged with no treatment through the pipeline by gravity flow into the newly designed sewage pumping station. After that, effluents are pumped to the networks of the TPP's industrial site and then fed to the sewage treatment facilities.

159. At the current design stage, an underground sanitary sewerage pump station with 1.5 m diameter and with pumps providing capacity 6-16 m3/hour and pressure lift 5-27 m, is provided. Manholes are installed along gravity-flowing sewerage networks at distance 35-50 m on straight piping, turns and interconnections.

Rainfall effluents

160. Rainwater from the roof of the CCPU's main building and from the roofs of auxiliary buildings and other facilities will be collected along the territory and discharged into the existing storm water sewage system. The final storm water discharge point is located in the area of the existing main building runoff drain system. At this stage, the coordinates of the connection point are not defined and they will be specified during the preparation of the detailed design documentation for the project.

Oil and Chemical effluents

161. Certain volume of oily wastewater will be generated within the operation of the new CCPU facilities in activities such as washing the equipment, washing the floors, drainage of transformer sites, washing the compressors, oily effluents in the stormwater, etc. These oily effluents will be collected and led to the oily effluents treatment facility.

162. Local facilities are used for the treatment of effluents from the Takhiatash TPP's CCPU without using the existing effluent treatment facilities. In particular, local effluent neutralization units and oil traps for oily wastewater treatment are used as part of the Chemical Water Treatment.

163. Chemical effluents from the water treatment plant and from the heat-recovery boiler blowdown, in a total amount of 115 m^3/h, are collected in the CCPU's slime lagoons and then discharged into the TPP's discharge channel. All effluents directed into surface-stream flow should comply with requirements of ―Sanitary Rules and Norms for the protection of surface waters against pollution" SanPiN №0056-96, Tashkent, 1996.

164. Furthermore, the following measures are proposed to improve the process and reduce effluents:

- Washing and backwashing water from the Na-cation filters is pumped back into the clarifiers.
- Washing water from the reverse osmosis facilities is collected and used for backwashing of the Na-cation filters and further on, after reuse, is pumped back into the clarifiers.
- The Na-cation filters recycling water is collected and neutralized in a separate neutralization unit (taking the concentration of salts in this stream into consideration) and then directed to the wet salt storage.
- The bitter-water concentrate from the reverse osmosis facilities is collected and partially used to replenish water losses from the preparation of salt solution at the salt storage and the remaining volume is discharged with the flushing of the circulation system.

Circulation system blowdown

165. In the closed cooling water circuit a constant evaporation of the water takes place. As a result, the remaining water has a high concentration in solids and dissolved salts, what makes it necessary to bleed it periodically. Blowdown water from cooling tower is relatively clean so that it is directly discharged into the outlet channel with no treatment.

166. The temperature, flow rate and pH of cooling water will be monitored in order to check its compliance with the discharge limits to the canal, according to current regulations.

B.2.2.7. Storage facilities

167. Three different storage facilities are located within Takhiatash TPP terrains. These are the chemical agents' active storage, the materials active storage and the drummed oil storage, whose dimensions are shown in Table 6.

Table 6. Dimensions of storage facilities

Building	**Dimensions (m)**	**Function**
Active storage of chemical agents	18 x 9	Active storage with chemical stocks for 15 days
Active storage of materials	18 x 18	Storage of spare parts and materials required for preventive maintenance and current repair of process equipment.
Drummed oil storage	36 x 12	Pure drum oil storage to supply oils to the main building consumers. Drums will have a capacity of 200 l, a preliminary estimation. Drum oil will be delivered to the main building by transport means. Pans and containers will be handled using automated lift trucks. Oil pans will be arranged in warehouses using self-propelled stacker-truck

168. Also, there is an underground emergency drain oil tank with the turbines with dimensions 4x3 m located above the engine room o the gas turbine plant.

B.2.2.8. Laboratories

169. The expansion project includes an express laboratory that will be placed in the boiler room building. It will be designed to systematically perform the express-analysis of water and steam quality.

B.2.2.9. Fire fighting system

170. Automatic fire-extinguishing at the facilities of newly CCPU is executed by the means of modern automatic fire fighting microprocessor system, which includes tools for fire detection, as well as for automatic fire-extinguishing at the relevant facilities. Fire precaution measures are provided in accordance with current fire safety rules and regulations for utility companies at Uzbekistan (2004) and ShNK 2.04.09-2007 ―automatic fire-fighting equipment for buildings and structures" as well as the correspondent international standards.

B.2.2.10. Power control system

171. The automated control system is designed to perform the functions of the logical control in automatic and manual modes, emergency and restrictive protection systems, warning and alarm, monitoring, displaying and archiving of technological parameters, high-speed recording of major events and figures in emergency situations.

B.2.2.11. Power evacuation

172. Power output of the new generator will be connected to the existing substation which will be adapted. For the adaptation of the substation to the new unit, existing transformer could be moved. If so, transformer oil must be managed in an environmental friendly way and taking good international practice in order not to cause soil pollution. As units III and IV are going to be decommissioned, the existing transmission line has enough capacity to evacuate power generated in the new CCPU.

B.3. Description of works

B.3.1. Construction phase

173. Due to the fact that the present project is not to build a new Thermal Power Station, but to extend an existing plant, and in view of the fact that the new CCPU will be located at the same site as the Power Station, it will not be necessary to build new access routes and certain infrastructure, since these are already in place for existing Units (for instance, no new water intake and discharge canal or transmission line are needed). Consequently, the extent and volume of the works will be less than those necessary for a new Power Station being built on a new site.

174. For the construction of CCPU and its auxiliary buildings and facilities, a land plot of 21 hectares shall be acquired to set new boundaries of the plant's protected territory. This area will be located on the southern border of the TPP, at the end of main building. Construction of CCPU shall involve removal of guardhouse, gatehouse, some production facilities and replacement of rail track. As part of CCPU construction it is planned to organize a new mud disposal field for the water treatment plant as well as an evaporation pond for chemical flushing of the waste heat boiler next to the existing mud disposal field.

175. Before the construction of CCPU it is important to make a preparation of the site, which includes: the dismantling of buildings, railways and security zone transfer. The construction of the CCPU is planned to take place between 2014 and 2018, pilot tests shall last from January 2018 till December 2019.

176. A description of the construction phase of the new CCPU and the new infrastructure required for operating it is detailed below.

Phase 1: Civil works

177. - Site grading and levelling. This consists of removal and storage of top soil and any old backfilled material in the site. The disposal excavated material will be transferred outside the area. Rough and finish grading, back filling and compaction will be done as agreed. Site grading will provide self-draining, graded site, and will be sloped away from buildings and equipment foundations to avoid ponding. The edges of all filled and excavated areas will be sloped and drained to give stable profiles. Prior the compaction of filled material, compaction trials will be carried out using the proposed equipment and procedures.

178. - Preparation of the temporary on-site buildings, in which will be housed the cabins and storage space for the various companies working on the construction site. The various materials supply zones will be properly marked out, in order to facilitate a clean and orderly site. A specific space for machines will be marked out.

179. - Excavations and building foundations, and equipment belonging to the new plant

180. - Building separation networks for drainage collecting (chemical substances, residual sanitary oily and clean rain water) and channelling for conduits, electrical conduits and cabling.

181. - Construction of the various warehouses and buildings. Design of the buildings will pay special attention to protection against fire and noise. Safety will be a priority. Each building will possess the facilities required according to its type and its function: Lighting, low voltage lighting, heating, air conditioning, ventilation, communication, floating cranes etc.

182. - Construction of internal roads and adaptation of the existing ones.

Phase 2: Assemblage

183. - As soon as the civil engineering phase has been completed, the various machines that constitute the Power Station will be assembled. Sequencing will be as follows: Mechanical assemblage, electrical assemblage and instrument assemblage.

184. - During the mechanical assemblage phase, hydraulic tests of all circuits will be carried out in the various systems.

185. - Before commissioning, ventilation and chemical cleansing of the boiler will be carried out. Demineralised or osmosis-processed water will be used for that purpose, to which will be added certain chemical reagents. The cleansing solutions will be maintained in circulation for a certain time, and at the end of the procedure, will be handed back to an authorised service provider.

Phase 3: Trials and commissioning

186. - Testing the various types of equipment (pumps, valves, etc).

187. - Systems trials.

188. - Operation guarantees trials of the new plant.

B.3.2. Decommissioning phase

189. "Decommissioning" a power plant can be defined as the cessation of the operations and the withdrawal of the facility from service, followed by its transformation into an out-of-service state and eventually, its complete removal.

190. The efficiency improvement project involves the decommissioning of the units III and IV. During the commissioning of the new combined cycle unit, in order to maintain the power plant available capacity, together with the more modern units V and VI, it will be necessary to keep units III and IV in operation, complementing the power generated by the CCPU in order to cover the demanded power at all time. Once the CCPU completes all tests and it is declared in commercial operation, it will start the decommissioning of the units III and IV.

191. Main activities involved in the decommissioning until the complete removal of the facilities and the estimated duration of them are as follows:

Table 7. Main activities involved in the decommissioning

No.	Activity	Description	Duration
1	Shut down and cool down of the units III & IV	Operation to be performed, according to current operation procedures, until the complete shutdown of all steam turbines, boilers and auxiliaries except service utilities, control system and fire fighting system.	Three (3) days
2	Disconnection of main interfaces	Units III and IV are physically disconnected from the HV switchyard and gas system. Motor control centers are disconnected from the supply bus bars. The low and medium voltage bus bars will be kept energized as required for the supply of basic services such as lighting, air compressors, service water, fire fighting systems, etc...	One (1) week
3	Emptying and cleaning of tanks and fluid systems	Stored liquids (oil, demineralized water, mazut, among others) will be reused as much as possible. Stored liquids below the pumping level of tanks and drains of cleaning activities will be drained and treated and properly disposed of by mean of authorized waste management agents or managed under good international practices regarding with the protection of the environment.	Two (2) months

No.	Activity	Description	Duration
4	Removal and disposal of hazardous waste materials (thermal and acoustic insulation/ mineral fibers from older production /sealing materials)	All these materials will be identified, inventoried and removed. Asbestos will be disposed of properly. Waste disposal comes under the remit of the provisions of the applicable legislation (stringer option between national and international standards).	Two (2) months
5	Dismantling of systems and components	In general technical equipment and components will be demounted in an inverse sequence as they were erected, starting from wiring and cabling and following with instruments, tubing, piping, equipment and supporting structures. Some equipment or components with remaining life could potentially be reused as spare parts for the remaining blocks or prepared for refurbishment. These activities will be performed in accordance with an established schedule and procedures, avoiding impact on operating units.	Eight (8) months
6	Demolition of buildings and structures	It will be carried out after complete dismantling of equipment and components. Demolition of units III and IV buildings will be engineered considering existing interfaces such as: Electrical and control Utilities Building access	Three (3) months
7	Waste management	Produced hazardous and non hazardous waste materials will be disposed of in accordance with applicable norms and permits from the Environmental Authorities and international standards	Two (2) months
8	Land remediation	Potential remaining land contamination will be assessed and afterwards materials potentially hazardous will be removed and disposed off. This activity will be carried out in accordance with international, national and local environmental regulations. The land formerly occupied by the units III and IV and related facilities will be finally released at a ~~-g~~reen field" condition, ready for a new potential use	One (1) month

192. According to the schedule, boilers No. 1-4 shall be shut down first, in the first half of 2018 since they are the most worn out boilers connected to a relatively low stack of 80 m; during the second half of 2018, boilers Nr 5 and 6 connected to the 150 m stack shall be shut down.

B.4. The project's environmental and social aspects

193. The implementation of the project for construction of the new CCPU to replace obsolete and worn-out boiler units shall help to improve environmental situation in the concerned area.

B.4.1. Natural resources, chemical substances and water

194. After the construction of CCPU, the production activity of Takhiatash TPP will be accompanied by withdrawal natural resources (natural gas), water and consumption of chemical substances.

B.4.1.1. Fuel consumption

195. Takhiatash TPP is based on a dual-fuel concept, firing natural gas as primary fuel and a liquid fuel oil (mazut) as a back-up for emergency situations. For the new CCPU natural gas will be both primary and back-up fuel.

Natural gas

196. The primary fuel used in Takhiatash is natural gas with the composition and properties showed in Table 8 and Table 9, respectively.

Table 8. Mole composition of natural gas fired in Takhiatash TPP

Component	Formula	Mole fraction (%)
Methane	CH_4	92.93
Ethane	C_2H_6	3.58
Propane	C_3H_8	0.78
n-butane	C_4H_{10}	0.18
iso-butane	C_4H_{10}	0.14
n-pentane	C_5H_{12}	0.05
iso-pentane	C_5H_{12}	0.06
Hexane	C_6H_{14}	0.16
Oxygen	O_2	0.08
Carbon dioxide	CO_2	1.30
Nitrogen	N_2	0.74

Table 9. Natural gas main properties at 20 ºC and 760 mm Hg (reference conditions)

Property	Value
LHV (kcal/m^3)	8278
Wobbe index (kcal/m^3)	11,780
Density (kg/m^3)	0.73

<u>**Current consumption of natural gas**</u>

197. Natural gas consumption from Bukhara field in Takhiatash TPP in 2011 amounted to 1117.2 million m^3 per year (at reference conditions of 20ºC and 760 mm Hg), for an annual electricity output to the mains of 3072.9 GW·h. The heat rate of the TPP was 12552 kJ/kWh.

Future consumption of natural gas

198. The consumption of natural gas expected for the new CCPU at 100% of the load in the average environmental conditions of the area is approximately 406.9 million m^3 per year. The total consumption of natural gas at Takhiatash TPP operating units V and VI and the CCPU will be 1070.4 million m^3 per year. The total heat rate will be 9672 kJ/kWh, being 11585 kJ/kWh and 7545 kJ/kWh for the block V-VI and the CCPU, respectively. All these values are shown Table 10.

Table 10. Main technical indices and fuel consumptions for current and future

Index	Current indices (before CCPU commissioning)		Future indices (after CCPU commissioning)	
	III and IV	V and VI	V and VI	CCPU
Annual electricity output (GW·h)	955.9	2320.4	2097.6	1903.3
Total	3276.3		4000.9	
Annual electricity output from buses (GW·h)	888.1	2194.6	1983.8	1785.6
Total	3082.7		3769.4	
Annual electricity output to the mains (GW·h)	885.3	2187.6	1977.5	1779.9
Total	3072.9		3757.4	
Heat rate for electricity supply (kJ/kW·h)	15215	11474	11585	7545
Total	12552		9672	
Annual heat supply (thousand Gcal)	3240	-	-	139100
Total	3240		139100	
Specific consumption of natural gas for heat supply (kJ/kcal)	5.567	-	-	4.511
Total	5.567		4.511	
Annual natural gas volumetric consumption (million m^3)	390.5	726.7	663.5	406.9
Total	1117.2		1070.4	
Annual natural gas mass consumption (kton)	285.1	530.5	484.4	297.0
Total	815.6		781.4	
Gas savings for the same electricity supplied to the mains of 3072.9 GW·h (million m^3)	-		321.2	
Increase of electric supply to the mains at the same fuel consumption rate of 1117.2 TW·h/year (GW·h)	-		854.4	

199. Considering these figures, the current natural gas supply capacity, taking into account the dismantling of units III and IV, will be quite sufficient after the commissioning of CCPU and the indices of Takhiatash TPP will clearly improve. The reduction of the heat rate for electricity supply is estimated at 2,880 kJ/kWh, from 12,552 kJ/ to 9,670 kJ/kWh. The reduction of the specific fuel consumption for heat supply is estimated at 1.056 kJ/kcal, from 5.567 to 4.511

kJ/kcal. The increase of annual electric supply to the mains is estimated at 854.4 GW·h at the same fuel consumption level of 1,117.2 million m^3 per year. Annual gas savings, compared to the current consumption in the existing equipment of Takhiatash TPP, are estimated at 321.2 million m^3 for an equal electricity output of 3,072.9 GW·h.

Fuel oil (Mazut)

200. Mazut, a distillate fuel oil, is required as a back-up fuel for emergency situations as, for example, a power supply failure just in the existing facilities. Mazut is stored for a power generation capacity of 15 days as there is a power supply guaranty to fulfil. Nevertheless, Mazut has not been used since 2004. The Table 11 provide main averaged technical characteristics of used mazut. The future CCPU will not require mazut as back-up fuel.

Table 11. Main averaged technical characteristics of used mazut

Low operating heat value, $Q^р_н$	38.345 MJ/kg
Contain in fuel working mass of:	
sulphur $S^р$,%	3,1
Ash $A^р$,%	0,031
Density p (at 0 ^{0}C and 760 mm.of Hg)	945 kg/m^3

B.4.1.2. Chemical products and materials consumption

201. In the following table, consumption of chemical and raw materials of the existing facilities at Takhiatash TPP during 2012 are presented.

Table 12. Information on main and auxiliary raw materials

№	Name	Type	Quantity	Units
1	Metal		260,067	tn
2	Brass	19×1×700	9600	units
3	Welding die	Разные	4879	tn
4	Wool		14	m^3
5	Asbestos	A5-50	131.1 (1)	tn
6	Technical rubber		957	tn
7	Salt		207	tn
8	Lime		390	tn
9	Cations	Ку-2-8	55,9	$м^3$
10	Sulphate coal	DAK	5100	tn
12	Car tire	Разные	31	units
13	Oil		9100	liters
15	Transformer oil	TP-22	50961	Kg
16	Turbine oil		540	Kg
18	Luminous lamp	DB-40	90	units
19	Paronite	Разные	2528	Kg

№	Name	Type	Quantity	Units
20	Benzin	AI-80	89361	liters
21	Dizel		97986	tn
22	Accumulators	Разные	23	units

(1) Average amount for asbestos is 94 tn/year

202. In the future situation, the above consumptions will be reducing as units III and IV are going to be decommissioned. The future consumption of chemical and materials will a sum of the part of the above table corresponding to the consumption due to the operation of the remaining units V and VI and the consumption due to the operation of the new CCPU.

203. The estimated annual consumption of chemicals for treating the make-up water for the circulating water system of the new CCPU is given in Table 13.

Table 13. Chemical products consumption

Product	**Consumption rate** *kg/m³ water*	**Annual consumption** *tons*	**Comments**
Lime carbonate	0.050	185.6	I-stage clarification with sodium carbonate. Water consumption from Amudarya river = 3,712,000 m^3
Sodium carbonate	0.30	1,113.6	
$FeSO_4$ coagulant	0.053	196.74	
Polyphosphonate (analogue- IOMS-1)	0.010	61.6 (on a per 770 ton/h basis)	
Sodium hypochlorite (10%)	0.02	123.2 (on a per 770 ton/h basis)	

204. The estimated annual consumption of chemicals for treating the make-up water for the steam cycle of the new CCPU is given in Table 14.

Table 14. Chemical products consumption for the treatment of the steam-water cycle make-up

Product	**Consumption rate** *kg/m³ water*	**Annual consumption** *tons*	**Comments**
Lime carbonate	0.050	14.4	I-stage clarification with sodium carbonate. Water consumption from Amu Darya river = 288,000 m^3
Sodium carbonate	0.3	86.4	
$FeSO_4$ coagulant	53	15.26	
Sodium chloride (100%)	1.0	288.0	Two stage cationization
Chlorine hydride (30%)	0.033	9.6	On reverse osmosis units
NaOH alkali (100%)	0.01	2.9	

B.4.1.3. Water requirements

205. Water supply is required for service and drinking purposes, production purposes and emergency fire-fighting.

206. The water required for normal operation of all units at Takhiatash TPP (the new CCPU and those already existing) can be classified in two types depending on its source, as follows:

a) Service and drinking water from pipeline supply system of Takhiastah city

207. Service and drinking water consumption for the existing TPP amounted to 3,460,000 m^3 in 2011. After the decommissioning of the III-IV units and the commissioning of the new CCPU, drinking water needs will remain at the same level, as number of workers will remain the same. There is no need of extension of the service and drinking water.

b) Water from canal Suenly used in cooling system, auxiliary services and water treatment plant for production technical water

208. Both existing units of TPP and the new facilities of the CCPU require water from canal Suenly for cooling system, auxiliary services and water treatment plant. In both cases, the main consumption corresponds to the cooling water system. In the first case, the circulation water system is an open circuit, so that the water consumed (from channel) for cooling is discharged again to the channel. In the second case, the cooling water system of CCPU is closed circuit, thus reducing the water intake from canal for cooling purposes.

209. The estimated consumption of make-up water (for replenishment of losses in water cooling towers, blow down of circulatory system, to makeup Chemical Water Treatment (CWT) of CCPU's water-steam cycle) is 916 m^3/h, including 110 m^3/h for make-up water pretreatment unit for auxiliaries, 770 m^3/h for replenishment of losses in water cooling tower for evaporation and blow down of circulatory system, and 36 m^3/h to makeup CCPU's water-steam cycle. Therefore, the annual water consumption for make-up of the CCPU's water steam cycle is 288,000 m^3 and the annual water intake from Suenly canal amounts to 7,328,000 m^3.

Table 15. Water consumption at the Takhiatash TPP

Water consumption	**Water flow (m^3/h)**	**Annual water consumption (m^3/yr)**
Steam cycle make-up	36	288,000
Cooling tower make-up	770	6,160,000
Make-up water pretreatment unit for auxiliaries	110	880,000
Total	916	7,328,000

210. For the current situation, the water intake at Takhtiatash TPP is 104,145m^3/h, including the water requirements of units III and IV (50,145 m^3/h) and for units V and VI (54000 m^3/h). On the contrary, the water intake needed for cooling water makeup for the new CCPU is estimated at 916 m^3/h.

211. Table 16**Error! Reference source not found.** shows that the annual water intake volume from Suenly Canal in the current situation amounts to 453.0 million m^3, whereas the future water requirements have been estimated at 277.4 million m^3. Therefore, the decommissioning of units III-IV and the commissioning of the new CCPU will lead to an annual reduction in the water intake from Suenly Canal estimated at 173.6 million m^3.

Table 16. Current and future technical water requirements from Suenly Canal

Parameter	**Units**	**Current (before CCPU commissioning)**		**Future (after CCPU commissioning)**	
Operating units	-	Units III-IV	Units V-VI	Units V-VI	New CCPU
Operating hours	h	3,084	5,525	4,994	8,000
Hourly water requirements for each unit	m^3/h	50,145	54,000	54,000	916
Total hourly water requirements for the TPP	m^3/h	104,145		54,916	
Annual water requirements	million m^3/yr	154.6	298.3	269.7	7.3
Total annual water requirements	million m^3/yr	453.0		277.0	
Water requirements reduction	million m^3/yr	0		175.9	

212. The change from the open once-through cooling system of units III-IV towards a closed circuit with cooling towers of the CCPU will lead to the reduction of the large water intakes and, at the same time, it will reduce the discharge of large amounts of warm cooling water to the canal and may also reduce the consumption and emission of chemicals.

213. However, regarding actual water consumption terms, the net technical water consumption of the TPP will increase due to make-up water needs for evaporation losses in the cooling towers of the CCPU. The explanation lies within the net water consumption of the current open cooling circuit, which is almost zero because all the intake water is subsequently discharged back to the canal.

214. Considering as an approximation a cooling tower cycles of concentration of 1.5, blow down flue rate would be 515 m^3/h and therefore, water consumed in evaporation process would be 225 m3/h. Considering 8000 operation hours for the CCPU, the annual consumption would be 1.8 million m3.

B.4.2. Generating sources

215. Generation sources for the Takhiatash TPP are and will be:

- Emissions
- Noise
- Effluents

- Waste
- Jobs

B.4.2.1. Emissions

Current emissions

216. In the TPP at present, the emission of pollutants into the air is caused by the exhaust gas combustion of natural gas in units III to VI. Natural gas is considered a clean fuel as it produces less atmospheric contamination than other liquid or solid fuels, due to the following reasons:

- Natural gas combustion gases lack any particles.
- They have a lower emission level of volatile organic compounds when compared with other fossil fuels.
- The presence of unburned fuel is lower due to the close contact between the natural gas and the oxidiser (air).
- It is the fossil fuel with the lowest carbon content. The greater H/C ratio of the natural gas composition with regard to other fossil fuels makes its combust release less CO_2.
- Natural gas almost entirely lacks any sulphur in its composition, so SO_2 emissions are insignificant. The low natural gas sulphur content is simply due to a small concentration of an odorant (Tetrahydrothiophene-THT), a mercaptan containing sulphur and which, for safety reasons, is added to natural gas to enable its detection. Under exceptional conditions resulting from faults in the supply system, natural gas may arrive with a higher sulphur contents for short periods of time.

217. Taking into account all of the above, it can be concluded that the only pollutant emitted to the atmosphere in significant amounts is NO_x.

218. Exhaust gases from boilers No. 1-4 (units III and IV) are discharged into the atmosphere through the 80 m high stack whereas gases from boilers No. 5-6 (unit III and IV), 7 (unit V) and 8 (unit VI) are discharged through the 150 m high stack. The below table is a summary of the main emission source parameters in the existing situation.

Table 17. Emission sources‘ main parameters

Parameter	Stack 1 (III and IV units)	Stack 2 (V-VI units)
Stack diameter (m)	5.1	7.2
Height (m)	80	150
Gas output speed (m/s)	20.0	21.2
Flow rate (m^3/s)	409.26	863.98
Temperature (ºC)	135	191

219. Based on the monthly emission data reported by the TPP, the annual emission rates from each boiler have been calculated by weighting the monthly emissions with the specific operating hours of each boiler and adding the monthly values for the whole year. According to these calculations, in 2011 total emissions of NO_2 and NO amounted to 2170.25 and 352.66 t/yr, respectively. In the same way, in 2012 total emissions of NO_2 and NO amounted to 2050.82 and 333.26 t/yr, respectively, as shown in Table 17**Error! Reference source not found.**.

220. Maximum allowed emissions (MAE) were calculated by unitary enterprises “Uzenergosozlash” and have been passed to State Nature Protection Committee for approval in 2009, which are also presented in Table 18**Error! Reference source not found.**.

221. As can be observed in the graph below, the existing emission values in the TPP are under the MAE.

Table 18. Existing emissions in 2011 and 2012 and emission limits (MAEs) as nominal or design capacity

Pollutant	**Existing emissions (2011)**		**Existing emissions (2012)**		**MAE**	
					Stack 1+Stack 2 = Total	**Stack 1+Stack 2 = Total**
	g/s	*t/y*	*g/s*	*t/y*	*g/s*	*t/y*
NO_2	83.75	2170.25	88.38	2050.82	158.47+283.38 =441.85	358.27+2768.02 =3126.28
NO	13.61	352.67	14.36	333.26	25.75+46.05 =71.80	58.22+449.8 =508.03
CO	0	0	0	0	3.14+6.58 =9.72	23.44+140.70 =164.16

Table 19. Average annual capacity emission limits

Pollutant	**MAE**	
	Stack 1+Stack 2 = Total	**Stack 1+Stack 2 = Total (8000 operating hours/y)**
	g/s	*t/y*
Nitrogen dioxide (NO_2)	35.054+110.76=145.814	4199
Nitrogen oxide (NO)	5.696+17.998=23.694	682
Carbon oxide (CO)	2.29+5.63=7.92	228

222. Monthly instrumental measurements of NO_2, NO, CO, SO_2 and benzopyrene in exhausted gases at the boilers have been conducted by the enterprise “Uzenergosozlash”. Having analyzed emissions in 2011 and 2012 it can be concluded that SO_2 and CO measurements recorded show a 0 value (which could indicate that the measurements were not taken or that there were mistakes in the measurements as it is very estrange to have a 0 value in these parameters). The NO_2 and NO values are shown in the following graphs.

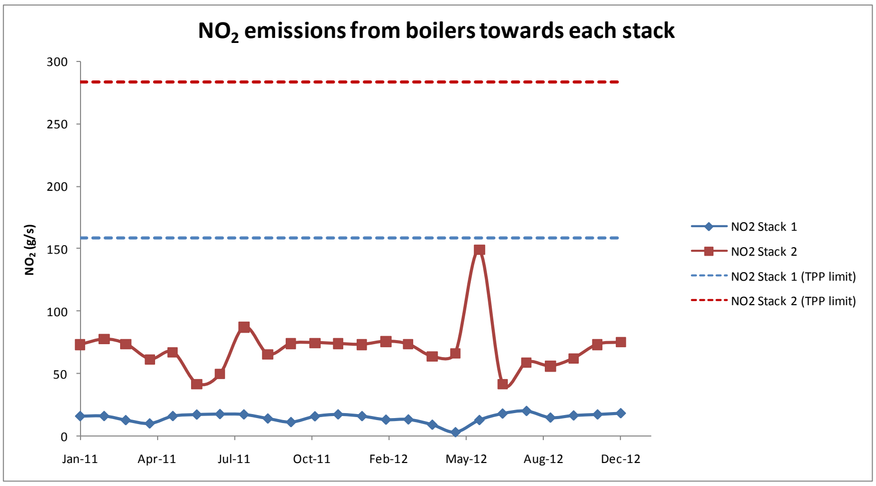


Figure 13. Comparison between NO2 emissions from boilers towards each stack and

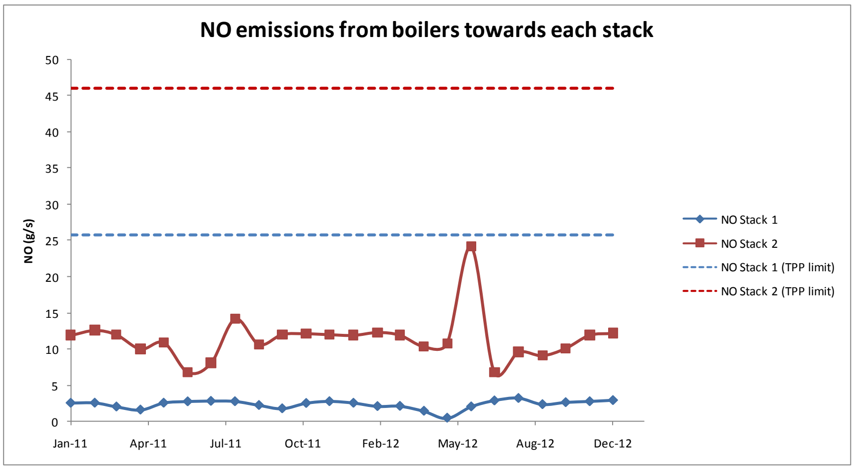


Figure 14. Comparison between NO emissions from boilers towards each stack and

223. Results of measurements showed that emissions from TPP do not exceed the approved MAEs.

224. Regarding international standards, the World Bank standard for boilers (table 6 C of the IFC EHS guidelines for thermal power plants (December 2008) only refers to NOx emissions. The WB standard for NOx is 240 mg/Nm^3 (Dry gas, 3% O_2).

225. In the following graphs the comparison between the World Bank standard and the monthly measurements between 2011 and 2012 can be observed.

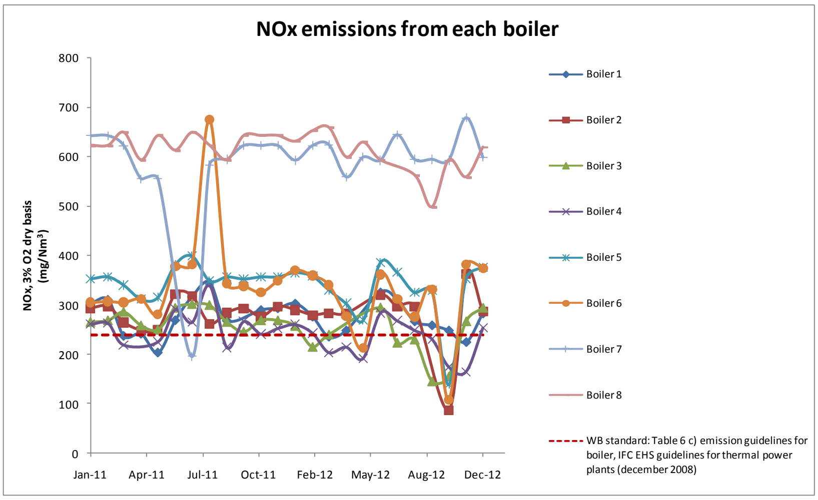


Figure 15. Comparison between total NOx emissions (mg/Nm3) from each boiler and

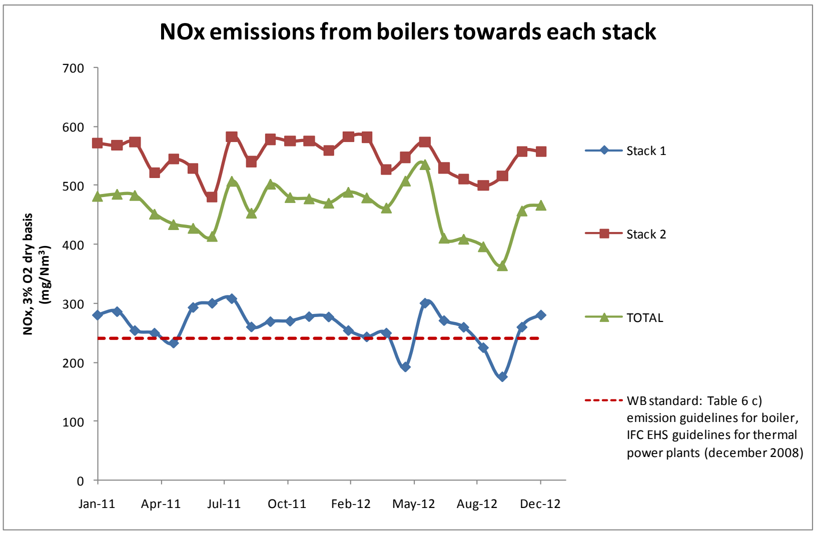


Figure 16. Comparison between total NOx emissions (mg/Nm3) from boilers to each

226. As can be observed, stack 2 exceeds World Bank standard, being boilers 7 and 8 the highest contributors. Stack 1 exceeds World Bank standard the most of the time, being the contribution of the boilers 1 to 4 quite similar.

227. The CO_2 emission per year for the existing TPP is 2400 (1000 $tCO2_e$).

Future emissions

228. In the future operation of the Takhiatash TPP, the emission of pollutants into the air will be caused by the exhaust gas generated in the combustion of natural gas both in the remaining units V and VI and in the future CCPU.

229. The exhaust gases of the remaining boilers 7 and 8 will be disposed of through the 150 m high existing stack and the new exhaust gases of the CCPU through a 60 m high individual stack. Final height of the stack was determined by the atmospheric modelling results (Annex III).

230. Taking into account the previous measurement of years 2011 and 2012 we already concluded that the results showed that emissions from the remaining units V and VI do not exceed approved MAE. Nevertheless, if we take into consideration the World Bank standard indicated above, the following graph shows how this standard is always exceeded.

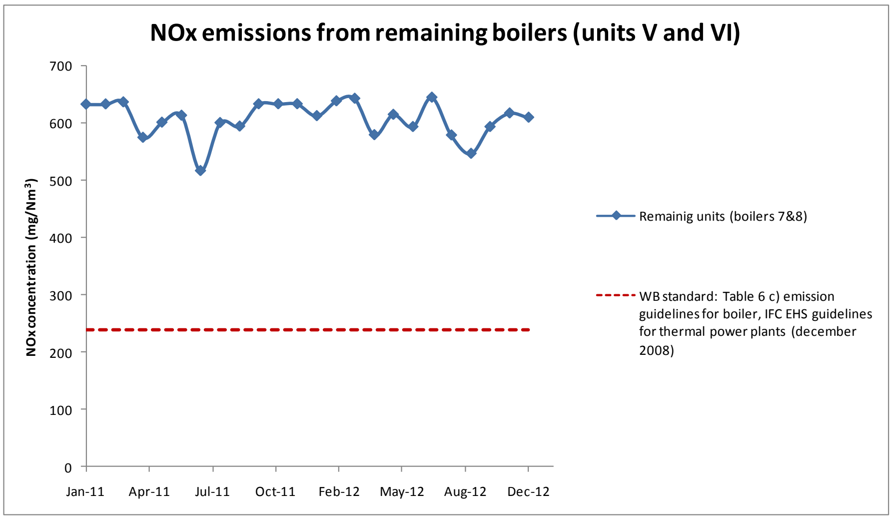


Figure 17. Comparison between total NOx emissions (mg/Nm3) from boilers of the remaining units (V and VI) to each stack and the World Bank limits.

231. As it was explained previously, natural gas is considered a clean fuel and also, the greater performance of the cycles, gives a 60% lower CO_2 emission than that of a conventional thermal power plant, with the resulting greenhouse effect reduction.

232. The gas cycle performance rises as the temperature of the combustion chamber gases increases. In contrast, the temperature rise implies an increase in the NO_x formation speed. The combustion chamber of the gas turbine is equipped with dry type low NO_x burners (Dry low NO_x Hybrid Burner Ring (HBR)), to counteract this harmful effect on the environment, achieving emissions below 25 ppm with 15% O_2 (approximately 51 mg/Nm^3 at 15% O_2, dry basis).

233. For the future CCPU, emission concentration levels for the various pollutants will be defined in compliance with the Uzbek legislation on industrial emissions (integrated pollution prevention and control) and the World Bank IFC EHS guidelines for Thermal Power Plants IFC Guidelines (December 2008), whichever is more stringent. World Bank standard for combustion turbine

(Table 6 B) is 51 mg/Nm^3 (dry gas, 15% O_2). This emission limit has been taking into account for the atmospheric dispersion model.

Table 20. Emission rates estimated for the future CCPU.

Parameters	Emission of the CCPU mg/Nm^3 (dry gas, 15% O2)
NO_2 emission rate*	51
NO emission rate**	43
CO emission rate***	20

*Worst case hypothesis: all NO_x emitted as NO_2
**Considering 84% of NO_x is emitted as NO
***Bibliographic data (very conservative)

234. The below table is a *résumé* of the main emission source parameters in the future situation. The above stack MAE for the existing TPP have been taking into account for the calculation of the emission of the remaining units V and VI. The Thermoflow program was used in calculation the gas emission parameters for the new CCPU.

Table 21. Main parameters of emission sources

Parameters	Stack 2 (V and VI units)	Stack 3 (new CCPP)
Stack diameter (m)	7.2	6.0
Gas output speed (m/s)	21.2	21.0
Flow rate (m^3/s)	650.41	582.00
Temperature (ºC)	191	112
Stack height (m)	150	60
NO_2 emission rate (g/s)	83.381	20.450
NO emission rate (g/s)	13.549	17.382
CO emission rate (g/s)	4.238	8.019

Table 22. Emission limits at the stacks

Pollutant	MAE	
	Stack 2+Stack 3 = Total	Stack 2+Stack 3 = Total (8000 operating hours/y)
	g/s	*t/y*
Nitrogen dioxide (NO_2)	83.381+20.450=103.831	2401+589=2990
Nitrogen oxide (NO)	13.549+17.382=30.931	390+500=891
Carbon oxide (CO)	4.238+8.019=12.257	122+231=353

235. Calculating NO_x will result from the adding NO and NO_2 of the remaining units V and VI and NO_2 of the CCPU (as it has been considered that all NO_2 is NO_x). Then, the reduction in the annual emission of NO_x from the existing situation (4199 t/y) to the future one (3380 t/y) will be approximately 30%.

236. Regarding CO_2 emissions, Uzbekistan is a country not listed in Appendix I of Kyoto protocol, and is therefore not required to limit its emissions of CO_2.

Table 23. CO_2 emissions for the different stages of the project

UNITS	CO2 Emission (1,000 tCO_2e)
A New Power Unit (CCPU)	*700*
Decomissioning (III and IV units)	1,000
Net Change	300
After New Project	2,100

B.4.2.2. Noise

237. Environmental noise campaigns in the existing TPP have never been undertaken. No historical data on this issue is able to analyze.

Works phase

238. During the decommissioning and construction phase temporary noise emissions may be caused by:

- Decommissioning equipment
- Construction equipment
- Concrete mixing plant
- Pile driving for construction
- Rock blasting and drilling
- Earth moving activity
- Generators
- Vehicles used for material transport

239. The following table shows equipment to be used in the Works phase and accompanying noise levels. The data was obtained from measurements carried out on similar construction sites. They therefore have an error margin of ± 3 dB(A).

Table 24. Equipment noise levels

Equipment	Maximum noise level	Use factor
Air compressor	98 dB(A)	0.4
Backhoe	101 dB(A)	0.16
Cement mixer	97 dB(A)	0.4
Cement pump	100 dB(A)	0.4
Cement vibrator	99 dB(A)	0.1
Crane	91 dB(A)	0.12

Equipment	Maximum noise level	Use factor
Crawler tractor	98 dB(A)	0.16
Generator	100 dB(A)	0.4
Grader	105 dB(A)	0,05
Drilling machine	102 dB(A)	0.1
Loader	92 dB(A)	0,16
Pneumatic tool	99 dB(A)	0.04
Pump	100 dB(A)	0.4
Saw	98 dB(A)	0.1
Truck	90 dB(A)	0.3
Power shovel	97 dB(A)	0.2
Welding station	90 dB(A)	0.3

240. Noise levels will vary overtime depending on the machines that may be operating at any given moment. The following graph shows the noise level variation from the noisiest equipment (105 dB(A)), with distance.

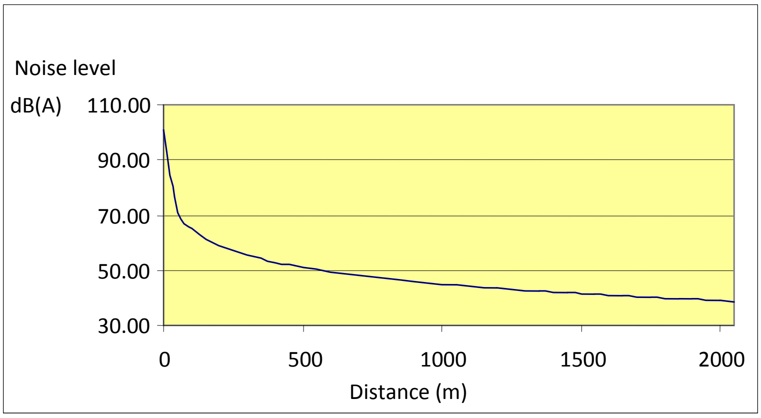


Figure 18 Reduction of noise levels generated by equipment, with distance

241. Construction activities which cause excessive noise shall be programmed for normal working hours.

Operating phase:

242. Draft equipment, electrical equipment, turbines, generators, pumps, gas pipe-lines, compressor are the main sources of noise and vibration on Takhtiatash TPP.

243. Much of the equipment in the new CCPU unit will create high noise levels during operation. After the commissioning of the CCPU, new sources of noise will be added to the existing ones: gas-turbine exhaust, steam-turbine, generators, transformers, stack, air filtering and conditioning system (AFCS), gas booster station, water cooling tower´s fans, make-up water pumps and clarified water.

244. The level of noise must not exceed 80 dB(A) in operational zone one meter apart from equipment on rigid foundation according to SanPiN № 0120-01 (Uzbek legislation).

B.4.2.3. Effluents

245. Effluents treatment processes and systems are describe in the previous point B.2.2.4

246. The overall flow of effluent shall decrease by 1.7 times after decommissioning of the obsolete units III and IV and the commissioning of the new CCPU. The effluents discharged to Suenly canal come from two different sources: cooling system blowdowns and effluents from the CWP.

247. For the future situation with the commissioning of the CCPU, cooling water system blowdown flow for the worst scenario (July, the hottest month with 45º C) has been estimated 515 m^3/h.

248. Flows from boiler and turbine section, blow-off water from the evaporating plants, cooling water from the oil coolers, bearings and packings of the rotating machinery glands are treated in the CWP and come into the waste water drainage system (WWD) to be further discharged into Suenly canal. After having been treated in the CWP, the flow of effluents discharged to Suenly canal will be 115 m^3/h.

249. Therefore, the overall volume of effluents discharged from the TPP into the canal will be 630 m^3/h (5,040,000 m^3/year).

250. The level of disposal of waste water to «Suenly» channel after the TPP treatment facilities in 2011 amounted to 442,007,000 m3/year.

B.4.2.4. Waste

a) <u>Construction phase</u>

251. Waste resulting from construction of the new CCPU unit will be classified as hazardous and non hazardous. Hazardous waste will mostly be oil and/or solvent soaked rags, empty metal or plastic paint pots, resin or solvent containers etc.

252. Non hazardous waste includes the group of household and similar waste (all domestic waste, waste generated in offices and toilets, packaging, plastics, paper, cardboard, wood, palettes etc.) and waste such as concrete, brick, rubble, iron scrap etc.

b) <u>Operation phase</u>

<u>Current Wastes</u>

253. During TPP operation 32 types of industrial and communal wastes are generating. General information on generating wastes and way of their disposal are presented in the below table. Total volume of wastes accumulated by the plant in 2011 was 85.521 tons, including 0.065 tons of toxic wastes.

254. Data on rate of application of materials used for repairing and O&M of equipment were used to calculate quantity and quality of generating wastes (column 4, Table 25). Toxic class of wastes was defined in accordance with SanR&N No 0128-02 ―Hygienic classifier of toxic industrial waste

in the Republic of Uzbekistan (column 5)". Places for temporare wastes storage and disposal is defined in accordance with RD Oz RH 84.3.17.2005 "Organizing and order of development of industrial and consumption wastes disposal" and SanR&N No 0127-02 "Sanitarian Rules of inventory, classification, storage and disposal of industrial wastes" (column 6). Waste characteristics and content were developed in accordance with RD Oz RH 84.3.19.2005 "Terms and definition" (columns 7 and 8).

255. In columns 9 and 10 the Basel Convention category is included. In column 9 the classification included in the Waste Datasheet of the TPP is indicated. In column 10 the category of the wastes that have not been identified in column 9 and the correction of some of them has been introduced.

256. Those wastes which category starts by "A" correspond to Annex VIII and therefore are considered hazardous wastes.

257. Those wastes which category starts by "B" correspond to Annex IX and therefore are considered non-hazardous wastes.

Table 25. Wastes generated at the Takhiatash TPP

Data on type, quantity, quality, main characteristics of waste and places of their disposal									
#	**Name of wastes**	**Units (per year)**	**Limits (t)**	**Toxic class in accordance with national classification**	**Place for disposal**	**Type/ state of aggregation/Generating source**	**Waste content**	**Waste code in accordance with Basel convention**	
1	2	3	4	5	6	7	8	9	10
1	Iron scrap metal	tn	284.8	4	Scrap to "Vtorcher met"	Inorganic; solid; rehabilitation of wastes	Steel 50%; Cast iron 50%	B1010	
2	Non-ferrous scrap metal (bronze)	tn	0.187	3	Scarp to "Vtorcvet met"	Inorganic; solid; Repairing and replacement of energy equipment	Sn – 3-17% Zn – 5-12%, Pb – 3-17%	B1010	
3	Non-ferrous scrap metal (cupper)	tn	0.19321	2	Scarp to "Vtorcvet met"	Inorganic; solid; Repairing and replacement of energy equipment	Ni 0 16% Cu – 84%	B1010	
4	Non-ferrous scrap metal (babbit)	tn	0.42662	3	Scarp to "Vtorcvet met"	Inorganic; solid; Repairing and replacement of energy equipment	Zn14-38%; Al- 2,5-6%	B1010	
5	Non-ferrous scrap	tn	0.76208	3	Scarp to "Vtorcvet met"	Inorganic; solid; Repairing and replacement of	Mn – 2% Si- 3,5%,	B1010	

Data on type, quantity, quality, main characteristics of waste and places of their disposal									
#	Name of wastes	Units (per year)	Limits (t)	Toxic class in accordance with national classification	Place for disposal	Type/ state of aggregation/Generating source	Waste content	Waste code in accordance with Basel convention	
	metal (brass)					energy equipment	Fe – 3%		
6	Stub	tn	0.552	4	Scrap to “Vtorcher met”	Inorganic; solid; welding	C-0.09% S – 0.04% P – 0.04% Mn- 0.5%	B1010	
7	Waste wood	m^3	66.43	4	Reused as raw materials	Organic; Solid; Replacement of wool construction and furniture repair	Wool - 100%		B3050
8	Used fire-resistant and thermo-isolated materials	tn	651.06	4	Reused	Inorganic; solid; Rehabilitation of thermo-isolation of boilers, ponds, pipelines	Chamotte crumbs – 55.7%, power-fire resistant brick – 25,7% Concrete aluminous – 16%, fire resistant clue – 2.6%	A2050	
9	Used asbestos	tn	46.731	3	Reused	Inorganic; solid; Rehabilitation of thermo-isolation of boilers, ponds, pipelines	Asbestos cardboard – 25-35%, asbestos cord – 10-15% Asbestos-vermiculite tile – 50-65%	A2050	

Data on type, quantity, quality, main characteristics of waste and places of their disposal									
#	**Name of wastes**	**Units (per year)**	**Limits (t)**	**Toxic class in accordance with national classification**	**Place for disposal**	**Type/ state of aggregation/Generating source**	**Waste content**	**Waste code in accordance with Basel convention**	
10	Technical rubber	tn	5.65	4	Sent for utilization into LLC ―Artur"	Organic; Solid; Energy equipment repairing	S – 2% Rubber – 92-98%	B3040	
11	Waste paper	tn	0.456	4	Sent to salvage	Organic; Solid; Replacement of electrical-isolation cardboard	Paper 85% Cardboard – 15%	B3020	
12	Used paranet	tn	1.2359	3	Removed to landfill	Inorganic; solid; paronit replacement			A2050 (asbestos/rubber)
13	Oiled rags	tn	2.625	3	Burned into the boiler furnace	Organic; Solid; Fitting in of electrical equipment	Cotton – 6-20% Wool – 14-28% Viscose – 13-30% Residual of transformer and diesel oils	B3030	A3020 (As are textile wastes that are mixed with hazardous wastes)
14	Mazut ashes	tn	0.366	2	Stored in evaporation ponds	Inorganic; solid; Mazut burning in boiler furnace			Depending on composition
15	Used turbine oil	tn	12.05	2	Reused	Organic; Liquid; Replacement of turbine oil		A3020	
16	Sludge from oil products	tn	1.89	3	Stored in evaporation ponds	Composite; Discharges from chemical treatment from oil products	Mazut – 2-15% Oil 3-18% Water 5-24% Clue 25-45%		A4060

Data on type, quantity, quality, main characteristics of waste and places of their disposal									
#	**Name of wastes**	**Units (per year)**	**Limits (t)**	**Toxic class in accordance with national classification**	**Place for disposal**	**Type/ state of aggregation/Generating source**	**Waste content**	**Waste code in accordance with Basel convention**	
17	Sludge from water treatment plants	th	1598	4	Stored in evaporation ponds	Inorganic; liquid; During acid washing of boilers			B2120
18	Used anthracite	tn	13.2	4	Burned into the boiler furnace	Organic; Solid Replacement of absorbents in mechanical filters	Coal 100%		B2060
19	Used cationite	tn	23.496	4	Removed to landfill	Inorganic; Solid Replacement of absorbents in filters			A3050
20	Insoluble salt residuals	tn	80	4	Removed to landfill	Inorganic; Composite; Dissolving of salt for filter regeneration	SO_4Ca – 81.45% Other – 18.55%		
21	Not-fuel burning of lime	tn	484.8	4	Removed to landfill	Inorganic; Solid; Dissolving lime	Clue 65-88% Sand – 2-5% Limestone 8-33%		
22	Used oil from transformers	tn	3.9466	2	Reused	Organic; Liquid; Replacement of transformer oil		A3020	
23	Used electrical isolated material	tn	0.06	3	Removed to landfill	Solid; Composite; Replacement of electrical isolation	Polymers -65-85% Cotton isolation – 12-35%	A3020	
24	Used luminescent lamp	tn	0.23828	1	Removed to demercuriation	Inorganic; Solid; Burned lump replacement	Al – 80.67% Vo-1.437% Cu –	A1030	

Data on type, quantity, quality, main characteristics of waste and places of their disposal									
#	**Name of wastes**	**Units (per year)**	**Limits (t)**	**Toxic class in accordance with national classification**	**Place for disposal**	**Type/ state of aggregation/Generating source**	**Waste content**	**Waste code in accordance with Basel convention**	
							7.05%		
25	Bottom sediments of mazut	tn	37.652	3	Stored in evaporation ponds	Composite; Solid; Sedimentation and polymerization of heave fractions	Heave hydrocarbons – 12-45% Mechanical admixture – 55-88%		A4060
26	Silt from calcium carbide	tn	0.4046	4	Removed to landfill	Inorganic; Composite; Welding and cutting of metal	$Ca(OH)_2$ H_2O - 12%		
27	Used tyres	tn	1.561	4	Sent to utilization	Organic; Solid; Replacement	Rubber – 70% Viscose cord – 20% Metal cord – 10%	B3040	
28	Used engine oil	tn	0.65117	2	Reused	Organic; Solid; Replacement		A3020	
29	Lead plates from battery	tn	0.33525	1	Scarp to ~~V~~torcvet met”	Inorganic; Solid; Replacement	Lead – 50-60% PbS- 20%	A1160	
30	Cases of battery	tn	0.08171	4	Scarp to ~~V~~torcvet met”	Organic; Solid; Battery replacement	Ebonite	A2010	
31	Used electrolyte	tn	0.12667	2	Reused	Inorganic; liquid; Battery replacement	H_2SO_4 - 28%	A4090	
32	Communal wastes	tn	257.283	Non-toxic	Removed to municipal landfill	Organic; Solid; Workers activity Cleaning of territory		B3060	

258. At the present, Takhiatash TPP waste management is organized as follows:

259. Reused:

- Used asbestos and thermo isolation materials are temporary collected at the open site with concrete covering and reused for boilers clothing during 30 days.
- Waste oil:
    - Waste engine oil shall be temporarily stored in a metal container with 0.2 m capacity and reuse as a lubricant for lifting and rotating mechanisms as needed for no more than180 days, the rest shall be transported to the oil storage on a quarterly basis.
    - Waste transformer oil shall be temporarily stored in a metal container, and within 30 days regenerated and re-used as designated or delivered to the oil storage.
    - Waste turbine-oil shall be temporarily stored in metal containers, and within 180 days, regenerated and re-used as designated or delivered to the oil storage.
- Waste cationite – part of it shall be used as an additive for other filters
- Electrolyte from batteries shall be reused for other batteries

260. Recycled:

- Iron and metal debris are temporary collected in an open space until 30 days. Stubs are collected into metal pails located next to the each welding equipment. Waste battery cases and lead plates shall be temporarily stored in the charging room without destroying. All the previous wastes are delivered to ―Vtorchermet" enterprise.
- Wool debris is collected into bags and sold to inhabitants.
- Waste rubber and tires are stored in metal containers and shall be delivered to ―Artur LLC" enterprise.
- Waste paper shall be temporarily stored and within 182 days shall be delivered to ―Vtorsyrye" enterprise.
- Blown LB-40 fluorescent lights shall be temporarily stored in a special storage room, in boxes, and within 182 days shall be delivered to a specialized organization on lamp utilization. This procedure is fulfilling the Cabinet of Ministers' Decree No 266 from 21.09.2011 "On approval of the collection and disposal of used mercury-containing lamps".

261. Recover:

- Oily rags, used anthracite and wool debris shall be temporarily stored burned in boiler furnaces.

262. Treat and dispose:

- Solid sediment and undead lime sludge, black oil and oily effluents and neutralized effluents are send to evaporation ponds.
- Certain fuel oil residues shall be temporarily stored in metal containers and within 30 days shall be delivered to the oil storage. All the oily wastes stored in the oil storage are finally, once there is enough quantity, send to a final oil base storage place.
- Insoluble salt residue, incompletely burned lime, waste cationite (cation exchange resin), used anthracite, waste paronite, oil sludge from the evaporation ponds and domestic waste shall be temporarily stored and then transported to the municipal landfill.

263. Places for temporarily and permanent storage wastes are presented at the following picture.

Figure 19. Places for temporarily and permanent storage wastes

Legend:

1- Ferrous scrap metal
2- Non-ferrous scrap metal
3- Insoluble residual of salt
4- Luminescent lumps
7- Battery
8- Tyres
9- Used engine oil
10- Communal wastes
11- Insoluble residual of lime
12- Thermo-isolated material
13- Oiled sludge
14- Rags

264. In Annex II pictures of the above facilities are shown. During the site visit, not evidence of the following storage was found:
   a. Concrete covered storage for asbestos and thermo isolation materials
   b. Metal container for paronite

Future wastes

265. The same kinds of hard waste as in existing conditions will be formed after the commissioning of the CCPU at Takhtiatash. Nevertheless, for the construction of the CCPU asbestos will be not permitted as it use is forbidden by the good international practice. Therefore, waste asbestos will not be produced in the operation of the new unit.

266. The waste management for the future Takhiatash TPP should be adapted to international guidelines and those wastes considered by the Basel Convention to be hazardous will under no circumstances be dumped on the terrain. A general guideline on waste management will be included in the mitigation measure chapter.

267. A new type of waste, hereinafter referred as pulp, will be generated in the operation of the CCPU. Makeup water from Amudarya River initially settles in a settling tank to remove suspended particles. Settlement tank cleaning from silt is provided with dredgers with storage in pulp dump. Settlement tank cleaning is periodic and performed sequentially in case of siltation of each section. Settled clarified water from pulp dump using pulp dump's clarified water pumping station is driven back to settling tank. Pulp dump, on the analogy of settlement tank is implemented in a dam with clay loam with bottom device and internal slope of impervious screen (concrete-membrane-concrete). The pulp dump is meant to be cleaned by excavators and transportation on dump-trucks for usage in agricultural needs but this procedure cannot be followed if the pump doesn't meet the sanitary conditions for this purpose. A complete analysis of the pulp must be undertaken to classify it under international standards as non hazardous previously to be used for agricultural purposes. Should not be accepted a waste that contains organics that are contaminated by potentially hazardous chemicals and/or pathogenic substances and micro-organisms that will not be rendered harmless by the process or may constitute a health or environmental risk.

c) Decommissioning phase:

268. The list of waste materials expected to be generated in the decommissioning of units III and IV is shown in Table 26 They have been classified as hazardous or non-hazardous according to the exposed by ―Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal".

Table 26. List of waste materials from the decommissioning of units III and IV

Nº	Materials	Name of equipment	Quantity per equipment (tons)	Total quantity (tons)	Hazard (according to Basel Convention)
1	Asbestos cement plaster	Turbines № 1-3	40.5	278.4	Hazardous (Annex I; A2050; Y36)
		Steam pipelines	5.4		
		Point Deaerator	4.95		
		Steam pipeline point POУ	6.15		
		Boilers Nº 1-6	221.4		
2	Basalt extra-thin fibre	Turbines № 1-3	14.4	37	Non-hazardous
		Steam pipelines	6.4		
		Point Deaerator	2.1		
		Steam pipeline point POУ	8.25		
		Boilers Nº 1-6	5.85		
3	Wire netting	Turbines № 1-3	3	16.95	Non-hazardous
		Steam pipelines	2.2		
		Point Deaerator	1.5		
		Steam pipeline point POУ	2		
		Boilers Nº 1-6	8.25		

Nº	Materials	Name of equipment	Quantity per equipment (tons)	Total quantity (tons)	Hazard (according to Basel Convention)
4	Fire resistant concrete	Boilers Nº 1-6	1080	1080	Non-hazardous
5	Thermo-isolated concrete	Boilers Nº 1-6	762	762	Non-hazardous (except if containing asbestos)

269. Mineral fibre, in case of being included within the materials to be decommissioned, could also have asbestos and therefore should be classified as hazardous.

270. The above is an initial classification and should be reviewed by the specialize enterprise in charge of the decommissioning. For the decommissioning phase a specific plan must be undertaken. This plan should include a Health and Safety plan and a waste management plan. Hazardous waste (especially asbestos) should be disposed in a specific landfill or storage complying national and international standards. If there is not an appropriate storage place at regional or national level, temporary hazardous waste storage should be constructed at the site.

B.4.2.5. Jobs

Current Jobs

271. At present, the number of employees of Takhiatash TPP is presented in the following table:

Table 27. number of employees of Takhiatash TPP

No	Name	On 07.01.2012
1	Total	1082
	Out of this:	
2	Administrative and managerial staff	39
3	Industrial and production personnel, including	935
3.1.	Managers	110
3.2.	Specialist	65
3.3.	Employees	6
3.4.	Workers	754
4	Non-industry personnel, including	108
4.1.	Managers	6
4.2.	Specialist	6
4.3.	Employees	0
4.4.	Workers	83
4.5	Home-based work	13

<u>Future Jobs</u>

272. The project will promote industrial development projects envisaged for the region. Consequently, this will promote socio-economic development in the region and indirectly in whole Uzbekistan.

273. The construction phase will constitute the highest levels of activity with up to 1.000 construction workers concentrated onto the project site. During operation phase, about 110 people will be required for long term operation of the plant (81 production workers and 29 administrative-management staff) but they will be covered with current workers from the TPP.

274. IFC Performance Standard 2 labor and working conditions” (January 2012) should be of application at hiring direct, contracted or supply chain workers.

B.5. The project’s health & safety aspects

<u>Current management</u>

275. Health and safety issues at the TPP are regulating by official document approved by Uzbek State Agency on monitoring in energy sector Uzgosenergonadzor” Order on approval rules of organizing works with personnel at the enterprises of energy sector». The document is revising every 5 years by Uzgosenergonadzor” and re-approved every year by Takhiatash TPP‘s director and head of department of emergency situation of Takhiatash city.

276. The document consists from 13 chapters. The chapters provide data and describe the organizing of the following activities:

1. General regulations
2. Organizational requirements
3. Preparing for new positions (New Task Employee)
4. Probation period
5. Checking knowledge
6. Duplication
7. Permit to work
8. Orientation on work safety, technical operating and fire safety
9. Test anti-damage and anti-fire trainings
10. Special trainings
11. Professional development
12. Observation of personnel work places
13. Team work with personnel.

277. Occupational health and safety structure at the TPP presented at the following figure:

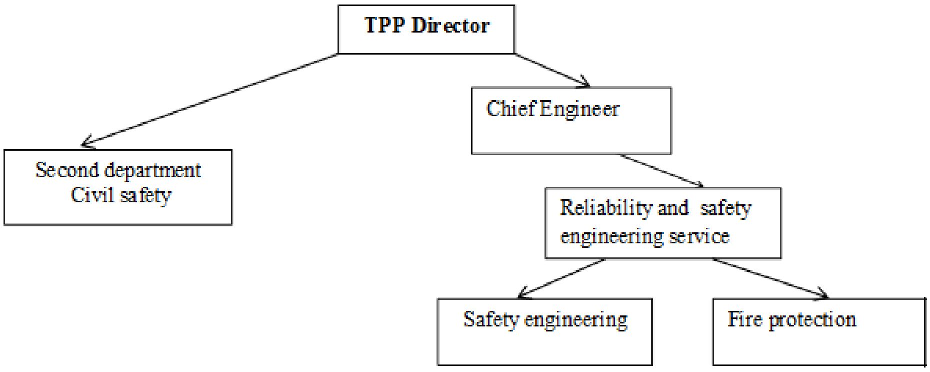


Figure 20. Occupational health and safety structure at the TPP

278. TPP director is responsible for performance of H&S works. There are three main departments working on these issues: safety engineering, fire protection and civil safety. The safety engineering department organizes and implements works on safety activity at the TPP. The fire protection department is responsible for fire protection at the TPP. Civil safety department is responsible for the works related with activities in emergency situations. This department is responsible for personnel activity during anthropogenic and natural disaster (earthquakes, hurricanes, flooding). Every department prepares an action plan for hall year. Usually the action plans cover the following topics:

- Number of planned trainings
- Planning number of people involved in trainings.
- Other planning activities – as work safety days and etc.

279. Safety engineering department submits reports on performed activity quarterly, civil safety department annually and fire protection department every two years.

280. Usually reports include information on number of conducted trainings and number of participants, results of conducted observations of work places, implementation of recommendations, provided by external checking organization or by the main office of Uzbekenergo, number and description of accidents taken places during reporting period

281. Takhiatash TPP has several health and safety procedures which are designed to fulfill national legislation.

282. Assessment of work places at Takhiatash TPP had been done in 2010 and working conditions of 166 places have been evaluated. As result of conducted assessment following was confirmed:

- 308 workers have rights on favourable reatirment;
- 568 workers have rights on additional nutrients (milk)
- 868 – on additional holidays

283. At the Tahkiatash TPP last evaluation of working conditions has been conducted in 2011 by Unitarian enterprises ―Uzenrgosozlash" as entity having certificate on conducting evaluation. Generally & working places at Takhiatash TPP have been evaluated by this entity.

284. Noise measurements for Takhiatash TPP have been done at 96 working places. Measurements showed exceeding of norms at the most of the reviewed places (around 80%). The biggest exceeding was at the generator - 23 dBA above norm.

285. Measurements of vibration have been conducted at the places with potential exceeding norms for vibration. 8 working areas have been observed. Vibration level at the most of the reviewed places also exceed norms. The highest exceeding was observed at the area close to generator – PAN 8 a. Vibration exceeded norm on 8 dB

286. Microclimate measurements have been conducted for 82 working places. Relative humidity didn't exceed norms, but temperature of most of the work places exceeded norms (around 90% of observed areas).

287. Air quality has been assessed at 18 work places. Measurements were done for potential pollutants for each place. The maximum exceed has been observed for CO (measured concentration was 36 mg/m3 and allowed 20 mg/m3) at the boilers drum and lime dust (36 mg/m3 and 6 mg/m3 accordingly) at the chemical reagents storage house. Exceeding on asbestos dust have been observed during turbine repairing (14 mg/m3 and 6 mg/m3 accordingly).

Future management:

288. For the future stage, a health and safety plan and procedures based on international standards (World Bank, IFC EHS general guidelines, april 2007) should be developed

C. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK AND STANDARDS

289. This section provides an overview of the relevant national and international legislation and policies applicable to the Project.

C.1. Uzbek Legislation

290. This chapter provides an overview of the basis of environmental and social policy of the Republic of Uzbekistan (RUz) including the description of the current institutional and regulatory frameworks, at both national and regional scales; the environmental policy and strategies; the national EIA procedure and the current project permitting status.

C.1.1. Institutional Framework

C.1.1.1. National Institutional Framework

291. The Republic of Uzbekistan (RUz) is an independent democratic republic based upon 1992 Constitution (as amended on 28 December 1993, 24 April 2003, 11 April 2007, and 18 April 2011). The national environmental and social policy in Uzbekistan is based on the provisions of the country's Constitution.

292. Under the 1992 Constitution the powers of the state are exercised in the interests of the people (Article 7). The most critical issues of the social and political life are brought up to nationwide discussion, referendum (Article 8).

293. Under the 1992 Constitution all RUz citizens have equal rights and freedoms and are all equal under the law without distinction as to gender, ethnicity, nationality, language, religion, social background, convictions, personal and social status (Article 18).

294. The Constitution defines personal rights and freedoms:

- the right to life (Article 24), the right to liberty and security (Article 25);
- he right of defence against trespass to honour and dignity, interference with privacy, family and home (Article 27), the right to free travel and movement (Article 28);
- the freedom of thought, speech and opinion (Article 29);
- the freedom of conscience (Article 31); political rights (Articles 32-35);
- economic and social rights: the right to property (Article 36);
- the right to work, to free choice of work, fair terms of work and protection against unemployment (Article 37)
- the right to paid leave (Article 38), the right to social welfare benefits in respect of old age, disability, loss of breadwinner, and other (Article 39), the right to qualified medical service (Article 40), the right to education (Article 41), and the right to creative work and inventions (Article 42).

295. The Constitution also provides safeguards of human rights and freedoms proclaiming that the state secures rights and freedoms of its citizens (Article 43) and guarantees to everyone juridical protection of rights and freedoms (Article 44) when males and females enjoy equal rights (Article 46).

296. Uzbekistan is a presidential republic in which the President is the executive head of the state who secures efficient coordination of governmental authorities (Article 89). The President issues decrees, resolutions and ordinances which shall be binding across Uzbekistan (Article 94).

297. The bicameral Supreme Assembly, or ‗Oliy Majlis' (OM), comprising the Legislative Chamber and the Parliament, is the legislature with a power to shape laws. In line with the Constitution any law has legal effect provided it is enacted by the Legislative Chamber, approved by the Parliament and signed by the President (Article 84). OM defines the national environmental and social policies, approves national environmental programs, develops and adopts national environmental and social legislation, coordinates environmental compliance monitoring actions, defines the rates of environmental charges and establishes respective incentives, etc.

298. The Cabinet of Ministers (CM) is the executive with the responsibility of securing efficient functioning of the national economy, social and community services, enforcement and enacting national laws and regulations. It comprises the Prime Minister, Deputy Prime Ministers, Ministers, State Committees Chairmen and the Government Executive of the Karakalpakstan Republic (Article 98). CM exercises state control of environment protection and natural resources management along with the State Committee for Nature Protection of the Republic of Uzbekistan and the local governments. Based on its environmental and social mandate CM pursues the national environmental and social policy; regulates natural resources management; is responsible for natural resources inventory and evaluation; coordinates development and implementation of national socio-economic programmes; develops mitigation measures; establishes procedures for collecting environmental charges, pollution and waste disposal fees; sets up limits for the use of natural resources and waste disposal; develops environmental education and awareness system; identifies zones of special environmental management, environmental protection and management regimes; develops international environmental relations[1].

299. The Councils of People's Deputies, or ‗Kengashi', led by governors known as ‗khokims', are the representative bodies of government authority in regions, districts, cities and towns (except for towns under regional jurisdiction and city districts). Under the Constitution they address any issues within their mandate and responsibility based on the interests of the state and its citizens (Article 99). The *Kengashi* are responsible for law and order; security and safety of citizens; issues of economic, social and cultural development; local budgets and taxes; local utilities; environment protection, civil registration; local standards and regulations (Article 100) and enforcement (Article 101). The term of office for both the *Kengashi* and the *khokim* is five years. The *khokim* is personally responsible for decisions and actions taken by *Kengash* while decisions of the *khokim* are binding to all ventures, institutions, organisations, associations as well as public officers and citizens across the respective territory (Article 104).

300. The environmental mandate of regional/local government authorities includes: identification of environmental priorities for the respective territory; approval of regional (local) environmental programs; inventory and evaluation of natural resources; inventory of environmentally hazardous facilities; logistical support to environmental actions; environmental permitting; waste management; collection of environmental charges; and environmental control. [2].

301. The gathering of citizens (*makhalla*) is an independent local form of self-government in Uzbekistan. *Makhalla* pursues general initiatives and actions locally, including environment-related ones. The main principles of *makhalla* are democracy, publicity, social justice, humanism and mutual aid. *Makhalla* is responsible for taking decisions on issues of local importance, including infrastructure improvement and development, arrangements for *khashars* (voluntary unpaid work on Sunday), provision of social aid to low-income families, etc.

302. Settlements, *kishlaks* (villages) and *auls* (mountain villages) are governed by *aksakals* (chairmen) and their advisors, who are elected by the gathering of citizens for a period of 2.5 years (Article 105).

[1] Law No.754-XII on Nature Protection dated December 9, 1992 (as amended).
[2] Law No.754-XII on Nature Protection dated December 9, 1992 (as amended).

C.1.1.2. Regional Institutional Framework of the Karakalpakstan Republic

303. The RuZ Constitution defines Karakalpakstan as an independent republic constituting a part of the Republic of Uzbekistan (Article 70). The Karakalpakstan Republic has its own Karakalpak Constitution (enacted on 9 April 1993) which may not contravene the provisions of the RUz Constitution (Article 71).

304. The law of the Republic of Uzbekistan is binding across Karakalpakstan (Article 72) while relations between the Republic of Uzbekistan and the Karakalpakstan Republic shall be governed by treaties and agreements between the two parties (Article 75).

305. The national institutional framework is mirrored in the Karakalpakstan Republic. Under the Karakalpak Constitution, which echoes all fundamental provisions of the RUz Constitution, the ‗Jokargy Kenes' (JK) of Karakalpakstan – the supreme body of power in Karakalpakstan – is the legislature (Article 68) who exercises its power through JK members who are elected for a period of 5 years (Article 69). The Chairman of Jokargy Kenes is the highest official of the Republic of Karakalpakstan responsible for interaction between the legislature and the executive of the Republic of Karakalpakstan and elected by the JK members (Article 80). The Presidium of Jokargy Kenes manages the work and operation of Jokargy Kenes and is composed of the Chairman of Jokargy Kenes, his deputies, chairmen of the committees and commissions, and the party leaders in JK of Karakalpakstan (Article 84).

306. The Council of Ministers of Karakalpakstan – the Government of the Republic of Karakalpakstan - is the executive in Karakalpakstan (Article 86). It is formed by the *Jokargy Kenes* of Karakalpakstan and has responsibility of securing effective functioning of the economy, social and community services, enforcing national and local laws and regulations (Article 87). The Council of Ministers is headed by the Chairman who is appointed by JK (as advised by the JK Chairman and the President of the Republic of Uzbekistan) and who enters into the Cabinet of Ministers of the Republic of Uzbekistan (Article 88).

C.1.1.3. Environmental Regulators

307. The State Committee for Nature Protection (SCNP) of the Republic of Uzbekistan (‗*Goskompriroda'*) is the primary environmental regulator. The *Goskompriroda* reports directly to the Parliament and is responsible at national, regional (oblast) and local (district) levels for the development and enforcement of the national environmental and conservation policy, overseeing environmental compliance, the integrated environmental management across various sectors, and securing healthy environment conditions across the country. The *Goskompriroda* mandate is set forth in the Regulation on the State Committee for Nature Protection of the Republic of Uzbekistan enacted by the Parliament in 1996.

308. The structure of *Goskompriroda* takes the form of a central body in Tashkent with regional branches and agencies providing scientific and technical support. Regional environmental authorities are structured similarly to the *Goskompriroda*. Karakalpakstan has its own State Committee for Nature Protection - *Goskompriroda* of the Karakalpakstan Republic, who is part of *Goskompriroda* of the Republic of Uzbekistan and reports to it. The Goskompriroda of the Karakalpakstan Republic will oversee the environmental compliance of the Project at construction and operation phases.

309. There are some other ministries and agencies in Uzbekistan that have responsibilities related to environment protection and control. Such responsibilities include facilitation in setting up and maintaining a robust system of state environmental control, development and implementation of

environmental programmes, strategies, and action plans to address conservation and sustainability issues.

310. Other state bodies of the Republic of Uzbekistan dealing with environment related issues are:

- Ministry of Agriculture and Water Resources (MAWR)
- State Committee for Land Resources, Surveys, Cartography and the State Cadastre (or *Goskomgeodezkadastr*)
- State Committee for Geology and Mineral Resources (or Goskomgeologia)
- Centre of Hydro-meteorological Service (or *Uzhydromet*)
- Ministry of Health (or MHRUz)
- State Inspectorate for Exploration Supervision, Operations Safety Supervision of Industry, Mining and Utilities Sector (or *Sanoatgeokontekhnazorat*)
- Ministry of Internal Affairs (or MVD).

311. All national ministries, state committees, inspectorates and other national institutions have their respective branches or offices operating in the Republic of Karakalpakstan that report to the central body of the respective ministry, state committee, inspectorate, etc.

C.1.1.4. Social Regulators

312. Social laws are developed, adopted, revised or amended by *Oliy Majlis*. Other national regulations are developed by the Cabinet of Ministers as advised by respective ministries and agencies responsible for social issues. These include:

- Ministry of Labour and Social Welfare (or MLSW);
- Regional (Oblast), municipal and local governments;
- State Inspectorate for Exploration Supervision, Operations Safety Supervision of Industry, Mining and Utilities (or *Sanoatgeokontekhnazorat*)
- the Ministry of Health (or MHRUz)
- the State Committee for Nature Protection (or *Goskompriroda*)
- the State Committee on Land Resources, Surveys, Cartography and State Cadastre (*Goskomgeodezcadastre*)
- the Trade Union Federation Council

313. The Ministry of Labor and Social Welfare of the Republic of Uzbekistan (MLSW) is the key regulator in the social sector responsible for labor-related issues, employment, pension benefits, social welfare and migration issues. The MLSW monitors compliance with the law and reports to the Cabinet of Ministers of the Republic of Uzbekistan. The MLSW mandate is set forth in the Regulations on the Ministry of Labor and Social Welfare enacted by the Cabinet of Ministers in 2007.[3]

314. The MLSW operates through its central body in Tashkent the network of its regional branches, local employment centres, social welfare departments and the MLSW of the Republic of Karakalpakstan. All report to the central MLSW body.

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[3] Decree of the Cabinet of Ministers of Uzbekistan on measures to implement Decree of the President of the Republic of Uzbekistan No.PP-616 of 06.04.2007 on measures to increase employment and improve performance of the authorities responsible for labour and social welfare

C.1.2. National EIA Procedure

315. The EIA procedure is regulated by Law on Environmental Expertise and The Regulation on State Environmental Expertise (SEE), approved by Decree No.491 of the Cabinet of Ministers on 31 December 2001 and amended in 2005 and 2009. The regulation defines the legal requirements for EIA in Uzbekistan. SEE is a review process conducted by the *Goskompriroda* Department for SEE (‗*Glavgosecoexpertiza'*) at either the national or regional level, depending on the project category.

316. State Committee of the Republic of Uzbekistan for Nature Protection (*Goskompriroda*) is specially authorized supreme and coordinating authority, implementing state control and intersectoral governance in Nature protection, using and reproducing nature resources. *Goskompriroda* of the Republic of Uzbekistan is under governance of and accountable to *Oliy Majlis* of the Republic of Uzbekistan.

317. By the law on ―Environmental Expertise", the SCNP is obliged to pursue the following objectives:

- Manage and monitor compliance with the State's environmental impact assessment procedures
- Review and approve environmental impact assessments
- Monitor implementation of conditions specified in the environmental impact assessment approval

318. According to the Regulations on State Environmental Expertise in the Republic of Uzbekistan Goskompriroda on state environmental expertise is:

- Head of administration on state environment expertise of *Goskompriroda* (*Glavgosecoexpertise*)
- State environment expertise of the Karakalpakstan Republic state committee for nature protection
- State environment expertise of Province and Tashkent city committee for nature protection (*Gosecoexpertise*)

319. *Goskompriroda* on state environmental expertise is a uniform system of State Environmental Expertise, methodological guidance of which implemented by *Glavgosecoexpertise*. *Glavgosecoexpertise* undertakes the state environmental expertise on below objects:

- Pre-project and project documentations, operating enterprises and other objects effecting negative impact on environment and population health, objects with special legal status (on activities belonging to Category I and II)
- Materials of integrated monitoring of the territory for assigning the status of conserving nature territories, emergency environment situation zone, as well as environmental disaster; (Paragraph in the Cabinet Ministers' Decree of the RUz No.95 from 01.04.2005)
- Documentation on creation new types of technique, technology, materials, stuffs, productions
- Programs of State projects, concept, schemes of location and productive forces development in economic and social sectors;
- Town planning documents for object designing with a total population of 50 thousand people.
- Projects of standard technical, instructional and methodological documents (technical specifications, standards, environmental standards, rules, instructions...), regulating economic and other activities related to the use of nature resources

320. State environmental expertise of the Republic of Karakalpakstan, Provinces and Tashkent city implements state environmental expertise upon the below objects:

- Pre-project and project documentations, operating enterprises and other objects effecting negative impact on environment and population health, objects with special legal status (on activities belonging to Category III and IV)
- Town planning documents for object designing with total 50 thousand population and below
- Project on protected natural areas management plans

321. Pursuant to Section 10 of the Regulation on SEE, the developer must conduct the EIA assessment process (‗OVOS' is the national acronym) in a staged approach, providing the *Glavgosecoexpertiza*/*Gosecoexpertisa* with OVOS documents for review at three distinct stages of the Project. Section 11 of the Regulation on SEE outlines the information that should be within the documentation at each of these stages. The three OVOS stages and their required deliverables are summarised as follows:

322. - Stage I: The ‗Concept Statement on Environmental Impact' (‗PZVOS' is the national acronym), to be conducted at the planning stage of the proposed project prior to development funds being allocated. The Concept Statement is required to provide details on environmental baseline conditions, land use, proposed construction methods, proposed technologies, plant and equipment, estimated discharges and emissions, waste management, considered alternative options, mitigation measures, health and safety risk assessment, environmental response planning and potential impacts.

323. - Stage II: The ‗Statement on Environmental Impact' (‗ZVOS' is the national acronym), to be completed where it was identified by the *Glavgosecoexpertiza/Gosecoexpertise* at Stage I that additional investigations or analyses were necessary. The Statement must be submitted to the *Glavgosecoexpertiza/Gosecoexpertise* before approval of the project's feasibility study, and therefore before construction. The Statement is required to assess the environmental suitability of the project's sites based on the results of engineering and geological investigations, modelling or other required studies, environmental analysis of technology relating to revealed site problems, the results of public consultation (if required) and also to justify the selected mitigation measures.

324. - Stage III: The ‗Statement on Environmental Consequences' (‗ZEP' is the national acronym) represents the final stage in the SEE process and is to be conducted before the project is commissioned. The report details the modifications to the project design which have been made from the *Glavgosecoexpertiza/Gosecoexpertise* review at the first two stages of the EIA process, the comments received through the public consultation, the environmental norms applicable to the project and environmental monitoring requirements associated with the project and principal conclusions.

325. SEE approval (*Glavgosecoexpertiza/Gosecoexpertise* opinion) is a mandatory document for project financing by Uzbek banks and other lenders (Section 18) at Stages I and II and for project commissioning at Stage III of the national EIA procedure.

326. An overview of the national EIA process is provided in Figure 21.

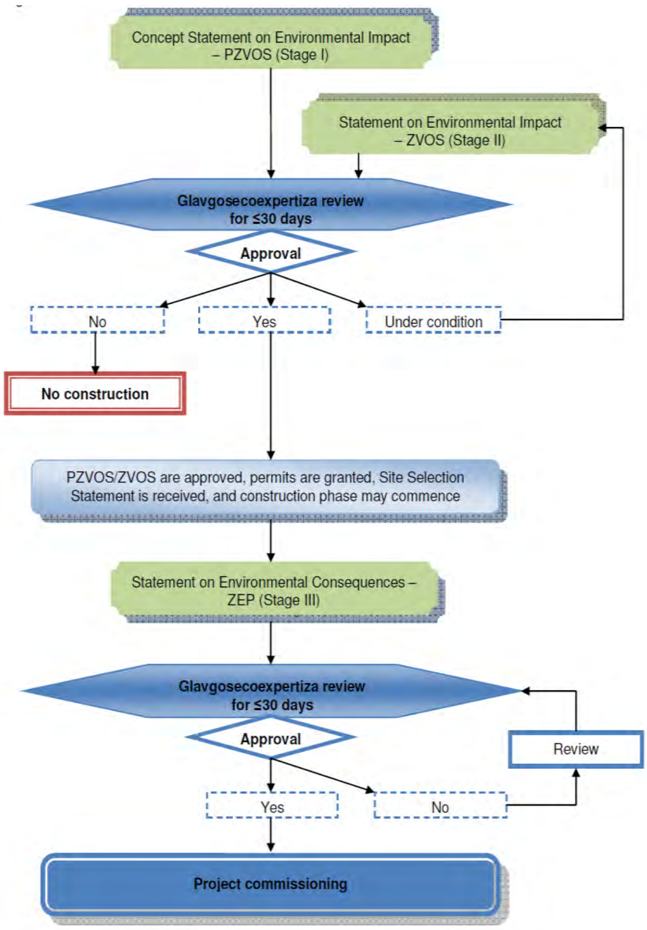


Figure 21. Uzbek EIA procedure [4]

327. All economic activities subject to SEE are classified into one of four categories:

- Categories I and II — ~~"h~~igh and medium risks of environmental impact" (SEE is conducted by the national SCNP within 30 days, all EIA materials are required);
- Category III — ~~"l~~ow risk of impact" (SER is conducted by regional branches of SCNP within 20 days, all EIA materials are required); and
- Category IV – ~~"l~~ow impact" (SEE is conducted by regional branches of SCNP within ten days, only a draft EIA is required).

[4] (Source: Regulation on the State Environmental Expertise in the Republic of Uzbekistan No.491 of 31.12.2001, as amended on 05.06.2009)

C.1.3. Project permitting status

328. This section reflects the Project permitting status as at the date when this EIA document was submitted.

329. In compliance with Appendix 2 of the Cabinet Ministers' Decree of the RUz No. 491, paragraph 37 (December 2001), the thermal power stations and other burning facilities with capacity 300 MW and more belong to Category 1 with respect to their environmental impact (high impact risk).

330. In compliance with national EIA requirements in the Republic of Uzbekistan, the ‗Concept Statement on Environmental Impact' was developed as part of Takhiatash TPP pre-feasibility study and submitted to the State Environmental Expertise Appraisal. The approval for this first stage was received in November 2012 (#18/963).

331. The environmental appraisal of the documents submitted established their compliance with the requirements of the nature protection related legislation applicable to the scope and content of the first stage of EIA and it was found advisable to proceed with the final stage of EIA, the Statement on Environmental Impact, for the purpose of establishing the limits to the emissions of pollutants and contaminants to the environment and to the production and disposal of wastes broken down for different years, according with the schedule for shutting down and decommissioning obsolete boiler equipment.

332. The State Environmental Appraisal of the State Nature Protection Committee of the Republic of Uzbekistan approved the draft environmental impact statement for the modernization of project Takhiatash TPP. Approval document is included in Annex VII

C.1.4. Environmental regulatory framework

333. The major emphasis of the environmental policy of Uzbekistan is on environmental safety being regarded as a strategic component of national security, and the most important aspect of protecting the vital interests of the state, society and identity. The environmental safety policy of the country is based on the Constitution, national laws, the National Security Concept of the Republic of Uzbekistan, the principles of the Rio de Janeiro Declaration on Environment and Development and the Johannesburg Declaration on Health and Sustainable Development with due regard of national commitments under international conventions and agreements, as well as legislative experience of leading countries.

334. Nowadays the conservation policy of Uzbekistan backed up with mitigation and environmental management measures is based on the following principles:

- integration of the economic and environmental policy to support conservation and restoration of the environment as pre-requisite for increasing the society standard of living;
- change from protection of individual elements of nature to the overall and integrated conservation of eco-systems
- responsibility of all members of the society for environment protection, biodiversity conservation, environmental improvement and securing healthy environmental conditions for the population

335. Since the country gained independence RUz has developed over 100 laws and regulations, and revised old Soviet legislation and policies. One of the country's objectives is the transition to sustainable social and economic development. For this purpose RUz has revised and improved the national environmental legislation, enacted new environmental laws and regulations, developed

programmes and action plans to address environmental issues and promoted sustainable use of natural resources.

336. Legal Framework in the field of Nature Protection and Management established in Uzbekistan, provides to the citizens the rights and duties specified in the country's Constitution. Specific articles that address environment protection issues within the Constitution are:

- Article 50. All citizens shall protect the environment
- Article 51. All citizens shall be obliged to pay taxes and local fees established by law
- Article 54. Any property shall not inflict harm to the environment
- Article 55. Land, subsoil, flora and fauna and other natural resources are protected by the state and considered to be resources of national wealth subject to sustainable use

337. Uzbekistan has enacted several supporting laws and statutes for environmental management, and is party to several international and regional environmental agreements and conventions. The key national environmental law is the Law on Nature Protection (1992).

338. A brief description of this law and the other supporting laws related to environmental protection is presented below.

C.1.4.1. Law on Nature Protection (1992)

339. The law ―On nature protection" (Law No.754-XII, 1992) states legal, economic, and organizational bases for the conservation of the environment and the rational use of natural resources. Its purpose is to ensure balanced relations between man and nature, to protect the environmental system and to guarantee the rights of the population of a clean environment. According to the legislation of the Republic of Uzbekistan, the Cabinet of Ministries of Republic of Uzbekistan, the State Nature Protection Committee (SNPC) and the local government bodies are responsible for implementing state laws on environmental protection and management and the use of natural resources. Article 25 of this law states that State Environmental Expertise (SEE) is a mandatory measure for environmental protection, preceded to decision making process. In addition, article 25 says that the implementation of the project without a positive conclusion of SEE is prohibited.

340. **Error! Reference source not found.** outlines some key articles of the Law on Nature Protection, and their associated requirements. Where appropriate, the specific quantitative emission/discharge limits applicable to the Project from national and regional legislation are described in the Project's commitments section.

Table 28. Main articles of the Law on Nature Protection (Law No.754-XII, 1992)

Article	Topic	Requirement
14	Environmental soil and standards	Environmental impacts shall be minimised by environmental norms and standards. Any project is subject to establishing maximum allowable norms of environmental load. This is undertaken at the detailed design phase of the Project by specialist Design Institutes.
19	Water and water bodies	The surface, underground and marine water resources of the Republic of Uzbekistan can be only used provided that there are sufficient water volumes in natural circulation; water purity is secured up to the standard, aquatic flora and fauna are under conservation, pollution of water bodies is avoided, ecological balance in water bodies is maintained and water

Article	Topic	Requirement
		bodies as landscape elements are not damaged.
20	Air	Changes in air quality, air pollution and air degradation shall be avoided to conform to established norms. In compliance with provisions of the international agreement all entities and individuals must phase out and at a later stage stop the production of ozone depleting substances.
20, 41, 45	Waste disposal; Environmental requirements to developments; Protection against contamination associated with waste	The owners of wastes have responsibility for safe disposal of waste in such a way that seeks to maximise opportunities for re-use or recycling and that is safe to the environment. Waste disposal shall logistically be arranged by local authorities. Key requirements include: • Ventures, organizations, establishments, and individuals should seek to implement waste-free and low waste technologies, reduce generation of production and consumption wastes, provide for their disposal and utilization and follow the procedures of their separation, storage, disposal and utilization. Commissioning of facilities that do not comply with these environmental requirements is forbidden. • It is forbidden to store and dispose of hazardous wastes on settlements lands, protected landscapes and recreational areas, historical sites, within water bodies, within water protection zones, in places where there is a risk to the life and health of citizens or in natural areas which are specially protected. • The disposal of wastes in the subsurface layer is permitted in exclusive cases, as justified through appropriate ground investigations. Requirements apply for the provision of health and safety of citizens and the protection of the environment. • The treatment of wastes and disposal or storage of wastes in landfills is authorised by the state bodies for nature protection.
33	Economic instruments to promote protection of the environment	The existing economic instruments include: • Resources user charges, pollution charges and other payments associated with environmental impact • Tax differentiation and financial incentives for introduction of low-waste and resource-recovery technologies • Taxes levied on environmentally hazardous technologies and operations • Licenses/permits to discharge and emit pollutants or to perform other environmentally hazardous activities • Allocation of responsibilities for the recovery of disturbed environment • Compensative payments for the damage to the environment • Deprivation of bonuses and awards for officers • Incentive prices and mark-ups for environmentally

Article	Topic	Requirement
		friendly products; • Economic sanctions against natural resources users for wasting natural resources and confronting with the established norms • Performance bonuses to groups and individual workers for promoting nature protection and manufacturing of environmentally friendly products • Other economic incentives as identified by the national legislation and local authorities.
34	Environmental changes	• Resources user charges and pollution charges include environmental taxes and other compulsory payments associated with the use of natural resources as well as compensative pollution charges associated with emissions, discharges and waste disposal, and conservation and renewal fees imposed on users of natural resources • Environmental tax rates and other payments associated with the use of natural resources are set in compliance with the legislation and depend on occurrence, quality, renewal capacity, accessibility, complexity, productivity, location, possibility of processing of natural resources and wastes re-use and recycling opportunities and other factors • Rates of pollution charges associated with emissions, discharges and waste disposal are subject for approval by the Cabinet of Ministers of Uzbekistan as advised by the Goskompriroda • Rates of conservation and renewal fees are subject for approval by the Cabinet of Ministers of Uzbekistan • Resources user charges constitute part of the primary cost of the product (works or services) • Compensative pollution charges and charges associated with exceeded norms and non-sustainable use of natural resources are collected by levy on the user profit • Collected resources user charges, conservation and renewal fees are transferred to the national budget • Collected compensative pollution charges associated with emissions, discharges and waste disposal are transferred to the relevant nature conservation funds • Paid resources user charges and compensative pollution charges does not exempt from the responsibility to undertake environmental activities and to repair the environmental damage.
35	Nature conservation funds	The Goskompriroda and its regional bodies may establish national and local nature conservation funds. The Regulation on the Nature Conservation Funds as approved by the Cabinet of Ministers of Uzbekistan details set-up and disbursement procedures. There are also Community Nature Conservation Funds that

Article	Topic	Requirement
		may be set up and operated as prescribed by law.
38	Emergency response and environmental hazards	Where accidents occur, an organisation should immediately initiate emergency response pursuant to the emergency response action plan with notification to respective governmental bodies, environmental authorities and emergency response organisations to mitigate environmental impacts associated with the accident.
46	Environmental certification	It is forbidden to use raw materials, implement technological processes and manufacture products without appropriate environmental or hygienic certificates or with deviation from established parameters.

C.1.4.2. Supporting national Legislation

341. State environmental control of issues related to the protection of soil and water, air, flora, fauna and specifically the environmental safety of the population is exercised through a range of national environmental laws and regulations. The main national and regional laws applicable to this project are explained in the following sections.

Air quality and air emissions

342. The following provides an overview of key legislation relating to air emissions in Uzbekistan and respective national requirements applicable to the Project.

343. The key regulators dealing with air emissions and ambient air quality in Uzbekistan are:

- The State Committee on Nature Protection (Goskompriroda) who develops air quality standards to protect the environment, the climate and the ozone layer
- The Ministry of Health who develops air quality standards (sanitary norms) to protect human health and oversees the compliance with hygienic norms and standards associated with air quality.

344. The key legislation relating to air emissions and ambient air quality in Uzbekistan applicable to the Project includes the following:

Table 29. Key environmental legislation of the RUz on air quality and air emissions

National laws
Law of the Republic of Uzbekistan on Atmospheric Air Protection No.353-I of 27.12.1996 (as amended on 10.10.2006) It describes regulations on atmosphere protection and its objectives. It specifies standards, quality and deleterious effect norms, requirements on fuels and lubricants, production and operation of vehicles and other transport means and equipment, ozone layer protection requirements, obligations of enterprises, institutions and organizations toward atmospheric protection, and compensations for damages from atmospheric pollutions. The Cabinet of Ministries of the Republic of Uzbekistan, SNPC and local government bodies are responsible for implementing the law.
Law of the Republic of Uzbekistan on State Sanitary Control

No.657-XII of 03.07.1992 (as amended on 03.09.2010) It regulates social relations on sanitary-epidemiological well-being and radiation safety, the right person to a healthy environment and other associated with it, the rights and guarantees of their implementation. Thus Article 9 of this law defines obligation to meet sanitarian norms, rules and hygiene regulation at the design, construction and commissioning projects.
Criminal Code, Section 4. Environmental Crimes approved on 22.09.1994 (as amended on 04.01.2011)- It is specifies the conception and defines punishment for violation of the norms and requirements of environmental safety, willful concealment or misrepresentation of environmental pollution, violation of flora and fauna, water, land, subsoil, protected areas use.
Law of the Republic of Uzbekistan on Environmental Expertise No.73-II of 25.05.2000 (as amended on 04.01.2011). It specifies the purposes, objectives and types of environmental expertise. The law defines the qualifications, duties and obligations of environmental experts. The State Nature Protection Committee (SNPC) has overall responsibility for implementing this legislation through The Departments of Environmental Expertise (Glavgosekoexpertiza and Gosecoexpertisa which are both under the SNPC) and the Provincial branches of SNPC.
Decrees
Decree of Oliy Majlis of Uzbekistan on **Enactment of the Law on Atmospheric Air Protection** No.354-I of 27.12.1996
Decree of the Cabinet of Ministers of Uzbekistan on **Approval of the Regulation on the State Environmental Expertise in the Republic of Uzbekistan** No.491 of 31.12.2001 (as amended on 05.06.2009)
Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Improving the System of Pollution and Waste Disposal Charges in Uzbekistan** No.199 of 01.05.2003 (as amended on 02.04.2010)
Decree of the Cabinet of Ministers of Uzbekistan on **The National Strategy for Reducing Greenhouse Gases Emissions (main provisions)** No.309 of 09.10.2000
Decree of the Cabinet of Ministers of Uzbekistan on **Measures to Implement the National Strategy for Reducing of Greenhouse Gases Emissions** No.389 of 09.10.2000
Regulations
Instructions on **Inventory of Pollution Sources and Rating Pollutant Emissions for Ventures in Uzbekistan** enacted by Order of the Chairman of the State Committee for Nature Protection of the Republic of Uzbekistan No.105 of 15.12.2005
Sanitarian Rules and Norms
Hygienic norms. List of Maximum Allowable Concentrations (MACs) of pollutants in ambient air of communities in the Republic of Uzbekistan including Annex 1. SanR&N RUz No.0179-04
Sanitary norms and requirements to protect ambient air in communities of the Republic of

Uzbekistan SanR&N RUz No.0246-08
Hygienic Norms. List of Maximum allowed concentration (MAC) of pollutants into the atmosphere air of settlements in Uzbekistan SanR&N No 0293-11
Hygienic Norms. List of maximum permissible concentration (MPC)- microorganism-producers in the air of settlement areas SanR&N No 0147-04

345. Rating of pollutant emissions in the air applicable to projects under design is done by setting the maximum allowable emissions of those substances into the atmosphere (MAE) MAE is the mass of pollutant emissions per unit of time from the respective source from the perspective of its development and dispersion of hazardous substances in the atmosphere, creating ground-level concentrations not exceeding the maximum permissible concentrations fixed by Uzbek State Environmental Committee. According to the Guidelines for Inventory of Sources and Rating the Emissions into the Atmosphere for Uzbek Enterprises, registered by the Ministry of Justice on 3 January 2006, No 15-33, rated emissions by ingredients shall meet the following conditions:

$$C_m \leq MAC_{max} \times Quota \text{ , where}$$

C_m: The maximum pollutant concentration at the border of the facility is determined by calculation based on the characteristics of the emission source and the gas-air mixture by the method of CIS-86 Methodology for Calculation of Concentrations in the Air of Harmful Substances Contained in the Enterprises Emissions, 1987.

MAC_{max}: The maximum single maximum permissible concentration (MAC), mg/m^3, determined by Uzbek SanR&N No 0179-04 Hygienic Regulations List of Maximum Permitted Concentrations of Pollutants in the Air of Populated Areas in the territory of the Republic of Uzbekistan.

346. The quota for the pollutants release into the atmosphere is the ultimate magnitude of the impact of a particular substance/combination of substances established for each enterprise as a percentage of the total influence of all enterprises located in the territory. The quota for pollutants is determined by Table 30.

Table 30. Quota for pollutants

Enterprise Category*	**Hazard Class of Exhausted Substance****			
	1	2	3	4
1	0.2	0.3	0.4	0.5
2	0.2	0.35	0.5	0.65
3	0.2	0.4	0.6	0.8

* Enterprise category (based on level of impact) is determined in accordance with Uzbek Cabinet Decree No 491 from 2001.

** Hazard Class is determined under Uzbek SanR&N No 0015-94 List of Maximum Permitted Concentrations (MAC) of Pollutants in the Air of Populated Areas in the territory of the Republic of Uzbekistan (1 – high hazard, 4 – the lowest hazard).

347. The MAE standard is established based on the analysis of areas of ground-level concentrations created by all sources of the enterprise for each substance. (in accordance with MAE are established for fully loaded process and gas-cleaning equipment and their normal operation). MAE shall not be exceeded in any 20-minute period of time.

348. Calculation of MAE values is done based on the results of the inventory of sources of exhausts in the atmosphere performed under the Guidelines for Inventory of Sources and Rating the Emissions into the Atmosphere for Uzbek Enterprises, Tashkent 2005 and the following documents:

- Uzbek Republic Law on Air Protection
- Uzbek Republic Law on Nature Conservation
- RD RU 34-567-2004 Guidelines. Calculation of annual MAE of pollutants in the atmosphere by equity contribution for TPP Uzbekenergo GJSC. Tashkent, 2004.

349. For this purpose inventory of all sources of pollutant exhausts shall be performed, data shall be collected by type and quantity composition of pollutants and sources shall be defined representing the greatest atmospheric air pollution hazard.

Water use and discharge

350. Water resources management, allocation and use in Uzbekistan are under the control of the Ministry of Agriculture and Water Resources (MAWR), which oversees national specialised associated, provincial and district departments of agriculture and water resources, and inter-provincial and inter-district canal management authorities.

351. Legislation related to water resources management, allocation and use within Uzbekistan is compiled in the next table:

Table 31. Key environmental legislation of the RUz on water use and discharge

National laws
Constitution of the Republic of Uzbekistan Article 55 ~~L~~Land, depths, water, flora and fauna and other natural resources are national wealth, should be rationally used and are under state protection”.
Law of the Republic of Uzbekistan on water and water use No.837-XII of 06.05.1993 It regulates the water relations, rational use of water by the population and economy. The law regulates the protection of waters from pollution and depletion, and prevention and liquidation of harmful effects of water, improvement of water bodies and the protection of the rights of enterprises and institutions, organizations and dehkan farms and individuals in the field of water relations. This Law also authorizes the State (through authorized agencies) to carry out management and control of water use and protection. The following special state agencies are authorized to regulate water use: • Ministry of Agriculture and Water resources management (MAWR) (surface water); • State Committee for Geology and Mineral Resources (or Goskomgeologia) • State Inspectorate for Exploration Supervision, Operations Safety Supervision of Industry, Mining and Utilities Sector (or *Sanoatgeokontekhnazorat*)

Land Code of the Republic of Uzbekistan Approved on 30.04.1998 It came into effect from July 1, 1998 and aims to regulate land relations in order to ensure that present and future generations have science-based, sustainable use and conservation of land, breeding and improvement of soil fertility, conservation and improvement of the environment and creating conditions for equitable development of all forms of management, the protection of individuals and legal entities‘ right for land, as well as strengthening the rule of law in this area. The law specifies that the system of land use management must be environmental, resource effective and provide for conservation of soil, limiting the impact on flora and fauna, geological resources and other components of the environment. Also, according to the Code, the estimate of negative impact of construction works or implementation of technologies to the state of lands and the effectiveness of measures envisaged for the use and protection of land is based on environmental impact assessment.
Decrees
Decree of the Cabinet of Ministers of the Ruepublic of Uzbekistan on **Rules of receiving industrial sewages and calculation of above standards pollutants discharges into the communal sewage system of the cities and other settlement areas of RUz** No.11 of 03.02.2010
Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Establishment of water protection and coastal zones at the Amudarya river in Surkhandarya, Khorezm province and Karakalpakstan** No. 27 of 07.02.2007
Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Limited water use in the Republic of Uzbekistan** No.385 of 03.08.1993
Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Confirming the regulations on water protection areas in water reservoirs and in other water bodies, rivers, main canals and collector, as well as drinking and domestic water supply sources, and for medical and recreation purposes in the Republic of Uzbekistan** No.174 of 07.04.1992
Resolution of Cabinet Ministries of RUz on **adoption of order of water use and water consumption in the Republic of Uzbekistan** No. 82 of 19 March 2013 The Regulation defines the followings: order of water use and consumption in the Republic of Uzbekistan; state management in water use. The document states that several Ministries are implementing control on water use: local governments entities, State nature protection committee, State Inspection for geological study of subsoil, Safety in industry, mining and domestic sectors of the Cabinet of Ministers, the Ministry of Health of the Republic of Uzbekistan, the Ministry of Agriculture and Water Management of the Republic of Uzbekistan in the manner prescribed by law. Also the regulation regulates trans boundary water bodies uses.
Regulations
Regulation Document on **Regulations on rationing discharges of pollutants into water bodies and on the terrain, taking into account technically achievable performance of wastewater treatment** RH 84.3.6:2004
Regulation Document on **Order of endorsement and approval of projects of wastes disposal and limits for its disposal**

RH 84.3.22:2006
Sanitarian Rules and Norms
Hygiene requirements for the protection of surface waters in RUz SanR&N No 0172-04
Main criteria for hygienic assessment of the level water bodies contamination for health risks population in Uzbekistan SanR&N No 0255-08
Sanitarian requirements for development and approval of maximum allowed discharges (MAD) of pollutants discharged into the water bodies with waste waters SanR&N No 0088-99
Others
Construction Norms and Rules on Guideline on content, endorsement and approval of design estimates for construction of enterprises, buildings (CNR) 1.03.01-96
Provision on the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan, 2001

352. All interrelations in water resources within Uzbekistan are based on the above mentioned documents and corresponding contracts on water delivery. Water is delivered on a contractual basis to all water consumers including provincial and district water organizations and separate units. As a rule, the volume of water passing through the border of the neighbouring states is specified in interstate agreements.

Waste Management

353. This section provides an overview of the key legislation concerning waste management and disposal in Uzbekistan. The Cabinet of Ministers of Uzbekistan sets and approves national policies, strategies, programmes and procedures relating to waste management including allocation of hazardous waste disposal sites and adjustment of waste disposal charge rates as set forth in Article 5 of the Law on Wastes. Local governments are responsible for waste management policies, strategies and procedures at the local level.

354. The normative documents shown in the following table are used for waste inventory and management at the Takhiatash TPP:

Table 32. Key environmental legislation of the RUz on waste management

National laws
Constitution of the Republic of Uzbekistan Article 55 ~~-~~Land, depths, water, flora and fauna and other natural resources are national wealth, should be rationally used and are under state protection”.
Law on Wastes No.362-II of 05.04.2002 (as amended on 04.01.2011) It addresses waste management, exclusive of emissions and air and water pollution, and confers authority to the SCNP concerning inspections, coordination, ecological expertise and establishing certain parameters with regard to the locations where waste may be processed. The Law

specifies that citizens have the right to a safe and healthy environment, to participate in the discussion of projects, and to compensation for damage to their lives, health or property. Dangerous waste that is transported domestically or internationally must pass ecological certification and be moved by special vehicles. The import of any radioactive waste for storage or burial is strictly forbidden. Although this is not specified in the Law, special privileges are given to persons and enterprises that develop and introduce technologies for reducing or recycling waste. Enterprises are responsible for their waste, but, if they recycle, they may be provided with assistance from the state budget, the National Fund for Nature Protection or voluntary payments. The principal objective of this law is to prevent negative effects of solid wastes on people‘s lives and health, as well as on the environment, reduce wastes generations, and encourage rational use of waste reduction techniques in household activities. The law regulates the procedures for treating solid wastes and defines the authorities of various institutions involved in solid wastes management. The law also stipulates the rules for transporting solid wastes and provides market base incentives for efficient treatment of solid wastes. The Cabinet of Ministries of the Republic of Uzbekistan, SNPC, Ministry of Health, Uzbek Agency “*Uzkomunhizmat*”, Agency on supervision for safe operation in the industry and mines inspectorate (hereinafter Agency “*Sanoatkontekhnazorat*”) are responsible for implementing the law.

Decrees

Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Measures to streamlining of the collection, preparation and delivery of secondary processing of waste paper**

No. 70 of 16.03.2009

Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Approval of the collection and disposal of used mercury-containing lamps**

No. 266 of 21.09.2011

Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Improving the System of Pollution and Waste Disposal Charges in Uzbekistan**

No.199 of 01.05.2003 (as amended on 02.04.2010)

Decree of Oliy Majlis of Uzbekistan on **Enactment of the Law of the Republic of Uzbekistan on Wastes issued**

No.363-II of 05.04.2002

Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Enhancing the Use and Recycling of Mercury Lamps and Devices**

No.405 of 23.10.2000

Orders:

Order of **disposal of hazardous chemicals and hazardous materials on special landfills, their protection and maintenance**, approved by the State Nature Protection Committee, Ministry of emergency situations, Ministry of Finance, Ministry of Healthcare,

No. 2438 of 20 March 2013.

The regulation provides definitions of hazardous chemicals, toxic materials, special landfills and special transportation vehicles. State organization “Qishloqkimyo” (Agriculture chemicals) is responsible for transportation handling and disposal of hazardous materials. Transportation of such materials has to be conducted in accordance with Resolution of Cabinet Ministries of RUz No. 35 of 16 February 2011 on “Rules of hazardous materials transportation on the territory of RUz”. The Ministry of Healthcare and State Nature Committee are involved into the endorsement of proper completion of works.

The following Ministries are responsible for conducting monitoring of the special landfills:

- State Nature Protection Committee – reviewing on complying with environmental requirements;
- Branches of Ministries of Health – reviewing on complying with sanitarian norms and rules during conducting works with hazardous chemical, toxic materials and their packages;

• Ministry of Emergency Situation – conducting works to avoid emergency situations and handling with consequences. • Branches of State Committee on Geology and mineral resources – conducting permanent monitoring of ground water quality.
Regulations
Regulation Document on The waste inventory procedure RD Oz RH 84.3.15.2005
Regulation Document on Guidelines for setting waste disposal limits RD Oz RH 84.3.16.2005
Regulation Document on Production and consumption waste. Procedure for developing the Waste Disposal Limit Document RD Oz RH 84.3.17.2005
Regulation Document on Production and consumption waste. Waste Data Sheet RD Oz RH 84.3.18.2005
Regulation Document on Production and consumption waste management. Terms and definitions RD Oz RH 84.3.19.2005
Regulation Document on Guidelines for setting waste generation RD Oz RH 84.3.21.2005
Production and consumption waste. Waste inventory and waste disposal limits approval procedure (issued by the Goskompriroda of Uzbekistan, 2006) RD Oz RH 84.3.22.2006
Requirements for handling mercury and its compounds, mercury-based waste, and mercury containing devices RD Oz RH 84.3.11.2004
Regulation on handling mercury-containing products in the Republic of Uzbekistan RD Oz RH 84.3.10.2004
Methodology for integrated waste hazard rating RD Oz RH 84.3.8.2004
Instruction for hazardous wastes generation, use and storage reporting as per Form No.3 – Hazardous Waste (half-year, annual reporting) (issued by the State Statistics Department of the Republic of Uzbekistan, 1997)
A Landfill for burial and land storage of industrial hazardous wastes KMK 201.12-96
Provisional waste norms for cities and regions of Uzbekistan approved by *khokimyats*
Sanitarian Rules and Norms
Sanitarian Rules of inventory, classification, storage and disposal of industrial wastes SanR&N No. 0127-02
Hygienic classifier of toxic industrial wastes in the Republic of Uzbekistan SanR&N No. 0128-02
Sanitarian requirements on storage and disposal of solid waste in special landfills SanR&N No. 0157-04
Sanitarian Rules and Norms on collection, transportation and disposal of wastes contained asbestos in Uzbekistan SanR&N No. 0158-04
List of asbestos-cement materials and construction, allowed for using and field of its

implementation SanR&N No. 0168-04
Sanitary regulations for collection, storage, transportation, disposal and recycling of municipal solid waste SanR&N No. 0068-96
Others
GOST 17.0.0.05-93 - Unified system of standards for environmental protection and rational use of resources. Waste Data Sheet. Composition, content, presentation and amendment procedures
GOST 30333-95 Material Safety Data Sheet. Basic principles. Information on safety during production, use, storage, transportation, and recycling (adopted as the interstate standard by Uzstandart letter _05/01-144 06.11.2003)
GOST 17.9.0.2-99 Environment protection. Waste management. Waste Data Sheet. Composition, content, presentation and amendment procedures
GOST 17.9.1.1-99 Environment protection. Waste management. Waste classification. Waste definition by the genetic principle and categorization
GOST 30774-2001 Resources saving. Waste management. Waste Hazard Data Sheet. Main provisions
GOST 30775-2001 Resources saving. Waste management. Identification and coding. Main provisions

355. The Uzbek Law on Wastes regulates waste management and requires entities to carry out rating and develop limits of waste disposal in order to ensure health and safety of both citizens and environment. The following provides an overview of key provisions of the Law applicable to the Project:

- The main objective is to ensure that waste management avoids any impact to life and health of citizens, and the environment. Any activity of any project may be restricted, suspended or terminated in case of non-compliance with waste legislation that entails damage to life and health of citizens, and the environment or when hazardous waste is generated without technical or other safety measures to protect life and health of citizens, and the environment (Article 17);
- The project shall comply with sanitary norms and standards, safety and environmental requirements to ensure efficient waste management (Article 22);
- Waste generated by the project shall be the property of the project (Article 4);
- The project shall comply with the respective waste management legislation of the Republic of Karakalpakstan (Article 3);
- Provided any international agreement signed by the Republic of Uzbekistan stipulates other requirements than those specified in the waste management legislation of the Republic of Uzbekistan, requirements of the international agreement shall govern (Article 3)
- It will be a responsibility of the Project (under Law on Wastes, Article 15) to:

    - keep records on generated waste and report to respective authorities (the Waste Inventory Document, the Waste Data Sheet, Waste Hazard Data Sheet, Form _ 3-Environment. Toxic Waste Generation, Handling and Storage Report);
    - rate the level of generated waste hazard (every five years);
    - develop, obtain approval of and comply with the Waste Generation Norms and Waste Disposal Limits;
    - collect, and properly store the waste in such a way as to prevent destruction and deterioration of waste of high resource value and subject to recycling;
    - take measures to develop and introduce waste recycling technologies;
    - prevent mixing of waste unless this is required by the applied technology;

- avoid storage, treatment, recycling and disposal of waste at illegal sites;
- monitor sanitary and environmental conditions at project owned waste disposal facilities;
- reinstate land disturbed as a result of waste management;
- maximise recycling and ensure environmentally safe disposal of non-recyclable waste;
- report to authorities on illegal waste disposal sites and measures taken;
- pay waste disposal charges;
- recover damage caused to the life, health and property of citizens, the environment, or other companies as a result of waste management.

Municipal Solid Waste

356. SanR&N RUz - 0157-04 - Sanitary requirements for storage and disposal of municipal solid wastes (MSW) at landfills in Uzbekistan defines that MSW shall be collected through a unified system of specialised utilities and shall be disposed at MSW landfills.

357. MSW may include various items, goods, materials unsuitable for further use, and waste like paper, food waste, wood, metals, textiles, leather, rubber, glass, stones, charcoal and ash, house and street sweeps, fallen leaves, parts and screenings (particles of 15 mm or less).

Hazardous waste in Uzbekistan

358. Hazardous waste in Uzbekistan is defined as waste that contain substances with at least one of the defined hazardous properties (toxicity, infectivity, explosive hazard, fire hazard, high reactivity, radioactivity) and available in such amounts and in such a way as to pose an imminent or potential risk to human life and health, the environment, both in their current state or when exposed to other substances.

359. Hazardous waste is classified into four groups known as ‗hazard classes'. Waste hazard is assessed based on the provisions of SanR&N - 0128-02 29.07.02 - Hygienic classifier of industrial hazardous waste and SanR&N - 0127-02 29.07.02 – Sanitary procedures for industrial waste inventory, classification, storage and disposal.

360. Waste hazard classes include:

- Class I – extremely hazardous waste;
- Class II – highly hazardous waste;
- Class III – moderately hazardous waste;
- Class IV – low-hazardous waste, and

361. Hazard classes, physical characteristics and chemical composition of toxic industrial waste are determined by designated process laboratories of companies or research institutes requiring involvement of specialists from Goskompriroda and the Sanitary Epidemiological Stations (SES).

362. The State Statistics Committee has generated a special statistics form to collect data on generated hazardous wastes: Form _ 3- Environment. Hazardous Waste Generation, Handling and Storage Report.

363. This report provides information on 15 streams of waste distinguished by pollutants (chrome, asbestos, mercury, etc.) and hazard classes.

Waste Transportation

364. Transportation of hazardous wastes shall be in specially designated types of vehicle with a waste transportation certificate and a permit. Responsibility for safe transportation of hazardous waste shall be with a transporting organization (Law on Wastes, Article 20).

365. Provided generated waste is subject to export and import operations, or hazardous waste is subject to transportation, an environmental certification procedure shall be completed by the project to confirm compliance with sanitary and environmental norms and standards associated with waste management (Law on Wastes, Article 19).

Waste Recycling and Re-use

MSW

366. MSW may be re-used as material for backfilling open pits and quarries provided food waste content is less than 15%.

Hazardous Waste.

367. The national requirement for mercury-containing waste and materials (spent mercury lamps, devices, etc.) is to use only specialized contractors for recycling and treatment properly licensed by Goskompriroda of Uzbekistan. Currently mercury recycling facilities are available in Tashkent, Andijan, Fergana, Navoi, Zaravshan and Bukhara cities (Decree of the Cabinet of Ministers of the Republic of Uzbekistan on Enhancing the Use and Recycling of Mercury Lamps and Devices No.405 of 23.10.2000).

Waste Storage and Disposal

368. The Law on Wastes (Article 22) specifies general requirements for waste storage and disposal. Waste disposal of recyclable waste is prohibited in Uzbekistan. Storage and disposal of waste in the environment including in nature conservation and protected areas, settlements, health and recreational areas or historical and cultural facilities is prohibited. Waste disposal in subsoil is allowed in exceptional cases provided special investigations prove it is safe for health, the environment, and natural resources.

369. Hazardous waste disposal facility of the project is subject to national approval.

370. All wastes (hazardous and non-hazardous) generated and landfilled by the Project will be subject to waste disposal charges used in Uzbekistan as an economic instrument to promote waste recycling and re-use.

MSW.

371. MSW landfills in Uzbekistan are accommodated in such a way as to ensure that landfill operations comply with sanitary and epidemiological requirements and are safe to both human health and the environment. A MSW landfill may service one settlement or a group of settlements.

372. MSW landfills may be used to dispose of construction waste and some types of industrial waste rated at Hazard Class III and IV however this will require a special approval from a respective Centre for Sanitary and Epidemiological Supervision (CSES).

Hazardous Waste.

373. Decontamination and disposal of toxic industrial wastes shall be carried out at special engineering facilities - landfills - taking into account their class of hazard, by incineration, neutralization or dumping.

374. Industrial hazardous waste shall be disposed at hazardous waste landfills as specified in SanR&N RUz - 0127-02 29.07.02 – Sanitary procedures for industrial waste inventory, classification, storage and disposal.

375. When dumping industrial waste rated under Hazard Class I, additional measures shall be taken to prevent migration of those substances from the waste into the environment.

376. When dumping solid and dust waste under Hazar Class II and III, sealing the bottom and side walls of those trenches is mandatory.

377. Industrial waste rated under Hazard Class III and IV may be disposed of at MSW landfills provided their share is 30% maximum and concentrations of toxic substances in aqueous leachate is similar to concentrations in MSW leachate (BODtotal and COD is 3400-5000 mg/l O_2 (SanR&N RUz - 0157-04)).

378. Industrial waste rated under Hazard Class IV may be disposed at MSW landfills as an insulating material provided concentrations of toxic substances in aqueous extract are similar to concentrations in MSW leachate, with BODtotal and COD being less than 300 mg/l O2, and waste homogeneous structure being made of minimum 250mm fractions (SanPiN RUz _0157-04 - Sanitary requirements for storage and disposal of municipal solid waste at MSW landfills in Uzbekistan).

379. Liquid industrial waste under Hazard Class IV shall be evenly spilled at the landfill. Liquid waste under Hazard Class I, II and III, prior to transportation to landfills shall be dehydrated to a pasty consistency at the enterprises. Hazard Class I shall be placed in hermetically closed steel containers after dehydration also.

380. Combustible waste as well as scrap, impregnated with varnishes, thinners, and enamels shall be burned in a special furnace at the landfill.

381. Related to the disposal of wasted asbestos, SanR&N No 0158-04 regulates a procedure of wasted asbestos handling. Chapter 4 describes the procedure of collecting wasted asbestos. Wastes contained asbestos have to be disposed by the method avoided dust generating. In case of manually collection wastes the personnel protection equipment for respiratory organs (respirators) should be used. Bulk materials collected by other methods should be placed into the impermeable bags (containers). Replacement of the bags (containers) should be conducted by mechanized methods.

382. Solid wastes contained asbestos should be storage into places where they will not be destroyed during period of storage. Bags (or other containers) used for storage of wastes should be disposal by grinding and packing into the dense transportable piles in the special indicated places. These bags could not be reused as a waste paper or package. It could be reused as secondary materials for production of asbestos – cement and other goods.

383. All containers with asbestos wastes should have appropriate inscriptions and labeling. During all process of operation on collecting and temporarily storage of wastes contained asbestos, all workers should wear appropriate wear and respirators. Works related with wastes loading, transportation, unloading and disposal should be mechanized; transportation should avoid spilling of wastes and

prevent pollution of environment. Transportation of unpacked asbestos in open trucks and railway platforms is prohibited.

384. Asbestos wastes belonged to Hazard Class IV could be disposed on MSW without limitations (quantity). Disposal asbestos wastes under Hazard Class III is limited and amount of such wastes should not exceed 30% of general amount of solid wastes. Asbestos wastes should be disposed on landfills with impervious layers with soil interlayer between them. This legislation also provides specification of landfills location and its organization (arrangement/structure).

385. Permits for combined landfilling of industrial and municipal waste are granted by local CSES based on results of analyses completed by accredited laboratories (SanR&N RUz - 0157-04).

386. Landfill owners are responsible for safe storage and disposal of waste to avoid potential impacts to human health and the environment (SanR&N RUz _0157-04).

Soil

387. Issues related to protection of geology, soils and groundwater in Uzbekistan are regulated by relevant national legislation including:

Table 33. Key environmental legislation of the RUz on soil, subsoil and groundwater

National laws
Law of the Republic of Uzbekistan on Subsoil No.2018-XII of 23.09.1994 This law aims to ensure sustainable and integrated use of mineral resources to meet the needs of the mineral raw materials and other needs, protection of mineral resources, environment, safety of operations in subsoil use and protection of subsoil users, protecting the interests of individuals, society and state. According to the Law, the monitoring of subsoil, which represents a system of observations of the subsoil to timely detect changes, assess, prevent and redress the negative processes, is established (Article 18). Geological studies are permitted only after obtaining a positive opinion of the state environmental assessment (Article 25). Licenses for construction and operation of underground facilities for the storage and disposal of waste shall be issued by the State Nature Protection Committee of the Republic of Uzbekistan as a result of direct negotiations
Decrees
Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Approval of Regulatory Documents in Conformity with the Law of Uzbekistan on Subsoil** No.19 of 13.01.1997 (as amended on 17.12.2010) Annex No. 2, Regulations on state control and supervision for usage and protection of subsoil, geological survey of subsoil and rational usage of mineral resources
Decree of the Cabinet of Ministers of Uzbekistan on **Improving the System of Pollution and Waste Disposal Charges in Uzbekistan** No.199 of 01.05.2003 (as amended on 02.04.2010)
Decree of the Cabinet of Ministries of the Republic of Uzbekistan on **Regulation on Measures for Ground Water Management, Enhancement of Ground Water Protection against Pollution and Depletion** No.179 of 08.04.1992

Sanitarian Rules and Norms
Sanitary rules and Norms on Development of hygiene studies to schemes of soil pollution in Uzbekistan SanR&N No 0272-09
Sanitary rules and Norms on Hygienic assessment of the contamination level of soils of different land use types in the specific conditions of Uzbekistan SanR&N No 0212-06
Hygienic requirements for the quality of the soil in settlements areas in specific natural-climatic conditions of Uzbekistan SanR&N No 0183-05

Biodiversity

388. The national biodiversity policy in Uzbekistan is based on the provisions of the National Constitution of 1992. Article 55 defines that flora and fauna as well as other natural resources are protected by the state and considered to be resources of national wealth subject to sustainable use. Biodiversity management and conservation in Uzbekistan are regulated through a range of national laws and regulations, gathered in Table 34 below.

Table 34. Key environmental legislation of the RUz on biodiversity

National laws
Law of the Republic of Uzbekistan on Protected natural areas No.710-II of 03.12.2004 It regulates relations in organization, protection and use of conserved territories, and management of protected nature reserved or territories. In the law are given the categories and management of conserved territories such as integrated (landscape) wildlife preserves, nature parks, state natural objects, areas for protection, conversion and restoration of certain natural and manmade objects and complexes. SNPC and local government bodies are responsible for implementing state control and protection of nature conserved territory and its usage.
Law of the Republic of Uzbekistan on Protection and use of flora No.543-I of 26.12.1997 It regulates protection and usage of flora growing in natural condition, as well as in cultivation and its reproduction and conservation of gene pool of wild plants. The Cabinet of Ministries of the Republic of Uzbekistan, local government bodies and special authorized agencies implement the law. SNPC and Head Department of Forestry under Ministry for Agricultural and Water Resources Management are the special authorized agencies in flora protection and its usage. The Cabinet of Ministries of Republic of Uzbekistan, local government bodies, SNPC and Head Department of Forestry are responsible for implementing on the national level the administration of the law.
Law of the Republic of Uzbekistan on Protection and use of fauna No.545-I of 26.12.1997 It defines the legal relationship aimed at regulating relations in the protection, use, restoration and reproduction of fauna in order to ensure the conditions of its existence, preservation of

species diversity, the integrity of natural communities and habitat. The choice of sites for all types of construction, pre-planning, design and project documentation, implementation of which may have impact on the wildlife or its habitat and projects unit hunting and fishing, projects, work on acclimatization and hybridization of animal protection plants, dangerous to wildlife and its habitat is subject to the state environmental assessment.
Law of the Republic of Uzbekistan on Forestry No.770-I of 14.04.1999 It describes main objectives of forest regulations and state forest fund and gives mechanism of state regulations and controls in the field of forest protection, conservation, use, and reproduction. The law stipulates the order of forest management, its types and cutting conditions of tree and bush plantations. The Cabinet of Ministries of the Republic of Uzbekistan, local government bodies, SNPC and Head Department of Forestry under Ministry for Agricultural and Water Resources Management are responsible for implementing the law.
Decrees
Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Confirmation of tax for calculation of damage recovery caused on flora of the RUz** No.293 of 27.07.1995
Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **National strategy and measures of the RUz on conservation of biological diversity** No.139 of 01.04.1998
Decree of the Cabinet of Ministers of Uzbekistan on **the Red Book of the Republic of Uzbekistan** No.109 of 09.03.1992
Decree of the Supreme Council of Uzbekistan on **Reinforcement of the Protection of Valuable and Endangered Species of Flora and Fauna and Harmonisation of their Use** No.937- XII of 03.09.1993
Appendix of the Decree of the Cabinet of Ministers of the Republic of Uzbekistan on **Classification of technogenetic, natural and environmental emergencies** No 455 from 27.10.1998

C.1.4.3. Supporting regional legislation

389. Furthermore, the Republic of Karakalpakstan has developed a series of laws specific to the region. Where Karakalpakstan legislation is in force this should be considered in parallel with national legislation. The key regional environmental laws applicable to this Project are:

- Law on Nature Protection (03.03.06)
- Law on Atmospheric Air Protection (16.08.97)
- Law on Protected Natural Areas (29.08.05)
- Law on Water and Water Management (24.12.93)
- Law on Subsurface Resources (29.08.06)
- Law on Environmental Expertise (05.10.07)
- Land Code (29.08.06)

C.1.4.4. Economic Instruments in Environmental Management

390. Economic instruments are used as supplements to the regulatory tools in Uzbekistan. These instruments apply the polluter pay principle (PPP) and user pay principle (UPP) approach. The main purpose of economic instruments is to provide a good basis for an adequate valuation of nature resources and promote their efficient and intended use.

391. The system of environmental charges and payments for the use of natural resources has been developing gradually. It plays a dual role: revenue-raising to finance public environmental spending and behaviour changing through creating incentives for reducing emissions, discharges and waste. First introduced in 1992, the system was revised in 1995 with the introduction of pollution charges based on gross emissions/discharges and values of disposed waste. In 2003 new changes have been introduced. Compensative pollution charges are now collected by the Goskompriroda and Nature Protection Funds, and distributed between the state budget - 60%, and Nature Protection Funds – 40%. The next step was the introduction of user charges levied on those who use water, land, forests, subsoil and other resources.

392. Since 1998, Uzbekistan launched a new tax system. Existing resource payments were transferred to the rank of taxes: water tax, land tax and subsoil tax. Proceeds raised are transferred to the state budget. Some non-compliance penalties like those associated with protected flora and fauna are collected by local Nature Protection Funds while few are shared between the state budget and the Nature Protection Funds at 50% by 50%.

393. Rates of pollution charges and environmental taxes are set by the Cabinet of Ministers. These will be applied to the project at the operational stage.

C.1.5. Social regulatory framework

C.1.5.1. Social Policies and Strategies

394. Uzbekistan pursues a policy of protecting human rights and freedoms in conformity with international standards. As a fully fledged member of the United Nations Organization, RUz assumes an obligation to comply with international human rights acts and apply them to the national policy and practice of law.

395. The Republic of Uzbekistan has ratified over 40 international acts on human rights, including:
   - the Universal Declaration of Human Rights (1948), ratified by RUz in 1991
   - the International Covenant on Civil and Political Rights (1966), ratified by RUz in 1995
   - the Convention on the Elimination of All Forms of Discrimination against Women (1979), ratified by RUz in 1995
   - the Convention on the Elimination of All Forms of Intolerance and of Discrimination Based on Religion or Belief (1981), ratified by RUz in 1997

396. All key provisions of the Universal Declaration of Human Rights (1948) were fully introduced in the 1992 Constitution of the Republic of Uzbekistan.

397. The social policy in Uzbekistan is defined at the national government level and is reflected in laws, regulations and national social programs. Some examples of national social programs implemented in Uzbekistan are listed below:

398. In 2007 Uzbekistan developed the Welfare Improvement Strategy (WIS) focused on the economic growth to reduce poverty in the country. The WIS strategy replaced two interim documents: the Living Standards Strategy for the Population of Uzbekistan (2004-2006) and the Interim Poverty

Reduction Strategy Paper (2005-2010). Through the WIS strategy the government is committed to implementing measures for improving living standards, social services and quality of education and health care, as well as addressing rural development issues.

399. Land issues in Uzbekistan are regulated by the 1998 **Land Code** which replaced the 1990 Law on Land and is considered as the principal legal instrument in dealing with land-related issues in Uzbekistan. It sets legal, economic and institutional framework for land allocation, use, ownership and conservation. According to the Land Code (Article 16) land is public property, protected by the state and considered to be the resource of national wealth subject to sustainable use.

400. The national legislation differentiates between agricultural and urban land and these are treated differently under Uzbek Law. While agricultural land issues are covered and treated under the Land Code, urban land issues are covered under the Civil Code, The Housing Code and the Urban Construction Code.

401. All information on the country's land including natural, economic, legal regimes of land, land categories, land quality and value, location and size of land plots, land allocation to owners, users, tenants as well as state registration of land ownership registration data is collected and stored in the **State Land Cadastre**.

402. Based on the information from the **State Land Cadastre** the National Land Report is issued annually to summarize information on the quantitative and qualitative conditions of the country's land including land classification by category, industry, owners, users, tenants, and other inventory parameters.

C.1.5.2. Key Social Legislation

403. Social legislation in Uzbekistan covers the whole spectrum of social related issues, including employment, health and safety, education, health care, social protection, migration and consumer rights. Table 35 provides a summary of the key social legislation of the Republic of Uzbekistan.

Table 35. Key social laws of the Republic of Uzbekistan

Employment and Occupational H&S
Law of the Republic of Uzbekistan on **State Sanitary Supervision** No.657-II of 03.07.1992 (as amended on 03.09.2010)
Labour Code of the Republic of Uzbekistan of 01.04.1996 (as amended on 22.12.2010)
Law of the Republic of Uzbekistan on **Occupational Health and Safety** No.839-XII of 06.05.1993 (as amended on 07.12.2001) It establishes a general order of organization of work safety regardless of the types of production, ownership and aims to ensure health and safety of citizens.
Law of the Republic of Uzbekistan on Protecting Health of Citizens No.265-I of 29.08.1996 (as amended on 19.05.2010) In order to protect the health of citizens, the Project will have an emergency preparedness and response plan, HIV/AIDS awareness initiatives, TB testing for employees, a gas rescue squad and a fire fighting service.
Law of the Republic of Uzbekistan on **Occupational Safety at Hazardous Industrial Facilities** No.ZRU-57 of 25.08.2006

Employment and Occupational H&S
Law of the Republic of Uzbekistan on **Mandatory State Social Insurance against Occupational Accidents and Diseases** No.ZRU-174 of 10.09.2008
Law of the Republic of Uzbekistan on **Compulsory Civil Liability Insurance of the Employer** No.ZRU-210 of 16.04.2009
Methodology of conducting assessment of labor conditions and work places attestation Approved by Ministry of Labor and Ministry of Health, 1996
Rules of work with personnel at energy production enterprises. Endorsement by Uzenergonadzor (under UE), 2002
Rules of fire safety regulations for power plants Approved by Uzenergonadzor and Main Department of Fire Safety, 2004
Rules of safety regulations for maintenance electrical Installations Approved by Uzenergonadzor, 2004
Standardized provision on organizing of labor safety works Approved by Labor Ministry and Professional Unions Federation of RUz, 1996
Sanitarian-hygienic norms of working area SanR&N No 0203-06
Sanitarian norms for noise level at the working places SanR&N No 0120-01
Sanitarian norms of allowed levels of electrostatic fields at the working places SanR&N No 0121-01
Sanitarian norms of general and local vibration at the working places SanR&N No 0122-01
Hygienic classification of work conditions by harmful and dangerous indicators of industrial environment, heaving and intensity of production SanR&N No 0141-03
Community H&S
Law of the Republic of Uzbekistan on the **Appeal of Citizens** No.1064-XII of 06.05.1994 (as amended on 13.12.2002)
Law of the Republic of Uzbekistan on the **Prevention of the Disease Caused by Human Immunodeficiency Virus (HIV)** No.816-I of 19.08.1999
Law of the Republic of Uzbekistan on **Protecting the Population against Tuberculosis** No.215-II of 11.05.2001
Women's rights
Family Code of the Republic of Uzbekistan of 01.09.1998
Social Protection and Welfare
Law of the Republic of Uzbekistan on Social Protection of Disabled Persons No.422-XII of 18.11.1991 (as amended on 11.07.2008)
Law of the Republic of Uzbekistan on Employment No.616-I of 01.05.1998 (as amended on 22.12.2009)
Indigenous peoples
1992 Constitution of the Republic of Uzbekistan (as amended on 18.04.2011)

Employment and Occupational H&S
Resolution of Oliy Majlis of Uzbekistan on Approval of the Declaration on the Elimination of All Forms of Intolerance and of Discrimination Based on Religion or Belief No.505-I of 30.08.1997
Resolution of Oliy Majlis of Uzbekistan on ratification of the Convention Concerning Discrimination in Respect of Employment and Occupation No.499-I of 30.08.1997
Land allocation and use
Civil Code of the Republic of Uzbekistan of 01.03.1997 (as amended 22.09.2010)
Land Code, approved on 30.04.1998 (as amended on 04.01.2011) All land allocation for the Project has been and will be conducted in accordance with the Land Code of the Republic of Uzbekistan. The law specifies that the system of land use management must be environmental, resource effective and provide for conservation of soil, limiting the impact on flora and fauna, geological resources and other components of the environment.
Law of the Republic of Uzbekistan on **State Land Cadastre** No.666-I of 28.08.1998 (as amended on 03.12.2004)

C.2. International Requirements

404. In addition to national and regional legislation, as Uzbekenergo has sought international finance, it is important that the Project meets international lending requirements. The following international guidelines are relevant to the Project and will be considered during the EIA process:

- ADB‘s Safeguards Policy Statement (June 2009)
- ADB´s Operations Manual Bank Policies: Safeguard Policy Statement (March 2010)
- ADB´s Operations Manual Operational Procedures: Safeguard Review Procedures (March 2010)
- ADB´s Operations Manual Bank Policies: Public Communications (April 2012)
- ADB´s Operations Manual Operational Procedures: Public Communications (April 2012)
- ADB´s Environmental Safeguards: A good practice sourcebook-draft working document (November 2012)
- ADB`s Environmental Assessment Guidelines (2003)
- IFC General Environmental, Health and Safety Guidelines (April 2007)
- IFC Thermal Power Plants Environmental, Health and Safety Guidelines (December 2008)
- IFC Waste Management Facilities Environmental, Health and Safety Guidelines (December 2007)
- Adopted International Conventions and Protocols.

405. Further details on these lending requirements are included in the following sections.

C.2.1. Asian Development Bank’s (ADB) Environmental Procedures

406. The ADB Safeguards Policy Statement (SPS) 2009 sets out policy principles and outlines the delivery process for ADB‘s safeguard policy in relation to environmental safeguards. The ADB has adopted a set of specific safeguard requirements that borrowers/clients are required to meet in addressing environmental and social impacts and risks. ADB staff will ensure that borrowers/clients comply with these requirements during project preparation and implementation.

407. The safeguard requirements (SR) are operational policies that seek to avoid, minimize or mitigate the adverse environmental and social impacts of projects. ADB‘s safeguard policy framework

consists of three operational safeguard requirements, which are identified in Table 36. A summary about how these safeguard requirements have been incorporated into this environmental and social assessment is included.

Table 36. ADB's safeguard policy

Safeguard	Scope and triggers	Action in EIA
SR1 Environmental Safeguard requirement	Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. The ADB requires the ESIA Report to be produced in line with their defined scope; to include explanation of meaningful consultation and grievance redress and include an EMP in line with their scope.	This report constitutes the EIA, and sets out the proposed management and mitigation actions for the significant environmental impacts. It also provides an explanation of meaningful consultation and includes an Environmental Management Plan for the management of environmental impacts.
SR2 Involuntary resettlement safeguard requirement	The involuntary resettlement safeguards al displacement (relocation, loss of residential f shelter) and economic displacement (loss of access to assets, income sources, or means as a result of (i) involuntary acquisition of nvoluntary restrictions on land use or on ally designated parks and protected areas. It whether such losses and involuntary e full or partial, permanent or temporary.	The Project will not result in any physical or economic displacement of People. No involuntary resettlement impacts are envisaged and therefore this safeguard policy is not triggered.
SR3 Indigenous peoples safeguard requirement	The Indigenous Peoples safeguards are triggered if a project directly or indirectly affects the dignity, human rights, livelihood systems, or culture of Indigenous Peoples or affects the territories or natural or cultural resources that Indigenous Peoples own, use, occupy, or claim as an ancestral domain or asset. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group	Ethnic Karakalpak people are not considered to meet all four of the ADB defining characteristics of Indigenous Peoples. No impacts over indigenous people are envisaged and therefore this safeguard policy is not triggered.

408. The need for detailed gender analysis has not been identified in relation to this Project. However, efforts will be made to encourage women's involvement in the Project and the realisation of benefits to women.

409. A consolidated Operations Manual specifies ADB's internal review procedures for due diligence and for supervision throughout the project cycle in relation to each safeguard policy area. In addition to the three safeguard policies, several sector policies have environmental safeguard elements, for example, those pertaining to water, energy, and forestry.

410. Projects are categorized, A, B or C based on the magnitude of their potential environmental and social effects. With reference to ADB's Safeguard Policy Statement SR1 on Environment, this Project is considered to be a ‗Category A' project for the purpose of this assessment. ADB defines a ‗Category A' project as one that is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented.

411. An environment and social assessment for a Category A project is required to examine the project's potential positive and negative impacts, compare them with those of feasible alternatives (including the ―without project" scenario) and recommend any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and to improve performance. This report constitutes the EIA on behalf of the Project sponsor. The above considerations have defined the rigor of this EIA, the scope of the EMP and the disclosure and consultation requirements for the Project.

C.2.1.1. World Bank IFC Environmental, Health and Safety Guidelines

412. ADB Safeguard Policy Statement indicates that during the design, construction and operation promoter must apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group´s Environment, Health and Safety Guidelines.

413. In this project, general and thermal power plants EHS IFC (World Bank Group) guidelines have been taken into account to:

- Establish specific standards for the project.
- Provide prevention and control measures for each source of pollution applicable to this type of industry Environmental Monitoring programs
- Provide occupational health and safety sources of threats, prevention and control measures and monitoring

C.2.2. International conventions

414. Under international cooperation in the field of environment protection, Republic of Uzbekistan signed number of International Conventions, which should be undertaken by State Committee for Nature protection o f the RUz. Those potentially applicable to the Project, and for which Uzbekistan is signatory, are outlined in Table 37.

Table 37. Key applicable international conventions and protocols

Convention or protocol	Overview	Relevance to project
Vienna Convention on Ozone Layer Protection (1985), ratified in 1993	The Montreal Protocol (a Protocol to the Vienna Convention on Ozone Layer Protection) is designed to protect the ozone layer by phasing out the production of numerous ozone depleting substances.	Through limitation of the release of chloride and bromide containing ozone depleting substances, the Project will support Uzbekistan's contribution toward the anticipated recovery of the ozone layer by approximately 2050.
Montreal Protocol on Substances that Deplete the Ozone layer 1987), ratified in 1993		
London (1990) and Copenhagen Amendments to the Montreal Protocol (1992), ratified in 1998		
UN Framework Convention on Climate Change (2007).	The Kyoto Protocol (a Protocol to the UN Framework Convention on Climate Change (UNFCCC)) aims to stabilize greenhouse gas concentrations in the atmosphere at	The Project will comply with all national standards for GHG emissions in order to contribute to Uzbek targets set in line with the adoption of the Kyoto
Kyoto Protocol (1997), ratified in 1999		

Convention or protocol	Overview	Relevance to project
	a level that would prevent dangerous anthropogenic interference with the climate system.	Protocol.
Convention Concerning the Protection of World Cultural and Natural Heritage (2004).	The Convention Concerning the Protection of World Cultural and Natural Heritage is the precursor to the establishment of UNESCO World Heritage Sites as a place (i.e. natural or built environment) that is listed by the UNESCO as of special cultural or physical significance.	Uzbekistan has four UNESCO World Heritage Sites. However, the Project will have no interaction with these. As such, requirements under the convention will not be triggered.
Convention on Biodiversity (1992), ratified in 1995	The Convention on Biological Diversity (CBD) is an international legally binding treaty with three principal goals: - conservation of biological diversity (or biodiversity) - sustainable use of its components - fair and equitable sharing of benefits arising from genetic resources.	Issues pertaining to biodiversity conservation and sustainable natural resource management are fully applicable to the Project and undergo assessment within EIA.
UN Convention to Combat Desertification (1994), ratified in 1995	The United Nations Convention to Combat Desertification is intended to combat desertification and mitigate the effects of drought through national action programs. The Convention is based on the principles of participation, partnership and decentralization; the backbone of Good Governance and Sustainable Development.	The Project will not result in accelerated desertification. Revenues from the Project within Uzbekistan can contribute to aspects of national action programs thereby supporting Uzbekistan‘s commitments.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989), ratified in 1996	The Basel Convention was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries. It does not, however, address the movement of radioactive waste. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.	The Project will comply with all national and international standards for hazardous waste generation and management. Issues pertaining to hazardous waste generation are applicable to the Project and undergo assessment within EIA.
Bonn Convention on	The Convention on the	Issues pertaining to Project

Convention or protocol	Overview	Relevance to project
Conservation of Migrating Species of Wild Animals (1998), ratified in 1998	Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range.	interactions with migratory species are not significant.
Convention on International Trade of Endangered Species of Flora and Fauna (1973); ratified in 2000	The aim of Convention on International Trade of Endangered Species of Flora and Fauna (‗CITES') is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Issues pertaining to biodiversity conservation are fully applicable to the Project and undergo assessment within EIA.

C.3. The project´s commitments

415. As mentioned previously, EHS IFC guidelines have been considered to establish the project standards. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Uzbek regulations differ from these levels and measures, the project will achieve whichever is more stringent.

416. The national legislation of Uzbekistan place a priority on provisions stipulated in international agreements as opposed to national law. Specifically, the Law on Nature Protection specifies (Article 53) that if the international agreement, which the Republic of Uzbekistan is signatory of, sets requirements other than those specified in the existing national environmental laws or regulations, the provisions of the international agreement shall prevail except where national legislation sets more stringent requirements.

417. If less constraining levels than those in the EHS IFC guidelines are selected for special reasons in the project's context, full detailed justification for every one of the alternatives shall be presented under the framework of the present EIA of the Project. The justification shall show that the proposed performance levels will protect the health of local human populations as well as the environment.

418. Environmental permits given to industrial installations include emission limit values that are developed separately for ambient air, water bodies and waste. Emission limit values are approved by the SCNP on the basis of the SEE. For planned activities that are subjected to an SEE, official approval received from SCNP for the national EIA and signed by the chairman is the equivalent of an environmental permit.

419. The terms and procedures for reviewing and approving emission limit values for substances emitted into the ambient air and water bodies, as well as waste disposal limits, are determined in compliance with the requirements of SEE procedures and by the allocation of competences on the approval of emission limit values by the SCNP Department for State Ecological Expertise for project of categories I and II and by the territorial committees for nature protection of a region, the Republic of Karakalpakstan or Tashkent City for categories III and IV. Waste disposal limits are approved for five years, and the standards of emission limit values for enterprises of categories I, II, III and discharge limit values for substances emitted into water bodies for any enterprise are approved for three years.

420. Emission permits are not based on an integrated approach to pollution prevention and control. Calculations of the standards of emissions discharge into air, water bodies and disposable wastes are based on different approaches. Standards are approved for different terms, and two different departments of the SCNP exercise control over their compliance (the Department for Air Protection

and the Department for Control over the Protection and Use of Land and Water Resources, as well as specialized inspectorates for analytical control).

421. Details of the specific international standards (EHS IFC guidelines) as well as national and specific site‘s limits in relation to ambient air quality, air emissions, effluents, noise and health and safety procedures are provided below.

C.3.1. Takhiatash TPP’s Standards on Ambient Air Quality

422. The General EHS Guidelines advise that ‗relevant standards‘ with respect to ambient air quality are national legislated standards or, in their absence, the current World Health Organisation (WHO) Air Quality Guidelines or other internationally recognised sources. Where a host country‘s legislated standards are less stringent than either the WHO or other internationally recognised sources, the IFC acknowledge that it is acceptable to use the national legislated standards as the principal standards that the Project is assessed against.

C.3.1.1. Uzbek standards

423. In accordance with ―SanR&N No 0293-11 Hygienic requirements, the list of MAC for pollutants in atmosphere in the territory of Populated areas in the Republic of Uzbekistan” above mentioned pollutants have to comply with following limits:

Table 38. Summary of the relevant Ambient Air Quality Standards for Protection of Human Health (mg/m3) at Takhiatash TP

Pollutants	Maximum allowed during 30 minutes	Maximum allowed average day	Maximum allowed average monthly	Maximum allowed average year	Hazard class
	mg/m³	*mg/m³*	*mg/m³*	*mg/m³*	-
NO_2	0.085	0,06	0,05	0,04	2
NO	0.6	0,25	0,12	0,06	3
SO_2	0,5	0,2	0,1	0,05	3
Benzapyerene	100,0E-7	100,0E-7	100,0E-7	100,0E-7	1
CO	5	4	3.5	3	4
Dust	0.15-0.5	0.1-0.35	0.08-0.2	0.05-0.15	3

C.3.1.2. International Standards

424. The legal reference limits pertaining to air quality for each of the pollutants are those corresponding to World Bank reference values. It should be pointed out that point 1.1. (Air Emissions and Ambient Air Quality) in the "Environmental, Health, and Safety General Guidelines" document (April 2007) states that emissions must not generate levels of pollutants equal to or greater than those set out in national legislation, or failing national legislation, reference values for air quality given by the WHO (Air Quality Guidelines Global Update, 2005), which are shown in Table 39.

Table 39. WHO Ambient Air Quality Guidelines (General IFC Guidelines ,2007)

Pollutant	Averaging Period	Guideline value in µg/m^3
SO_2	24-hour 10 minutes	20 500
NO_2	1 year 1-hour	40 200
PM10	1 year 24-hour	20 50
PM2.5	1 year 24-hour	10 25
Ozone	8-Hour daily maximum	100

C.3.2. Takhiatash TPP's Standards on Air Emissions

425. Currently, for future new CCPU, Maximum Allowed Emissions (MAE), have not been determined. The limits will be calculated and should be approved during the project construction phase before the project commission. MAE for the new CCPU will be calculated based on national legislation and international standards, whichever is more stringent. In this respect, IFC standards are based on concentration measured at an oxygen percentage and MAE are based in a mass flue which could allow dilution of pollutants. Future emission standard should be established in concentration units.

C.3.2.1. Takhiatash TPP current emission standards

426. For existing units of the Takhiatash TPP, Maximum Allowed Emissions (MAE) are calculated by unitary enterprises ―Uzenergosozlash" and have been passed to State Nature Protection Committee for approval in 2009. Table 40 shows the MAE calculated for the Takhiatash TPP and **Error! Reference source not found.** includes the calculation procedure of these MAE.

Table 40. Pollutants maximum allowed emissions for Takhiatash TPP

Pollutant	Existing situation		MAE		Exceed	
	g/s	t/y	g/s	t/y	g/s	t/y
Nitrogen dioxide	441,8480	3126,2838	441,8480	3126,2838	-	-
Nitrogen oxide	71,80000	508,02715	71,80000	508,02715	-	-
Carbone oxide	9,722000	164,16310	9,722000	164,16310	-	-

Table 41. Calculation of MAE for Takhiatash TPP

№	Name of value	Formula, source	Value for stack №1	Value for stack №2	Sum	Notes
1	Annual consumption of natural fuel B_{gas}, thousand.nm3 B_{mazut}, t	Inventory Data	140233 0	841882 0	982115 0	
2	Annual consumption of conditional fuel, ton of conditional fuel (tcf) Gas (Bg)c Mazut (Bм)c Total, Bc	$B_c \times Q^p_{nG}$ $B_c \times Q^p_{nM}$	163191,1 0,00 163191,1	979710,1 0,00 979710	1142901,3 0,0 1142901,3	$Q^p_{nG} = 8146\ kkal/m^3$ $Q^p_{nM} = 10915.5\ kkal/\!$ $Q_c = 7000\ kkal/m^3$
3	Annual consumption of heat, Qyear , G kal/year	$B \times Q_c \times 10^{-9}$	1,142	6,858		
4	Hourly nominal consumption of conditional fuel into boiler room Bb, tcf /hour	$n \times B_c \times Q^p_{nM}$	78,8	165,1	243,8	
5	Hourly nominal consumption of fuel heat in boiler rooms, Q hour, G kal/hour	$B_b \times Q_c \times 10^{-3}$	551,32128	1155,4286	1706,7499 2	
6	Working hours, hour	Inventory Data	2839	6942		
7	Average annual boiler capacity, b, portion from nominal	$Q_{year} \div Q_{hour} \times \tau$	0,730	0,855		
8	Secondly emission of pollutants from stacks with nominal capacity, g/s MNO_2 MNO MSO_2 Mazut ash MCO	Inventory Data	158,464 25,75 0 0 3,142	283,384 46,05 0 0 6,58		

№	Name of value	Formula, source	Value for stack №1	Value for stack №2	Sum	Notes
9	Maximum ground concentration of pollutants from stacks with nominal boiler capacity, quotas from maximum allowed concentration (MAC) $qnNO_2$ qnNO $qnSO_2$ qn3M qnCO	Analyze of scatter band (dispersion of pollutants)	0,077122 0,001769 0 0 0,00042	0,024109 0,000561 0 0 0,00021	0,101231 0,00233 0 0 0,00063	
10	Temperature of exhausted gases at the rated (nominal) and average annual capacity degree C T_{nom} $T_{average}$	Inventory Data	135 135	191 191		
11	Temperature of ambient air, T_{at}, ºC	Inventory Data	35	35		
12	Difference in temperature T_{nom}-T_{at} T_{av}-T_{at}	Inventory Data	100 100	156 156		
	Quota of source in ground concentration NO_2 NO SO_2 Mazut ash CO	Calculation of dispersion, input of source (maximum concentration)	0,7618417 0,7592275 0 0 0,6666667	0,2381583 0,2407725 0 0 0,3333333	1 1 0 0 1	

№	Name of value	Formula, source	Value for stack №1	Value for stack №2	Sum	Notes
13	Approved quota in MAC NO_2 NO SO2 Mazut ash CO	$q_{source(source\ input)} \times$	 0,2514078 0,3796137 0 0 0,6666667 0,1939834	 0,0785922 0,1203863 0 0 0,3333333 0,0560166	 0,33 0,5 0 0 1 0,25	
14	Maximum ground concentration from stuck at the average annual capacity MAC quote qav NO_2 qav NO qav SO_2	$q_{NO_2} \times b \times \sqrt{T}_{nom} \div$ $q_{SO_2} \times b \times \sqrt{T}_{nom} \div$ $q_{SO_2} \times b \times \sqrt{T}_{nom} \div$	 0,0456219 0,0010465 0	 0,0185682 0,0004321 0	 0,0641901 1 0,0014785 3 0	Stuck # 1 K=2.2 Stuck # 2 K=2.36
15	Emission of NO_2 from boiler rooms at the nominal capacity (at the condition of the not exceed ground concentration 0,33 MAC) Mn NO_2, g/s	$(q_{NO_2}(ap) \div q_{NO_2}) \times$ Inventory Data	516,572 158,464	923,795 283,384	1440,3674 8 441,848	
16	Secondly emission of nitrogen oxide from stacks with nominal capacity, g/s (at the condition of the not exceed ground concentration 0,5 MAC) MNO, g/s	Inventory Data	25,750	46,050	71,800	
17	Secondly emission of CO from stacks with nominal capacity, g/s (at the condition of the not exceed ground concentration 1,0 MAC) MCO, g/s	Inventory Data	3,142	6,58	9,722	

№	Name of value	Formula, source	Value for stack №1	Value for stack №2	Sum	Notes
19	Secondly emission of nitrogen dioxide from stacks with average annual load (at the condition of the not exceed ground concentration 0,33 MAC) $M_{cp}NO_2$, g/s	$(q_{NO_2}(ap) \div q_{NO_2}) \times$ Inventory Data	465,141 35,054	876,841 110,76	1341,9825 7 145,814	
20	Secondly emission of nitrogen dioxide from stacks with average annual load (at the condition of the not exceed ground concentration 0,5 MAC) M_{av} NO, g/s	Inventory Data	5,696	17,998	23,694	
21	Secondly emission of carbon oxide from stacks with average annual load (at the condition of the not exceed ground concentration 1,0 MAC) M_{av} CO, g/s	Inventory Data	2,2929	5,63	7,9229	
23	Annual maximum allowed emission (MAE) of NO_2 , at the condition of the not exceed ground concentration 0,33 MAC for average annual capacity of boiler room, MAE NO_2 , t/year	Inventory Data	358,27	2768,02	3126,29	
24	Annual maximum allowed emission (MAE) of NO, at the condition of the not exceed ground concentration 0,5 MAC for average annual capacity of boiler room, MAE NO , t/year	Inventory Data	58,22	449,8	508,02	
25	Annual maximum allowed emission (MAE) CO , at the condition of the not exceed ground concentration 1,0 MAC for average annual capacity of boiler room, MAE CO , t/year	Inventory Data	23,435	140,701	164,136	

C.3.2.2. International Standards

427. Relevant IFC standards applicable to combustion facilities rated over 50MWth are presented in the IFC Guidelines for Thermal Power Plants. The only pollutant limited by these Guidelines for the technologies presented on the project is NO_x. Table 42 presents the relevant emission limits for NOx specified within the EHS Guidelines for both natural gas boilers and turbines.

Table 42. Pollutant Emissions Limit Values in the "Environmental Health and Safety Guidelines" document for thermal power plants, December 2008, for natural gas boilers and natural gas turbines rated >50MWth (Tables 6-B and 6-C)

ombustion technology /fuel	IO_x concentration level (mg/Nm^3), Dry basis	Excess O_2 content (%)
xisting units: Natural Gas Boilers (Table 6-C)	240	3
ıture CCPU: Natural Gas Turbines > 50 MW_{th} (Table 6-B)	51 (25 ppm)	15

C.3.3. Takhiatash TPP's effluent standards

428. Currently, for future new CCPU, Maximum Allowed Discharge (MAD), have not been determined. They will be calculated at the same stage as MAE for new unit. MAD for the new CCPU will be calculated based on national legislation and international standards, whichever is more stringent. In this respect, IFC standards are based on concentration and MAD are based in a mass flue which could allow dilution of pollutants. Future discharge standards should be established in concentration units. When ambient water characteristics already exceed standards, effluent characteristics should not increase ambient values.

C.3.3.1. Current Takhiatash TPP effluent standards

Control of pollutants discharge into the surface water

429. The impact of the activity of commercial entities on surface and ground water is determined by the following factors:

- Water consumption and water management determining changes in the natural material balance of the aquatic environment
- Discharge of pollutants with service water directly into water bodies

430. Discharge of all categories of waste water is regulated by hygienic requirement and quality norms for surface water in accordance with SanR&N No 0172-04 Hygiene requirements for the protection of surface waters in RUz and Attachment to Construction Norms and Rules (CNR) 1.03.01-96 -Guidelines on content, order, approval and endoresement of design estimate for enterpises, building construction";.

431. In Table 43 below presents the general effluent standards into the water bodies classified by type of use.

Table 43. General water standards

Indicators	**Purpose of water use**			
	Domestic use	**Cultural and service**	**Fishery needs**	
			Highest and first category	**Second category**
Suspended solids	Compared with the natural conditions the content of suspended solids at wastewater discharge shall not be increased by more than			
	0.25 mg/dm^3	0.75 mg/dm^3	0.25 mg/dm^3	0.75 mg/dm^3
	For reservoirs and watercourses containing at low water above 30 mg/dm^3 suspended solids, there may be an increase to 5%. Suspensions with fallout rate of more than 0.4 mm/s for watercourses and more than 0.2 mm/s for discharge reservoirs are prohibited			
Floating matter	There shall not be a film of oil products and concentrations of other contaminants on the water surface			
Color	Shall not be detected in the column of height		There shall be no foreign colour	
	20 sm	10 sm		
Smell and test	Intensity of more than 1 point is not permitted		Water must not give extraneous odours and flavours to fish meat	
Temperature	Temperature of water at the discharge point must not exceed 3ºC in comparing with average monthly temperature of the hottest month		Temperature of water at the discharge point must not exceed 5ºC in comparing average monthly temperature of the hottest month. Increasing of temperature more than 28 ºC in summer and till 8ºC in winter is not allowed	
Hydrogen exponent (pH)	Shall not beyond 6.5...8.5 pH		Shall not beyond 6.5...8.5 pH	
Mineralization	Shall not exceed by dry residue 1000 mg/dm^3, including chlorides - 350mg/dm^3 and sulphates - 500 mg/dm^3		Rated according to water bodies intoxications	
Dissolved oxygen	No less than 4 mg/dm^3 in any period of the year in a sample taken by 12 a.m. on the same day		In winter shall be no less than	
			6 mg/dm^3	
			No less than 6 mg/dm^3 in any period	

Indicators	Purpose of water use			
	Domestic use	Cultural and service	Fishery needs	
			Highest and first category	Second category
			of the year in a sample taken by 12 a.m. on the same day	
BOD	At 20ºC must not exceed 3.0 mg/dm^3	6.0 mg/dm^3	At 20 º C shall not exceed 3.0 mg/dm^3 if in winter the dissolved oxygen content in the water of the first* category fishing water bodies fell to 6.0 mg/dm^3, and in the second** – to 4 mg/dm^3, then discharge in them is only permitted to wastewater that does not change the BOD	
COD	Shall not exceed 15.0 mg/dm^3	30.0 mg/dm^3		
Causative agent (of a disease)	Not allowed			
Chemicals (pollutants)**	Shall not be contained in concentrations exceeding the MAC			

Deleted: *

*- The first category includes water bodies, where valuable fish species highly sensitive to oxygen are kept and reproduced in.

** - The second group includes water bodies used for other aquatic economy needs.

432. Maximum allowed concentration of most spread pollutants are presented in Table 44.

Table 44. . Maximum permissible concentration of pollutants in the water of surface water bodies by usage categories (mg/m3)

Pollutants	Water usage categories (Handbook of environmentalist, Tashkent 2010)			
	Fishery	**Communal**	**Drinking water**	**Irrigation**
COD	15	40	30	40
BOD_{20}, mg_{O2}/L	3	3-6	3-7	10
pH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Mineralization	1000	1000	1000-1500	1000
Including: sulphates	100	500	400-500	
Chlorides	300	350	250-350	

Pollutants	Water usage categories (Handbook of environmentalist, Tashkent 2010)			
	Fishery	Communal	Drinking water	Irrigation
Ammonium nitrogen (ammonium salt) (NH_4^+)	0,5	2	0,5	1,5
Nitrogen	9.1	25	45	25
Nitrogen nitrite	0.02	0.5	3	0.5
Nitrite	0,08	3,3	3	
Nitrate	40	45	45	
Phosphate (PO_4^{3-})	0,3	1	3,5	1
Ether soluble	0,05	0,8	0,8	0,8
Oil products	0,05	0,3	0,1	0,3
SAS	0,1	0,5	0,5	0,5
Phenol	0,001	0,001	0,001-0,1	0,001
Fluorine (F)	0,05	1,5	0,7	1
Arsenic (As)	0,05	0,05	0,05	0,1
Iron (Fe)	0,05	0,5	0,3-3	5
Chromium (Cr^{6+})	0,001	0,1	0,05	0,1
Copper (Cu)	0,001	1	1	1
Zinc (Zn)	0,01	1	3	5
Cyanides	0,05	0,1		
Lead (Pb)	0,03	0,1	0,03	0,2
Nickel (Ni)	0,01	0,1	0,1	
Cadmium (Cd)	0,005	0,01		
Cobalt (Co)	0,1	1		
Molybdenum (Mo)	0,0012	0,5	0,25	
Strontium ($Sr^{2+)}$		2	7	
Selenium (Se)	0,001		0,01	
Mercury (Hg)		0,005	0,0005	

Control of pollutants discharges into the water bodies

433. According to current practice in the country, quality standards for surface waters or their natural composition and properties shall be maintained in waterways in where discharge of sewage or other economic activities affect the conditions of ***water bodies used for domestic and municipal purposes***. The area in where the characteristic should be maintained is located one kilometer

downstream the discharge point to the body of water .In water bodies (lakes) the requirements shall be maintained in the area within a radius of one kilometre from the discharge point.

434. Within sewages discharges or other types of economic activities affecting the conditions of ***water bodies used for fishery***, surface water quality standards or their natural composition must be respected throughout the area of water use, starting with a baseline alignment, determined in each case by the SCNP, but no more than 500 m from the point of discharge of sewage or the location of other sources of pollution of surface waters. According to data provided into the ―Permission on maximum allowed discharge of pollutants into the water body (Takhiatash TPP)", Suenly canal is receiver of discharging from TPP waste water, belonged to category of water bodies used for fishery purposes.

435. Rating of discharges of pollutants is carried out by establishing the maximum allowed discharges (MAD) of these substances in wastewater into water bodies. MAD is the maximum mass of matter in wastewater allowable for discharge under the established regime at a given point of the water body, to ensure water quality standards at the points of water use. MAD is calculating based on requirements indicating into SanR&N No 0088-99 «Sanitarian requirements for development and coordinating of projected MAD of pollutants, discharged into the water bodies with waste water» and Uz RH 84.36.2004"Regulations on discharge of pollutants into water bodies and on the terrain, taking into account technically achievable performance of wastewater treatment." In according with these documents, MAD is derived from the maximum allowed concentration (MAC) of substances in the water at the points of water use, the assimilative capacity of the water body and the optimal mass distribution of substances between water users, discharging wastewater.

436. The value of the MAD is defined as the product of average daily flue of wastewater q (m^3/h) to the allowable concentration of the discharge of contaminants C (g/m^3).

$$MAD\ (g / h) = q \times C$$

Norms of MAD developed considering:

- categories of water object receiving drainage waters;
- quality of water in river, water reservoir;
- stream assimilation properties of water object;
- possibility of dilution by water receiving bodies
- MAC of pollutants in water
- General requirements for content and properties of water bodies

437. If the ambient contamination of the water body for some indicators cannot provide standard quality of water in the checkpoint, then the MAD for these indicators are calculated on the basis of allocation of regulatory requirements for the composition and properties of water bodies. If the ambient contamination of the water body exceeds norms, MAD could be developed with consideration ambient water quality. Control of discharges of pollutants into water bodies could be done for 20 parameters that characterize the top 20 industrial pollutions in Uzbekistan.

438. In calculating the norms of MAD diluted and assimilative capacity of water bodies, justification rules are specific hydrologic data, hydro biological and other observations by organizations that have a license to conduct such operations. The initial water quality data can be based on natural background values for

unpolluted areas of water bodies within the reserves with similar geological and geographical conditions and stock research materials of the past.

439. Control of discharges of pollutants on the terrain is based on the type, permeability and filterability of soils forming a natural bottom of water body data, the amount of information about the natural decrease in areas receiving wastewater, groundwater levels and their qualitative composition.

440. The norms determine the type of ***sewage*** discharge treatment facilities that produce clean municipal wastewater. Since the vast majority of sewage treatment plants (STP) in the country are based on biological treatment, then a mixture of domestic and industrial wastewater sent to biological treatment should meet the following requirements[5]:*

- pH should not be below 6.5 and above to be 8.5;
- temperature must not be lower 6°C and above 30°C;
- The total concentration of dissolved salts are not higher of MAD;
- BODfull should not exceed 250-500 mg/l;
- must not contain any un dissolved tar and oil;
- Must not contain surfactants.

Current Takhiatash TPP effluent standards.

441. **There are two types of approved limits** for discharging waste water on the TPP. One of them are limits for discharging water into the water body (canal Suenly) and the other one are limits for discharging water into the municipal sewage system.

442. Limits on going at the present on the TPP have been prepared in 2012. ***Limits on maximum allowed discharges into the water courses*** have been endorsed by Karakalpakstan Nature Protection Committee, Unitary Enterprise ―Uzenergosozlash" under the UE, Takhiatash TPP and they were approved by State Nature Protection Committee (national level). Expiration date of these limits is 3 years (till 2015). Conclusion of State Environmental Expertise from 2012 officially endorses these limits.

443. The document of the TPP ***―Limits on maximum allowed discharges into the water courses"*** contains information on TPP as a subject of water use and source of waste water. This document includes general information on Takhiatash TPP, water use situation on the plant and describes sources of using water and waste water discharge and disposal. The document also provides calculation of maximum allowed discharges into the water courses based on national regulations.

a) Limits for discharging waste water into Suenly canal:

444. As it is mentioned in section B of this chapter, MAD should be designed with consideration of water quality of water in water body – wastewater receiver. According to data provided into the ―Permission on maximum allowed discharge of pollutants into the water body (Takhiatash TPP)" water quality in canal ―Suenly" (receiver of discharging wastewaters from TPP) is characterized by the pollutants indicated in Table 45. Based on national water quality standards and ambient concentration of

[5] Construction norms, Sewage norms and regulations 2.04.03-96, Tashkent 1997

pollutants into the canal Suenly, State Nature protection Committee defines norms of pollutants (MAC_T) for Takhiatash TPP.

445. Calculation of limits for maximum allowed waste water discharges (MAD) is done based on the formula provided above:

$$MAD_e = q_e \times C_e,$$

here q_e – established flue for TPP

and C_e – establised concentration for pollutants (for Takhiatash TPP) (Table 45)

446. Volume of water using for turbo-units cooling is 502331 thousand m^3/year or 57343.72 m^3/h. This amount is accepted as established q_e and have been using for calculation of MAD (Table 45).

Table 45. Water quality in Suenly canal, national norms for pollutants and norms for TPP (Book ~~-~~Permission on maximum allowed discharge of pollutan

#	Indicator	Unit	Canal Suenly Average 2009	Canal Suenly Average 2010	Canal Suenly Average for 2 years	National Norms for pollutants in water body MAC	Norms for pollutants into the discharging water (for Takhiatash TPP) C_e	Calculated MAD g/hour
1	Suspended solids	mg/dm^3	107	89.3	98.15	Increasing on 0.75 mg/dm^3	103*	5940809,
2	Mineral content, including	mg/dm^3	867	764	815.5	1000	785**	45014820,2
3	Chloride	mg/dm^3	294	200	247	300	300	14249914,4
4	Sulphate	mg/dm^3	299	225	262	100	265**	15196085,8
5	Nitrogen nitrate	mg/dm^3	0.199	0.19	0.194	9.1	9.1	57343,72
6	Nitrogen nitrite	mg/dm^3	0.036	0.018	0.027	0.02	0.026	1490,94
7	NH_4^+	mg/dm^3	0.198	0.124	0.161	0.5	0.5	8028,12
8	Fe	mg/dm^3	0.43	0.12	0.275	0.05	0.3**	17203,12
9	BOD_5	mg_{O_2}/dm^3	0.15	0.06	0.105	3	3	172031,16
10	Oil products	mg/dm^3	1.6	1.4	1.5	0.05	1.45**	83148,394
11	pH	-	8.2	8.2	8.2	6.5-8.5		

* - in accordance with national standards (Table 43), in case if during the low water period mineralization of water course (body) exceeds 30 mg/l, it is allowed exceeding of suspended solids of 5 % relative to the existing (ambient) concentration in river Table 43, section A). Thus, existing (natural) average concentration of suspended solids is 98.15 mg/dm^3 and 5% of this amount is 4.9, and consequently is 103 mg/dm^3.

** - Conclusion of State Environmental Expertise states that ~~—~~.for Takhiatash TPP MADs should be established in accordance with national MACs, with the exception of following pollutants: suspended solids, sulphates, iron and oil products. MAD for these pollutants shouldn't exceed ambient pollution of canal Suenly."

447. Discharge of pollutants not included into the Table 45 is prohibited.

b) Limits for discharging waste water into municipal sewage system:

448. Two types of sewage water are discharging into the municipal sewage system:

- Industrial waste water after comprehensive waste water treatment plants (on the TPP) go through outlet #1. Flow is 103.43 thousand m^3/year or 283.37 m^3/day or 11.807 m^3/hour.
- Communal and sanitarian discharges from TPP go through outlet #2. Flow is 66.328 thousand m^3/year or 181.72 m^3/day or 7.571 m^3/hour.

449. Communal waste water is discharging through outlet #2 without any treatment. Communal sewage is treated at the Takhiatash city municipal waste water treatment plant WWTP. Concentration of pollutants into the discharging water does not exceed permissible concentration.

450. MAD for discharging water into the sewage network is calculated in comply with Resolution of Cabinet Ministries of RUz # 11 from 2010 ~~—~~On additional measures on improving environmental protection activity in communal services", ~~—~~Rules on receiving industrial waste water and order of compensations calculation for exceeding MAD into the municipal and other settlements sewage network". Principle of calculation of MAD into the municipal sewage system is the same as for MAD into the water courses.

$$MAD= C_e \times q_p$$

Where C_e – established concentration for TPP, mg/dm^3;
q_p – projected flue, m^3/day

Table 46. MAD for discharging into the municipal sewage network

#	Pollutants	Actual concentration of pollutants discharged into the WTTP, 2012, mg/m^3	Established concentration C_e mg/dm^3	MAD, g/day
Outlet # 1, actual flow (q_a) – 210.41 m^3/day,(q_p) project flow – 283.37 m^3/day				
1	Suspended solids	77.2	500	141685
2	Dry residual	13.88	2000	566740
3	Chloride	154.3	350	99179.5
4	NO_3^-	0.158	45.0	12751.65
5	NO_2^-	0.043	3.3	935.121
6	NH_4^-	0.255	2.5	708.425
7	Fe	0.106	5.0	1416.85
8	Oil products	Abs	1.0	283.37
9	BOD_5	Abs	22.6	6404.162
10	Phosphates	-	2.5	708.425
11	pH		6.5-8.5	
Outlet # 2, actual flow – 166.3 m^3/day, project flow –181.72 m^3/day				
1	Suspended matter	94.35	500	90860.
2	Dry residual	1313	2000	363440
3	Chloride	157	350	63602
4	NO_3^-	0.204	45.0	8177.4
5	NO_2^-	0.203	3.3	599.676
6	NH_4^-	0.068	2.5	454.3
7	Fe	0.255	5.0	908.6
8	Oil products	Abs	1.0	181.72
9	BOD_5	Abs	22.6	4106.87
10	Phosphates	-	2.5	454.3
11	pH		6.5-8.5	

C.3.3.2. International Standards

451. EHS IFC standards for thermal power plants are shown in Table 47.

Table 47. Effluent guidelines applicable for direct discharges of treated effluents to surface waters for general use*

Parameter	Discharge Limit
pH	6 – 9
Total suspended solids (mg/L)	50
Oil and grease (mg/L)	10
Total residual chlorine (mg/L)	0,2
Total chromium, Cr (mg/L)	0,5
Copper, Cu (mg/L)	0,5
Iron, Fe (mg/L)	1
Zinc, Zn (mg/L)	1
Lead, Pb (mg/L)	0,5
Cadmium, Cd (mg/L)	0,1
Mercury, Hg (mg/L)	0,005
Arsenic, As (mg/L)	0,5
Temperature increase by thermal discharge from cooling system	Waste water temperature shall not cause a temperature increase of more than 3°C at a mixing zone boundary, scientifically determined, taking into account notably, quality of surrounding water, use of the receiving water, potential end receivers, and assimilation capacity. Specific requirements shall be determined by the present environmental assessment depending on sensitive aquatic surroundings at the point of and discharge.

* IFC EHS guidelines for thermal power stations of December 2008, Table 5

C.3.4. Takhiatash TPP noise standards

C.3.4.1. Uzbek Standards

452. To ensure acceptable levels of sound pressure and sound levels in rooms, workplaces, industrial sites, in residential and public buildings, living areas of cities and other settlements the project must comply with a couple of Uzbek legislations.

453. The Uzbek national construction noise norms that are relevant to all stages of the construction phase are provided by law KMK 2.01.08-96 ―Protection from noise” and detailed in Table 48 below.

Table 48. Uzbek construction noise norms (KMK 2.01.08-96 –Protection from noise”)

Premises and territories	Equivalent sound pressure levels, Leq (dB)									Level of sound, (dBA)
	31.5	63	125	250	500	1 kHz	2 kHz	4 kHz	8 kHz	
1. Hospital and sanatorium wards, operating hospitals	68	51	39	31	24	20	17	14	13	25
2. Living rooms in apartments, living premises in rest/care homes, sleeping rooms in children boarding-schools	72	55	44	35	29	25	22	20	18	30
3. Doctor's offices in hospitals, sanatoriums, polyclinics, audience halls of concert-halls, rooms in hotel, living rooms in campus	78	59	48	40	34	30	27	25	23	35
4. Hospital and sanatorium territories adjacent to the buildings	78	59	48	40	34	30	27	25	23	35
5. Territories adjacent to living houses (in 2 m from cladding structures), residential areas of neighbourhoods and housing estates, grounds of schools and pre-school institutions, school territories	84	67	57	49	44	40	37	35	33	45
6. Class premises, exercise rooms, auditoriums of schools and other educational facilities, conference halls, audience halls of theatres, clubs, cinemas, halls for court sessions and meetings.	82	63	52	45	39	35	32	30	28	40
7. Administration working premises, working premises of design and engineering organisations, scientific	86	71	61	54	49	45	42	40	38	50

Premises and territories	Equivalent sound pressure levels, Leq (dB)									Level of sound, (dBA)
	31.5	63	125	250	500	1 kHz	2 kHz	4 kHz	8 kHz	
and research institutes										
8. Café, restaurant, canteen halls, lobby of theatres and cinemas	89	75	66	59	54	50	47	45	43	55
9. Trading halls of shops, sport halls, waiting halls of airports and transport stations, reception centers of housekeeping/ municipal services	93	79	70	63	58	55	52	50	49	60

454. The ~~S~~anitarian Rules and Norms on providing allowed noise level into the living building, public building and territory of living area" (SanR&N No.0267-09) establish the maximum admissible noise level into the living areas, both inside and outside buildings, as Table 49 shows.

Table 49. Admissible noise level into the living area, both inside and outside the buldings (SanR&N No.0267-09)

Name of area	Level of sound pressure, octave bands with average geometric mean frequencies (dB)								Level of sound, (dBA)
	63	125	250	500	1000	2000	4000	8000	
Living room of flats, bedrooms of resorts (inside)									
Day time	63	52	45	39	35	32	30	28	40
Night time	55	44	35	29	25	22	20	18	30
Territories adjacent to living houses (outside)									
Day time	75	66	59	54	50	47	45	43	55
Night time	67	57	49	44	40	37	35	33	45

455. Uzbek Sanitary Protection Zone. The Sanitary-Protection Zone (SPZ) is defined as the minimum exclusion zone around a given industrial facility in order to protect sensitive receptors from noise emissions, amongst other contaminants. The SPZ aims to provide the required level of protection from site emissions under normal operational conditions.

456. The extent of the SPZ is fixed by the nature of the site and can be estimated according to the industrial categorization of land use. The dimensions of the SPZ are defined by way of calculation and establishing permissible emission limits.

457. The following land uses are typically prohibited within an SPZ:

- Residential properties;
- Public or individual country houses;
- Production and storage of drinking water; and,
- Parks, sports, educational and medical facilities.

458. The following land uses are allowed within an SPZ:

- Non-living areas for standby emergency personnel, premises for rotational personnel, trade and meal facilities hotels;
- Administration buildings, design bureaus and research labs; and,
- Sport and recreational facilities of the closed type, public baths and laundries, garages, transport parking places, fire stations, communications, oil and gas pipelines, transmission lines, facilities for technical water supply, cooling water facilities, pump canalisation stations, recycling water supply installations, gas stations and transport service stations.

459. Discussions with the relevant environmental authorities, in combination with air emissions and noise campaign results will confirm the eventual size of the SPZ.

C.3.4.2. International standards

460. The project must observe World Bank Directives ("Environmental, Health and Safety General Directives, 2007 ") based on those of the WHO. As for the impact of noise beyond the perimeter, the EHS Guidelines stipulate that such noise shall not exceed the levels given in the table below, nor shall they result in a greater increase of ambient noise than 3 dB at the nearest receiving area outside the site.

461. The respective limit values in the IFC Environmental, Health and Safety (EHS) Guidelines that apply to new and existing thermal power plants are detailed in Table 50.

Table 50. Maximum Allowable Noise Levels (General IFC Guidelines, 2007)

Receiver	**One hour LAeq (dBA)**	
	Day time	**Night time**
	7h00 – 22h00	**22h00 – 07h00**
Residential, institutional and educational	55	45
Industrial and commercial	70	70

C.3.5. Takhiatash TPP Waste management and standards

462. Hazardous and non-hazardous wastes will be managed separately and in an environmentally sound manner. For the future waste management of Takhiatash TPP (construction, operation and

decommissioning phases) hazardous classification will be based on national or international (Basel Convention) definitions, whichever is more stringent, as Uzbekistan is a signatory part of this Convention.

C.3.5.1. Uzbek standards

463. It will be a responsibility of the Project (under Law on Wastes, Article 15) to develop, obtain approval of and comply with the Waste Generation Norms and Waste Disposal Limits;

Wastes Inventory

464. At the design phase the Project shall complete a waste inventory procedure as specified in Goskompriroda‘s Guideline O'z RH 84.3.15:2005 - The waste inventory procedure is required in order to identify all types of actually generated waste (both domestic and industrial), their physical, chemical, mechanical and hygienic characteristics and consumer properties.

465. The waste inventory shall be undertaken once and be updated in case of major repairs, upgrades or process modifications. This document will also serve as a basis for Waste Data Sheets (WDS) and the Waste Disposal Limit Document to be developed by the Project at the design phase. The Waste Inventory Document is subject to approval by Goskompriroda.

466. A WDS is a document to confirm the point of origin, amounts, properties and potential hazards of waste.

467. The WDS aims at assessing risks associated with waste management and obtaining information on waste as a recoverable resource.

468. The WDS should be developed for each type of generated waste and shall include the following information:

- waste description, location, company information
- general data of generated waste including generation rate (t/year), total amount accumulated, type, aggregative state, code (local + international)
- waste specific characteristics like density, mass, humidity, composition, hazard class, etc

Waste Generation Norms and Waste Disposal Limits

469. The Law on Wastes specifies (Article 18) the general requirement for any project to set and comply with waste generation norms and waste disposal limits. The procedures for setting waste generation norms and waste disposal limits were developed and approved by Goskompriroda in 2005 (O'z RH 84.3.21:2005 - Guidelines for setting waste generation norms and O'z RH 84.3.16:2005 - Guidelines for setting the waste disposal limit, respectively).

470. Waste Generation Norm (WGN) is a fixed amount of a particular type of waste generated per unit of the manufactured product or per unit of crude material. WGN aims at minimizing waste generation and improving waste management.

471. Waste Disposal Limit (WDLs) is maximum amount of waste permitted for temporary storage for a fixed period of time. WDLs aim at reducing environmental impact associated with generated waste. Limits are

set based on actually available storage areas, production capacity, crude material consumption, preventive measures and waste management planning. Limits should be summarised in the WDL Document to be developed by the Project at the design phase based on waste inventory and provisions of Goskompriroda's Guideline O'z RH 84.3.17:2005 – Order of organization and development of limits for production and consumption wastes.

C.3.5.2. International Standards

472. The project will comply with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989), ratified in 1996. Hazardous wastes generated by the project (construction, operation and decommissioning phases) should be classified under this Convention. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.

473. Waste management of the project (construction, operation and decommissioning phases) will be based also on chapter 1.6. of general EHS IFC guidelines (April, 2007).

C.3.6. Takhiatash TPP Health and safety standards

C.3.6.1. Uzbek standard

474. In accordance with provision # 18 of Law on Labor Protection of RUz –Administration is obliged to implement sanitarian-hygienic working conditions, preventing on-the-job injury rate and industrial diseases". Attachment # 2 to Resolution of Cabinet Ministries of RUz # 267 dated 2000, defines –Order of development and coordinating works on labor protection". Chapter #3 of this regulation states about necessity of providing proper and safety working conditions. Every enterprise, regardless of form of property, has to conduct assessment of working conditions. Assessment of working conditions is based on results of evaluation of working places. Evaluation of working places is conducted in accordance with –Methodology of working places", approved by Ministries on Labor and Health (1996). Timing of conducting –Evaluation of working places" is established by enterprise, but shouldn't be less than one time per 5 years. In accordance with Methodology, every type working places should be evaluated, and the evaluation includes data on the following factors:

1. Chemical,
2. Physical,
3. Microclimate,
4. Brightness
5. Burden of labor
6. Intensity of works

475. The level of burden of labor is defining based on this data. Favourable penssion, additional holydays and specified food provision have to be provided for the staff working in the high level of burden labor working conditions.

Noise standards

476. Noise impact from the industry is characterized by:

- Frequency (Hz);
- The frequency and duration of noise% in daytime and at night;
- Sound pressure level (dB);
- the character of noise (a constant level and variability (intermittent))

477. To ensure acceptable levels of sound pressure and sound levels in rooms, workplaces, industrial sites, in residential and public buildings, living areas of cities and other settlements requirements are provided in the following regulations:

- SanR&N No 0120-01 ―Sanitarian norms for noise level at the working places”
- KMK 2.01.08-96 ―Protection from noise”

478. Calculated noise levels are based on passport data of more noisy equipment. Sound pressure levels at the boundary of industrial enterprises, the level of sound in the design point in the object to be protected from noise, are determined in accordance with above-mentioned regulations.

Table 51. Admissible noise level at the working places (SanR&N No 0120-01)

	Type of activities, working place	**Level of sound pressure, dB, octave bands with average geometric mean frequencies (Hz)**									**Level of sound, dB (A)**
		31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
1	Creative activity, management with high requirements, scientific activity, design activity, teaching, medical treatment, administration rooms and etc.	86	71	61	54	49	45	42	40	38	50
2	High qualified activity required concentration, management activity, measurements and analytical activities at the laboratories, management rooms at the technical departments, laboratories	93	79	70	63	58	55	52	50	49	60

	Type of activities, working place	Level of sound pressure, dB, octave bands with average geometric mean frequencies (Hz)									Level of sound, dB (A)
		31.5	63	125	250	500	1000	2000	4000	8000	
3	Works related with other receiving instructions and acoustic signs, works required auditory control, controller, dispatcher, room foreman	96	83	74	68	63	60	58	56	54	65
4	Works required concentration, works related with conducting monitoring and remote management of technological cycles: work places at the control panel at the monitoring rooms without noise connection through phone; at the laboratory with noisy equipment	103	91	83	77	73	70	68	66	64	75
5	Execution of all types of work with the exception of works mentioned at parag 1-4 and similar to them) at the permanent work places at the workrooms.	107	95	87	82	78	75	73	71	69	80

479. For assessment of noise level at the Takhiatash TPP three types of working places have been observed: analytical laboratories (row 2); controller rooms (row 3); workrooms (row 5).

Vibration standards

480. Level of vibration is defined in accordance with SanR&N No 0122-01 Sanitarian norms of general and local vibration at the working places.

481. As defined in this document hygienic vibration, impacted at the human, implementing by following methods:

- Frequency (spectral) analysis of rationing parameters
- Integral assessment based on frequency of rationing parameters

- Vibration dose

482. General vibration is divided by 3 categories depending of generating sources:

Table 52. Categories of vibration depending on generating sources

Category	Description	Generating sources
Category 1	Transportation vibration	• Agricultural and industrial tractors, combines • Trucks • Snowplough
Category 2	Transportation-technological vibration	• Excavators, industrial and construction cranes • Track machine, concrete placers
Category 3	Technological vibration, impacted at the human at the working places in stationary machines	• Machine tool • Woodworking machine • Electrical machine • Stationary electrical installations • Pump and ventilation units

483. Category 3 also divides on the three 3 technological types:

a) At the permanent working places in workrooms
b) At the working places in storehouses, dining rooms, communal and other facilities without machinery generating vibration;
c) At the working places of administrative buildings, laboratories, medical entities and workrooms for intellectual workers

Table 53. Sanitarian norms of general vibration category 3 – technological types "a"

Average gemetrical frequency of octane band (Hz)	Allowed values for vibro acceleration and vibro speed by axes X Yo, Zo			
	Vibro acceleration		Vibro speed	
	m/s^2	dB	m/s^2	dB
2.0	0.14	53	1.3	108
4.0	0.1	50	0.45	99
8.0	0.1	50	0.22	93
16.0	0.20	56	0.20	92
31.5	0.40	62	0.20	92
63.0	0.80	68	0.20	92
Corrected and eqvivalent corrected values, their levels	0.1	50	0.2	92

Table 54. Sanitarian norms of general vibration category 3 – technological types "b"

Average gemetrical frequency of octane band (Hz)	**Allowed values for vibro acceleration and vibro speed by axes Xo, Yo, Zo**			
	Vibro acceleration		**Vibro speed**	
	m/s^2	**dB**	**$m/s^2 \cdot 10^{-2}$**	**dB**
2.0	0.056	45	0.50	100
4.0	0.04	42	0.18	91
8.0	0.04	42	0.089	85
16.0	0.08	48	0.079	84
31.5	0.16	54	0.079	84
63.0	0.32	60	0.079	84
Corrected and eqvivalent corrected values, their levels	0.04	42	0.079	84

Table 55. Sanitarian norms of general vibration category 3 – technological types "c"

Average gemetrical frequency of octane band (Hz)	**Allowed values for vibro acceleration and vibro speed by axes Xo, Yo, Zo**			
	Vibro acceleration		**Vibro speed**	
	m/s^2	**dB**	**$m/s^2 \cdot 10^{-2}$**	**dB**
2.0	0.02	36	0.18	91
4.0	0.014	33	0.063	82
8.0	0.014	33	0.032	76
16.0	0.028	39	0.028	75
31.5	0.056	45	0.028	75
63.0	0.112	51	0.028	75
Corrected and equivalent corrected values, their levels	0.014	33	0.028	75

Micro climate standards

484. Indicators, characterized metereological conditios in close work rooms (microclimate) are:

A) – air temperature;
B) – air relative humidity;
C) – air moving speed;
D) – intensity of heat radition.

485. Optimal microclimate conditions are active for all working zone in working wooms without dividing on permnent and temporary. Optimal and allowed indicators of temperature relative humidity and speed of air movement in worknig zone of working rooms have to comply with values, indicated into the Table 56.

Table 56. Optimal and allowed norms of temperature relative humidity and speed of air movement in working zone of working rooms

Season	**Work category**	**Temperature (°C)**					**Humidity (%)**		**Speed of movement (m/s)**	
			Allowed							
			Upper limit		**Lower limit**					
			At the working places							
		Optimal	**Permanent**	**Non-permanent**	**Permanent**	**Non-permanent**	**Optimal**	**Allowed At the working place – permanent and non-permanent no more than**	**Optimal**	**Allowed At the working place – permanent and non-permanent no more than**
Cold season	Light - 1a	22-24	25	26	21	18	40-60	75	0,1	No more than 0,1
	Light - 1б	21-23	24	25	20	17	40-60	75	0,1	No more than 0,2
	Middle weight – Iia	18-20	23	24	17	15	40-60	75	0,2	No more than 0,3
	Middle weight – Iiб	17-19	21	23	15	13	40-60	75	0,2	No more than 0,4
	Heavy - III	16-18	19	20	13	12	40-60	75	0,3	No more than 5
Warm season	Light - 1a	25-27	31	32	24	23	40-60	30 (at 32°C)	0,1	0,3-0,5
	Light - 1б	24-26	31	32	23	22	40-60	35 (at 31°C)	0,2	0,3-0,6
	Middle weight - IIa	23-25	30	31	22	21	40-60	40 (at 30°C)	0,3	0,3-0,7
	Middle weight – IIб	22-24	29	30	21	20	40-60	45 (at 29°C)	0,3	0,4-0,7
	Heavy - III	21-23	27	29	20	19	40-60	50 (at 28°C)	0,4	0,4-0,7

Air at the workplace

486. Air quality at the work places is regulated by SanR&N No 0046-95 Hygienic Norms. List of Maximum allowed concentration (MAC) of pollutants into the air of work area.

C.3.6.2. International standards

487. In the construction and decommissioning phases, chapter 4.2. of the general EHS IFC guidelines (April 2007) must be fulfilled.

488. In the operation phase, chapter 2 of the general EHS IFC guidelines (April 2007) and chapter 1.2. of the thermal power plants EHS IFC guidelines (December 2008) must be fulfilled.

D. ALTERNATIVE SOLUTIONS EXAMINED AND JUSTIFICATION FOR THE SELECTED SOLUTION

489. This section will explain why and how certain decisions were made. To do so, the alternatives for the situation with and without the project as well as within the alternative with the project are analyzed.

490. The alternatives considered are focused mainly on three aspects: site location, fuel selection, combustion technology used for electricity production and cooling system.

491. The different alternatives to the proposed project do not offer the same opportunities to capitalize on existing infrastructure and other related resources available for the proposed project so that the different selected solutions are justified within this chapter.

D.1. “No project” alternative

492. The main goals of the Takhiatash TPP‘s CCPU project are to cut operational expenses, to increase the efficiency and the reliability of the energy supply to consumers, as well as to improve the environmental quality within its area of influence.

493. The ―No project” alternative means that Uzbekenergo decides not to construct the CCPU at Takhiatash TPP and continues operating the technically obsolete and physically worn-out equipment of III and IV units.

494. As a result, the reliability and technical condition of the equipment would decrease and this option would result in even lower technical and economic indicators. Furthermore, accidental risks with potential negative consequences for the environment would increase.

495. The power demand outlook in Karakalpakstan region is strong and, furthermore, Takhiatash TPP not only provides the North-West region of the country with electricity but also heats water for consumers supply in Takhiatash town and for covering its own needs.

496. Operational lifetime of Takhiatash TPP‘s equipment ranges from 22 to 43 years, which is the main reason for the equipment reliability degradation and increases the probability of accidental risks with potential negative consequences for the environment.

497. Not carrying out the project would mean potentially reducing the planned coverage of the energy demand in Uzbekistan in case of failure of the worn-out equipment, with the resulting parallel reduction in both economic development (delay in the development or investment in Takhiatash area and the supplied cities due to a lack of infrastructure, etc.) as well as the quality of life of its inhabitants (limited access to electricity and poor environmental conditions).

498. Given the consequences indicated and the social impact produced if the ―no project” alternative is considered, the most appropriate alternative is believed to be going ahead with the construction of the CCPU at Takhiatash TPP as long as this Environmental Impact Assessment demonstrates that it will produce an overall impact that is compatible with, controllable by and fits perfectly into the sustainable

development policy framework maintained by the Uzbek authorities and the ADB on the condition that the preventive and corrective measures as well as the environmental monitoring program are observed.

D.2. "With project" alternative

499. The implementation of the Takhiatash CCPU is a priority project within the development program in Uzbekistan. The ―with project" alternative will result in a quantitative improvement of the environmental quality in the area of the TPP and an increased economic development in the region and country. If this Environmental Impact Assessment demonstrates that the project will produce an overall impact that will be compatible with, controllable by and fits perfectly into the sustainable development policy framework maintained by the ADB and Uzbek authorities on the condition that the preventive and corrective measures as well as the environmental monitoring program are observed, this alternative would be selected.

D.2.1. Justification for sites selection

500. The site of existing Takhiatash TPP is located in the city of Takhiatash, 3 km to the south-west of the city centre, on the left bank of Amudarya river. It occupies the central part of the Republic of Karakalpakstan, located in north-western Uzbekistan.

501. One of the main objectives of the project is to supply the strong power demand outlook in Karakalpakstan. In this context, the locations for installation must be limited to the area to be served. Locations outside this range are too far from the consumers.

502. Apart from the above, there were several weighty reasons justifying the choice of Takhiatash as a site for the new CCPU. Among these reasons, the following may be noted:

- Location of the new CCPU within the terrains of the Takhiatash TPP, so the area has been previously developed for industrial use. This avoids certain issues that may arise if the plant is located in a new site in natural areas not previously impacted, such an increase of the impact on the landscape, the vegetation and wildlife.
- Existing distribution and transport structure, so, the project will not require for this purpose either further investments or soil use changes:
    - Interconnection with the national electricity network due to the already existing transmission line.
    - Gas supply to the new CCPU through gas pipeline with a Gas Distribution Plant at just two kilometres from the power plant area (current supply point).
- Proximity of water supply in sufficient quantities for the power plant (Suenly canal)
- Good communication infrastructure (roads)
- Minimal impact on populated areas in the neighbourhood: No resettlement of people living on or close to site area.
- Proximity of large consumption conglomerations, such as Takhiatash and Nukus.

D.2.2. Choosing combustion technology

503. An important aspect to choose an appropriate combustion technology is the amount of atmospherics emissions associated with the same.

504. The primary emissions to air from the combustion of fossil fuels or biomass are sulfur dioxide (SO2), nitrogen oxides (NOX), particulate matter (PM), carbon monoxide (CO), and greenhouse gases, such as carbon dioxide (CO2). Depending on the fuel type and quality, mainly waste fuels or solid fuels, other substances such as heavy metals (i.e., mercury, arsenic, cadmium, vanadium, nickel, etc), halide compounds (including hydrogen fluoride), unburned hydrocarbons and other volatile organic compounds (VOCs) may be emitted in smaller quantities, but may have a significant influence on the environment due to their toxicity and/or persistence.

505. The amount and nature of air emissions depends on factors such as the fuel (e.g., coal, fuel oil, natural gas, or biomass), the type and design of the combustion unit related to the thermal efficiency (e.g., reciprocating engines, combustion turbines, or boilers), operating practices, emission control measures (e.g., primary combustion control, secondary flue gas treatment), and the overall system efficiency.

Table 57. Contributions of emissions from different LCP categories to the total air emissions from IPPC installations operating in EU-15 in 2001 according to the European Pollutant Emission Register 2001 (EPER) [193, EC, 2001]

LCP category	Contribution to total emissions from IPPC installations (%)										
	SO_2	NO_X	NH_3	CO_2	N_2O	CH_4	PM_{10}	Hg_{tot}	Dioxins+ furans	NMVOC	CO
LCPs over 300 MW	64.6	53.4	0.5	54.4	7.6	0.2	38.1	28.8	19.0	0.7	4.4
LCPs 50 – 300 MW	3.6	6.0	N1	5.0	21.0	0.2	2.1	2.6	0.2	0.7	2.8
Gas turbines	0.9	3.6	0.03	5.5	0.4	0.3	0.1	N1	0.3	0.1	0.3
Stationary engines	0.3	1.2	N1	0.1	N1	0.05	0.2	0.3	N1	0.1	0.03
All LCPs	69.4	64.2	0.5	65.0	29.0	0.8	40.5	31.7	19.5	1.6	7.5

Notes:
N1 No emissions reported for this category.

506. <u>CO2 emissions:</u>

Carbon dioxide is the main reaction product from the combustion of all fossils fuels. These emissions are directly related to the carbon content of fuels, where gaseous fuels have significantly lower CO2 emissions than other fossil fuels. The content of carbon varies for coal and lignite (hard and brown coal) between 61 and 87 wt-%, for wood it is about 50 wt-%, and for gasoil and heavy fuel oil about 85 wt-%

Table 58. Specific CO2 emission factors fot the main fuels burned in large combustion plants (192, TWG, 2003)

Fuel	Specific CO_2 emission factors as a range. (t CO_2/ TJ (g/kWh))
Natural gas	55 (198)
Heavy fuel oil (HFO)	80 (288)
Light fuel oil (LFO)	77 (277)
Hard coal	95 (342)
Lignite	110 (396)

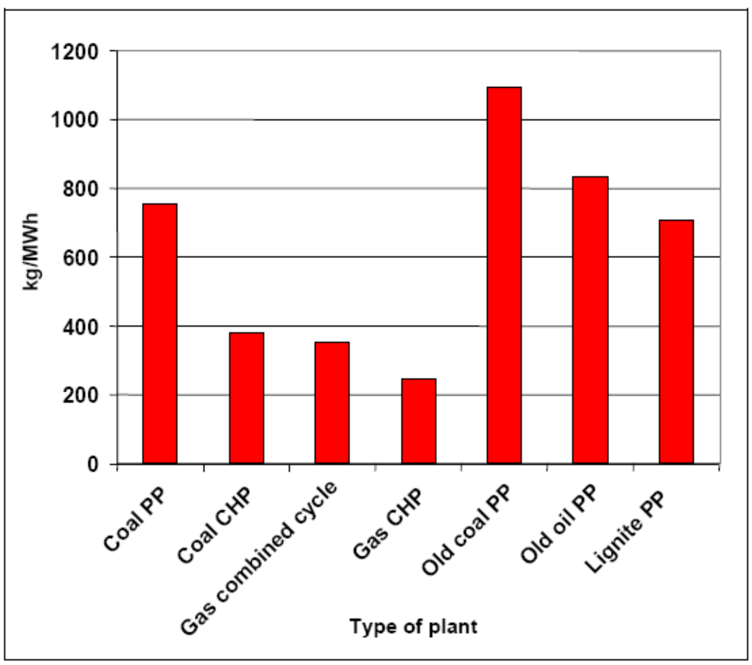


Figure 22. Examples of CO2 releases for different types of combustion plants

507. <u>Particulate matter (dust) emissions:</u>

Particulate matter (dust) emitted during the combustion of solid or liquid fuels arise almost entirely from their mineral fraction. By combustion of liquid fuels, poor combustion conditions lead to the formation of soot. Combustion of natural gas is not a significant source of dust emissions. The emission levels of dust, in this case, are normally well below 5 mg/Nm3 without any additional technical measures being applied.

508. In the following table can be seen the Best Available Technologies (BATs) for the reduction of particulate emissions from some combustion plants.

Table 59. BAT for the reduction of particulate emissions from some combustion plants

Capacity (MW_{th})	Dust emission level (mg/Nm^3)						BAT to reach these levels
	Coal and lignite		Biomass and peat		Liquid fuels for boilers		
	New plants	Existing plants	New plants	Existing plants	New plants	Existing plants	
50 – 100	5 – 20*	5 – 30*	5 – 20	5 – 30	5 – 20*	5 – 30*	ESP or FF
100 – 300	5 – 20*	5 – 25*	5 – 20	5 – 20	5 – 20*	5 – 25*	ESP or FF in combination FGD (wet, sd or dsi) for PC ESP or FF for FBC
>300	5 – 10*	5 – 20*	5 – 20	5 – 20	5 – 10*	5 – 20*	

Notes:
ESP: Electrostatic precipitator) **FF:** Fabric filter **FGD(wet):** Wet flue-gas desulphurisation
FBC: Fluidised bed combustion) **sd:** semi dry **dsi:** dry sorbent injection
* Some split views appeared in these values and are reported in Sections 4.5.6 and 6.5.3.2 of the main document.

509. <u>SO2 emissions:</u>

Sulphur oxides emissions mainly result from the presence of sulphur in the fuel. Natural gas, for example, is generally considered free from sulphur, and for this reason no additional technical measures are needed. For the rest of fuels, that need more emission reduction measures, the Beste Available Technologies (BATs) for the reduction of SO2 emissions form some combustion plants are summarised in the following table.

Table 60. BAT for the reduction of SO2 emissions form some combustion plants

Capacity (MW_{th})	SO_2 emission level (mg/Nm^3)						BAT to reach these levels
	Coal and lignite		Peat		Liquid fuels for boilers		
	New plants	Existing plants	New plants	Existing plants	New plants	Existing plants	
50 – 100	200 – 400* 150 – 400* (FBC)	200 – 400* 150 – 400* (FBC)	200 – 300	200 – 300	100 – 350*	100 – 350*	Low sulphur fuel or/and FGD (dsi) or FGD (sds) or FGD (wet) (depending on the plant size). Seawater scrubbing. Combined techniques for the reduction of NO_x and SO_2. Limestone injection (FBC).
100 – 300	100 – 200	100 – 250*	200 – 300 150 – 250 (FBC)	200 – 300 150 -300 (FBC)	100 – 200*	100 – 250*	
>300	20 – 150* 100 – 200 (CFBC/ PFBC)	20 – 200* 100 – 200* (CFBC/ PFBC)	50 – 150 50 – 200 (FBC)	50 – 200	50 – 150*	50 – 200*	

Notes:
FBC: Fluidised bed combustion
CFBC: Circulating fluidised bed combustion
PFBC: Pressurised fluidised bed combustion
FGD(wet): Wet flue-gas desulphurisation
FGD(sds): Flue-gas desulphurisation by using a spray dryer
FGD(dsi): Flue-gas desulphurisation by dry sorbent injection
* Some split views appeared in these values and are reported in Sections 4.5.8 and 6.5.3.3 of the main document.

510. <u>NOx emissions:</u>

NOX emissions are emited in any combustion process due to the N2 natural content in the combustion air. The principal oxides of nitrogen emitted during the combustion are nitric oxide (NO) and nitrogen dioxide (NO2), referred as NOx.

511. The Best Available Technologies (BATs) for coal, lignite, peat, biomass, liquid fuel and gas fired combustion plants are summarised in the following tables:

Table 61. BAT for the reduction of NOx from coal-and lignite-fired combustion plants

Capacity (MW_{th})	Combustion technique	NO_X emission level associated with BAT (mg/Nm^3)			BAT options to reach these levels
		New plants	Existing plants	Fuel	
50 – 100	Grate-firing	200 – 300*	200 – 300*	Coal and lignite	Pm and/or SNCR
	PC	90 – 300*	90 – 300*	Coal	Combination of Pm and SNCR or SCR
	CFBC and PFBC	200 – 300	200 – 300	Coal and lignite	Combination of Pm
	PC	200 – 450	200 – 450*	Lignite	
100 – 300	PC	90* – 200	90 – 200*	Coal	Combination of Pm in combination with SCR or combined techniques
	PC	100 – 200	100 – 200*	Lignite	Combination of Pm
	BFBC, CFBC and PFBC	100 – 200	100 – 200*	Coal and Lignite	Combination of Pm together with SNCR
>300	PC	90 – 150	90 – 200	Coal	Combination of Pm in combination with SCR or combined techniques
	PC	50 – 200*	50 – 200*	Lignite	Combination of Pm
	BFBC,CFBC and PFBC	50 – 150	50 – 200	Coal and Lignite	Combination of Pm

Notes:
PC: Pulverised combustion
BFBC: Bubbling fluidised bed combustion
CFBC: Circulating fluidised bed combustion
PFBC: Pressurised fluidised bed combustion
Pm: Primary measures to reduce NO_x
SCR: Selective catalytic reduction of NO_x
SNCR: Selective non catalytic reduction of NO_x
The use of anthracite hard coal may lead to higher emission levels of NO_X because of the high combustion temperatures
* Some split views appeared in these values and are reported in Section 4.5.9 of the main document.

Table 62. BAT for the reduction of NOX from peat, biomass and liquid fuel-fired combustion plants

Capacity (MW_{th})	NO_X -emission level (mg/Nm^3)				BAT to reach these levels
	Biomass and Peat		Liquid fuels		
	New plants	Existing plants	New plants	Existing plants	
50 – 100	150 – 250	150 – 300	150 – 300*	150 – 450	Combination of Pm SNCR/ SCR or combined techniques
100 – 300	150 – 200	150 – 250	50 – 150*	50 – 200*	
>300	50 – 150	50 – 200	50 – 100*	50 – 150*	

Notes:
Pm: Primary measures to reduce NO_x
SCR: Selective catalytic reduction of NO_x
* Some split views appeared in these values and are reported in Section 6.5.3.4 of the main document

Table 63. BAT for the reduction of NOX and CO emissions from gas-fired combustion plants

Plant type	Emission level associated with BAT (mg/Nm^3)		O_2 level (%)	BAT options to reach these levels
	NO_x	CO		
Gas turbines				
New gas turbines	20 – 50	5 – 100	15	Dry low NO_x premix burners or SCR
DLN for existing gas turbines	20 – 75	5 – 100	15	Dry low NO_x premix burners as retrofitting packages if available
Existing gas turbines	50 – 90*	30 – 100	15	Water and steam injection or SCR
Gas engines				
New gas engines	20 – 75*	30 – 100*	15	Lean-burn concept or SCR and oxidation catalyst for CO
New gas engine with HRSG in CHP mode	20 – 75*	30 – 100*	15	Lean-burn concept or SCR and oxidation catalyst for CO
Existing gas engines	20 – 100*	30 – 100	15	Low NO_x tuned
Gas-fired boilers				
New gas-fired boilers	50 – 100*	30 – 100	3	Low NO_x burners or SCR or SNCR
Existing gas-fired boile	50 – 100*	30 – 100	3	
CCGT				
New CCGT without supplementary firing (HRSG)	20 – 50	5 – 100	15	Dry low NO_x premix burners or SCR
Existing CCGT without supplementary firing (HRSG)	20 – 90*	5 – 100	15	Dry low NO_x premix burners or water and steam injection or SCR
New CCGT with supplementary firing	20 – 50	30 – 100	Plant spec.	Dry low NO_x premix burners and low NO_x burners for the boiler part or SCR or SNCR
Existing CCGT with supplementary firing	20 – 90*	30 – 100	Plant spec.	Dry low NO_x premix burners or water and steam injection and low NO_x burners for the boiler part or SCR or SNCR

SCR: Selective catalytic reduction of NO_x **SNCR**: Selective non catalytic reduction of NO_x
DLN: dry low NO_X **HRSG:** heat recovery steam generator **CHP:** Cogeneration
CCGT: combined cycle gas turbine
* Some split views appeared on these values and are reported in Section 7.5.4 of the main document..

512. For new gas turbines, dry low NOX premix burners (DLN) are considered a Best Available Technology.

513. <u>Thermal efficiency:</u>

The efficiency with which energy can be generated is an important indicator of the emission of the climate relevant gas CO2. One way to reduce the emission of CO2 per unit of energy generated is the optimisation of the energy utilisation and the energy generating process. Increasing the thermal efficiency has implications on load conditions, cooling system, emissions, use of type of fuel and so on. The Best Available

514. Technology conclusion to increase efficiency and the Best Available Technology associated levels are summarized in the following tables.

Table 64. Levels of thermal efficiency associated with the application of BAT measures for coal and lignite fired combustion plants

Fuel	Combined technique	Unit thermal efficiency (net) (%)	
		New plants	Existing plants
Coal and lignite	Cogeneration (CHP)	75 – 90	75 – 90
Coal	PC (DBB and WBB)	43 – 47	The achievable improvement of thermal efficiency depends on the specific plant, but as an indication, a level of 36* – 40 % or an incremental improvement of more than 3 % points can be seen as associated with the use of BAT for existing plants
	FBC	>41	
	PFBC	>42	
Lignite	PC (DBB)	42 – 45	
	FBC	>40	
	PFBC	>42	

PC: pulverised combustion **DBB:** dry bottom boiler **WBB:** wet bottom boiler
FBC: fluidised bed combustion **PFBC**: pressurised fluidised bed combustion
* Some split views appeared in this value and are reported in Section 4.5.5 of the main document

Table 65. Thermal efficiency levels associated with the application of BAT measures for peat and biomass fired combustion plants

Fuel	Combined technique	Unit thermal efficiency (net) (%)	
		Electric efficiency	Fuel utilisation (CHP)
Biomass	Grate-firing	Around 20	75 – 90 Depending on the specific plant application and the heat and electricity demand
	Spreader-stoker	>23	
	FBC (CFBC)	>28 – 30	
Peat	FBC (BFBC and CFBC)	>28 – 30	

FBC: fluidised bed combustion **CFBC:** circulating fluidised bed combustion
BFBC: bubbling fluidised bed combustion **CHP:** Cogeneration

Table 66. Efficiency of gas-fired combustion plants associated to the use of BAT

Plant type	Electrical efficiency (%)		Fuel utilisation(%)
	New plants	Existing plants	New and existing plants
Gas turbine			
Gas turbine	36 – 40	32 – 35	-
Gas engine			
Gas engine	38 – 45		-
Gas engine with HRSG in CHP mode	>38	>35	75 – 85
Gas-fired boiler			
Gas-fired boiler	40 – 42	38 – 40	
CCGT			
Combined cycle with or without supplementary firing (HRSG) for electricity generation only	54 – 58	50 – 54	-
Combined cycle without supplementary firing (HRSG) in CHP mode	<38	<35	75 – 85
Combined cycle with supplementary firing in CHP mode	<40	<35	75 – 85
HRSG: heat recovery steam generator	**CHP**: Congeneration		

515. The following <u>alternative technologies</u> for power generation from fossil fuels will be discussed and compared, particularly in order to increase efficiency and thereby effectiveness of the plant and to reduce environmental impact:

- Generation of 250-280 MW by an oil-fired conventional plant
- Generation of 250-280 MW by a coal-fired conventional plant
- Generation of 250-280 MW by a combined cycle power plant CCPP

516. <u>Generation of 250-280 MW by an oil-fired conventional plant</u>

The oil-fired conventional power plant uses fuel oil is a fraction obtained from petroleum distillation, either as a distillate or a residue and is burnt in a furnace or boiler for the generation of heat or used in an engine for the generation of power.

517. The combustion of fuel oil is not complete in comparison with natural gas and will produce CO2, NOX, SO2 and particulate emissions. In order to control the atmospheric emissions till standards, the oil-fired conventional plant would need facilities to reduce the NOX, SO2 and particulate emissions.

518. The oil-fired conventional plants will need additional expenditure due to the choice of fuel and the need to control the pollutants emissions till standards:

- Construction of facilities for the control of NOX, SO2 emissions.
- Water and additional chemical products consumption from the facilities to control emissions.
- Gypsum treatment and disposal.
- Appropiated fuel oil storage and handling.

519. Generation of 250-280 MW by a coal-fired conventional plant

Coal is one of the largest source of energy for the generation of electricity worldwide, as well as one of the largest worldwide anthropogenic sources of carbon dioxide releases. The atmospheric emissions due to coal combustion, even with desulfurization treatment, are much higher in comparison with other fossil fuels. Gross carbon dioxide emissions from coal usage are about double the amount from natural gas and will produce more NOX, SO2 and particulate emissions than fuel oil.

520. The coal-fired conventional plants will need additional expenditure due to the choice of fuel and the need to control the pollutants emissions till standards:

- Construction of facilities for the control of NOX, SO2 emissions and particulate matter.
- Water and additional chemical products consumption from the facilities to control emissions.
- Gypsum treatment and disposal.
- Botton and fly ash handling and disposal
- Coal yard
- Coal unloading, transportation, storage and grinding.

521. Generation of 250-280 MW by a combined cycle power plant

Natural gas is the cleanest fossil fuel for producing energy and is composed mainly by methane CH_4. Before natural gas can be used as fuel, it must undergo processing to remove almost all materials other than methane, so the emission of SO_2 are not significant as well as the emission of particulate matter and CO_2 , due to its higher molecular weight Hydrogen/Carbon (H/C). The combustion of natural gas only will produce NOx and CO_2 emissions.

522. The Combined Cycle technology takes advantage of the thermal energy of the exhausted gas from the gas cycle to generate water steam to be reused at the steam cycle. Due to that fact, the efficiency of the Combined Cycle technology is highly superior in comparison with other conventional thermal technology.

523. Combined Cycle technology can provide 57% of electrical efficiency that means electricity generation on the basis of more competitive prices in comparison with other technologies. Moreover, natural gas produces energy with the lowest rate emissions per produced kWh and the CCPP does not need additional expenditure for emissions control and fuel storage in comparison with fuel and coal.

Findings

524. The best combustion technology chosen for the new power generation unit, from the environmental point of view, is the combined cycle option, which offers a high number of advantages over the other existing conventional steam power units at Takhiatash TPP:

- Decrease in relative fuel consumption
- Decrease in NO_x emissions due to design features of gas turbine combustors and effective combustion mode
- Decrease in gross discharge to atmosphere (no SO_2 and particulate emissions, lower CO_2 and NO_x emissions than coal and fuel-oil)

- Lower percentage of COVs and unburned fuel.
- Decrease in the level of atmospheric pollution by CCPU discharges compared to the decommissioned boilers No.1-6
- Decrease in the level of atmospheric pollution by CCPU discharges after modernization compared to current environmental conditions
- Decrease in the emission the main greenhouse gas (CO_2 emissions are 60% less than in a conventional technique). This opens the possibility of securing a contribution to the cost of installation under the Clean Development Mechanism of the United Nations Framework convention on Climate Change (UNFCC). This mechanism allows improvement of the emission performance to be reflected in carbon credits, which can then be sold.
- No need of flue gas desulphurization plant (FGD), SCR plant for NO_x reduction and particle collector devices. Neither additional consumables nor residue from facilities to reduce atmospheric emissions.
- Decrease of accidental risk by means of using ACS system controlling CCPU operation
- Very competitive energy prices in comparison with other technologies: moderate investment values, short period of execution and high efficiency
- Lower risks of fire and soil pollution
- No additional land occupation due to storage and disposal needs

525. In summary:

Table 67. Table Comparison of technologies

ASPECTS		COAL-FIRED CONVENTIONAL	OIL-FIRED CONVENTIONAL	COMBINED CYCLE
EMISSIONS	SO2	xxx	xx	-
	NOX	xxx	xx	x
	PARTICLES	xxx	xx	-
	CO2	xxx	xxx	x
Operation of flue gas desulphurization plant (FGD)	To reduce SO2	xxx	xxx	-
Operation of SCR plant for NOx reduction and particle collector	To reduce NOx	xxx	-	-
Operation of low NOx burner	To reduce NOx	xxx	xxx	x
Operation of particle collector devices.	To reduce particulate matter	xxx	-	-
Gypsum disposal & treatment	From desulfurization process	xxx	xx	-

ASPECTS		COAL-FIRED CONVENTIONAL	OIL-FIRED CONVENTIONAL	COMBINED CYCLE
Fly ash and Fly bottom disposal	From combustion process	xxx	-	-
Coal yard	Coal storage	xxx	-	-
Risks of fire and soil pollution	Due to fuel storage	xxx	xxx	-
Cooling demand	Steam cycle	xxx	xxx	x
Land ocupation	Plant &disposal facilities	xxx	xx	x
Energy demand	Plant Operation	xxx	xx	x
Fuel demand	Plant Operation	xxx	xx	x

526. On top of that, Takhiatash CCPU will use NOx burner systems to control NOx emissions till standards. The basic principle is the staged injection of the fuel gas without affecting the boiler efficiency.

D.2.3. Cooling system

527. Cooling is required in order to maintain the operational state of the fluid carrying energy from the boilers to the turbines (steam). After having been used for driving the generator, the steam becomes "dead" steam, and needs to be transformed back into a high density fluid (liquid water) so that it may once more be able to transfer heat from the thermal boiler. For this purpose, there are several alternatives, being the most common the open circuit and the closed circuit cooling towers.

528. Although the water consumption of Combined Cycle technology is lower than a conventional power plant, the choice of adequate refrigeration system minimizes the water consumption.

a) Open circuit:

529. It uses water from the sea, from a river, from a lake or from a dam in a single pass (i.e. once) and then returns the water to the same source at a temperature higher than 10°C, but with the same characteristics and without lowering salinity.

530. This type of cooling requires large volumes of water; therefore it can only be used on sites close to the sea or to large dams. This ensures better diffusion of the thermal gradient.

531. The big advantage is that no water is consumed. The disadvantage is the increase of the temperature in the discharge which cause an impact on the fauna and flora of the receptor water body.

b) <u>Closed circuit:</u>

532. Closed-circuit requires rather smaller volumes of water. Steam first goes through a wet cooling tower in which it passes through a fine-mesh system which then transfers the heat to the atmosphere.

533. Part of the water is lost as steam. Another part condenses into water and flows into the tank located at the bottom of the tower, from where it is returned into the steam circuit.

534. The circuit is not completely closed, since part of the water is lost through evaporation into the atmosphere. It is necessary to resupply the circuit with additional fresh water from a water source (river, dam, sea etc). Moreover, the water flowing to the tank at the bottom of the cooling tower contains concentrated levels of salts resulting from evaporation; therefore some of it is purged back to the original water source to relieve the circuit and avoid salt accumulation

535. This type of cooling system requires continuous water supply to compensate for evaporation and purging.

536. Wet cooling towers fall into two main categories: natural draft and mechanical draft.

- **Natural draft towers** use very large concrete chimneys to introduce air through the media. Due to the large size of these towers, they are generally used for very large water flow rates.
- **Mechanical draft towers** use large fans to force or suck air through circulated water. The water falls downward over fill surfaces, which help increase the contact time between the water and the air, what helps to maximize the heat transfer between the two. Cooling rates of mechanical draft towers depend upon their fan diameter and speed of operation.

<u>Findings</u>

537. Closed circuit solution has been selected in order to avoid increasing the water intake from Suenly canal as well as not significantly increasing the temperature of the channel's water, issues that may occur with an open circuit cooling system.

538. Natural draft tower option has been discarded because of their huge shape, construction difficulties and cost, therefore the cooling alternative selected for the Takhiatash new CCPU corresponds to the aforementioned closed circuit scheme using 5 wet mechanical draft towers. This system consists of passing cold water through the condenser tubes. The steam going out of the steam turbine flows around these tubes and condenses by transferring its heat to the water flowing through the pipes. Circulating water is returned to the towers with an increase in temperature of approximately 8 °C, from which, once cooled, it is collected in the tanks at the bottom and pumped back into the circuit. Figure 23**Error! Reference source not found.** shows a diagram explaining the operation of a mechanical draft cooling tower.

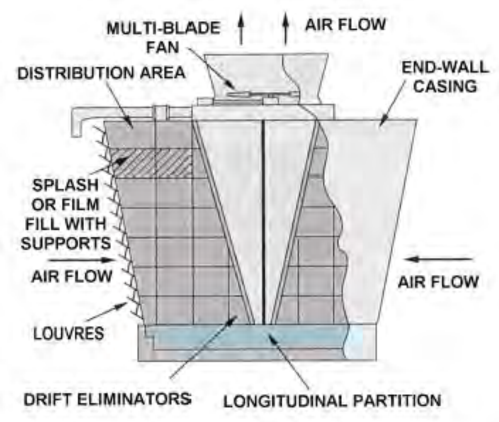


Figure 23. Mechanical draft cooling tower

539. The impacts of the cooling system are discussed in the relevant sections of this Environmental Impact Assessment.

<u>CONCLUSION:</u>

540. As described in the Project Description chapter, alternatives chosen for the project are the best option on location and technology, both combustion and cooling system. As locate the project in an existing industrial area with part of the existing facilities to be used for the new CCPU (transmission line, water intake and discharge canals, gas supply) the environmental potential impacts are going to be minimized. By other hand, combined cycle technology based on natural gas and refrigerated with a closed cooling water systems gather the most environmental friendly power generation among those fuel combustion technologies. This technology achieves the highest rate of power generation with the lowest rate of air emission pollutants. The closed refrigeration system has the advantage to decrease the amount of water intake and discharge reducing the temperature increase of the effluent compared to those open system

E. ENVIRONMENTAL BASELINE

541. The Environmental Baseline provides a general overview of the existing environmental and social conditions prevailing in the Study Area. In particular, this study sheds the light on key environmental sensitivities that may influence the project plans. It also serves as an environmental management tool that enables the identification and assessment of the impacts resulting from the proposed project.

542. The data presented in the environmental baseline study was mainly collected through two inter-dependant means: (i) a desk study of existing data records, review of previous studies and publications on the area, and (ii) Field survey of the Study Area consisting of a site visit and visual documentation.

543. Regarding existing data records, monitoring information gathered by the TPP environmental team has been analyzed: water, groundwater and soil quality analysis. As these primary information was considered not to be sufficient it has been completed with site surveys (noise campaign, water quality analysis including World Bank parameters regarding effluent standards, soil analysis of the new area where the future CCPU is going to be located).

544. Nevertheless, time period coverage of the primary data was not enough in some cases as the ideal data collection period exceeded the environmental assessment period. Therefore, data collection is advised to continue in the EMP for some of the environmental factors in order to provide a more complete baseline previously to the commissioning of the project.

E.1. Physical environment

545. Takhiatash TPP is located in Takhiatash city, in Khodjeyliy region of the Republic of Karakalpakstan (3km to the South-West of the city centre). The surface area is relatively flat with no significant deviation in either direction and is characterized by an altitude of 76.30-76.70 m.

E.1.3. Climate and meteorology

546. In terms of climatic conditions, the area belongs to the Central Asia zone of deserts and semi-deserts with sharp continental climate meaning hot, dry summer and cold, wet winter period. The average air temperature according to the observations of the meteorological stations located on the territory of the republic is +13.7ºC and the average for the growing season is +22.6ºC. The absolute maximum temperature registered is +36ºC. In winter, there are temperatures as low as -16.0ºC, but they are short in duration not exceeding a period of 30 days.

547. In long-term data, precipitation is in the amount of 80-100 mm per year and in terms of timing, it falls in the autumn-winter period. The average humidity in the Republic of Karakalpakstan is 56%. Winds blow constantly throughout the year mainly from the northeast at a speed of 10.5m/sec, at times – 7.12m/sec, and in the spring and summer months turn into dust whirls.

548. The area of the left bank of the Amu Darya river is under large amplitude fluctuations of the air temperature (daily and annual) at pronounced contrasts of precipitation periods:

- The maximum precipitation rate falls on winter and spring;
- Rapid increase of the temperature during the spring to summer transition period create unique thermal conditions and provide important for biota phases of wet and warm spring and hot and dry summer.

549. According to a number of environmental features, Takhiatash is located in the zone of relatively favorable environmental conditions in relation to the areas of irrigated lands of Khorezm region.

550. Analysis of climate conditions of the Takhiatash TPP region was conducted on the base of meteorological station data (Figures 24 and 25).

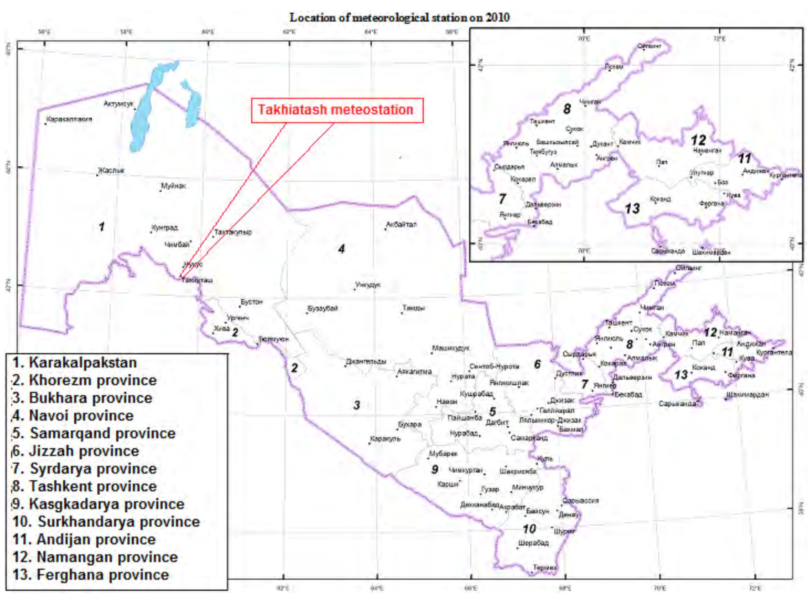


Figure 24. Location of meteo-station

551. In the following table climate conditions related to temperature, precipitation and wind are shown:

Table 68. Climate characteristics, m/s Takhiatash

Characteristic	**Measurement units**	**Value**
A coefficient, depending on the atmosphere thermal stratification and defining conditions of horizontal and vertical dispersion of air contaminants	-	200
Average annual air temperature	°C	13,64
Maximal temperature	°C	45,00
Minimal temperature	°C	-26,80
Average minimal air temperature	°C	-8,59
Average maximal air temperature	°C	35,75
Average air temperature in January	°C	-3,42
Average air temperature in July	°C	28,54
Maximal ground surface temperature	°C	62,00
Minimal ground surface temperature	°C	-30,00
Average ground surface temperature	°C	15,83
Average annual precipitation	мм	110,60
Annual frequency of wind direction for 16 rhumbs	%	
N		16,64
NNE		5,69
NE		18,68
ENE		2,68
E		12,58
ESE		5,31
SE		17,87
SSE		0,68
S		3,53
SSW		0,95
SW		6,57
WSW		1,50
W		7,14
WNW		1,69
NW		11,13
NNW		2,98
Calm		15,06
Number of cases with relate to gradations		
0-1	m/s	38,28
2-3		44,29
4-5		12,78
6-7		1,77
8-9		0,83
10-11		1,83
12-15		0,63
15		0,10
The highest speed of the wind, exceeding of which is 5%, U*	m/s	5,45

552. Climate in the Takhiatash TPP region – sharp continental is characterized by wide annual and daily temperature fluctuation range. Annual air temperature is 13,64 oC. Maximal temperature 45,00 oC, minimal -26,80 oC.

553. Annual precipitation level is 110,60 mm. Small amount of precipitation and high temperature causes heating of the ground, which conditions the dryness of underlying terrain. Maximal ground temperature is up to +62 oC, minimal values are down to –30,0 oC.

554. Winds of north-east (18,68 %), north (16,64 %) and east (12,58 %) directions prevail in Takhiatash city. Annual wind speed is 2,26 m/s, maximal wind speed is 25,0 m/s. Most often, winds with speed of 2-3 m/s (44,29 %) and 0-1 m/s (38,28 %) are indicated. From February to May strengthening of winds is indicated.

555. Winds with the speed of 12-15 m/s are indicated in 0,63 % of cases. On rare occasions (in 0,10 % of cases) the speed of winds reach 15 m/s and higher, because of the proximity of desert and dryness of underlying terrain is accompanied by significant dust transfer.

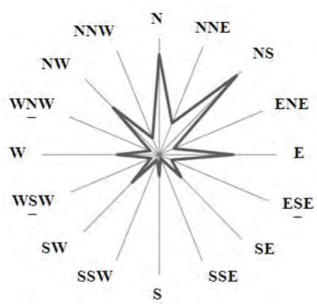


Figure 25. Takhiatash city wind rose.

556. Thus, high air and ground temperature in summer time, small amount of precipitation lead to the increase of natural dust level of the region. High frequency of winds with the speed of 2-3 m/s and higher facilitates distribution to the long distances of contaminants coming from high, hot sources of emission and dissemination of low unorganized discharges.

E.1.2. Air quality

557. Air quality in a region depends on a number of inter-dependent factors that may act directly or indirectly, such as pollutant emissions, weather conditions, or existing physiographic characteristics at a given spot.

558. Main industrial enterprises of the Takhiatash city are Takhiatash TPP, construction industry enterprises, communal and motor industries enterprises: sintering plant, cereal products plant, repair and engineering plant, building structures and details plant, which characterized by dust emissions.

559. City boiler-houses, which mainly operate on the base of the fuel oil emit into the air the oxides of nitrogen, sulphur, carbon, benzpyrene, solid particles, hydrocarbons.As Takhiatash city is located very closely to such industrial centres as Nukus, Urgench and Khodjeyli, the city air is under the impact of their industrial plants.

560. Significant contribution into contamination of the environment is made by motor and railway transportations, which emit oxide of nitrogen and carbon, soot, benzpyrene, aldehydes.

561. The circumstance, worsening the negative impact of the industrial plants on the environment is distribution of sandy salt particulates from the drained bottom of the Aral sea. Radius of action of salty dust storms reaches 300 km. More than 80t/km^2 of dry fallouts precipitate in Takhiatash city region.

562. Powerful sources of natural air contamination are Kyzyl-Kum and Kara-kum deserts; flat relief facilitates an unimpeded spreading of dust to the large distances.

563. In accordance with data provided by State Nature Committee of Republic Karakalpakstan (2012) Takhiatash the main air pollution sources in Karakalpakstan are presented by following big enterprises in decreasing contribution:

- Kungrad UMG (Branch of Uzbek Oil-gas company) – 14.7%
- Kungrad soda production plant (Chemical industry) – 14.0%
- ―Shimologaztaminat" (Domestic gas supply sector) – 13.8%
- Takhiatash TPP – 13.6%
- Tuley UMG (Branch of Uzbek Oil-gas company) – 11.1%
- Karakalpak UMG (Branch of Uzbek Oil-gas company) – 10.0%
- Akchakal UMG (Branch of Uzbek Oil-gas company) – 1.0%

564. Air conditions in the Takhiatash TPP region are determined by the emissions of above mentioned facilities and depend on the conditions of their spread and spread of the dust from the bottom of Aral sea.

565. In order to determine air quality in the preoperational phase, data from the following existing air quality stations conducted by the Main Hydrometcenter of the Republic of Uzbekistan in Nukus and Kizketken settlement area was analyzed:

- # 5 monitoring station located in Kizketken near Nukus.
- # 7 monitoring station located in Nukus.

Figure 26. Location of the air quality monitoring stations.

Table 69. Exact location and equipment at the 2 measuring points

Exact location and equipment at the 2 measuring points		
Measuring points	Coordinates	Parameters Measured
# 5	42° 27' 36.522" N 59° 36' 15.208" E	Dust, SO2, NO2, NO, Phenol
# 7	42°23'24.74"N 59°38'29.88"E	Dust, SO2, NO2, CO Phenol

566. Measurements analyzed were carried out over two periods of approximately 2 years as follows:

Table 70. Measuring point and period

Measuring point and period		
Measuring points	**Period start**	**Period ending**
# 5	03/01/2011	31/12/2011
	03/01/2012	30/12/2012

Measuring point and period		
Measuring points	**Period start**	**Period ending**
# 7	03/01/2011	31/12/2011
	03/01/2012	30/12/2012

567. Maximal one-time and average concentrations of dust, SO_2, NO_x, CO during 2011-2012 are presented in the tables underneath

568. In order to analyze the existing air quality in the area, we need to compare values recorded in the area using applicable standards indicated previously.

- NO_2:

Table 71. World Bank values recorded for NO_2 (μg/m3)

VALUES RECORDED FOR NO2 (μg/m3). WORLD BANK GROUP IFC GUIDELINES 2007			
Measuring points	Year	Annual mean value (Limit value: 40 $\mu g/m^3$)	Hourly value (Limit value: 200$\mu g/m^3$)
# 5	2011	24.25	40.00
	2012	20.53	50.00
# 7	2011	24.28	50.00
	2012	20.48	40.00

Table 72. National Standards for Air Pollutants values recorded for NO_2 (μg/m3)

VALUES RECORDED FOR NO2 (μg/m3). NATIONAL STANDARDS FOR AIR POLLUTANTS				
Measuring points	Year	Annual mean value (Limit value: 40 $\mu g/m^3$)	Monthly value (Limit value: 50$\mu g/m^3$)	Daily value (Limit value: 60$\mu g/m^3$)
# 5	2011	24.25	29.36	36.67
	2012	20.53	24.49	30.00

VALUES RECORDED FOR NO2 (μg/m3). NATIONAL STANDARDS FOR AIR POLLUTANTS				
Measuring points	Year	Annual mean value (Limit value: 40 $\mu g/m^3$)	Monthly value (Limit value: 50$\mu g/m^3$)	Daily value (Limit value: 60$\mu g/m^3$)
# 7	2011	24.28	29.07	36.67
	2012	20.48	24.36	33.33

569. As can be observed in the above tables neither national nor international NO_2 standards are exceeded

- NO:

Table 73. National Standards for Air Pollutants values recorded for NO (μg/m3)

VALUES RECORDED FOR NO (μg/m3). NATIONAL STANDARDS FOR AIR POLLUTANTS				
Measuring points	Year	Annual mean value (Limit value: 60 $\mu g/m^3$)	Monthly value (Limit value: 120$\mu g/m^3$)	Daily value (Limit value: 250$\mu g/m^3$)
# 5	2011	12.84	16.54	16.67
	2012	10.92	14.72	80.00

570. No national or international standards are exceeded for NO.

- CO:

Table 74. National Standards for Air Pollutants values recorded for CO (µg/m3)

VALUES RECORDED FOR CO (µg/m3). WORLD BANK GROUP IFC GUIDELINES 2007			
Measuring points	Year	Monthly mean value (Limit value: 3500µg/m^3)	Daily value (Limit value: 4000µg/m^3)
# 7	2011	2500.00	3000.00
	2012	2506.67	3333.33

571. As for NO2 and NO, no national or international standards are exceeded for CO.

Table 75. Average and maximum concentration (mg/m3), Nukus (#5) and Takhiatash (#7) in 2012

Pollutant	№ check points	Months																							
		01		02		03		04		05		06		07		08		09		10		11		12	
		Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max
Dust	№5	0,2	0,4	0,3	0,5	0,4	0,6	0,5	0,8	0,5	0,8	0,5	1,4	0,5	0,7	0,3	0,7	0,3	0,7	0,3	0,9	0,3	0,6	0,3	0,6
	№7	0,2	0,7	0,4	0,8	0,4	0,6	0,5	0,8	0,5	0,7	0,5	1,6	0,5	0,8	0,3	0,6	0,3	0,6	0,3	0,5	0,3	0,7	0,2	0,4
SO_2	№5	0,012	0,017	0,012	0,017	0,013	0,018	0,013	0,019	0,014	0,019	0,013	0,018	0,014	0,019	0,013	0,018	0,013	0,018	0,010	0,019	0,005	0,002	0,004	0,012
	№7	0,012	0,017	0,012	0,017	0,012	0,017	0,013	0,018	0,014	0,019	0,013	0,018	0,014	0,019	0,013	0,019	0,013	0,020	0,010	0,022	0,004	0,013	0,005	0,011
CO	№7	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	3	4	2	4
NO_2	№5	0,03	0,04	0,03	0,03	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,02	0,04	0,01	0,03	0,02	0,03
	№7	0,02	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,03	0,04	0,02	0,05	0,01	0,03	0,02	0,03
NO	№5	0,01	0,02	0,01	0,02	0,01	0,02	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,01	0,02	0,01	0,02	0,01	0,01	0,01	0,02
Phenol	№5	0,002	0,004	0,002	0,004	0,002	0,004	0,002	0,005	0,003	0,005	0,002	0,005	0,003	0,005	0,002	0,005	0,002	0,004	0,002	0,005	0,001	0,004	0,001	0,004
	№7	0,002	0,004	0,002	0,005	0,002	0,004	0,002	0,005	0,003	0,005	0,002	0,004	0,003	0,005	0,002	0,005	0,002	0,004	0,002	0,005	0,001	0,004	0,001	0,004

Pollutant	№ check points	Month																							
		01		02		03		04		05		06		07		08		09		10		11		12	
		Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max
Dust	№5	**0,3**	**0,9**	**0,4**	**1,0**	**0,3**	**0,6**	**0,4**	**0,7**	**0,4**	**1,1**	**0,4**	**0,7**	**0,3**	**0,6**	**0,3**	**0,6**	**0,4**	**0,8**	**0,4**	**0,6**	**0,4**	**0,8**	**0,3**	**0,9**
	№7	**0,2**	**0,8**	**0,4**	**0,9**	**0,3**	**0,6**	**0,4**	**0,8**	**0,3**	**0,8**	**0,3**	**0,6**	**0,3**	**0,6**	**0,2**	**0,6**	**0,4**	**0,8**	**0,4**	0,8	**0,4**	**1,0**	**0,4**	0,8
SO_2	№5	0,006	0,012	0,008	0,015	0,010	0,017	0,010	0,017	0,011	0,017	0,011	0,020	0,010	0,018	0,010	0,019	0,009	0,017	0,009	0,017	0,008	0,017	0,009	0,015
	№7	0,006	0,013	0,007	0,016	0,010	0,017	0,010	0,017	0,012	0,019	0,012	0,019	0,010	0,022	0,010	0,019	0,010	0,017	0,010	0,017	0,009	0,017	0,009	0,017
CO	№7	3	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
NO_2	№5	0,01	0,03	0,02	0,03	0,02	0,03	0,02	0,04	0,02	0,04	0,02	0,04	0,02	0,04	0,02	0,04	0,02	0,04	0,02	0,05	0,02	0,03	0,02	0,03
	№7	0,01	0,03	0,02	0,03	0,02	0,04	0,02	0,04	0,02	0,04	0,02	0,04	0,01	0,02	0,02	0,04	0,02	0,04	0,02	0,04	0,02	0,04	0,02	0,04
NO	№5	0,01	0,01	0,01	0,02	0,01	0,02	0,01	0,02	0,01	0,02	0,01	0,02	0,02	0,04	0,01	0,02	0,01	0,02	0,01	0,03	0,01	0,02	0,01	0,02
Phenol	№5	0,002	0,003	0,001	0,004	0,001	0,004	0,002	0,004	0,002	0,004	0,002	0,004	0,002	0,005	0,002	0,005	0,002	0,005	0,002	0,006	0,002	0,005	0,001	0,006
	№7	0,002	0,003	0,001	0,003	0,001	0,004	0,002	0,005	0,001	0,004	0,002	0,004	0,002	0,005	0,001	0,004	0,002	0,005	0,002	0,005	0,001	0,005	0,001	0,004

E.1.3. Noise

572. With the purpose of knowing the currently background level noise in the surrounding areas of Takhiatash TPP, a background noise level measuring campaign was carried out on 4th and 5th March 2013 in the day and at night time. Noise measurements were conducted twice per day, always in accordance with appropriate national regulation GOST 12-1050-86 «Method of noise measurements at the working places". Results of the campaign are shown in Annex IV attached to this EIA.

573. The measuring points were selected in certain places in order to be representative of the levels of noise at Takhiatash TPP site. Half of the points are located along the zone's perimeter, bounding the current thermal power plant (points 1 to 4, located at industrial area); the other four are outside the plot of the power plant in order to be representative of the noise perceived by the population of the nearby settlements (points 5 to 8, located at residential areas).

574. These measuring points are included in the image below.

Figure 27. Location of monitoring points for noise measurements

575. For sound level measuring was used a Noise meter -003-M2_No 2431, tested on 9th September 2012 with number of certificate 786/05.

576. Regarding applicable legislation, it has been considered international and national requirements. The will be applicable depending on the existence of national legislation as well as the location of the different measuring points.

577. Residential areas noise standards are the same for the national and World Bank standards. Industrial areas noise standards are included just in the World Bank guidelines (see chapter 3).

578. Results of the background campaign are shown in the table below. This is the final summery of all the data gathered by the campaign. They have been processed in order to obtain an average for day and night time, and draw conclusions about currently background level noise at Takhiatash TPP.

Table 76 . Results of the pre-operational campaign

Point	Receiver	Monitoring campaign results (dB(A))		Reference standard, by law (dB(A))	
		Day	Night	Day	Night
P1	Industrial area	55	62	70	
P2	Industrial area	54	60		
P3	Industrial area	55	62		
P4	Industrial area	51	44		
P5	Residential area	53	54	55	45
P6	Residential area	58	64		
P7	Residential area	48	40		
P8	Residential area	45	43		

579. As noticeable in the table above, noise levels measures go over the limits in two cases. Night measures in points P5 and P6 do not comply with the limits established, as well as day noise levels for P6. This might be due to the proximity of Takhiatash TPP to residential areas which are considered as special sensitive places.

580. The highest level of noise was measured in point No 6. It is a residential settlement of a former army unit and the houses are located in close proximity to the fence of the plant premises and near the location of the planned Combined-Cycle Plant.

581. Apart from the points mentioned, measurements carried out in all the other points show that the background noise levels comply with what requirements of the standards.

E.1.4. Geology

582. The territory of the Republic of Karakalpakstan is a plain with shallow closed depressions, crossed by many dry ancient creeks and riverbeds as well as abandoned and existing irrigation canals. The relief is relatively smooth with a general slope of 0.0001 to the north and northwest.

583. The low Sultan-Uizdag mountain range is located in the southern part of the Republic in the Amudarya district and the small Kuskanatau and Beltau hills are located in the northern part in the Kegeyli and Takhtakupyr regions.

584. Kyzylkum desert areas are covered with ridged and hilly quicksand. The Amudarya River flows across the country from north to south for more than 500km and divides the territory into two regions – the Right Bank and the Left Bank region

585. The geological structure of the Amudarya Delta on the territory of Karakalpakstan is composed of many kinds and types of sediments of the Cretaceous Tertiary and Quaternary periods. Cretaceous sediments occur on the right bank of the Amudarya River.

586. Tertiary sediments are noticeable in the Tuya-Muyun, Kyzylkum, Ustyurt and other areas in the form of red and red-yellow clay sediments.

587. Quaternary sediments are widely spread throughout the territory of the present and emerging Amudarya Delta and are composed of sand, sandy loam and clay loam brought by the water. These sediments have a relatively good permeability, loose structure and are unstable to erosion processes. The quaternary sediments are subject to reclamation and groundwater and its regime are formed there.

588. The complexity of the geological structure of the Amudarya River delta and the availability and aquicultural use of irrigated land determine the characteristics of its geological conditions and the formation of the groundwater regime.

589. The alluvial plains of the delta composed of sand, sandy loam, loam, clay layers and other solid sediments in the form of separate strata, lenses and mounds obstruct the movement of groundwater from the outside and restrain the outflow of seepage and surface water.

590. The territory of Takhiatash TPP is confined to the left bank of the Amu Darya delta plain. It is composed of quaternary sediments, which are sandy loam, clay loam, clay and sand.

591. Lithologic description of rocks:

- Made ground – light brown, stiff, macroporous clay loam (depth of 1,2m).
- Grayish brown, stiff clay loam with sandy layers (depth of 3,6m).
- Dark grayish brown, plastic sandy loam (depth of 5m).
- Dark grayish brown, stiff clay loam with sandy layers (depth of 7,8m).

- Dark gray, fine, watered sand (depth of 8,7m).
- Dark grayish brown plastic sandy loam with clay layers (depth of 10,0m).

592. Non-collapsible soil. According to the results of laboratory data and hydrochloric acid extracts the sands are considered saline, as the freely and medium soluble salt content is over 0,5%. Sandy loam, clay loam and clay are nonsaline. Content of freely and medium soluble salts is less 5%. Seismicity of the area is 7 points; the estimated seismicity is 8 points.

E.1.5. Soil

593. The study area is characterized by meadow oasis soils of the desert zone. Desert climate and irrigation moisture regimes impact on salinization susceptibility of the soil. Irrigated agriculture significantly changed the soil. It completely lost the gray soil profile structure.

594. Soil is affected by salinization and continues to undergo the precipitation of salts from the Aral sea. As a result, the chloride-sulfate type of salinity was formed on the area. The reaction of soil solution is slightly alkaline: soil and ground have 8-9pH.

595. Urban environment where an agricultural use of lands is limited causes an increased soil salinity, as there is almost no system of seasonal irrigation of soil cover. It causes to the increased content of alkaline chlorides, sulfates, carbonates, etc in the soil.

596. Local pollution processes are caused by the peculiarities of urban agglomeration. Generally, the soil is affected by salinity, as well as by weak (1-1.5 MAC), but occurring contamination by heavy metals (chromium, molybdenum). To the north of the city along the flow of groundwater the water is polluted (lower MAC) by listed toxic elements, as well as the soil has an increased salinity.

597. Soil texture is an important indicator of physical properties. Their composition is characterized by mineral particles of different size in destroyed aggregate complexes of minerals. The particles have different mineral composition: large particles mostly consist of quartz, silt particles consist of fine-grained quartz and feldspar, fine-dispersed particles consist of authigenic and terrigenous clay minerals. Mineral particles spreading has stratified structure and is characterized by frequent vertical and lateral changes of different texture layers. It reflected on the soil cover of the area, extending to the power within 1m. No regularities in lithological horizon changes in soils were observed.

598. Horizontal distribution of the top 30sm (arable) horizon clearly shows the reduction of the lithological composition. It is related with the impact of channel and riverine sediments of the Amu Darya river as well as with the eolian transport of desert sand.

599. Humus content is important for the soil. Its concentration impacts on buffer and absorptive capacity of toxic components. For the region, the soil has low the humus content in the topsoil (less than 0.9%). The humus content decreases by several grades in the following underlying layer. Therefore, in general, the screen buffer role of soils for man-made penetration of toxic elements from the

surface to the groundwater and accumulation on the surface is low. The scattering and removal of elements dominates.

600. Clear connection of toxic agent halos with contaminant sources cannot be established due to the lack of large industrial facilities in the area. The spatial connection of pollution halo with agglomeration of Takhiatash town was established only for the mild chromium, molybdenum, arsenic and selenium contamination. Thus, in Nukus along the railway only a few points with arsenic up to 20 mg/kg were recorded against the regional average content of 9.5 mg/kg. Selenium content in the soil increases in the region. It is typical for the metallogeny of the territory.

601. Pollution halos are more extensive on irrigated lands to the north of Takhiatash. This contamination process is related with the use of fertilizers, herbicides, etc.

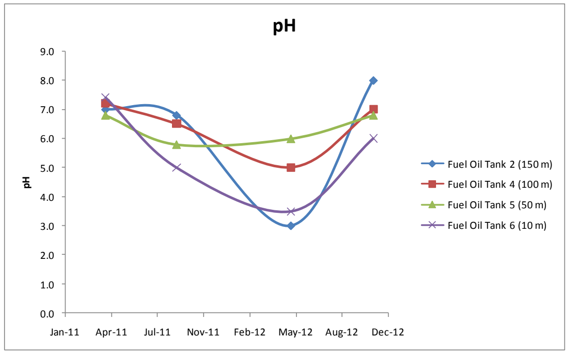
602. Prosperous situation in ground and surface toxic contamination in Takhiatash town is caused by poor infrastructure development of industrial facilities. The city has only a few local industries. Moreover, salinity and plastering have great impact on soil contamination.

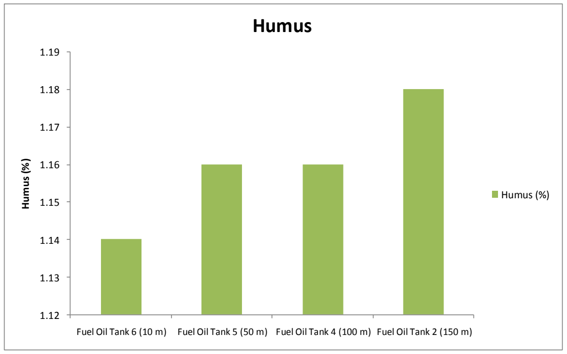
603. As for the whole zone of deserts with irrigated lands in terms of hydromorphic regime, they have a high carbonate content (5-10% CO_2) with a quite significant distribution from the surface to depth. Ca dominates in the composition of carbonates, exceeding Mg content 7-10 times.

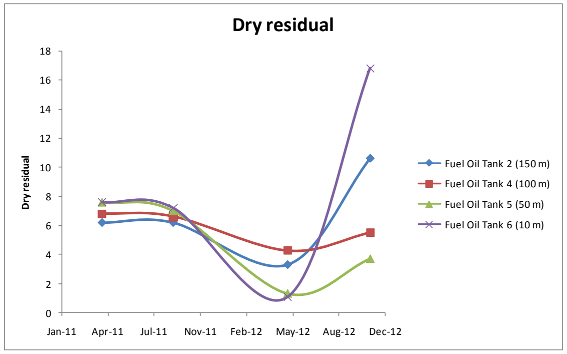
604. The soil is everywhere plastered; the gypsum content of about 1% and increases to the upper horizons of the soil. Soil salinity and plastering process in the city increases due to the limited technology of regular seasonal flushing typical for irrigated land.

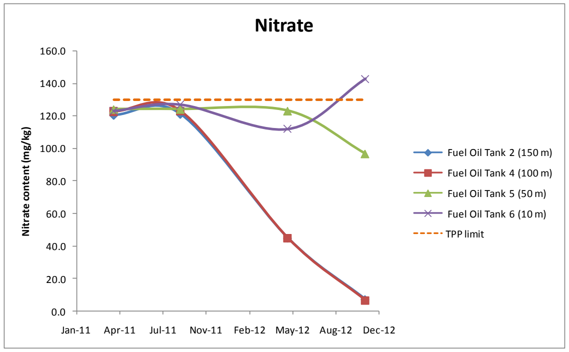
605. Low discharge of groundwater (500-1500 m3/ha) and arid climate leads to the salt accumulation. The evaporation is 10-12 times greater than rainfall rate (the evaporation rate is 2000-2500 mm/year). Salt, brought by ground water, accumulates in the soil horizon. In Takhiatash, which has the high groundwater level (1-2 m or less from the surface), the capillary rise of water to the surface and evaporative concentration of salts is very high.

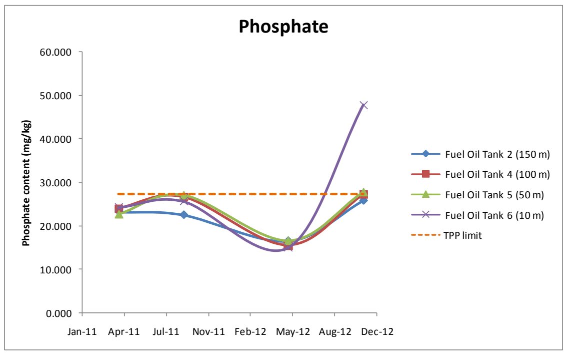
606. At the Takhiatash TPP site, samples from four different points were analyzed in a twice-a-year basis. These points are located in the vicinities of the fuel tanks, at 10, 50, 100 and 150 m of distance from the tanks. The sampling depth ranges from 0 to 30 m. The analyzed parameters were the content of humus, the pH, dry residual and the content of nitrates, phosphates, oil products and three metals: copper, zinc and manganese. In the following charts, measurements of years 2011 and 2012 can be observed.

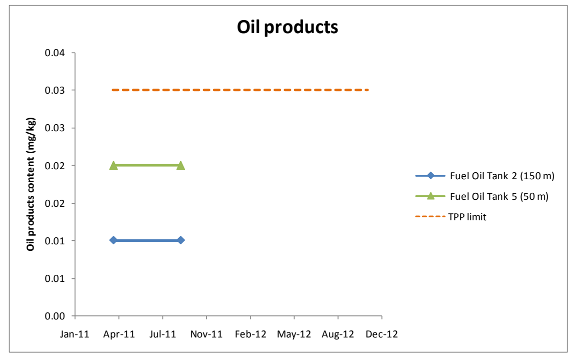

pH
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
pH
Jan-11
Apr-11
Jul-11
Nov-11
Feb-12
May-12
Aug-12
Dec-12
Fuel Oil Tank 2 (150 m)
Fuel Oil Tank 4 (100 m)
Fuel Oil Tank 5 (50 m)
Fuel Oil Tank 6 (10 m)

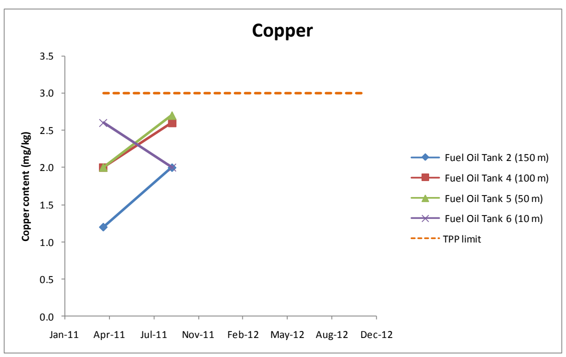

Humus
1.19
1.18
1.17
1.16
1.15
1.14
1.13
1.12
Humus (%)
Fuel Oil Tank 6 (10 m)
Fuel Oil Tank 5 (50 m)
Fuel Oil Tank 4 (100 m)
Fuel Oil Tank 2 (150 m)
Humus (%)

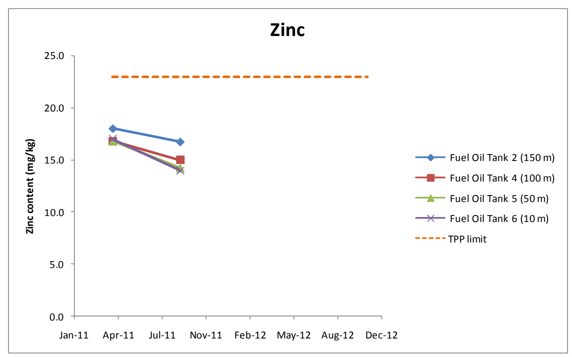

Dry residual
18
16
14
12
10
8
6
4
2
0
Dry residual
Jan-11
Apr-11
Jul-11
Nov-11
Feb-12
May-12
Aug-12
Dec-12
Fuel Oil Tank 2 (150 m)
Fuel Oil Tank 4 (100 m)
Fuel Oil Tank 5 (50 m)
Fuel Oil Tank 6 (10 m)

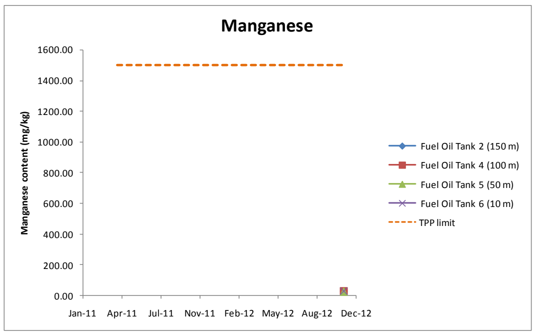

Nitrate
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Nitrate content (mg/kg)
Jan-11
Apr-11
Jul-11
Nov-11
Feb-12
May-12
Aug-12
Dec-12
Fuel Oil Tank 2 (150 m)
Fuel Oil Tank 4 (100 m)
Fuel Oil Tank 5 (50 m)
Fuel Oil Tank 6 (10 m)
TPP limit


Phosphate
Phosphate content (mg/kg)
60.000
50.000
40.000
30.000
20.000
10.000
0.000
Jan-11
Apr-11
Jul-11
Nov-11
Feb-12
May-12
Aug-12
Dec-12
Fuel Oil Tank 2 (150 m)
Fuel Oil Tank 4 (100 m)
Fuel Oil Tank 5 (50 m)
Fuel Oil Tank 6 (10 m)
TPP limit


Oil products
Oil products content (mg/kg)
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
Jan-11
Apr-11
Jul-11
Nov-11
Feb-12
May-12
Aug-12
Dec-12
Fuel Oil Tank 2 (150 m)
Fuel Oil Tank 5 (50 m)
TPP limit


Copper
Copper content (mg/kg)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jan-11
Apr-11
Jul-11
Nov-11
Feb-12
May-12
Aug-12
Dec-12
Fuel Oil Tank 2 (150 m)
Fuel Oil Tank 4 (100 m)
Fuel Oil Tank 5 (50 m)
Fuel Oil Tank 6 (10 m)
TPP limit


Zinc
Zinc content (mg/kg)
25.0
20.0
15.0
10.0
5.0
0.0
Jan-11
Apr-11
Jul-11
Nov-11
Feb-12
May-12
Aug-12
Dec-12
Fuel Oil Tank 2 (150 m)
Fuel Oil Tank 4 (100 m)
Fuel Oil Tank 5 (50 m)
Fuel Oil Tank 6 (10 m)
TPP limit



607. **Humus.** Humus content is important for the soil because its concentration impacts on buffer and absorptive capacity of toxic components. For the region, the soil has humus content between 1.14 and 1.18%. The humus content decreases by several grades in the following underlying layer. Therefore, in general, the screen buffer role of soils for man-made penetration of toxic elements from the surface to the groundwater and accumulation on the surface is low. The scattering and removal of elements dominates.

608. **pH.** The analyses determined that the soil in the surroundings of the fuel tanks has a neutral or slightly acid pH. Measurements performed in May 2012 show a more acid pH.

609. **Dry residual.** The dry residual was also measured. Its values widely vary from 1.10 to16.80.

610. **Nitrates and phosphates.** The content of phosphates does not vary significantly and is very close to the TPP's limits (27.2 mg/kg). The content of nitrates shows a wide variation and is also below the TPP's MAC (130 mg/kg).

611. **Oil products.** Oil products appear in soil samples in a concentration between 0.01 and 0.02 mg/kg, which is below the TPP's limit (0.03 mg/kg) and, logically, it decreases with the distance to the fuel tanks.

612. **Metals.** The copper, zinc and manganese content in the soil samples has been measured. Copper was detected at levels ranging between 1.2 and 2.7 mg/kg, whereas the detected levels of zinc vary between 14 and 18 mg/kg. As it can be observed in the charts, the TPP's MACs are not exceeded.

613. In addition to these analysis, a comprehensive soil study has been carried out in order to confirm or rule out potential soil contamination with hazardous substances or petroleum products within the area of the future CCPU. On 2nd March 2013, 13 samples were taken in different places situated within Takhiatash TPP plot. Points 1 to 9 are located in the new area for the CCPU and points 10 to 13 in the existing evaporation ponds. They are marked in the image below.

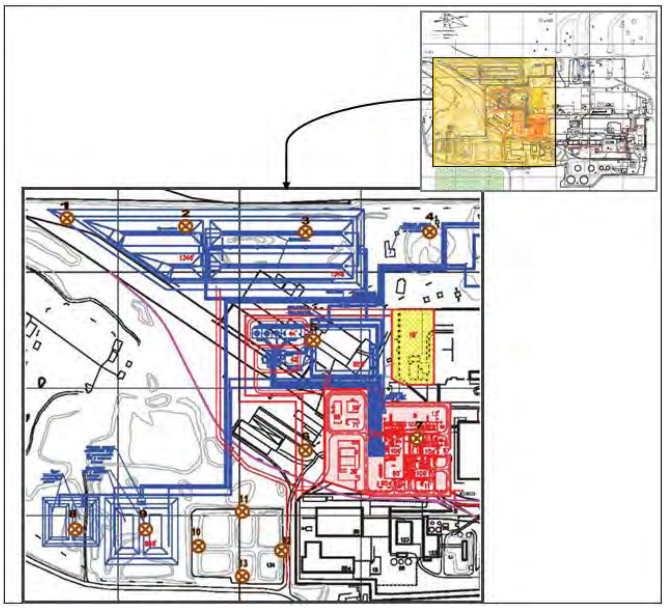


Figure 28. Sampling site within Takhiatash TPP plot

614. All soil samples have been analyzed within the stipulated holding time limits for the following parameters:

- Organochlorine Pesticides: α-HCH, ϒ-HCH, DDE, DD, DDT.
- Heavy Metals: lead, mercury, cadmium copper, zinc, cobalt, nickel, arsenic.
- Dry residue, moisture, phenol, humus, pH and oil products.

615. The results obtained by a specialised laboratory have been compared to the following Uzbek and international standards:

- Soil Quality Regulation. State Secretary for Housing, Planning and the Environment and State for Transport, Public Works and Water Management of The Netherlands (2006).
- GOST 28168-89 «Soils Sampling», SanRaN RU No 0191-05 «Maximum allowable concentrations (MAC) and tentative allowable concentrations (TAC) of exogenous harmful substances in soil».

616. MACs (Maximum Allowable Concentration), as based on their scientific substantiation criteria, reflect all possible ways of indirect effects of contaminants on the environment (plants, animals and humans), soil biological activity and the process of self-purification. In other words, MACs are based on the principle of a soil that would be fit for all possible functions, ranging from heavy industry to a

domestic vegetable garden and including being an ecosystem. Concentrations of contaminants exceeding the MACs do not necessary mean the likelihood of exposure to soil contamination at levels of potential concern to human health, due to the use of this site for human activity.

617. The principle of a multifunctional soil has been abandoned in most countries and nowadays a balance is established between the protection of the soil and its use for economic and social purposes. New soil policies set soil quality criteria for different soil functions.

618. Therefore, The concentrations of contaminants in the 13 soil samples have been also compared against their respective maximum values for industrial soil quality class, established in the Soil Quality Regulation[6] (SQR) of The Netherlands. The reason for choosing the Dutch soil quality criteria is that they are considered worldwide among the leading international approaches to setting soil screening values.

619. In Annex V, it can be found all the information related to soil sampling and analysis results and their interpretation and conclusions. In order to draw conclusions, the results of the analyses carried out are shown in the following graphs.

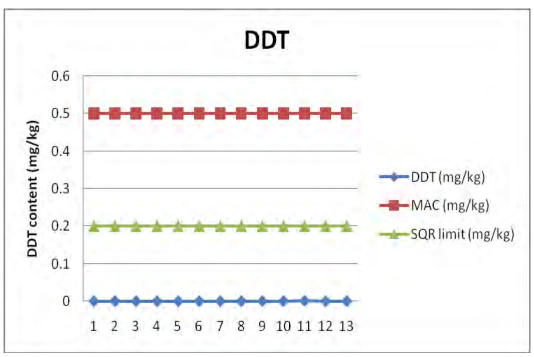


Figure 29. Results of Organochlorades Pesticides content in soil samples

[6] *Soil Quality Regulation*. State Secretary for Housing, Planning and the Environment and State Secretary for Transport, Public Works and Water Management of The Netherlands (2006).

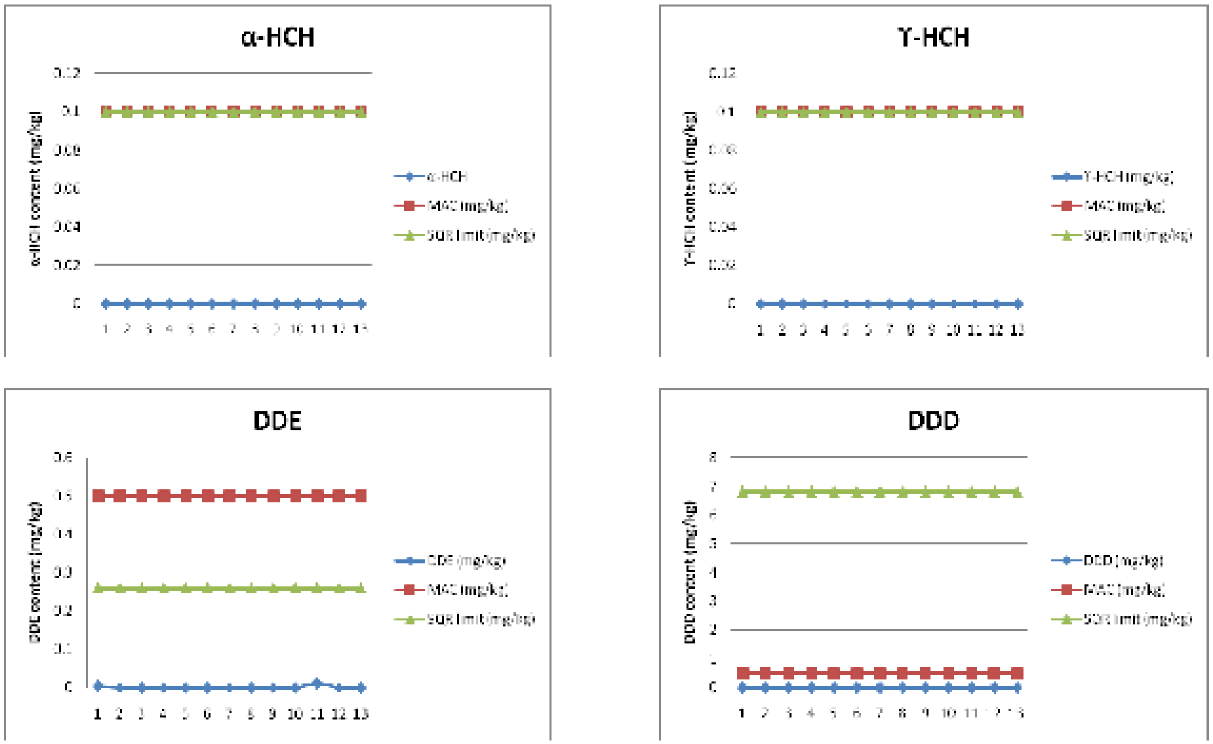


Figure 30. Results of Organochlorades Pesticides content in soil samples

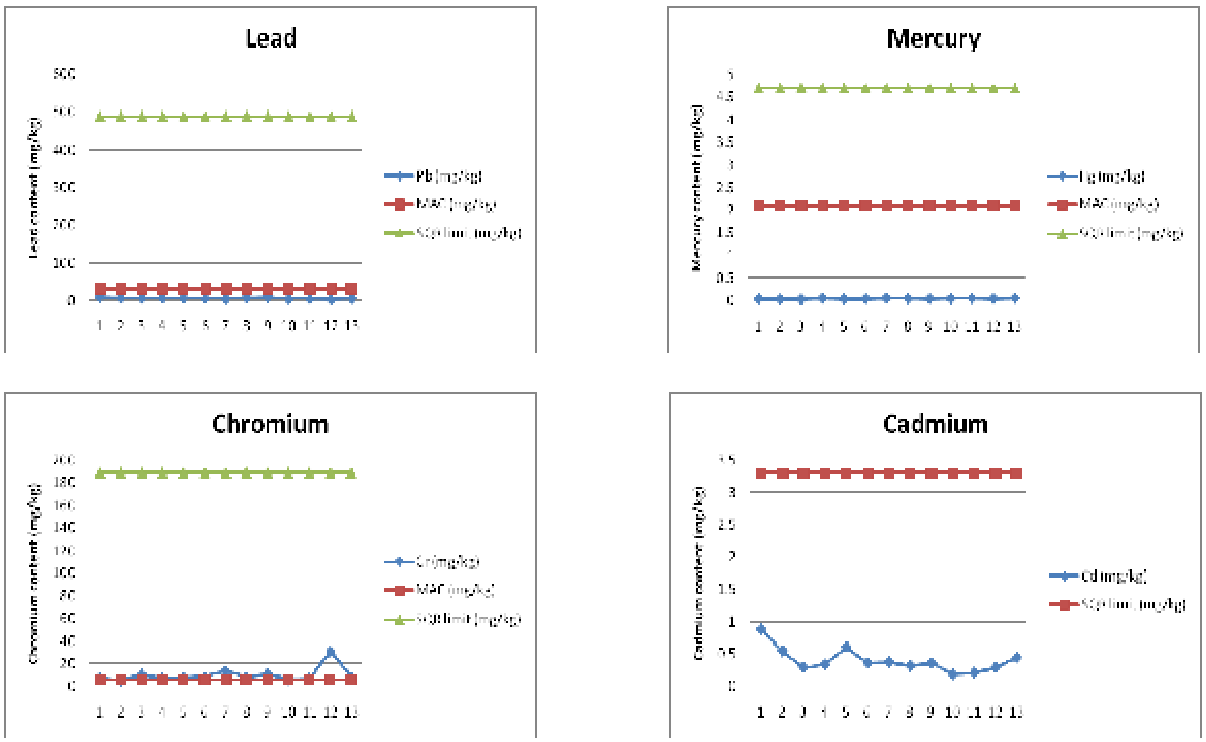


Figure 31. Results of Heavy metals content in soil samples

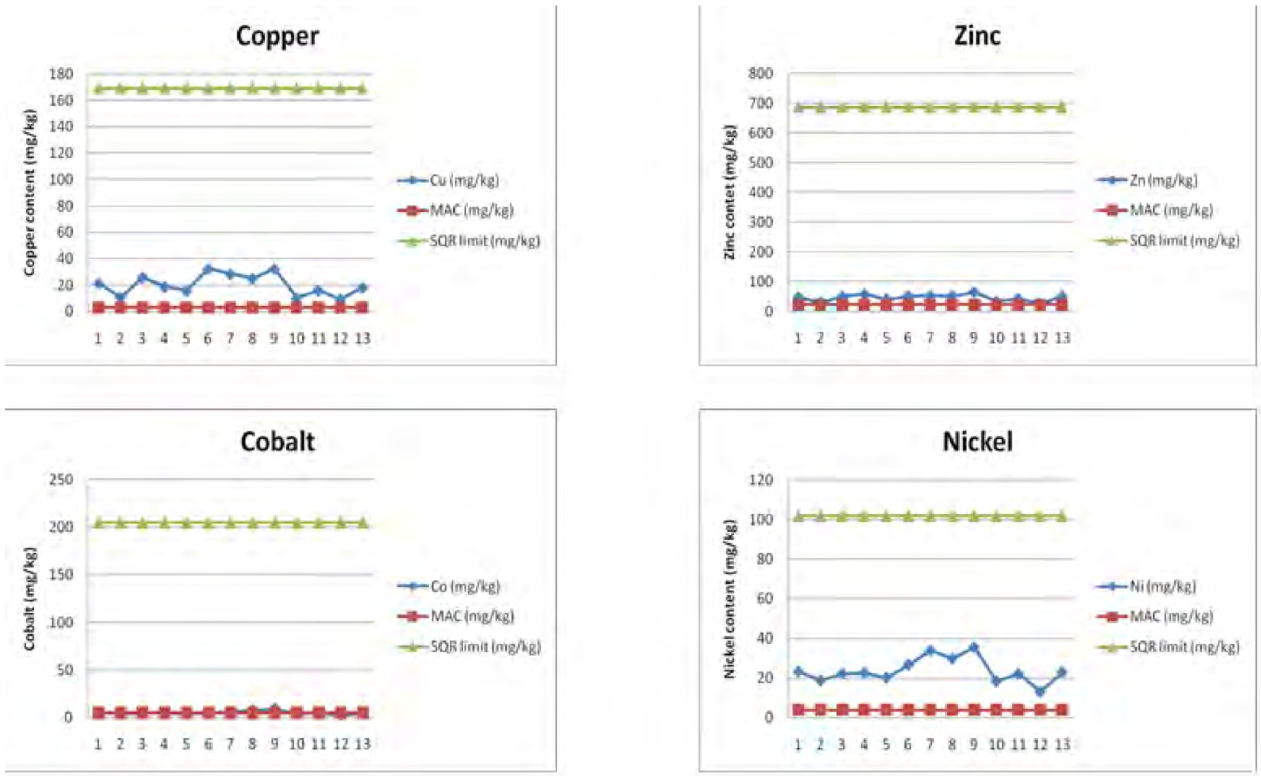


Figure 32. Results of Heavy metals content in soil samples

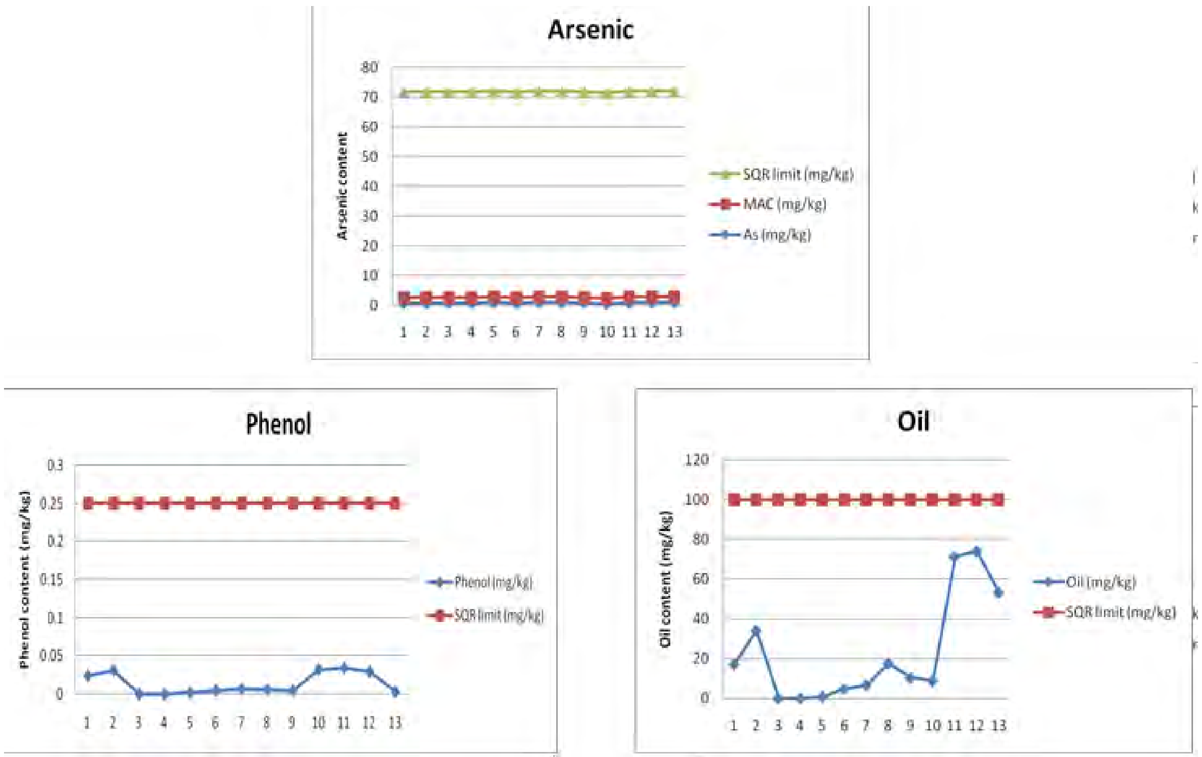


Figure 33. Results of Arsenic, Phenol and oil content in soil samples

620. All detected contaminant concentrations in soil are much below their respective corrected maximum value for industrial soil quality class.

621. In the judgment of the environmental professional, the results of the analysis of 13 soil samples from the Takhiatash TPP area support a professional opinion that there are not ―unacceptable" levels of contaminants in soil for its intended industrial use and, consequently, the site that do not require further assessment or investigation, regarding potential soil contamination.

E.1.6. Hydrogeology

622. Underground waters of the Amu Darya delta consist of artesian and ground waters. Artesian waters appear in the Cretaceous and Jurassic sediments, and groundwater appears in the Quaternary alluvial deposits of the Amu Darya River.

623. Quaternary aquifer of the Aral delta of the Amu Darya River is a single groundwater basin, which is generally defined as inland. Desiccation of the Aral Sea, hydrological regime of the Amudarya River and the largest irrigation canals as well as Tuyamuyun reservoir impact on the groundwater level. The formation of groundwater regime is related to the irrigation regime. The maximum falls on the irrigation period and reaches 0,6-0,8m, as well as minimum falls on the autumn and winter months. The fluctuation range reaches 1m.

624. At the TPP site ground water appear at the depth of 0.3-2.2 m. According to hydro-regime observations the water table maximum position is noted during May-June months and minimum during October-November. The water is saline and has strong sulfate aggressive to concrete in ordinary cement.

625. Ground waters of alluvial sediments have various degrees of mineralization. Fresh waters occur as lenses near the Amu Darya river bed and narrow water strips along irrigation channels. Mineralization of ground waters gradually increases with the increase of distance from fresh waters. In few dozen meters from the Keneges channel the mineralization degree increases from 2,4 to 12,3 g/dm3.

626. The majority of ground waters belong to the sulfate-sodium-calcium type, sometimes they belong to the chloride-sulfate-sodium type. They have sulfate aggressivity to concrete in ordinary cement and high corrosivity to metal. Content of hydrocarbon fluctuates with the range 421-573 mg/dm^3; chloride 1336-4752 mg/dm^3; sulfate 2400-2784 mg/dm^3; calcium ion 560-1080 mg/dm^3; magnesium –576-612 mg/dm^3; sodium and potassium 441-2296 mg/dm^3 . Chemical analysis of groundwater:

- Dry residue - 4048 mg/dm^3;
- HC03 ion content - 325 mg/dm^3;
- C1 ion content - 770 mg/dm^3;
- S04^2 ion content - 1679 mg/dm^3 ;
- Ca^2 ion content - 256 mg/dm^3;
- Mg^2 ion content - 63 mg/dm^3;
- Na +K ion content - 1012 mg/dm^3 . Filtration rate – 1.6 m/days

627. The area is characterized by high-level phenol contamination of groundwater. Due to the absence of general sewer systems and cleaning of discharges of livestock and agricultural enterprises big area of ground waters is contaminated with phenols (up to 10-30 MAC and more for drinking water). Phenols (phenic acid, carbolic acid, herbicides, etc.) are toxic to humans and biota. But the most carcinogenic impact occurs in the case of chlorination of, for example, drinking water, since it leads to the formation of very stable chloroorganic compounds – dioxins.

628. Thus, Takhiatash is located in the area of high level phenol contamination of groundwater - up to 10-30 MAC and more, that is, in the high-risk area of adverse impact on human health when using groundwater for human consumption.

629. Hydrological conditions of the area are unfavorable for the construction, as groundwater is close to the surface and aggressive to concrete of all types of sulfate-resistant cement. Without drainage basements can be flooded and emergency situations can occur.

630. Uzbekenergo carries out regular monitoring (every three months) of underground water quality inside the wells and in the immediate vicinity of the Takhiatash TPP site.

631. In order to study the groundwater composition, a piezometric network formed by 57 wells-piezometers was deployed at the TPP. Some of the 57 wells located at the TPP are inactive and require reconstruction. The location of the wells where the analysis where performed is shown in following figure.

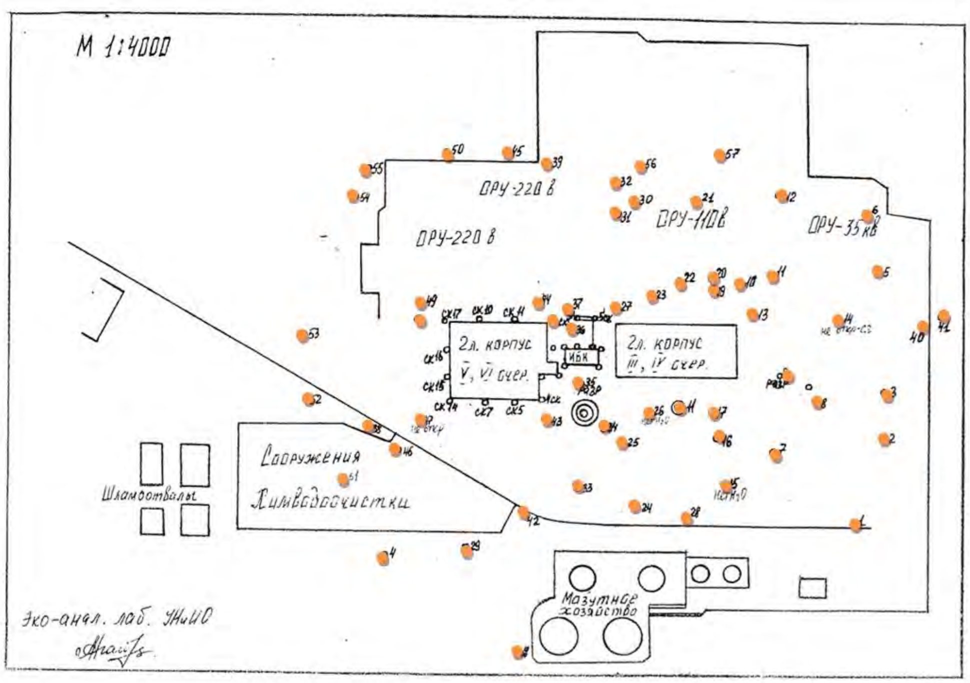
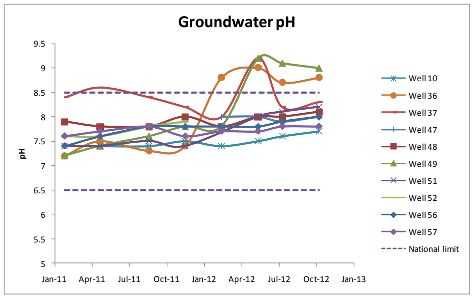
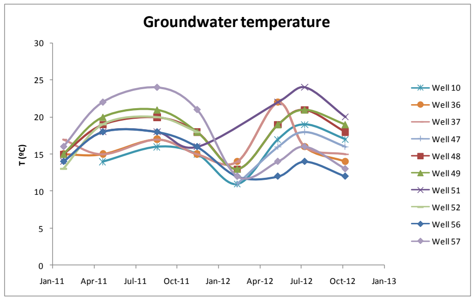


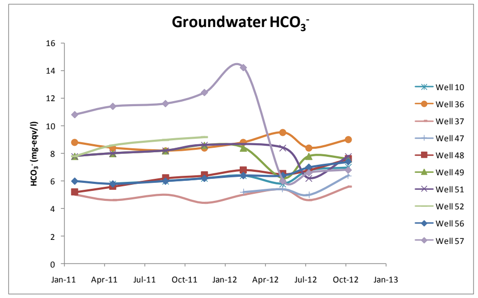
Figure 34. Groundwater sampling

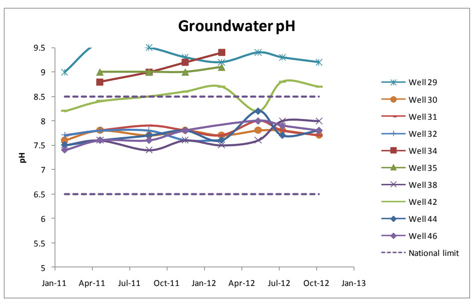
632. The figures in the next page give the groundwater characteristics measured inside the TPP site and in the immediate vicinity. These groundwater measurements analyze 9 parameters: content of cations (Ca2+, Mg2+, Na+), chlorides (Cl-), sulphates, carbonates (HCO3-), pH, hardness and temperature. As there are no Uzbek Standards specifically for groundwater, the ones for surface water can be used as reference.

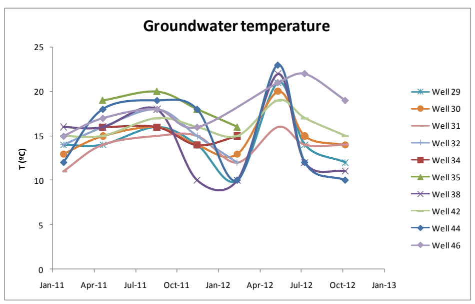
Results of groundwater analysis.

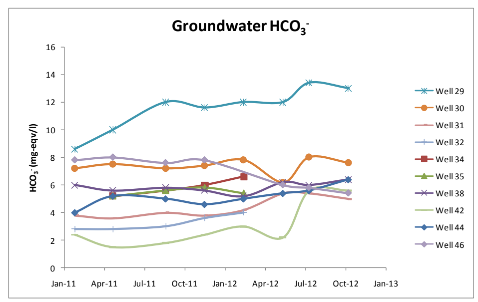


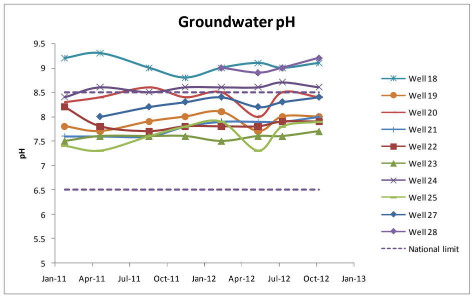


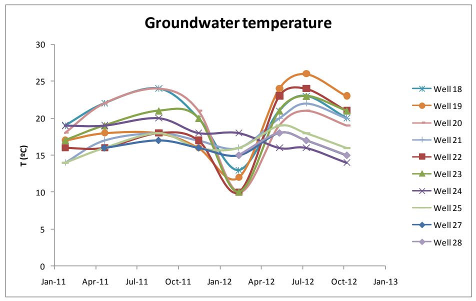


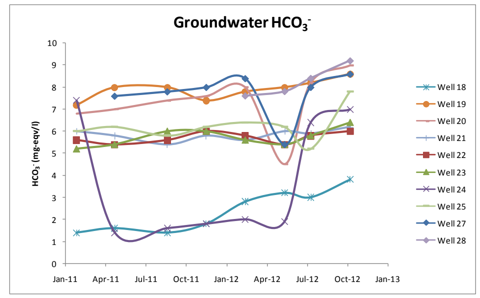


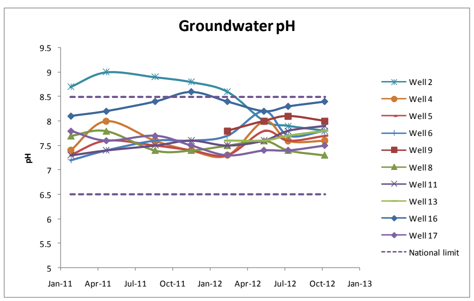


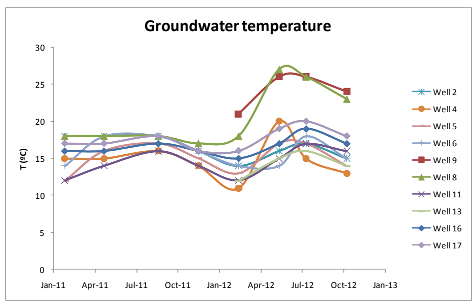


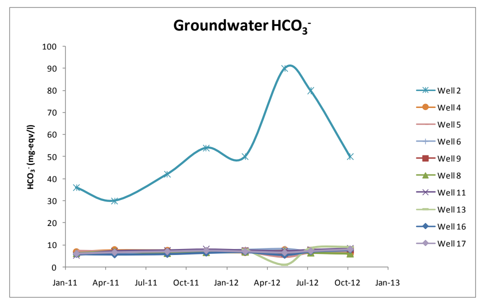

Groundwater pH
pH
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28
National limit

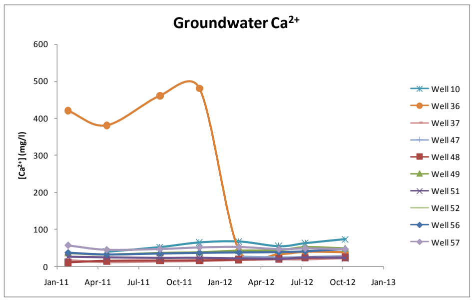

Groundwater temperature
T (ºC)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28

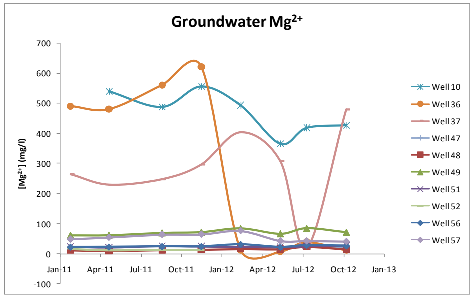

Groundwater HCO3-
HCO3- (mg-eqv/l)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28

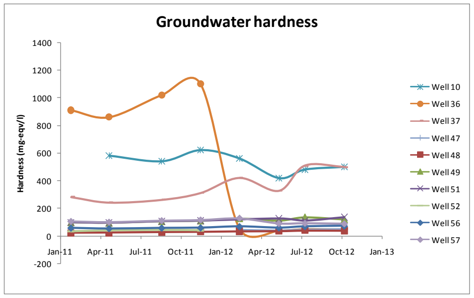

Groundwater pH
pH
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17
National limit

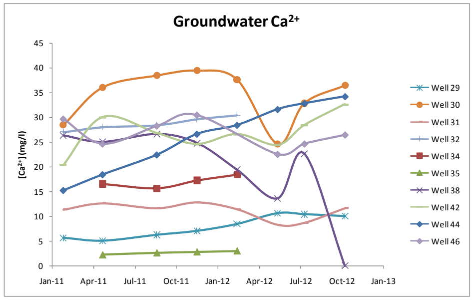

Groundwater temperature
T (ºC)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17

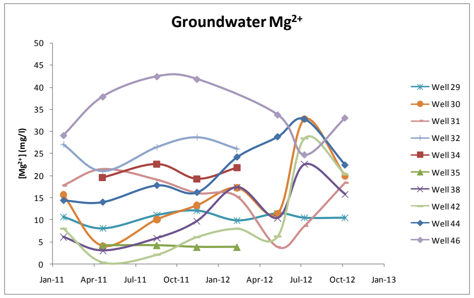

Groundwater HCO3-
HCO3- (mg-eqv/l)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17

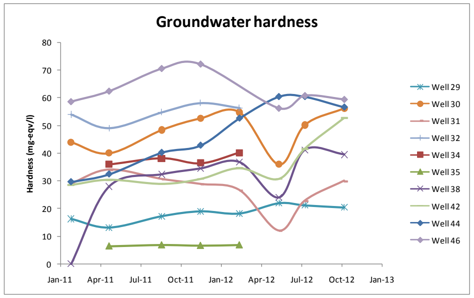

Groundwater Ca^{2+}
[Ca^{2+}] (mg/l)
Well 10
Well 36
Well 37
Well 47
Well 48
Well 49
Well 51
Well 52
Well 56
Well 57

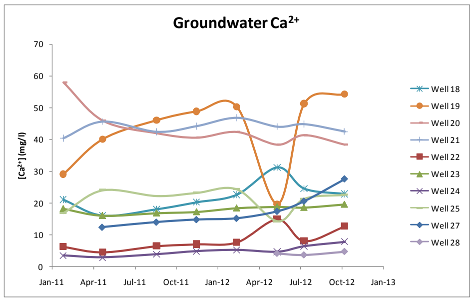

Groundwater Mg^{2+}
[Mg^{2+}] (mg/l)
Well 10
Well 36
Well 37
Well 47
Well 48
Well 49
Well 51
Well 52
Well 56
Well 57

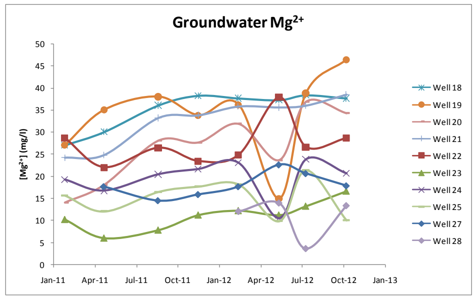

Groundwater hardness
Hardness (mg-eqv/l)
Well 10
Well 36
Well 37
Well 47
Well 48
Well 49
Well 51
Well 52
Well 56
Well 57

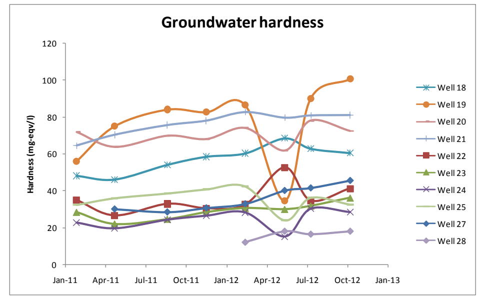

Groundwater Ca^{2+}
[Ca^{2+}] (mg/l)
Well 29
Well 30
Well 31
Well 32
Well 34
Well 35
Well 38
Well 42
Well 44
Well 46

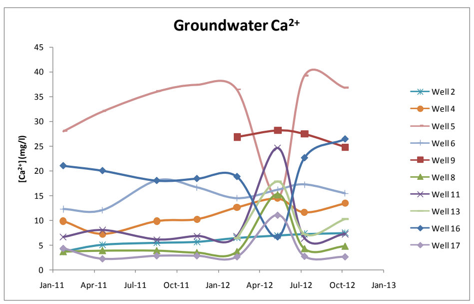

Groundwater Mg^{2+}
[Mg^{2+}] (mg/l)
Well 29
Well 30
Well 31
Well 32
Well 34
Well 35
Well 38
Well 42
Well 44
Well 46

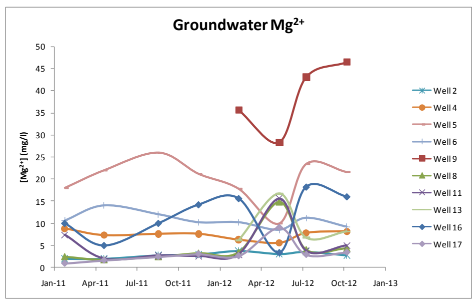

Groundwater hardness
Hardness (mg-eqv/l)
Well 29
Well 30
Well 31
Well 32
Well 34
Well 35
Well 38
Well 42
Well 44
Well 46

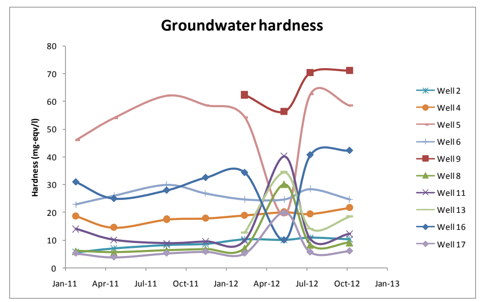

Groundwater Ca^{2+}
$[Ca^{2+}]$ (mg/l)
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28

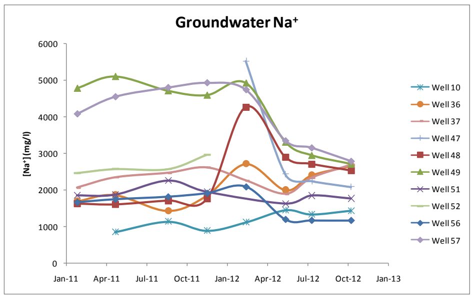

Groundwater Mg^{2+}
$[Mg^{2+}]$ (mg/l)
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28

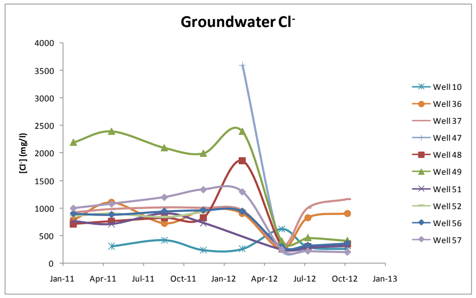

Groundwater hardness
Hardness (mg-eqv/l)
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28

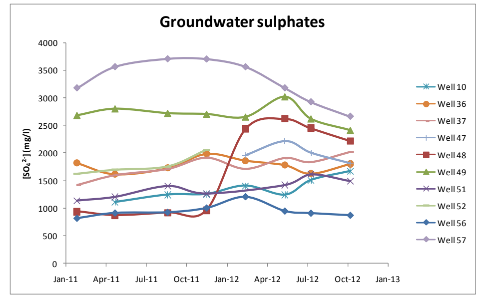

Groundwater Ca^{2+}
$[Ca^{2+}]$ (mg/l)
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17

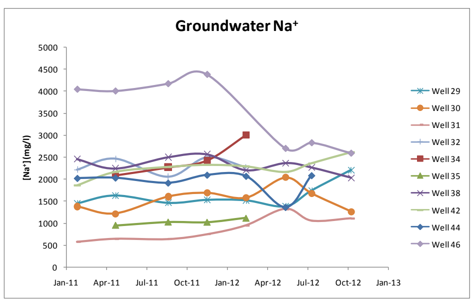

Groundwater Mg^{2+}
$[Mg^{2+}]$ (mg/l)
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17

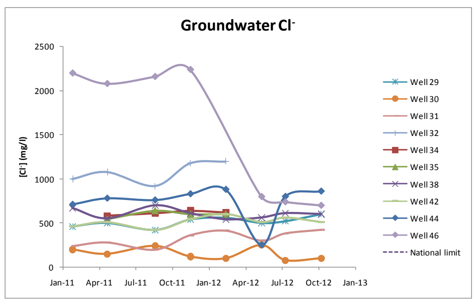

Groundwater hardness
Hardness (mg-eqv/l)
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17

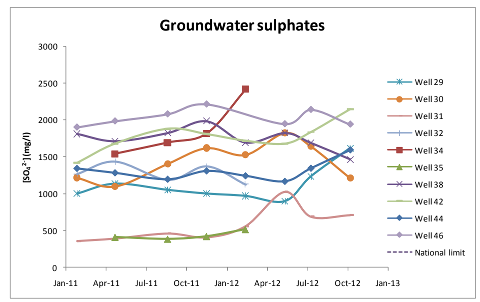

Groundwater Na+
[Na+] (mg/l)
0 1000 2000 3000 4000 5000 6000
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 10
Well 36
Well 37
Well 47
Well 48
Well 49
Well 51
Well 52
Well 56
Well 57

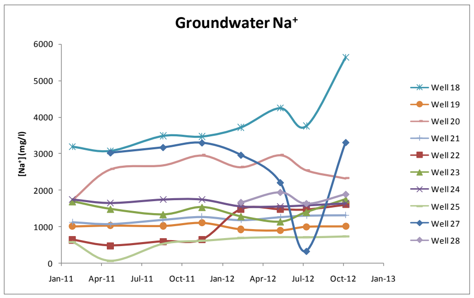

Groundwater Cl-
[Cl-] (mg/l)
0 500 1000 1500 2000 2500 3000 3500 4000
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 10
Well 36
Well 37
Well 47
Well 48
Well 49
Well 51
Well 52
Well 56
Well 57

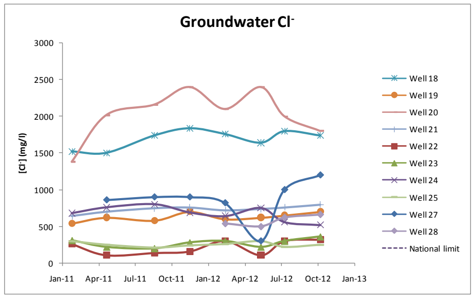

Groundwater sulphates
[SO4 2-] (mg/l)
0 500 1000 1500 2000 2500 3000 3500 4000
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 10
Well 36
Well 37
Well 47
Well 48
Well 49
Well 51
Well 52
Well 56
Well 57

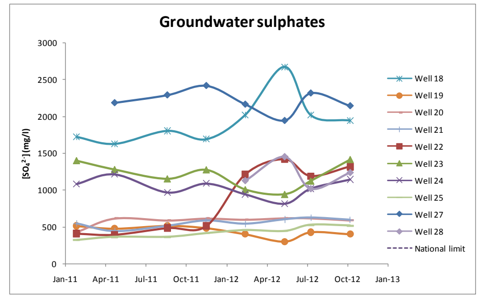

Groundwater Na+
[Na+] (mg/l)
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 29
Well 30
Well 31
Well 32
Well 34
Well 35
Well 38
Well 42
Well 44
Well 46

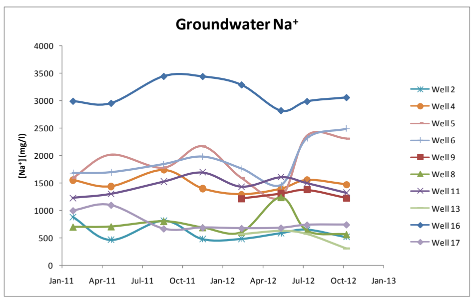

Groundwater Cl-
[Cl-] (mg/l)
0 500 1000 1500 2000 2500
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 29
Well 30
Well 31
Well 32
Well 34
Well 35
Well 38
Well 42
Well 44
Well 46
National limit

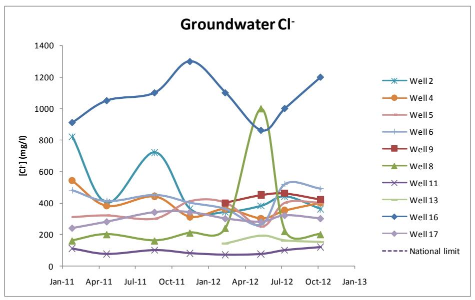

Groundwater sulphates
[SO4 2-] (mg/l)
0 500 1000 1500 2000 2500 3000
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 29
Well 30
Well 31
Well 32
Well 34
Well 35
Well 38
Well 42
Well 44
Well 46
National limit

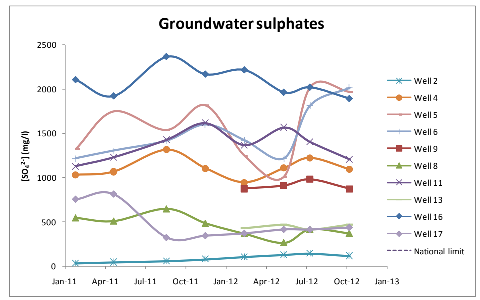

Groundwater Na+
[Na+] (mg/l)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28


Groundwater Cl-
[Cl-] (mg/l)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28
National limit


Groundwater sulphates
[SO4 2-] (mg/l)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 18
Well 19
Well 20
Well 21
Well 22
Well 23
Well 24
Well 25
Well 27
Well 28
National limit


Groundwater Na+
[Na+] (mg/l)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17


Groundwater Cl-
[Cl-] (mg/l)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17
National limit


Groundwater sulphates
[SO4 2-] (mg/l)
Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13
Well 2
Well 4
Well 5
Well 6
Well 9
Well 8
Well 11
Well 13
Well 16
Well 17
National limit

Comments.

633. **Chlorides.** As it can be observed in the charts, the content of chlorides greatly varies among the different wells. It ranges between 100 and 1300 mg/l although it occasionally reaches 2,400 mg/l.

634. **Sulphates**. The content of sulphates greatly varies among the different wells, ranging from 300 to approximately 2,700 mg/l. The maximum content in sulphates corresponds to well nº 49, which amounts to 3,700 mg/l. Such high concentrations could be due partly to the influence of the Aral Sea influence and partly due to artificial pollution from sulphate products used in agriculture.

635. **Sodium**. Sodium is usually associated with chloride ions, highly soluble in water, and is affected by the basic exchange process with alkaline earths. The presence of salt bearing formations or the influence of seawater provide additional quantities of those elements, as is the case in the area of interest with the proximity of the Aral Sea, where concentration levels of Na+ range from 500 to 3,500 mg/l, reaching in certain measurement points 5,000 mg/l.

636. **Calcium and magnesium**. Calcium content is closely linked to magnesium content, and they define the hardness of the water. Local content levels in Ca^{2+} and Mg^{2+} vary between 3-60 mg/l and 2-45 mg/l, respectively. Some measurements at wells nº 10, 36 and 37, which are located in the surroundings of the power island buildings, show very high content in calcium and magnesium, reaching 500 and 600 mg/l.

637. **Carbonates.** Carbonates are present in rather lower levels than other substances. Locally, concentration levels vary between 1.5 and 14 mg-eqv/l.

638. **Temperature.** The temperature of underground water, at a given place and time, is an indication of the state of balance between heat input and heat extraction at the place in question. For practical purposes, it can be considered that aquifers possess a neutral zone, at constant temperature, and that any significant variations above this temperature are caused by daily or seasonal ambient temperature variations. In all cases, underground water temperature varies very little among the different wells, ranging between 10 and 24 ºC depending on the season.

639. pH. Underground water is slightly alkaline, with pH values between 7 and 9.5 as the graphs show. There are certain wells (nº 2, 18, 28, 29) that exceed the National upper pH limit for surface water (applicable to groundwater), established in 8.5.

E.1.7. Surface Hydrology

640. The closest to the Takhiatash TPP large surface watercourse is Amudarya river. Amudarya is the largest river in catchment area and water availability in Central Asia and is formed by Pyandj and Vakhsh rivers conjunction. Its total length from Pyandj River head to Aral Sea is 2574 km, from conjunction place 1.415 km. Takhiatash city locates at the lower (downstream Tuyamuyun) reaches of Amudarya basin. In lower reaches on both riverbanks big canal system are constructed: Tashsaka, Pakhtaarna, Klychniyazbay, Urgench-Oktyabr-arna, Khan-yab (Sovet-yab), Kyzytken, Suenli.

641. The Amudarya River is the irrigation source of the Republic of Karakalpakstan and in dry years, collector water is used for irrigation by mixing it with irrigation water from the canals.

642. There are no other sources of irrigation in the territory of the Republic. Existing lakes are mainly located on the periphery of the irrigation systems and their formation and inflow result from the river spill water. The lake water is highly mineralized and is not suitable for irrigation.

643. Water is drawn from the river by main canals. The southern regions: Turtkul, Beruni and Ellikkala are served by the Pakhta-arna main canal. The total irrigated area is 98.9 thousand ha. The water intake at the border of the regions in 2004 was 1,595.04 million m3.

644. The Suenli main canal serves the group of Left Bank regions: Khojaly, Shumanay, Kanlykul, Kungrad and Muinak with a total irrigated area of 152.2 thousand ha. The actual water intake was 1,886.24 million m3.

645. According to the GlavHydromet, for the last 5 years water flow rate at Kipchak (the closest monitoring point at the Amudarya river) transit was lower than long-time average annual (663 m^3/s) and amounted to 509 m^3/s. Average deep is 6-7 meters and width 16-42 meters, being average speed 1.1-1.2 m/s. Chemical composition of the river water is formed to a large degree under the impact of contaminants coming to the river on the territory of Turkmenistan, agricultural flows and waste waters of factories in Drujba, Turtkul, Urgench and Mangit cities. Water of Amudarya river is characterized by high turbidity. For the period of observations the long-time average annual turbidity was equal to 1,995 kg/m^3; minimal – 1,4 kg/m^3. Long-time average annual water turbidity fluctuates from 0,24 кг/m^3 in January to 5,1 kg/m^3 in May. Granulometric composition of suspended load from 0,1 % (1- 0,5 mm) to 39,5 % (0,05- 0,01 mm).

646. Oxygen regimen of the water in the closest to Takhiatash city transit (in Nukus city region) is satisfactory. The average concentration of dissolved oxygen is 10,9 mg O_2/dm^3. The content of organic substances in terms of COD - mg O_2/dm^3

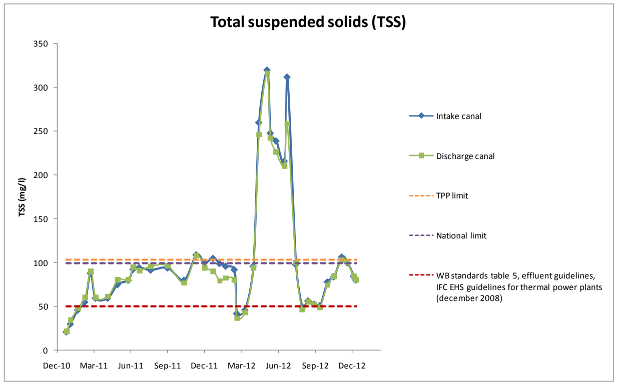
647. Contamination of river water by toxic agents: with regard to phenols – 1 MAC, to nitrite and nitrate nitrogen – 0,8 MAC, to copper, zinc, arsenic, chrome, fluorine – significantly less than threshold limit values. Content of HCCH amounted to 0,008 mg/dm^3, while according to the regulation norms there should be no HCCH at all. Mineralization of water is at the level of 1 MAC

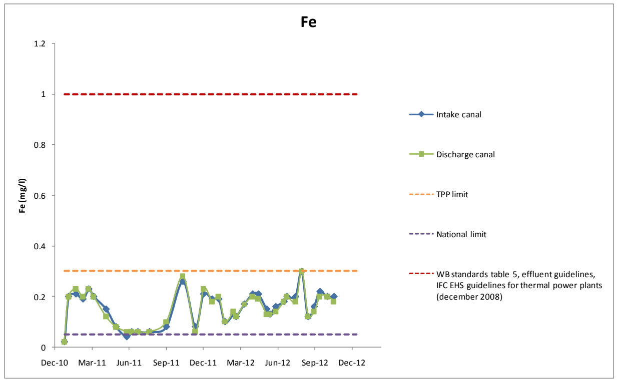
648. Analysis of technogeneous products of pollution showed that pesticides, widely used on the irrigated areas of Karakalpakstan and Khorezm region are not represented in the surface waters of the observed territory (close to Takhiatash city). Their concentration do not exceed 1 MAC in Takhiatash region, while their concentration on the irrigated areas reach tens of MAC.

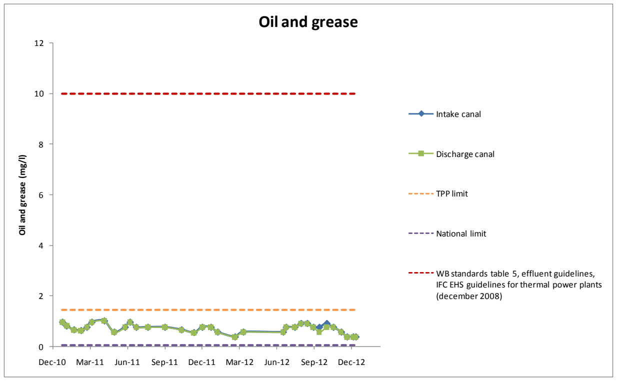
649. Available results of the previously conducted studies confirms that the large part of the Takhiatash area is under the intensive negative regional impact of phenol contamination of surface waters. Quality of river water falls into the III class – class of moderately contaminated waters.

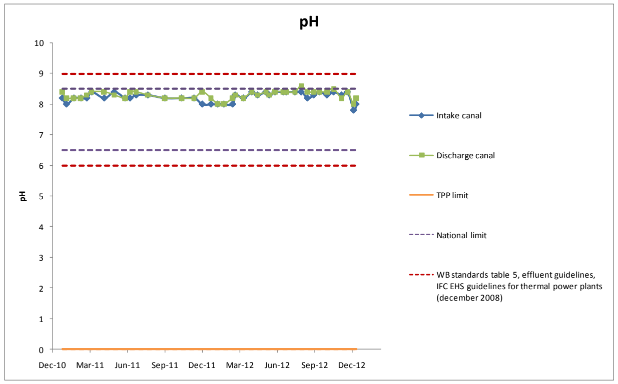
650. Takhiatash TPP intake and discharge is located in Suenly canal. In order to reflect the water quality conditions of the Suenly channel, a number of parameters are measured in both Takhiatash TPP intake and discharge points to the channel in a bimonthly basis. These parameters have been represented in charts shown below in order to reflect the water quality all over the years 2011 and 2012 and compared with the World Bank standards for effluents and the national and specific TPP limits .

Results of surface water analysis.

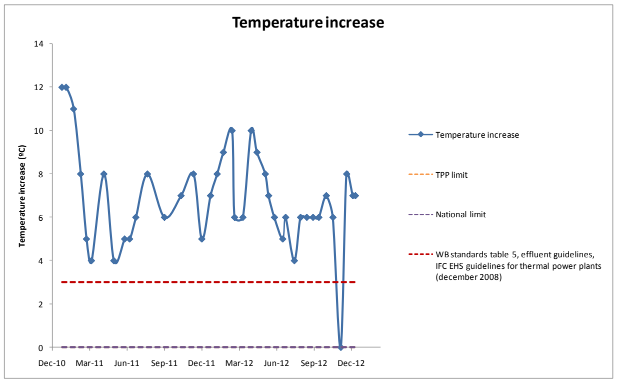


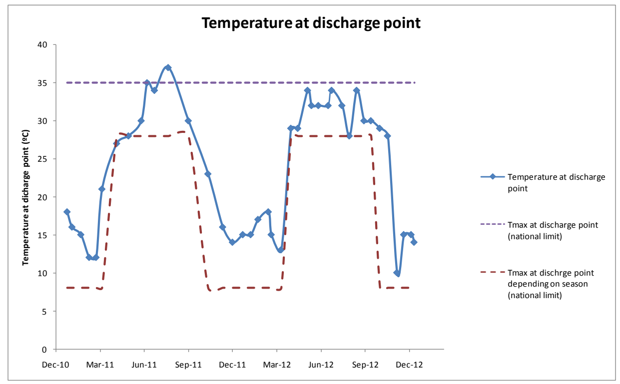


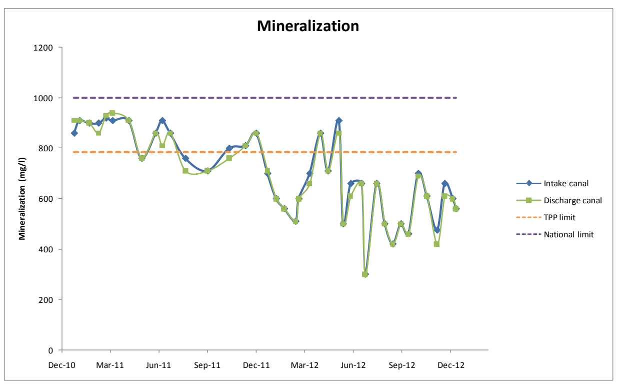


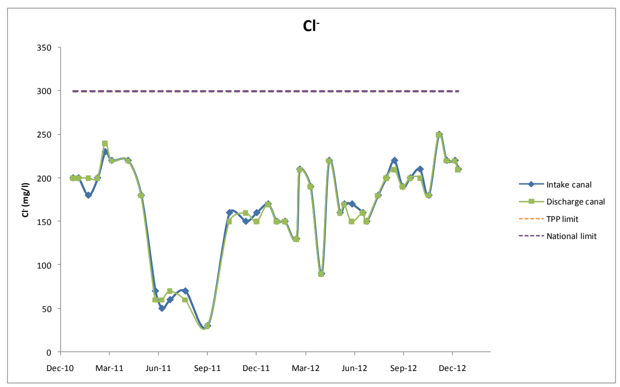


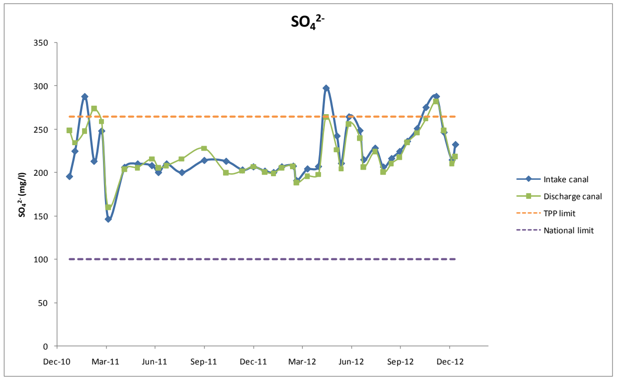
Results of groundwater analysis.



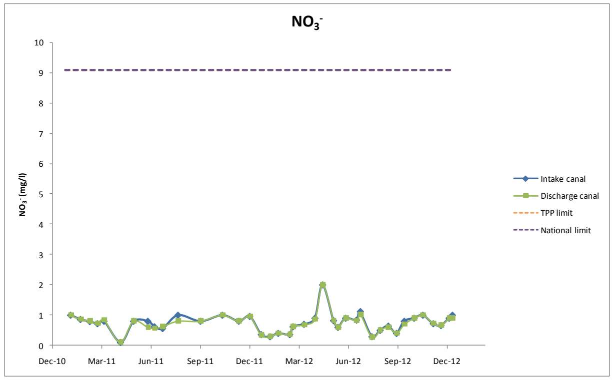




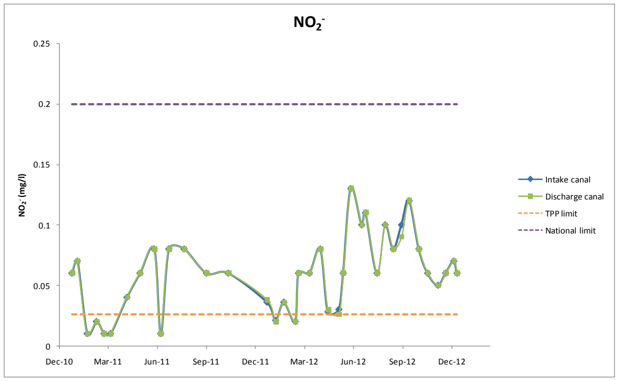




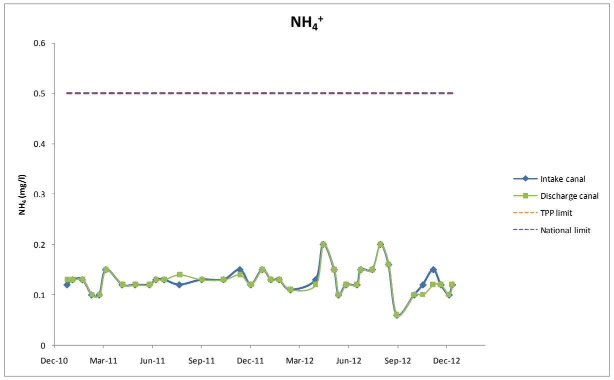
SO4 2-
SO4 2- (mg/l)
Intake canal
Discharge canal
TPP limit
National limit



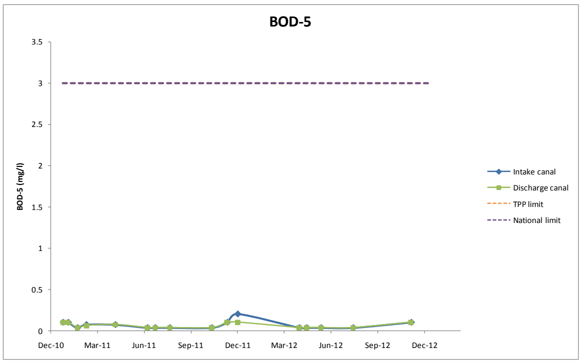
NO3 -
NO3 - (mg/l)
Intake canal
Discharge canal
TPP limit
National limit



NO2 -
NO2 - (mg/l)
Intake canal
Discharge canal
TPP limit
National limit



NH4 +
NH4 (mg/l)
Intake canal
Discharge canal
TPP limit
National limit



Comments.

633. **Total suspended solids**. The content of total suspended matter widely varies from one measurement to the next, having reached values above 300 mg/l.

634. The World Bank's standard is frequently exceeded at discharge point but this is because it is already exceeded at the intake point. The maximum allowable concentration of total suspended solids for the TPP (103 mg/land the national limit (100 mg/l) are less restrictive but they are also exceeded at certain points. It seems that in some periods TSS of the discharge point is lower than in the intake, as if the water process in the TPP operation would reduce this parameter.

635. **Iron**. The concentration of iron in water at intake and discharge points is very similar and it ranges from 0.05 to 0.3 mg/l. These values are below both World Bank´s standard and the TPP's limits. However, the intake water quality exceeds the content of iron established by the national limits.

636. **Oil and grease**. The content of oil and grease is the same for intake and discharge water and it remains mainly constant between 0.4 and 0.9mg/l, approximately. This value is below both World Bank´s standard and the TPP's limits. However, even the intake water exceeds the national limits which is more restrictive.

637. **Temperature increase**. As the cooling system of the TPP is an open circuit, the increase in temperature from intake to discharge points is quite high. The maximum allowable temperature increase defined by World Bank standards is set at 3ºC, value which is greatly exceeded by the TPP discharge.

638. According to surface water quality criteria in Uzbekistan standards establish a temperature increase limit for fishing purposes (Suenly canal is defined in this category) of 5ºC in comparing average monthly temperature of the hottest month. As in this period of measurements (2011-2012)

maximum temperature has been 30ºC, increase allowed should not exceed 35ºC but, a maximum absolute temperature at the discharge point is established in 8 ºC for winter and 28 ºC for summer. Both standards are exceed even at the intake point.

639. **pH**. The water pH, at both intake and discharge points, hardly varies and is between 8 and 8.5. It meets World Bank's standards as well as the national and the TPP's limits.

640. **Mineralization**. Although all the measurements are below the national limit for mineralization parameter, in several occasions the TPP's limit is exceeded.

641. **Chlorides**. The content of chlorides widely differs between different measurements depending on the date, varying from 30 to 250 mg/l. Nevertheless, these values do not exceed the TPP's and National standards, established in 300 mg/l.

642. **Sulphates**. The concentration of sulphates slightly varies between intake and discharge points and in certain measurements it is lower in discharge water. It ranges from 145 and 300 mg/l, values that exceed national standard (100 mg/l) and, sometimes, are above the TPP's limit (265 mg/l).

643. **Nitrates and ammonia**. The concentration of nitrates and ammonia scarcely varies between intake and discharge points and, in certain measurements, the content of both substances in discharged water is lower than the intake. These parameters do not exceed the TPP's limits, which are the same than Uzbek standards.

644. **Nitrites**. At the same way that nitrates and ammonia, the concentration of nitrites hardly varies between intake and discharge measurements. The content of nitrites is below the National limit but, in many occasions, it is above the TPP's limit (0.026 mg/l), which is much more stringent.

645. **Biological Oxygen Dema**nd. The Biological Oxygen Demand (BDO_5) is the precise amount of oxygen required to eliminate organic matter in water through aerobic biological processes, referred to a five day period. BDO_5 measurements are between 0.036 an 0.2 mg/l, which are much below both the National and the TPP's limits.

646. It can be concluded that, except temperature, the parameters that exceed standards are being already exceeded by the water quality in the Suenly canal previously to the intake for the TPP. In some cases the discharge values improve water quality compared with the intake values. For temperature, the operation of the TPP clearly causes an important increase of this parameter in the Suenly canal after the TPP discharge.

647. In order to find out the value concentration of the parameters included in the World Bank effluent standards (thermal power plants EHS IFC guidelines, 2007) that are not being currently monitored, an analysis was undertaken on the 6th of march of 2013 which results are shown in the next table:

Table 77. Results of analysis undertaken within EIA

	Water intake canal			Water discharge canal			TPP limits	WB limits
Parameter	Actual concentration mg/dm^3	Compliance with TPP limits?	Compliance with WB limits?	Actual concentration mg/dm^3	Compliance with TPP limits?	Compliance with WB limits?	MAC mg/dm^3	MAC mg/dm^3
Pb	0.0001	✓	✓	0.0001	✓	✓	0.03	0.5
Cd	0.00032	✓	✓	0.00035	✓	✓	0.005	0.1
Cu	0.0065	X	✓	0.0059	X	✓	0.001	0.5
Zn	0.011	X	✓	0.0096	✓	✓	0.01	1
Fe	0.6435	X	✓	0.7155	X	✓	0.3	1
Cr^{3+}	0.007	-	✓	0.0065	-	✓	-	0.5
As	0.022	✓	✓	0.0126	✓	✓	0.05	0.5
Hg	Not detected	-	✓	Not detected	-	✓	-	0.005
pH	7.78	✓	✓	7.94	✓	✓	6.5-8.5	6-9
Suspended solids	10	✓	✓	120	X	X	103	50
Residual chlorine	Not detected	-	✓	Not detected	-	✓	-	0.2
Oil products	0.08	✓	✓	0.22	✓	✓	1.45	10

648. World Bank standards are fulfilled except suspended solids at the discharge point. National standards are fulfilled except for Cu, Fe, Zn (at the intake) and Suspended solids (at the discharge). From the parameters that are exceeded both in the intake and discharge, only Cu concentration decreases at the discharge. Fe has an increase at the discharge of 1.1. times. Oils products, even if is fulfilled, has an increase at the discharge of 2.75 times. Special attention is to be provided to the Suspended solids parameter where the value at the discharge is 12 times higher than at the intake.

E.2. Biological environment

E.2.1. Flora

649. On the vast territory of the Republic of Karakalpakstan, which includes the lower course and delta of the Amudarya River, the adjacent sand and gypsum Kyzylkum deserts, the Ustyrt plateau and the Aral Sea there are about 1,000 species of higher plants and up to 400 species of vertebrates. The natural conditions of the area under study have defined the development of arid vegetation communities. Precipitation in winter and spring has led to the fact that plants have adapted to its effective use for the development of biological and soil processes. Therefore, vegetation especially in the sands and takyrs covers the area in early spring with a solid cover of sand sedge and other plants. Various types of wormwood and Salsola shrub also find here favourable conditions for their development. Thus, upon occurrence of favourable moisture conditions observed in early spring, sands are covered with quite diverse and abundant vegetation, the main and most typical

representatives being sand sedge — Carex physodes, Haloxylon, Salsola, Calligonum and other shrubs. In addition, there is common annual Salsola vegetation including xerophilous and halophilic herbaceous annual plants of the goosefoot (Chenopodiaceae) family. Most of these plants have an extended growing season: Their shoots appear in early spring; the plants slowly grow and bloom throughout the spring and summer, their ripening only occurring in fall. Very few species of the annual goosefoot family have a short growing season, ending their life cycle shortly after the ephemerae. The most common are annual Salsola species (turcomanica, crassa), Halimocnemis (karelinii, molissima, sclerosperma, etc.), Suaeda, Petrosimonia, Gamanthus (gamocarpus) and some other species.

650. Vegetation of Takhiatash town is represented by ornamental and fruit trees, vegetable and field crops. Woody vegetation includes the following: acacia, willow, Turkmen elm and poplar. The most popular fruit trees are apple, quince, pear, apricot and cherry. Plant species composition is small and represented by 20 species of trees and shrubs. Vegetation is sparse. Thickset of ornamental trees can be found in the town center: in the park and on the main streets. High soil and water salinity, high insolation, dust storms as well as insufficient irrigation system cause to the paucity of vegetation.

651. The presence of halophytic species (Halostachus Caspian, Aeluropus) - indicators of high soil salinity - in the vegetation cover confirms the presence of stress in the environmental situation of the city. Habit of these plants is much less than normal.

652. Vegetation within the radius of 2-3 km from Takhiatash TPP has various degrees of drying, especially the tops of trees. Significant degree of drying was observed in elms and black poplars. Aryan poplar (Turanga), Matsuda willow and Turkmen oleaster are the most resistant species to contaminants and natural conditions.

653. Thus, the region has scanty vegetation. Some species (black poplar and elm) are in poor condition due to man-made and natural factors.

E.2.2. Fauna

a) Terrestrial fauna

654. Fauna of the territory is varied. The most notable of the mass of desert animals are the many and various reptiles, rodents and small insects crawling on the ground.

655. Sparseness of vegetation, dispersal of shelters and food resources have developed the ability to move fast in many desert animals. It is typical for many running insects, arachnids, lizards, snakes, birds, and mammals. Such, for example, is the extremely agile mesh lizard chasing small insects. The gazelle and the tolai hare are quite fast runners. Exceptions are relatively rare – these are animals well protected from enemies and with a better supply of food. Such, for instance, are the shell-covered steppe tortoise (the herbivorous form, only active in spring during the growing

season of ephemera and ephemeroids), quill-protected porcupine, long-eared and Brandt's hedgehogs.

656. The steppe tortoises are rather numerous in the desert. Among the other specific members of this order, we must mention the sand boa, which easily mines the dry sand, and the rather numerous in the desert fine, delicate and extremely fast arrow-snakes. They mainly hunt lizards in which they wait for, hiding in the branches of the shrubs.

657. The most remarkable feature of the fauna of the desert rodents is the exceptional diversity of species and the abundance of the group of original prancing animals — jerboas.

b) Aquatic fauna

658. There are more than 50 types of fish in Aral sea basin. Withdrawing water for agricultural activity, construction number of dams and canals negatively impacted on the fishes. Around 10 types of fish are included into Uzbekistan book as a rare species. Among them are big and small Pseudosaphirhynchus kaufmanni, Barbus brachycephalys, Aral acipenser nudiventus. There are some fishes into the Suenly as well. Among them Ctenopharyngodon idella and Silurus glanis. However, in most of the cases these fishes flow in Suenly canal from the closest lakes over the high water level in Amudarya river.

E.2.3. Natural Protected Areas

659. There are three protected areas on the territory of Karakalpakstan:

- Low Amudarya biospheric reserve (established in 2011) – in accordance with IUNC classification belonged to category 1.
- Saygachiy preserve (1991) – Category IV.
- Sudochue lake (1991) - Category IV.

660. The closest protected area to the project is Low Amydarya biospheric reserve which locates on the territory of Amudarya, Beruniy district of Republics Karakalpakstan around 75 km on the east-south from Takhiatash city.

Figure 35. Location of Baday Tukay Reserve

661. The Low Amudarya Biosphere Reserve with a total area of 68,717.8 ha is established based on closing the Baday – Tugay State Reserve and the transfer of its 6,462.1 ha land to the State Biosphere Reserve as well as on land plots of:The Kipchat forestry, Amudarya region and Beruni forestry, Beruni region, Republic of Karakalpakstan, with a total area of 5,106.2 ha.Thus, the conservation area is 11,568.3 ha.

662. The territory of the Low Amudarya State Biosphere Reserve is picturesque and has a high level of biological diversity of the flood-plain forest.In addition, the largest areas of flood-plain forests of the Republic of Uzbekistan are on the lower Amudarya River and should be regarded as a natural reserve of unique flora and fauna.Currently, in the Low Amudarya State Biosphere Reserve flood-plain forests two types of Asiatic poplars:Heterophyllous poplar (Populus diversifolia) and blue-gray poplar (Populus pruinosa) as well as two types of oleasters: Elaeagnus ongustifolia and Elaeagnus orientalis are the major tree species.

663. Forage vegetation is more diverse and there are good stocks of plants such as:Karelinia, Alhagi, Halostachys, liquorice, and several types of tamarisk that grow in the additionally included flood-plain forests Taldyk– Tugay and Nazarkhan.

664. There are 167 plant species in the reserve of which two are in the Red Book of the Republic of Uzbekistan. The fauna includes: 26 species of fish, 2 species of amphibians, 13 species of reptiles, more than 91 species of birds, 15 species of mammals including the Amudarya pheasant, the jackal, the jungle cat, and the wild boar. Among species listed in the IUCN Red Book and the Red Book of the Republic of Uzbekistan are: Fish – 5, birds – 4, mammals – 1: Big Amudarya shovelnose, pike chub, ostroluchka (Capoetobrama kuschakewitschi), white-eye (Abramis sapa), Aral barbell (Barbus brachycephalus), marsh harrier, great and small white heron, pygmy cormorant, and Bukhara deer (Cervus elaphus bactrianis).

665. Currently, the number of deer in the nature and the neighbouring territories is more than 300.

Figure 36. Amudarya Pseudoscaphirhynchus kaufmanni.y Tukay Reserve

E.3. Socio-economic environment.

666. Takhiatash TPP is located in Takhiatash city, in Khodjeyliy region of the Republic of Karakalpakstan. In general, Republic of Karakalpakstan has an important role in the economy of Uzbekistan. Gross regional product of the Republic of Karakalpakstan in the period 2010-2011 in current prices is 1 389.8 billion soums, the growth rate for the period 2009-2010 in comparable prices is 110.0%. In Karakalpakstan GRP the share of agriculture industry is 9.6%, construction 8.3 %, trade and catering – 8.1%, transport and communication - 7,6%, taxes – 6,4%.

Table 78. Consolidated macroeconomic indicators of Karakalpakstan for 2010-2011.

Indicator	Amount
Gross Regional Product	1.389,8 billion sum
Volume of industrial production	406.673,8 billion sum
Gross agricultural output in current prices	482.353,9 billion sum
Volume of investment	457.852,4 billion sum
Retail turnover	684.244,6 billion sum
Paid services	207.459,5 billion sum
Foreign trade turnover	115.426,2 thousand USD

Indicator	Amount
Revenues of the local budget	512.914,2 billion sum
Local public expenditure	509.008,4 billion sum

667. Takhiatash TPP is located in Takhiatash city, in Khodjeyliy district of the Republic of Karakalpakstan.

668. Khodjeyli region was found in 1927, the total area of the district is 750 km square. Takhiatash city was found in 1953 and locates at the right bank of Amudarya river. Takhiatash city had it own Hokimiyat[7] but from now on forwards it will belong to the Khodieyli Hokimiyat. There are 10 Makhallas[8] in Takhiatash city, with the total number of 9745 families residing in 8841 households. The average size of the household is 5.5 people. The closest mahalla to the TPP is called –4 Brigada".

E.3.1. Employment

669. The average number of people working in different branches of national economy in Takhiatash city is presented in the following table and graph.

Table 79. Amount of people per branches of national economy

Branches of national economy	Number of people
Total in national economy of Takhiatash city	16.700
Including:	
Industry	1.721
Agriculture	1.630
Transport	785
Logistics	44

7 Local authorities/local government
8 Mahalla - In Uzbekistan, this word means a body of self-governance of citizens. Oficially named as Mahalla assembly of citizens (MAC). Makhalla is a traditional neighbourhood community in urban areas. After independence, makhallas have been revived as an institute of social control.

Branches of national economy	Number of people
IT sector	4
Providing services	740
Health care, physical, art	1.090
Finance and insurance	99
Others (administration, internal affairs, community organizations and etc.)	9.626

Figure 37. Employment of Takhiatash city

670. In Takhiatash city 61.2% are people of employable age The employment level of employable age population in the city is a little lower than in average in Karakalpakstan and in 2012 was about - 61%. At the same time population of the city characterised by a high percentage of youth within the population (almost 32%). In 2012, 1,525 people were registered in employment offices as seeking for job, and 1,374 (or 90%) were provided with the employment during this period of time.

Table 80. Employment Indicators in Karakalpakstan and Takhiatash City

Karakalpakstan AR	Total
Employable-Age Population	982,300
Employed	609,026
Takhiatash City	Total
Employable-Age Population	27,300
Employed	16,700
Officially registered People seeking for Employment	1,525
Provided with Employment	1374
Receive unemployment subsidies	n/a

Source: Households Survey, February 2013

E.3.2. Distribution of income

671. Distribution of average incomes of workers in Takhiatash city by branches of national economy in 2012[9].

Table 81. Distribution of average incomes of workers in Takhiatash city by branches of national economy in 2012

Branches of national economy	Income, sum	Income, US$
Takhiatash city	1.038.444,0	507
Including:		
Industry	1.160.009,6	566
Agriculture	529.357,9	258
Transport	1.204.850,2	588
Communication	846.495,5	413
Trade	795.557,5	388
Construction	895.805,6	437
Health care, physical, social security	699.139,3	341
Education	788.156,9	384
Culture and art	478.879,6	234
Finance	975.975,0	476
Administration	1.018.018,9	497

[9] Data provided by Takhiatash hokimiyat, 2012

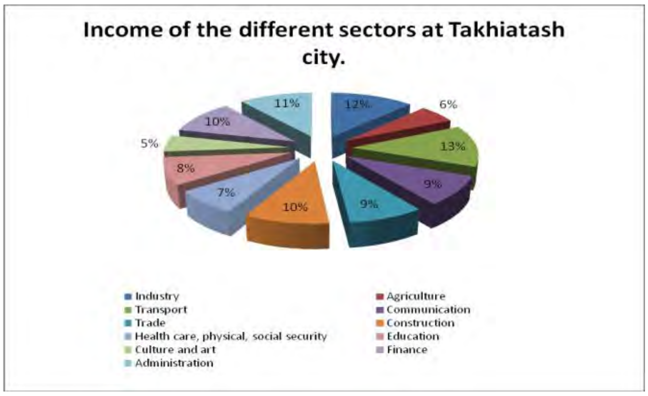


Figure 38. Income per sector at Takhiatash city.

672. Average monthly income per family in 2012 was 1047584,6 sum and per family member 115.372,8 sum.

E.3.3. Socio-economic conditions

673. The total population in Khodjeyli district is 134.4 thousand people, and 47.5 thousand people in Takhiatash city. From them 49% are males and 51% are females. From total population around 25 % is less than 16 years old. Ethnic distribution of population is presented in Table 82 (percentage as for 1989).

Table 82. Ethnic distribution of population

Ethnic	Khodjeyli district[10] (%)	Takhiatash city[11] (%)
Karakalpak	33.9	18.1
Uzbek	36.2	19.4
Kazakh	27.1	44.4
Russian	0.5	3.05

[10] http://sovminrk.gov.uz/lang/ru/cities-and-regions/khodzhayli/
[11] Data provided by Takhiatash hokimiyat

Ethnic	Khodjeyli district[10] (%)	Takhiatash city[11] (%)
Korean	1.1	3.05
Turkmen	5.7	6.7
Others	2.4	5.3

E.3.4. Land use

674. Land use distribution in Khodjeyli district are presented below:

Area: 705 km. Sq (70.582 ha), from them:

- Agricultural land — 35.081 ha.
- High saline — 1.453 ha.
- Settlement are and yards — 4.708 ha.
- roads — 1.845 ha.
- forest area — 1.411 ha.
- streets — 698 ha.
- other lands (rivers, hills, industrial zones, transmission lines) — 26.839 ha.

675. Focusing on Takhiatash city, it has to be mentioned that there are no land dedicated to agricultural activities.

E.3.5. Infrastructure facilities

676. As for January 1 of 2013, 99.8% of total population of Takhiatash city is connected to centralized water supply system. There are two drinking water supply sources in Takhiatash city: canal —Aginbaev” and —Tuyamyun-Nukus” water pipe system. —Tuyamyun-Nukus” water pipe system originated from Tuyamyun water reservoir. The total length of water pipe system is 78.6 km. 19,5% of houses connected to municipal sewage network. 99.9% of houses are connected to centralized gas supply system.

677. Takhiatash city has a municipal waste water treatment plant with a biological treatment. Communal wastes are disposed at the municipal landfill located 2 km to the south from Takhiatash city.

Figure 39. Location of Takhiatash city Municipal landfills and water treatment plant

678. These landfills are using for the disposal of communal wastes from the Takhiatash city and most part of the industrial wastes from Takhiatash industrial enterprises. According to national legislation[12], only permitted wastes are allowed to be disposed on the municipal landfills. Other hazardous wastes like used batteries, oil residual, luminescent lumps have to be disposed in accordance with appropriated regulations - in specialized treatment plants or special disposal places for hazardous materials.

679. The landfill is not sited, designed and operated to isolate the wastes from the surrounding environment as indicated for instance in the IFC EHS Waste Management Facilities Guidelines (December 2007).

- e.g. the location of the municipal landfill is closer that the 250 meters to residential areas
- There is not a soil cover material, with base and side slopes designed o minimize infiltration and facilitate collection of leachate.
- There are not low-permeability landfill liners to prevent migration of leachate.
- There is not drainage and collection system and landfill cover (daily, intermediate, and final) to minimize infiltration.
- There is not a leachate treatment on site and/or discharge to municipal wastewater treatment.
- There are not perimeter drains and landfill cell compaction, slopes and daily cover materials to reduce infiltration of rainfall into the deposited waste.

[12] SanR&N No 0127-02 –Sanitarian Rules of inventory, classification, storage and disposal of industrial wastes”

- There is not a prevention system of the run-on precipitation into the active area of the landfill neither a collection and control run-off system.
- Quantity and quality of leachate generated is not measure and recorded.
- There are not groundwater monitoring wells

Figure 40. Takhiatash city municipal landfill

680. Takhiatash TPP uses this landfill for the disposal of its wastes. Domestic effluents are also driven to the municipal treatment plant.

E.3.6. Transportation

681. There is Nukus-Khodjeyli highway at 4km to the north of TPP. Railway and road run at the distance of 150m from Takhiatash TPP. Further railway runs at the distance of 1,3km.

682. On the other hand, the closest airport is at Nukus, around 20 km far away from the TPP.

E.3.7. Power sources of transmission

683. The only power supply source in the area is the Takhiatash TPP. The TPP supplies with energy to all Karakalpakstan, Khorezm province and some districts in Central part of Uzbekistan.

684. At the same time, some pilot projects founded through various national and international organizations are being implemented in Karakalpakstan. Among them, Goskompriroda and UNDP

own a project called “Clean energy for rural community in Karakalpakstan” which consist in a pilot solar PV station (capacity 100 watt) installed in Karayzyak and Takhtakupir districts of Karakalpakstan.

E.3.8. Planned development activities

685. There are several development activities currently taken place in the Karakalpakstan. Chemical, gas-refining industries and construction materials production are been developed in the Republic. A number of big gas production and treatment companies (“Lukoil”, “Gazprom”, «KNOC», «KOGAS», «DAEWOO international») are operating in Usturt plateau. There is an increasing production in textile goods, the most of them to export.

686. The Government pays special attention to the construction of rural houses. There is a special investment program for the development of rural area supported with credit from ADB.

E.3.9. Public Health

687. EIA conducted by design institute provides results of analysis of the health status of the project area, which was conducted on the basis of statistical recording of sickness rate in Karakalpakstan in comparison with the general sickness rate of population of the Republic of Uzbekistan.

688. Statistical data analysis showed that the level of overall sickness rate and the majority of clinical entities in the Republic of Karakalpakstan is higher than the average rate for Uzbekistan.

689. In nosological groups sickness rates are higher than national average rates: diseases of the blood and blood-forming organs (3 times higher), genitourinary system (1.6 times higher), nervous system and sense organs (1.4 times higher), skin and subcutaneous tissue (1.3 times higher), respiratory organs (1.1 times higher). Pregnancy complications are 1.2 times higher than in Uzbekistan in general.

690. In the Republic of Karakalpakstan diseases of the blood and blood-forming organs (45.0% of total incidences), respiratory organs (15.1%), nervous system and sense organs (8.0%), urinary system (6.3 %), digestive system (4.9%) and diseases of cardiovascular system (4.3%) dominate in clinical entities.

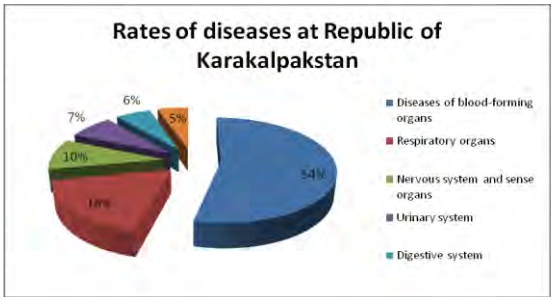


Figure 41. Diseases at Republic of Karakalpakstan

691. In the dynamics of the past five years the overall level of population sickness goes down, at the same time there is a steady growth of cancer diseases, diseases of the endocrine system, blood and blood-forming organs.

692. Similar results were observed in the group of adults, except for the additional excess rate for diseases of the musculoskeletal system in comparison with the national average rate.

693. The incidence of children under 14 years in the Republic of Karakalpakstan is generally lower than the incidence of the adult population. However, the excess of the national average rate observed for child diseases of the blood and blood-forming organs (3.4 times), genitourinary system (1.1 times), nervous system and sense organs (1.2 times) is higher than among adults.

694. Among adolescents aged 15-17 years in the Republic of Karakalpakstan the sickness rate is higher than among children under 14.

695. In addition, the overall sickness rate of adolescents is higher the average national rate (1.3 times higher), including the four clinical entities: endocrine disorders (1.1 times), diseases of the blood and blood-forming organs (2.7 times), nervous system and sense organs (1.3 times), diseases of the skin and hypodermic glands (1.4 times).

696. In Karakalpakstan the rate of hepatitis, cholelithiasis and stone formation in kidneys and ureters is higher than in Uzbekistan in general.

697. The main health problems include the following:

a) decreased kidney and liver function, arthritis, chronic bronchitis, typhoid and hepatitis, which increased dramatically over the past 10-15 years;
b) high rate of maternal and infant mortality;
c) increased level of genetic disorders;

d) children's diseases, typhoid, tetanus, intestinal diseases caused by the lack of purified water and poor sewage treatment in many settlements;
e) acute respiratory infections, especially among children;
f) anemia almost among all women, as well as among children and men.

698. By the criteria of health indicators Tahiatash town refers to 3rd grade: dangerous level, the zone of pre-critical environmental situation under the "Methodical guidelines on environmental hygiene division of the territory of the Republic of Uzbekistan on the risk degree to public health”.

699. Takhiatash city has one hospital for 200 beds and has following departments: infection departments, children‘s ward, maternity ward. Moreover, there are two more clinics: adults and children, designed to provide service for 500 patients.

E.3.10. Education

700. There are 4 Universities on the territory of Karakalpakstan: the Karakalpak State University, Nukus Pedagogical University, the Nukus Branch of Tashkent Pediatric Medical Institute, the Nukus Branch of Tashkent Information Technology University, the Nukus Branch of Tashkent Agrarian University, the Nukus Branch of Tashkent State Art Institute.

701. 645 pupils enrolled in 9 secondary schools located in Takhiatash city. There are 2 colleges – Takhiatash.

E.3.11. Vulnerable groups and gender issues

702. There are no vulnerable groups or ethnic minorities defined on the project area and gender issues are not objet of special investigation either as inequality has not been observed.

E.3.12. Cultural properties & cultural heritage

703. Karakalpakstan locates in historical area of Ancient Khorezm. There are a number of historical monuments: Gyaur Kala (4th-3rd centuries, BC), Toprak-Kala (3rd-2nd centuries, BC), Ayaz-Kala (4th-2nd centuries, BC), Kyzyl-Kala (3rd-2nd centuries, BC) as well as architectural ensembles of the later period, such as the mausoleum of Naridzhan-Bobo (14th cent.) and the unique Maslumhan-Sulu Mausoleum (14th-17th centuries).

704. Fragments of ancient inscriptions, which are considered the oldest in Uzbekistan, have been found during archaeological excavations of Koi-Krilgan-Kala. Details of sculptures, frescoes, inscriptions on ancient Khorezm language are stored in the Karakalpak Museum of Fine Arts.

705. The closest historical monuments to the Takhiatash TPP are remains of Mizdakhan city and the Mausoleum Mazlumhon Suluv. Mizdahkan is remains a major medieval town, located 8 km west of the city Khodjeyli[13].

Figure 42. Archaeological vestiges of Mizdakhan city

[13] http://xodjeyli.uz

ENVIRONMENTAL AUDIT REPORT

1. Executive Summary

The aim of this environmental audit report is to determine the degree to which the existing units of Takhiatash TPP currently in operation are meeting the stipulated national environmental requirements as well as the ADB's Safeguard and World Bank Group Environmental, Health and Safety Guidelines. The aim is to determine the nature and extent of all environmental areas of concern.

The audit visit took place between 17th and 18th January 2013 at the Takhiatash Thermal Power Plant (Uzbekistan).

This report has been developed according to the standards on format described in "Appendix 1 Safeguards Requirements 1: Environment" of the ADB's Safeguard Policy Statement (June 2009) and Annex A "Background on accepted international practice in conducting and compiling environmental audit reports, references and links to examples" of IFC Guidance note 1 "Assessment and management of environmental and social risks and impacts" (January 2012).

As a result of the audit carried out, it is concluded that the operation of the existing units of Takhiatash TPP exceeds some international standards (World Bank Group EHS guidelines) regarding emissions, thermal discharge of effluents, noise levels and waste management. This is a logical conclusion, given the worn out and old existing equipment currently operating at the TPP. In this case, suitable mitigation measures such as the implementation of cleaner and more efficient technologies is highly advisable. According to this strategy, the replacement of old and inefficient units by new and more efficient ones will reduce the emission of pollutants and GHG to the air improving air quality of the area and globally, will reduce the intake and discharge flue rate improving thermal effluent dispersion in the water body, will reduce the consumption of natural gas, etc. A global decrease in noise level would be also expected.

It has been found that the adequacy of the documentation and operation of the Takhiatash TPP EHS management to the requirements of the World Bank Guidelines need to be strengthened. Certain aspects of the procedures should be modified and new ones need to be developed, as indicated in the tables included in Chapter 6 (Corrective Action Plan), in order to improve the compliance with international requirements.

The corrective action plan must be taken into account as a set of recommendations to improve environmental performance of the Takhiatash TPP in order to achieve, step by step, an EHS management system at the level required by international institutions and good practices. It should be pointed out that this Corrective Action Plan should be agreed and budgeted by the TPP management unit if decided to be implemented. Actions that just imply a management improvement could be put in place as soon as possible taking advantage of the good disposition of the TakhiatashTPP staff.

2. Facilities description

The site of existing Takhiatash TPP is located in the city of Takhiatash, 3 km to the south-west of the city centre, on the left bank of Amudarya river. It occupies the central part of the Republic of Karakalpakstan (Khodjeyliy region), located in north-western Uzbekistan. The capital city of the Republic, Nukus, is located 20 km from the north of TPP industrial site

Figure 1. Location of the surrounding inhabited areas

Figure 2. Location of the TPP, Takhiatash city, Amudarya River and the intake and discharge points at Suenly canal

Figure 3. Aerial photograph of the existing Takhiatash TPP

The structure of the Takhiatash TPP's working team is shown in the following organizational chart.

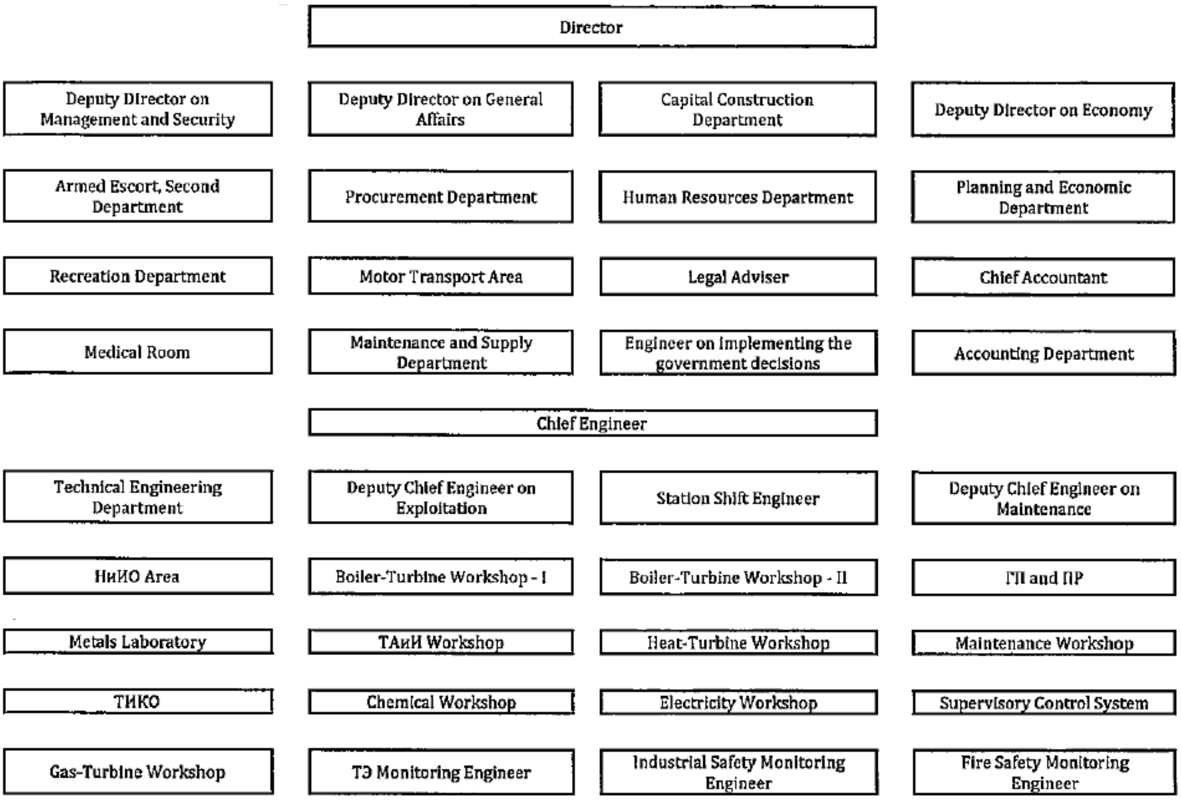


Figure 4. Takhiatash TPP organizational chart

At present, the number of employees of Takhiatash TPP amounts to 1082 people. This figure is broken down in the following table:

Table 1. Number of employees at Takhiatash TPP on 07.01.2012

No	**Name**	**Number or employees**
1	Total	1082
	Out of this:	
2	Administrative and managerial staff	39
3	Industrial and production personnel, including	935
3.1.	Managers	110

No	Name	Number or employees
3.2.	Specialist	65
3.3.	Employees	6
3.4.	Workers	754
4	Non-industry personnel, including	108
4.1.	Managers	6
4.2.	Specialist	6
4.3.	Employees	0
4.4.	Workers	83
4.5	Home-based work	13

The existing plant currently consists of four power generation units (III-IV-V-VI) with a total installed capacity of 730 MW. It also comprises a heating water converter plant to supply not only the TPP’s own hot water requirements but also Takhiatash city.

III and IV units include six drum boilers of two different types (No. 1-4 are TGM-151 model and No. 5-6 are TGM-151-B). The steam pipeline scheme provides parallel operation for the boilers No.1-6. all of the boilers are designed to burn both natural gas and mazut.

Exhaust gases from boilers No. 1-4 are discharged into the atmosphere through the 80 m high stack whereas gases from boilers No. 5-6 are discharged through the 150 m high stack.

Unit III includes two steam turbines with capacity of 100 MW each and Unit IV includes one steam turbine with capacity of 110 MW.

V and VI units include two drum boilers with natural circulation, designed to burn both natural gas and mazut.

Exhaust gases from boilers No. 7-8 are discharged into the atmosphere through the 150 m high stack.

V and VI units include two steam turbines (K-215-130) with a capacity of 210 MW.

Table 2. Table. Main equipment of the TPP's power island

Units	III & IV						V & VI	
Capacity	(100 + 100 + 110) = 310 MW						(210 + 210) = 420 MW	
Boilers	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	TGM-151 220 t/h; 110 kgf/cm2; 540°C 12 gas and oil burners frontal located				TGM-151-B 220 t/h; 110 kgf/cm2; 540°C 4 gas and oil burners frontal located		TGME-206 670 t/h; 140 kgf/cm2; 545°C 12 gas and oil burners located into the 2 tiers at the back panel	
Stack	80 m				150 m			
Turbines	3 steam turbines (K-100-90) - Condensing type - Single-shaft - HP and LP 90 kgf/cm2; 535°C						2 steam turbines (K-215-130) - Condensing type - Single-shaft - HP, IP and LP 130 kgf/cm2; 540°C	

The different facilities of the plant are explained in detail below.

2.1. Fuel system facilities

The main fuel for Takhiatash TPP is natural gas from Bukhara deposit. Natural gas from the GDP (Gas distribution plant) comes to two GDS (Gas distribution stations) through two aerial pipelines. The GDP is located 2 km away from the TPP.

Mazut, a type of residual black oil (type M-40), from Fergana and Bukhara oil refineries is used as back-up fuel. Mazut is stored for a power generation capacity of 15 days as there is a power supply guaranty to fulfill. Nevertheless, Mazut has not been used since 2004.

Fuel oil facilities consist of a mazut pumping station and a mazut storage with an overall capacity of 250,000 m^3: This storage comprises 6 metal tanks within the TPP terrains, with a capacity of 50,000 m^3 ((2 x 3,000 m^3) + (2 x 10,000 m^3) + (2 x 12,000 m^3)), which have a compacted soil/concrete secondary containment wall in order to prevent any fuel oil spreading. There is also a mazut storage 35 km away from the TPP whose capacity amounts to 200,000 m^3 (20 x 10,000 m^3). The location of this storage is shown in **Error! Reference source not found.**.

Fuel oil transportation from receiver tanks to reservoirs and from there to the boiler units is carried out in a closed circuit to prevent overflowing.

Figure 5. Location of mazut storage in reference to Takhiatash TPP

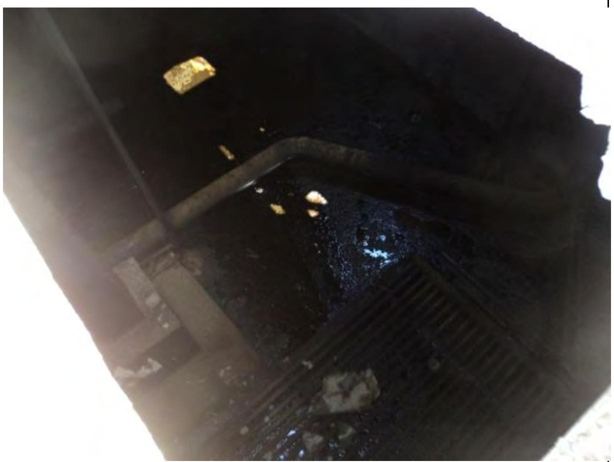
This mazut storage has been designed in 4 groups with 5 tanks per group. Every one of the tanks has a capacity of 10,000 m^3 (60m x 40m basement x 5m depth). Tanks and groups are constructed in concrete (walls, basement and roof) over the ground. The layout of the mazut storage can be observed in the following picture.

Figure 6. Layout of mazut storage

Mazut is transported in and out of the storage site in cisterns on the railway (visible at the south of the above picture). Currently, a layer of 20-40 cm of mazut remains in all of the 20 tanks but maintenance operations are being undertaken in order to clean it. This residual mazut is being transported to Taskent.

View of one of the groups constructed over the ground.

Top view of one of the groups. As it can be observed, the construction material of the roof (as well as the rest of the cube) is concrete. Steam and mazut distribution pipes are disposed along the ceiling of the groups.



Interior view of one of the tanks from the top. A layer of residual mazut can be observed.

Cisterns on the railway are being filled with residual mazut to be transported to Taskent by train.

2.2. Water supply and water treatment systems

The water supply source for the existing units of the TPP is Suenly canal, which is fed by Amudarya river.

Raw water from Suenly canal is used for production needs of the TPP. The raw water quality is characterized by a high content of suspended solids, mineralization, chloride ions, sulphates and oil products. Water is treated in the Water Treatment Plant (WTP) for conditioning, previously to its use in the process. Water treatment process consists of the following stages:

- **Clarification**

Raw water enters the clarification tanks and is treated with lime milk, coagulant and polyacrylamide by partial decarbonization and coagulation for the removal of suspended solids. Clarified water is then sent to mechanical filtration.

- **Mechanical filtration**

Clarified water is driven to the mechanical filters where a complete removal of suspended solids takes place. Mechanical filters are divided into two units, four filters in each block.

- **Decarbonization**

After mechanical filters, water is led to the calcinators, where the removal of dissolved carbon dioxide takes place. Decarbonized water is collected into tanks.

- **Na-cation filtration**

Decarbonized water is treated in Na-cation filters, where a complete softening takes place, and from there it is conducted to the chemically treated water tanks.

The poor quality of the raw water, reflected in its high indicators of turbidity and its high content of suspended matter, mineral salts and hardness salts, requires the consumption of high volumes of chemicals and a reliable operation of the water make-up filters.

The chemical unit provides the necessary chemical reagents for water treatment, and comprises:

- Salt: 4 working pits of salt and salt solution tanks.
- Liming: Unit for preparation of lime milk.
- Coagulation: Unit for preparation of coagulant.

The result of the water treatment is the reduction of hardness (from 11 to 2) by salt consumption.

The chemically treated water, stored in tanks, is led to the evaporation units. Replenishment of steam losses and condensate of high pressure is made by the distillate product of the evaporation units.

The conservation of the water in the boilers' circuit consists in a correction of the make-up water with hydrazine, ammonium and tri-sodium phosphate. The objective is to prevent problems of corrosion of the components due to scale deposits, impurities, etc.

2.3. Cooling water system

Water from Suenly canal is also used for the cooling water system. The TPP currently operates with an open once-through cooling system. This means that intake water from the canal passes through the condenser and, after the heat exchange, warm water is directly discharged back to the canal. Apart from the thermal increase, discharge water characteristics are practically the same as at the intake point.

2.4. Drinking water system

Drinking water for consumption of the TPP's personnel is supplied from the local pipeline system of Takhiatash city.

Drinking water is fed for consumption of plant personnel and service water is also used for sanitary needs (showers, eye washers, toilets…).

2.5. Heating water system

Heating water converter plant is designed for covering part of the Takhiatash city heating needs, as well as heating administrative, residential and industrial buildings of Takhiastash TPP. The water is heated in boilers as heating system water: 400 t/h in boilers πCB200-7-15 and 250 t/h in boiler πCB125-7-15. The water temperature at inlet/outlet is 70/150ºC.

Water is fed to the atmospheric deaerator in order to remove the oxygen and feed water is chemically softened in the water treatment plant.

2.6. Effluents treatment system

Description of the treatment systems of the effluents generated in the TPP is presented in the following paragraphs. Depending on their nature, the effluents are subjected to various types of processing:

- **Oily and acid effluents**

These effluents are conducted for treatment to the Purification Complex of Industrial waste water. This complex includes 2 facilities to treat industrial waste water: Greasy/oily treatment system and acid waste water neutralization system:

- **Acid waste water neutralization system.** These chemically contaminated effluents contain effluents resulting after washing regenerative air heater and acid washes of boilers. Acid waste water (up to 800 m^3) is directed to the acid waste water neutralization unit. Acid solution is neutralized by lime water and up to pH 9.5-10. The neutralized effluent is discharged into evaporation sludge ponds identified as nº 5 and nº 6. Currently, sludge pond nº 5 is not being used (see picture below).
- **Oily/greasy treatment system.** The oily effluents are water flows from areas that may have been contaminated by oils and greases such as fuel-oil handling system, open oil warehouse, blowdowns from boiler and turbine units, cooling water coolers, cooling of bearings and seals of the rotating machinery, etc. Oily waste water is directed to the oily water treatment system, with capacity of 50 t/h.

  Oily/greasy waste water goes through several stages of the treatment. Firstly, waste water is collected into the receiving tanks, where the largest oil fractions ascend to the surface of water due to the sedimentation process. Initially pre-cleaned water goes to an oil remover for cleaning from emulsified oil and mechanical impurities. Partly-cleaned water is conducted to an intermediate reservoir of pressure flotation. After flotation stage, cleaned water is directed to two filtration processes. In the first stage water is treated on the mechanical filter filled with anthracite. In the second stage water is cleaned in the coal or claydite filters.

Treated effluent is returned to the Water Treatment Plant and oily residue is discharged into the evaporation sludge ponds identified as nº 1 and nº 2. Currently, sludge pond nº 2 is not being used (see picture below).

- **Cooling System discharge**

As previously mentioned, the cooling system is an open circuit type and therefore requires water supply from Suenly canal. After being used for cooling purposes in the condenser, cooling water increases its temperature and is discharged into Suenly canal. Cooling system is once-through therefore the volume of water intake is almost equal to the volume of water discharge.

Raw water from intake canal is characterized by a high content of suspended solids and mineralization, including chloride ions, sulphates and oil products. Quality of discharged water is almost the same as initial water and main pollution is thermal, with an increase in temperature of 8-10 ºC. Effluent from cooling system does not contain neither poisonous nor toxic matters.

- **Sewage effluents**

Sanitary sewage is discharged into the sewage collector, which is connected with the municipal sewage network. Municipal network ends up in the Takhiatash city municipal waste water treatment plant (WWTP). Takhiatash municipal sewage system is based on biological treatment.

- **Water treatment plant (WTP) effluents**

Blown water from clarification tanks and non-used water from the regeneration of the Water Treatment Plant are effluents that contain small amounts of salts. These effluents are discharged into the municipal sewage network because they do not contain neither hazardous nor toxic components. These effluents are sent to the Takhiatash city municipal waste water treatment plant (WWTP).

Sludge from the liming section of the Water Treatment Plant is conducted to the evaporation sludge ponds, identified as nº 3 and nº 4 (see picture below). This sludge is formed by incompletely burned lime.

Figure 7. Evaporation ponds at Takhiatash TPP

All the sludge disposal sites are non-filterable with impervious screens at the bottom and sides in the form of poured asphalt of 20mm width. Tiling construction – concrete lining - 30 mm, poured asphalt –20 mm, reinforced concrete protective lining of 120 mm made of Portland cement concrete. Ground area of the sludge disposal site is treated with herbicides.

The calculated area of evaporation is 3,300 m^2. The total evaporation of flows is ensured. The capacity of the sludge collector is 1,700 m^3. Currently, sludge tanks are 1/3 full.

On a regular base, lime wastes are delivered to the specialized building organizations. According to the TPP's statistical data, the whole amount of accumulated wastes is 84 tons, 0.065 tons of them are of III toxic class of hazard[3] (oil sludge).

2.7. Waste management system

At the present, Takhiatash TPP waste management is organized as follows:

a) Reused:

- Used asbestos and thermo isolation materials are temporary collected at the open site with concrete covering and reused for boilers clothing during 30 days.
- Waste oil:

[3] SanR&N – 0128-02 29.07.02 – Hygienic classifier of industrial hazardous waste and SanR&N – 0127-02 29.07.02 – Sanitary procedures for industrial waste inventory, classification, storage and disposal (see point 3.1.4.2. C of chapter 2 of the EIA)

  - Waste engine oil shall be temporarily stored in a metal container with 0.2 m^3 capacity and reused as a lubricant for lifting and rotating mechanisms as needed for no more than 180 days. The remaining volume shall be transported to the oil storage on a quarterly basis.
  - Waste transformer oil shall be temporarily stored in a metal container, and within 30 days regenerated and re-used or delivered to the oil storage.
  - Waste turbine-oil shall be temporarily stored in metal containers and within 180 days, regenerated and re-used as designated or delivered to the oil storage.
- Waste cationite – part of it shall be used as an additive for other filters
- Electrolyte from batteries shall be reused for other batteries

b) Recycled:

- Iron and metal debris are temporary collected in an open space until 30 days. Stubs are collected into metal pails located next to the each welding equipment. Waste battery cases and lead plates shall be temporarily stored in the charging room without destroying. All the previous wastes are delivered to "Vtorchermet" enterprise.
- Wood debris is collected into bags and sold to inhabitants.
- Waste rubber and tires are stored in metal containers and shall be delivered to "Artur LLC" enterprise.
- Waste paper shall be temporarily stored and within 182 days shall be delivered to "Vtorsyrye" enterprise.
- Blown LB-40 fluorescent lights shall be temporarily stored in a special storage room, in boxes, and within 182 days shall be delivered to a specialized organization on lamp utilization. This procedure fulfills the Cabinet of Ministers' Decree No 266 from 21.09.2011 "On approval of the collection and disposal of used mercury-containing lamps".

c) Recover:

- Oily rags, used anthracite and wood debris shall be temporarily stored and burned in boiler furnaces.

d) Treat and dispose:

- Solid sediment and unconsumed lime sludge, black oil and oily effluents and neutralized effluents are sent to evaporation ponds.
- Certain fuel oil residues shall be temporarily stored in metal containers and within 30 days shall be delivered to the oil storage. Once there is enough quantity, all the oily wastes stored in the oil storage are sent to a final oil base storage place.
- Insoluble salt residue, incompletely burned lime, waste cationite (cation exchange resin), used anthracite, waste paronite, oil sludge from the evaporation ponds and domestic waste shall be temporarily stored and then transported to the municipal landfill.

Places for temporary and permanent storage of wastes are presented in the following picture.

Figure 8. Places for temporarily and permanent storage wastes

Legend:

1. Ferrous scrap metal
2. Non-ferrous scrap metal
3. Insoluble residual of salt
4. Luminescent lumps
7. Battery
8. Tires
9. Used engine oil
10. Communal wastes
11. Insoluble residue of lime
12. Thermo-isolated material
13. Oiled sludge
14. Rags

2.8. Health and safety management

Health and safety issues at the TPP are regulated by the official document approved by Uzbek State Agency on monitoring in energy sector “Uzgosenergonadzor” “Order on approval rules of organizing works with personnel at the enterprises of energy sector“. This document is reviewed every 5 years by “Uzgosenergonadzor” and re-approved every year by Takhiatash TPP’s director and the head of department of Emergency Situation of Takhiatash city. The annual approval is needed to include any new regulation that may arise during that period.

This document consists of 13 chapters which provide data and describe the organizing of the following activities:

1. General regulations
2. Organizational requirements
3. Preparation for new positions (New Task Employee)
4. Probation period
5. Checking knowledge
6. Duplication
7. Work permit
8. Orientation on work safety, technical operating and fire safety
9. Anti-damage tests and anti-fire trainings
10. Special trainings
11. Professional development
12. Observation of personnel work places
13. Team working with personnel.

The occupational health and safety structure of the TPP is presented at the following figure:

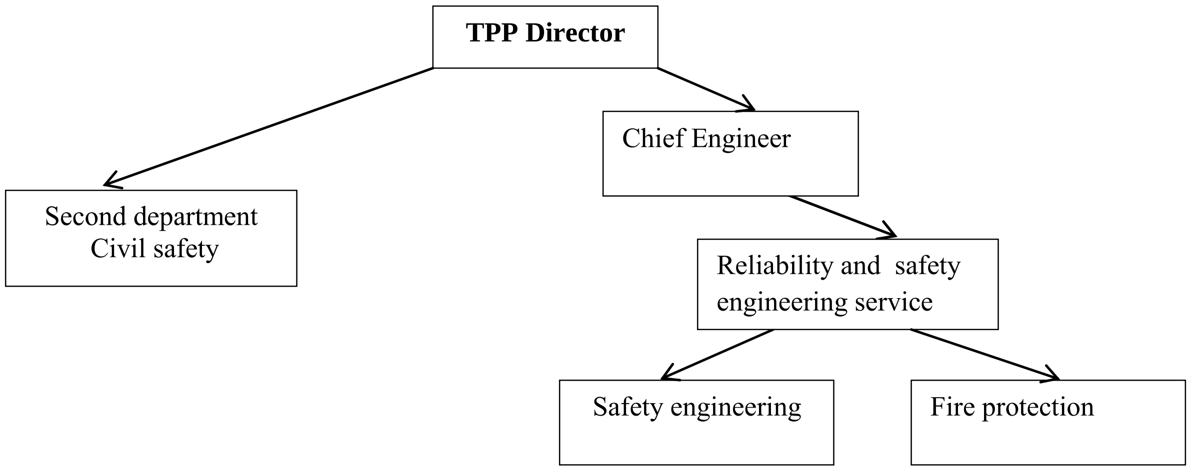


Figure 9. Occupational health and safety structure at the TPP

TPP Director is responsible for the performance of H&S works. There are three main departments working on these issues: safety engineering, fire protection and civil safety. The safety engineering department organizes and implements works on safety activities at the TPP. The fire protection department is responsible for fire protection at the TPP. Civil safety department is responsible for the activities in emergency situations. This department is responsible for personnel activity in case of anthropogenic and natural disasters (earthquakes, hurricanes, flooding). Every department prepares an Action Plan for the whole year. Usually the action plans cover the following topics:

- Number of planned trainings
- Number of people planned to be involved in trainings.

- Other planning activities, such as work safety days and etc.

Safety engineering department submits reports on their activity in a quarterly basis, civil safety department annually and fire protection department every two years.

Reports normally include information on the number of trainings conducted and their number of participants, the results of the observations of work places, the implementation of recommendations provided by external checking organizations or by the main office of Uzbekenergo, number and description of accidents occurred during the reporting period, etc.

3. Summary of national, local and any other applicable environmental laws, regulations and standards

In Uzbekistan, environmental permits given to industrial installations include emission limit values that are developed separately for ambient air, water bodies and waste. Emission limit values are approved by the SCNP on the basis of the SEE.

The terms and procedures for reviewing and approving emission limit values for substances emitted into the ambient air and water bodies, as well as waste disposal limits, are determined in compliance with the requirements of SEE procedures and by the allocation of competences on the approval of emission limit values by the SCNP Department for State Ecological Expertise for the TPP. Waste disposal limits are approved for five years, and the standards of emission limit values and discharge limit values for substances emitted into water bodies are approved for three years.

Emission permits are not based on an integrated approach to pollution prevention and control. Calculations of the standards of emissions discharged into air, water bodies and disposable wastes are based on different approaches. Standards are approved for different environmental areas and two different departments of the SCNP exercise control over their compliance (the Department for Air Protection and the Department for Control over the Protection and Use of Land and Water Resources, as well as specialized inspectorates for analytical control).

The below paragraphs summarize the host country (Uzbekistan) and other applicable environmental standards required by ADB and World Bank Group. The following guidelines have been taken into account:

- IFC General EHS guidelines, April 2007
- IFC EHS guidelines for Thermal Power Plants, December 2008
- IFC EHS guidelines for Waste Management Facilities, December 2007

A very detailed analysis of the applicable legislation has been included in chapter 3 of the EIA.

3.1. Standards on Ambient Air Quality

3.1.1. National standards

In accordance with “SanR&N No 0293-11 Hygienic requirements, the list of MAC for pollutants in the atmosphere in the territory of populated areas in the Republic of Uzbekistan have to comply with following limits:

Table 3. Summary of the relevant Ambient Air Quality Standards for Protection of Human Health (mg/m^3) at Takhiatash TPP

Pollutants	**Maximum allowed during 30 minutes**	**Maximum allowed average day**	**Maximum allowed average monthly**	**Maximum allowed average year**	**Hazard class**
	mg/m^3	mg/m^3	mg/m^3	mg/m^3	
NO_2	0.085	0,06	0,05	0,04	2
NO	0.6	0,25	0,12	0,06	3
SO_2	0,5	0,2	0,1	0,05	3
Benzapyerene	100,0E-7	100,0E-7	100,0E-7	100,0E-7	1
CO	5	4	3.5	3	4
Dust	0.15-0.5	0.1-0.35	0.08-0.2	0.05-0.15	3

3.1.2. International Standards

The legal reference limits pertaining to air quality are those corresponding to World Bank reference values in the "Environmental, Health, and Safety General Guidelines" document (April 2007), reference values given by the WHO (Air Quality Guidelines Global Update, 2005), which are shown in **Error! Reference source not found.**.

Table 4. WHO Ambient Air Quality Guidelines (General IFC Guidelines ,2007

Pollutant	**Averaging Period**	**Guideline value in µg/m^3**
SO_2	24-hour 10 minutes	20 500
NO_2	1 year 1-hour	40 200
PM10	1 year 24-hour	20 50
PM2.5	1 year 24-hour	10 25
Ozone	8-Hour daily maximum	100

3.2. Takhiatash TPP's Standards on Air Emissions

3.2.1. National emission standards

For the existing units at the Takhiatash TPP, Maximum Allowed Emissions (MAE) are calculated by unitary enterprises "Uzenergosozlash" and were sent to State Nature Protection Committee for approval in 2009. **Error! Reference source not found.** shows the MAE calculated for the Takhiatash TPP.

Table 5. Pollutants maximum allowed emissions for Takhiatash TPP

Pollutant	Existing situation		MAE		Exceed	
	g/s	t/y	g/s	t/y	g/s	t/y
Nitrogen dioxide	441,8480	3126,2838	441,8480	3126,2838	-	-
Nitrogen oxide	71,80000	508,02715	71,80000	508,02715	-	-
Carbone oxide	9,722000	164,16310	9,722000	164,16310	-	-

As can be observed, national emission standards are based on flue mass rate instead of on concentration units. This could allow diluting the volume of exhaust gas emitted to the atmosphere.

3.2.2. International emission standards

Relevant IFC standards applicable to combustion facilities rated over 50 MWth are presented in the IFC EHS Guidelines for Thermal Power Plants (2008).

Table 6. Pollutant Emissions Limit Values in the "IFC EHS Guidelines for thermal power plants" (December 2008), for boilers (Table 6-C)

	Emission guidelines (mg/Nm^3)			Dry basis, Excess O_2 content (%)
Combustion technology/fuel	**NO_x (1)**	**SO2 (1)**	**PM (1)**	
Natural Gas	240	-	-	3
Liquid fuels (Plant>/=600 MWth)	400	200-850	50	

*(1) Considering a Non Degraded Airshed after analysis of local air quality baseline

3.3. Takhiatash TPP's effluent standards

3.3.1. National effluent standards

There are two types of approved limits for discharging waste water on the TPP. Ones of them are limits for discharging water into the water body (Suenly canal) and the other ones are limits for discharging water into the municipal sewage system.

Limits applicable at the present on the TPP have been prepared in 2012. ***Limits on maximum allowed discharges into the water courses*** have been endorsed by Karakalpakstan Nature Protection Committee, Unitary Enterprise "Uzenergosozlash" under the UE, Takhiatash TPP and they were approved by State Nature Protection Committee (national level). Expiration date of these limits is 3 years (until 2015). Conclusion of State Environmental Expertise from 2012 officially endorses these limits.

According to data provided into the "Permission on maximum allowed discharge of pollutants into the water body (Takhiatash TPP)" water quality in canal "Suenly" (receiver of discharging wastewaters from TPP) is characterized by the pollutants indicated in **Error! Reference source not found.**. Based on national water quality standards and ambient concentration of pollutants into the canal Suenly, State Nature protection Committee defines norms of pollutants (MAC) for Takhiatash TPP.

Volume of water using for turbo-units cooling is 502,331 thousand m^3/year or 57,343.72 m^3/h. This amount is accepted as established and has been used for the calculation of MAD.

Table 7. Water quality in Suenly canal, national norms for pollutants and norms for TPP (Book "Permission on maximum allowed discharge of pollutants into the water body (Takhiatash TPP))

#	Indicator	Unit	Canal Suenly Average 2009	Canal Suenly Average 2010	Canal Suenly Average for 2 years	National Norms for pollutants in water body MAC	Norms for pollutants into the discharging water (for Takhiatash TPP) C_e	Calculated MAD g/hour
1	Suspended solids	mg/dm^3	107	89.3	98.15	Increasing on 0.75 mg/dm^3	103*	5940809
2	Mineral content, including	mg/dm^3	867	764	815.5	1000	785**	45014820,2
3	Chloride	mg/dm^3	294	200	247	300	300	14249914,4
4	Sulphate	mg/dm^3	299	225	262	100	265**	15196085,8
5	Nitrogen nitrate	mg/dm^3	0.199	0.19	0.194	9.1	9.1	57343,72
6	Nitrogen nitrite	mg/dm^3	0.036	0.018	0.027	0.02	0.026	1490,94
7	NH_4^+	mg/dm^3	0.198	0.124	0.161	0.5	0.5	8028,12
8	Fe	mg/dm^3	0.43	0.12	0.275	0.05	0.3**	17203,12

#	Indicator	Unit	Canal Suenly Average 2009	Canal Suenly Average 2010	Canal Suenly Average for 2 years	National Norms for pollutants in water body MAC	Norms for pollutants into the discharging water (for Takhiatash TPP) C_e	Calculated MAD g/hour
9	BOD_5	mg_{O2}/dm^3	0.15	0.06	0.105	3	3	172031,16
10	Oil products	mg/dm^3	1.6	1.4	1.5	0.05	1.45**	83148,394
11	pH	-	8.2	8.2	8.2	6.5-8.5		

* - in accordance with national standards, in case of the mineralization of water course (body) exceeds 30 mg/l during the low water period, it is allowed a 5 % exceed in suspended solids concentration relative to the existing (ambient) concentration in river. Thus, existing (natural) average concentration of suspended solids is 98.15 mg/dm^3 and 5% of this amount is 4.9, and consequently is 103 mg/dm^3.

** - Conclusion of State Environmental Expertise states that "…for Takhiatash TPP MADs should be established in accordance with national MACs, with the exception of the following pollutants: suspended solids, sulphates, iron and oil products. MAD for these pollutants should not exceed ambient pollution of canal Suenly."

Discharge of pollutants not included in **Error! Reference source not found.** is prohibited.

MAD for discharging water into the sewage network is calculated in comply with Resolution of Cabinet Ministries of RUz # 11 from 2010 "On additional measures on improving environmental protection activity in communal services", "Rules on receiving industrial waste water and order of compensations calculation for exceeding MAD into the municipal and other settlements sewage network".

Table 8. MAD for discharging into the municipal sewage network.

#	Pollutants	Actual concentration of pollutants discharged into the WTTP, 2012, mg/m^3	Established concentration C_e mg/dm^3	MAD, g/day
Outlet # 1, actual flow (q_a) – 210.41 m^3/day,(q_p) project flow – 283.37 m^3/day				
1	Suspended solids	77.2	500	141685
2	Dry residual	13.88	2000	566740
3	Chloride	154.3	350	99179.5
4		0.158	45.0	12751.65
5		0.043	3.3	935.121
6		0.255	2.5	708.425
7		0.106	5.0	1416.85
8		Abs	1.0	283.37
9		Abs	22.6	6404.162
10	Phosphates	-	2.5	708.425

#	Pollutants	Actual concentration of pollutants discharged into the WTTP, 2012, mg/m^3	Established concentration C_e mg/dm^3	MAD, g/day
11	pH		6.5-8.5	

#	Pollutants	Actual concentration of pollutants discharged into the WTTP, 2012, mg/m^3	Established concentration C_e mg/dm^3	MAD, g/day
Outlet # 2, actual flow – 166.3 m^3/day, project flow –181.72 m^3/day				
1	Suspended matter	94.35	500	90860.
2	Dry residual	1313	2000	363440
3	Chloride	157	350	63602
4		0.204	45.0	8177.4
5		0.203	3.3	599.676
6		0.068	2.5	454.3
7		0.255	5.0	908.6
8		Abs	1.0	181.72
9		Abs	22.6	4106.87
10	Phosphates	-	2.5	454.3
11	pH		6.5-8.5	

3.3.2. International Standards

EHS IFC effluents standards for thermal power plants are shown in **Error! Reference source not found.**.

Table 9. Effluent guidelines applicable for direct discharges of treated effluents to surface waters for general use (Environmental Health and Safety guidelines for thermal power plants, December 2008, Table 5)

Parameter	Discharge Limit
pH	6 – 9
Total suspended solids (mg/L)	50
Oil and grease (mg/L)	10
Total residual chlorine (mg/L)	0,2
Total chromium, Cr (mg/L)	0,5
Copper, Cu (mg/L)	0,5
Iron, Fe (mg/L)	1
Zinc, Zn (mg/L)	1
Lead, Pb (mg/L)	0,5
Cadmium, Cd (mg/L)	0,1

Parameter	Discharge Limit
Mercury, Hg (mg/L)	0,005
Arsenic, As (mg/L)	0,5
Temperature increase by thermal discharge from cooling system	Waste water temperature shall not cause a temperature increase of more than 3°C at a mixing zone boundary, scientifically determined, taking into account notably, quality of surrounding water, use of the receiving water, potential end receivers, and assimilation capacity. Specific requirements shall be determined by the present environmental assessment depending on sensitive aquatic surroundings at the point of and discharge.

For treated sanitary sewage discharges, IFC EHS general guidelines standards are as follows:

Table 10. Effluent guidelines applicable for treated sanitary sewage discharges (Environmental Health and Safety general guidelines, april 2007, Table 1.3.1.)

Parameter	Discharge Limit
pH	6 – 9
Total suspended solids (mg/L)	50
Oil and grease (mg/L)	10
BOD (mg/L)	30
COD (mg/L)	125
Total nitrogen (mg/L)	10
Total phosphorus (mg/L)	2

3.4. Takhiatash TPP Waste management and standards

3.4.1. National standards

Data on the rate of application of materials used for repairing and O&M of equipment were used to calculate quantity and quality of generated wastes (column 4,**Error! Reference source not found.**). Toxic class of wastes was defined in accordance with SanR&N No 0128-02 “Hygienic classifier of toxic industrial waste in the Republic of Uzbekistan (column 5)”. Places for temporary wastes storage and disposal is defined in accordance with RD Oz RH 84.3.17.2005 “Organizing and order of development of industrial and consumption wastes disposal” and SanR&N No 0127-02 “Sanitarian Rules of inventory, classification, storage and disposal of industrial wastes” (column 6, **Error! Reference source not found.**). Waste characteristics and content were developed in accordance with RD Oz RH 84.3.19.2005 "Terms and definition" (columns 7 and 8, **Error! Reference source not found.**).

In columns 9 and 10 of **Error! Reference source not found.** the Basel Convention category is included. In column 9 the classification included in the Waste Datasheet of the TPP is indicated. In column 10 the category of the wastes that have not been identified in column 9 and the correction of some of them have been included.

- Those wastes which category starts by "A" correspond to Annex VIII and therefore are considered hazardous wastes.
- Those wastes which category starts by "B" correspond to Annex IX and therefore are considered non hazardous wastes.

Table 11. Data on type, quantity, quality, main characteristics of waste and places of their disposal.

#	Name of wastes	Units (per year)	Limits (t)	Toxic class in accordance with national classification (1)	Place for disposal	Type/ state of aggregation/Generating source	Waste content	Waste code in accordance with Basel convention	
1	2	3	4	5	6	7	8	9	10
1	Iron scrap metal	tn	284.8	4	Scrap to "Vtorchermet"	Inorganic; solid; rehabilitation of wastes	Steel 50%; Cast iron 50%	B1010	
2	Non-ferrous scrap metal (bronze)	tn	0.187	3	Scarp to "Vtorcvetmet"	Inorganic; solid; Repairing and replacement of energy equipment	Sn – 3-17% Zn – 5-12%, Pb – 3-17%	B1010	
3	Non-ferrous scrap metal (cupper)	tn	0.19321	2	Scarp to "Vtorcvetmet"	Inorganic; solid; Repairing and replacement of energy equipment	Ni 0 16% Cu – 84%	B1010	
4	Non-ferrous scrap metal (babbit)	tn	0.42662	3	Scarp to "Vtorcvetmet"	Inorganic; solid; Repairing and replacement of energy equipment	Zn14-38%; Al- 2,5-6%	B1010	
5	Non-ferrous scrap metal (brass)	tn	0.76208	3	Scarp to "Vtorcvetmet"	Inorganic; solid; Repairing and replacement of energy equipment	Mn – 2% Si- 3,5%, Fe – 3%	B1010	
6	Stub	tn	0.552	4	Scrap to "Vtorchermet"	Inorganic; solid; welding	C-0.09% S – 0.04%	B1010	

#	Name of wastes	Units (per year)	Limits (t)	Toxic class in accordance with national classification (1)	Place for disposal	Type/ state of aggregation/Generating source	Waste content	Waste code in accordance with Basel convention	
							P – 0.04% Mn- 0.5%		
7	Waste wood	m^3	66.43	4	Reused as raw materials	Organic; Solid; Replacement of wool construction and furniture repair	Wool - 100%		B3050
8	Used fire-resistant and thermo-isolated materials	tn	651.06	4	Reused	Inorganic; solid; Rehabilitation of thermo-isolation of boilers, ponds, pipelines	Chamotte crumbs – 55.7%, power-fire resistant brick – 25,7% Concrete aluminous – 16%, fire resistant clue – 2.6%	A2050	
9	Used asbestos	tn	46.731	3	Reused	Inorganic; solid; Rehabilitation of thermo-isolation of boilers, ponds, pipelines	Asbestos cardboard – 25-35%, asbestos cord – 10-15% Asbestos - vermiculite tile – 50-65%	A2050	
10	Technical rubber	tn	5.65	4	Sent for utilization into LLC “Artur”	Organic; Solid; Energy equipment repairing	S – 2% Rubber – 92-98%	B3040	
11	Waste paper	tn	0.456	4	Sent to salvage	Organic; Solid; Replacement of electrical-isolation cardboard	Paper 85% Cardboard – 15%	B3020	

#	Name of wastes	Units (per year)	Limits (t)	Toxic class in accordance with national classification (1)	Place for disposal	Type/ state of aggregation/Generating source	Waste content	Waste code in accordance with Basel convention	
12	Used paranet	tn	1.2359	3	Removed to landfill	Inorganic; solid; paronit replacement			A2050 (asbestos /rubber)
13	Oiled rags	tn	2.625	3	Burned into the boiler furnace	Organic; Solid; Fitting in of electrical equipment	Cotton – 6-20% Wool – 14-28% Viscose – 13-30% Residual of transformer and diesel oils	B3030	A3020 (As are textile wastes that are mixed with hazardous wastes)
14	Mazut ashes	tn	0.366	2	Stored in evaporation ponds	Inorganic; solid; Mazut burning in boiler furnace			Depending on composition
15	Used turbine oil	tn	12.05	2	Reused	Organic; Liquid; Replacement of turbine oil		A3020	
16	Sludge from oil products	tn	1.89	3	Stored in evaporation ponds	Composite; Discharges from chemical treatment from oil products	Mazut – 2-15% Oil 3-18% Water 5-24% Clue 25-45%		A4060
17	Sludge from water treatment plants	th	1598	4	Stored in evaporation ponds	Inorganic; liquid; During acid washing of boilers			B2120
18	Used anthracite	tn	13.2	4	Burned into the boiler furnace	Organic; Solid Replacement of absorbents in mechanical filters	Coal 100%		B2060
19	Used cationite	tn	23.496	4	Removed to landfill	Inorganic; Solid			A3050

#	Name of wastes	Units (per year)	Limits (t)	Toxic class in accordance with national classification (1)	Place for disposal	Type/ state of aggregation/Generating source	Waste content	Waste code in accordance with Basel convention	
						Replacement of absorbents in filters			
20	Insoluble salt residuals	tn	80	4	Removed to landfill	Inorganic; Composite; Dissolving of salt for filter regeneration	SO_4Ca – 81.45% Other – 18.55%		
21	Not-fuel burning of lime	tn	484.8	4	Removed to landfill	Inorganic; Solid; Dissolving lime	Clue 65-88% Sand – 2-5% Limestone 8-33%		
22	Used oil from transformers	tn	3.9466	2	Reused	Organic; Liquid; Replacement of transformer oil		A3020	
23	Used electrical isolated materials	tn	0.06	3	Removed to landfill	Solid; Composite; Replacement of electrical isolation	Polymers -65-85% Cotton isolation – 12-35%	A3020	
24	Used luminescent lamp	tn	0.23828	1	Removed to demercuriation	Inorganic; Solid; Burned lump replacement	Al – 80.67% Vo- 1.437% Cu – 7.05%	A1030	
25	Bottom sediments of mazut	tn	37.652	3	Stored in evaporation ponds	Composite; Solid; Sedimentation and polymerization of heave fractions	Heave hydrocarbons – 12-45% Mechanical admixture – 55-88%		A4060
26	Silt from calcium carbide	tn	0.4046	4	Removed to landfill	Inorganic; Composite; Welding and cutting of metal	$Ca(OH)_2$ H_2O - 12%		
27	Used	tn	1.561	4	Sent to	Organic;	Rubber –	B3040	

#	Name of wastes	Units (per year)	Limits (t)	Toxic class in accordance with national classification (1)	Place for disposal	Type/ state of aggregation/Generating source	Waste content	Waste code in accordance with Basel convention	
	tyres				utilization	Solid; Replacement	70% Viscose cord – 20% Metal cord – 10%		
28	Used engine oil	tn	0.65117	2	Reused	Organic; Solid; Replacement		A3020	
29	Lead plates from battery	tn	0.33525	1	Scarp to “Vtorcvetmet”	Inorganic; Solid; Replacement	Lead – 50-60% PbS- 20%	A1160	
30	Cases of battery	tn	0.08171	4	Scarp to “Vtorcvetmet”	Organic; Solid; Battery replacement	Ebonite	A2010	
31	Used electrolyte	tn	0.12667	2	Reused	Inorganic; liquid; Battery replacement	H_2SO_4 - 28%	A4090	
32	Communal wastes	tn	257.283	Non-toxic	Removed to municipal landfill	Organic; Solid; Workers activity Cleaning of territory		B3060	

The toxic class referred to in **Error! Reference source not found.** is in accordance with the National Uzbek classification as shown in **Error! Reference source not found.**.

Table 12. Toxic class in accordance with national classification is as follows:

Toxic Class	Waste hazardous grade
Class 1	Extremely hazardous waste
Class 2	Highly hazardous waste
Class 3	Moderately hazardous waste
Class 4	Low-hazardous waste

3.5. Takhiatash TPP noise standards

3.5.1. National noise Standards

The “Sanitarian Rules and Norms on providing allowed noise level into the living buildings, public buildings and territory of living area” (SanR&N No.0267-09) establish the maximum admissible noise level into the living areas, both inside and outside buildings, as **Error! Reference source not found.** shows.

Table 13. Admissible noise level into the living areas, both inside and outside the buildings (SanR&N No.0267-09)

Name of area	Level of sound pressure, octave bands with average geometric mean frequencies (dB)								Level of sound, (dBA)
	63	125	250	500	1000	2000	4000	8000	
Living room of flats, bedrooms of resorts (inside)									
Day time	63	52	45	39	35	32	30	28	40
Night time	55	44	35	29	25	22	20	18	30
Territories adjacent to living houses (outside)									
Day time	75	66	59	54	50	47	45	43	55
Night time	67	57	49	44	40	37	35	33	45

3.5.2. International noise standards

The TPP must observe World Bank Directives (“Environmental, Health and Safety General Guidelines, 2007“) based on those of the WHO. As for the impact of noise beyond the boundaries, the EHS Guidelines stipulate that such noise shall not exceed the levels given in the table below, nor shall they result in a greater increase of ambient noise than 3 dB at the nearest receiving area outside the site.

Table 14. Maximum Allowable Noise Levels (IFC EHS General Guidelines, 2007)

Receiver	One hour LAeq (dBA)	
	Day time	Night time
	7h00 – 22h00	22h00 – 07h00
Residential, institutional and educational	55	45
Industrial and commercial	70	70

3.5.3. International Standards

The TPP should comply with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989), ratified in 1996 by Uzbekistan. Hazardous wastes generated by the TPP should be classified under this Convention. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation.

Waste management of the TPP should be based also on chapter 1.6. of the General EHS IFC Guidelines (April, 2007).

4. Audit and site investigation procedure

The audit procedure has been based on reviewing documents and records, interviews with staff and site reconnaissance observations to generate objective evidence. Environmental monitoring results have been also assessed.

Three types of audit activities were used to assess the level of conformity of the Takhiatash TPP's operational environmental management system:

1. Review of documentation
2. Interviews
3. Site visit

4.1. Document and record review

During the audit, a wide variety of environmental documents and records were reviewed. The documentation review is part of the overall evidence gathering phase.

- Norms for maximum allowed emissions for OJC "Takhiatash TPP", Tashkent 2009
- Permission on maximum allowed discharge of pollutants into the water body. OJC "Takhiatash TPP", State Nature Protection Committee of RUz, Tashkent 2012
- Communal-ecological norms (limits) for waste water discharge into sewage system. OJC "Takhiatash TPP". State Nature Protection Committee of RUz, Tashkent 2012
- Inventory of industrial wastes. OJC "Takhiatash TPP", Tashkent 2007
- Wastes passports. OJC "Takhiatash TPP", Takhiatash 2007
- Limits for waste disposal. OJC "Takhiatash TPP", Tashkent 2008
- Rules on organization of work with personnel in the energy sector, "Uzgosenergonadzor", 2002
- Materials of work places assessment. Minutes of measurements of harmful industrial factors. Map of work conditions at the work places. OJC "Takhiatash TPP". Takhiatash 2010.
- Annual reports on air emissions, generated wastes and their disposal, water use and effluents flows.
- Waste contracts

TPP monitoring records of:

- Monthly air emissions samples from years 2011 and 2012
- Water quality analysis at intake and discharge points every 15 days from years 2011 and 2012
- Groundwater quality analysis every three months from years 2011 and 2012
- Soil analysis every six months from years 2011 and 2012

All documents and existing records were submitted as documental evidence during the audit visit or after it.

Apart from the information provided by the TPP, several environmental surveys and analysis have been undertaken for the EIA and analyzed for the present environmental audit:

- Noise measurement campaign.
- Water intake and discharge quality analysis.
- Soil analysis at the new facility location and existing evaporation ponds.

4.2. Site reconnaissance

The site and areas subject to the report were toured in order to get acquainted with the location and activities and also to gather evidence on actual on-site environmental practices. Annex II of the EIA (photographic report) shows visual evidence of the audit.

4.3. Staff interviews

In addition, interviews were carried out during the audit with plant managers and personnel in order to verify the environmental management system.

Table 15. Staff interviews

#	Name	Position	Location
1	Babajonova Zulfiya	Chief of chemical department	Takhiatash TPP
2	Frolova Aelita	Engineer of eco-analytical laboratory, chemical department	Takhiatash TPP
3	Abdullaev Komol	Environmental Engineer	Takhiatash TPP
4	Esemuratov Satbay	Work safety engineer	Takhiatash TPP
5	Eshanov Alamurat	Chief foremen, Heating isolation and boiler cleaning department	Takhiatash TPP
6	Fayzullaev Abdurahmon	Deputy chief of material procurement department	Takhiatash TPP
7	Atagonova Sanargul	Air pollution monitoring department	Karakalpak State Nature Protection Committee

#	Name	Position	Location
8	Karabaeve Shirin	Soil pollution department	Karakalpak State Nature Protection Committee
9	Mambetov Kengesbay	Air protection department	Karakalpak State Nature Protection Committee
10	Seitniyazov Komol	Soil resources protection department	Karakalpak State Nature Protection Committee
11	Artikboev Nodir	Work safety department	The main office of Uzbekenergo
12	Khomova Tatyana	Environmental Engineer	Design institute “TEP” Uzbekenergo
13	Akromov Bakhodir	Engineer (work safety)	Uzenergosozlash Uzbekenergo
14	Birukov Evgeniy	Engineer (water discharges)	Uzenergosozlash Uzbekenergo
15	Muksimov Akmal	Engineer (solid wastes)	Uzenergosozlash Uzbekenergo
16	Konstantinovskiy Rafael	Chief of environment protection department	Uzenergosozlash Uzbekenergo

What follows is a summary of the actual environmental management and control procedures currently applied at the TPP, concluded after review of documents, staff interviews and site visit.

A. General EHS management, monitoring and report:

There are different tasks (monitoring) undertaken by different areas of the TPP organization structure. Staff (number of people) dedicated to environmental, health and safety issues should be adequate. Analysis and monitoring results are recorded in hardcopy. Monitoring program is based in national methods for sample collection, preservation and analysis. There is no evidence that the national methods comply with quality and strictness of the international methodological standards.

Automated and manual equipment is being calibrated under national regulations. There is not a plan of calibration and maintenance neither sampling nor analysis Quality Assurance/Quality control (QA/QC) plans.

The Takhiatash TPP annually submits two kinds of reports:

1. Air emissions, generated wastes and disposal and financial report on environmental taxes. This information is submitted to the Goskompriroda of Karakalpakstan and Statistical Department of Karakalpakstan:
2. Water use and effluents flues. This information is submitted to the following relevant organizations:
   - Low Amudarya authority of irrigation system (responsible for management of surface water, under the Ministry of Agriculture and Water Resources Management).

- Goskompriroda
- Takhiatash “Vodocanal” – organization responsible for drinking water supply and domestic waste water treatment
- Department of Environmental protection in Uzbekenergo.

B. Air emission and ambient air quality:

Conventional old units of the TPP run with an average thermal efficiency of 31%. This means that, compared with a more efficient technology, current Takhiatash technology emit higher quantities of pollutants and GHG by power unit.

There is not a continuous emission monitoring system at the stacks of the TPP. A monthly emission test is conducted by “Uzenergosozlash” at the boilers. No emission test at the stacks is been carried out in order to have direct measurement of emission levels.

Based on the monthly emission data reported by the TPP, the annual emission rates from each boiler have been calculated by weighting the monthly emissions with the specific operating hours of each boiler and adding the monthly values for the whole year.

Maximum allowed emissions (MAE) were calculated by unitary enterprises “Uzenergosozlash” and have been passed to State Nature Protection Committee for approval in 2009, which are also presented in **Error! Reference source not found.**and **Error! Reference source not found.**.

Table 16. Existing emissions in 2011 and 2012 and emission limits (MAEs) as nominal or design capacity

Pollutant	**Existing emissions (2011)**		**Existing emissions (2012)**		**MAE**	
					Stack 1+Stack 2 = Total	**Stack 1+Stack 2 = Total**
	g/s	*t/y*	*g/s*	*t/y*	*g/s*	*t/y*
NO_2	83.75	2170.25	88.38	2050.82	158.47+283.38 =441.85	358.27+2768.02 =3126.28
NO	13.61	352.67	14.36	333.26	25.75+46.05 =71.80	58.22+449.8 =508.03
CO	0	0	0	0	3.14+6.58 =9.72	23.44+140.70 =164.16

Table 17. Average annual capacity emission limits

Pollutant	**MAE**	
	Stack 1+Stack 2 = Total	**Stack 1+Stack 2 = Total (8000 operating hours/y)**
	g/s	*t/y*
Nitrogen dioxide (NO_2)	35.054+110.76=145.814	4199
Nitrogen oxide (NO)	5.696+17.998=23.694	682
Carbon oxide (CO)	2.29+5.63=7.92	228

Having analyzed emissions in 2011 and 2012 it can be concluded that SO_2 and CO measurements recorded show a 0 value (which could indicate that the measurements were not taken or that there were mistakes in the measurements as it is very estrange to have a 0 value in these parameters). The NO_2 and NO values are shown in the following graphs.

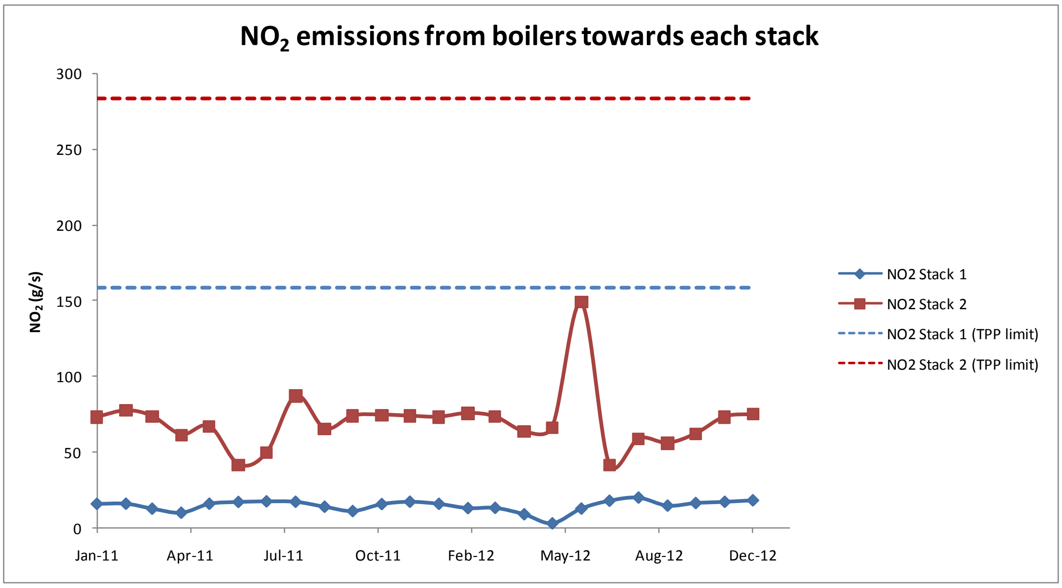


Figure 10. Comparison between NO_2 emissions from boilers towards each stack and the TPP's limits

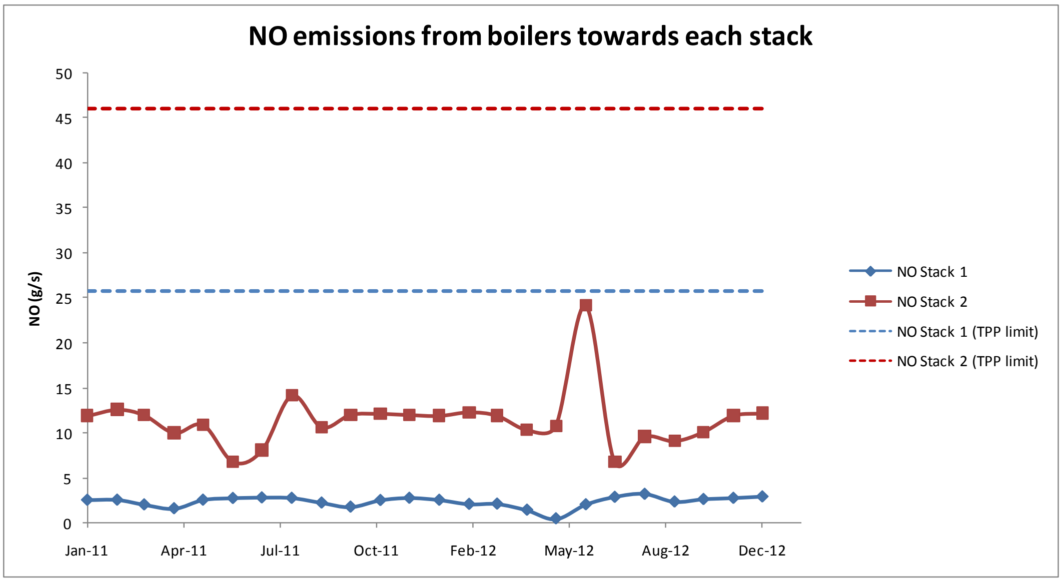


Figure 11. Comparison between NO emissions from boilers towards each stack and the TPP's limits

Regarding international standards, the World Bank standard for boilers (table 6 C of the IFC EHS guidelines for thermal power plants (December 2008)) only refers to NOx emissions when burning natural gas. The WB standard for NOx is 240 mg/Nm^3 (Dry gas, 3% O_2).

In the following figures the comparison between the World Bank standard and the monthly measurements between 2011 and 2012 can be observed.

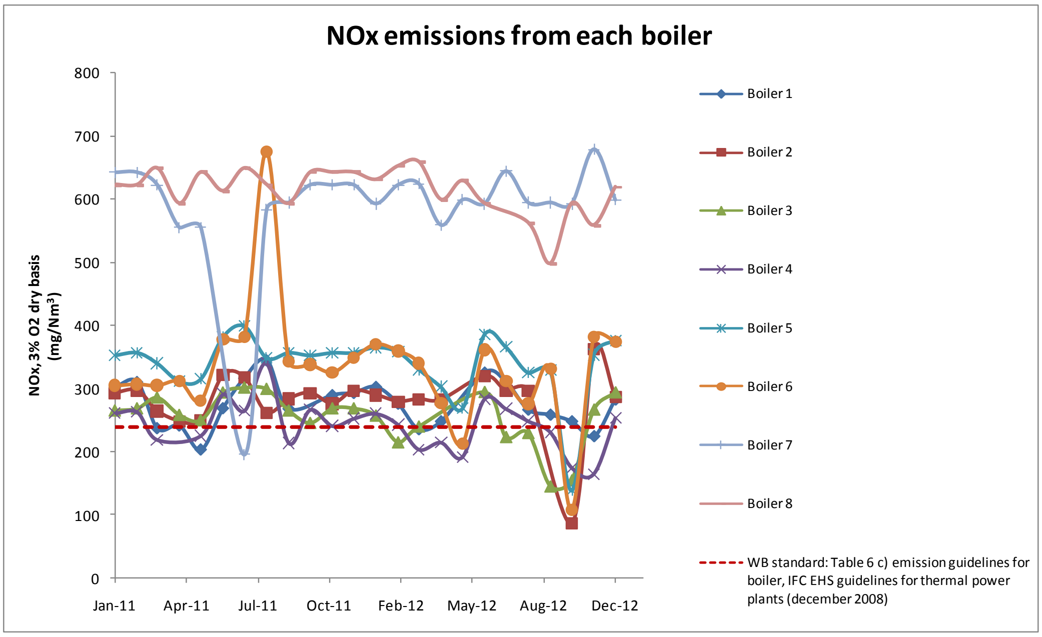


Figure 12. Comparison between total NO_x emissions (mg/Nm^3) from each boiler and the World Bank limits

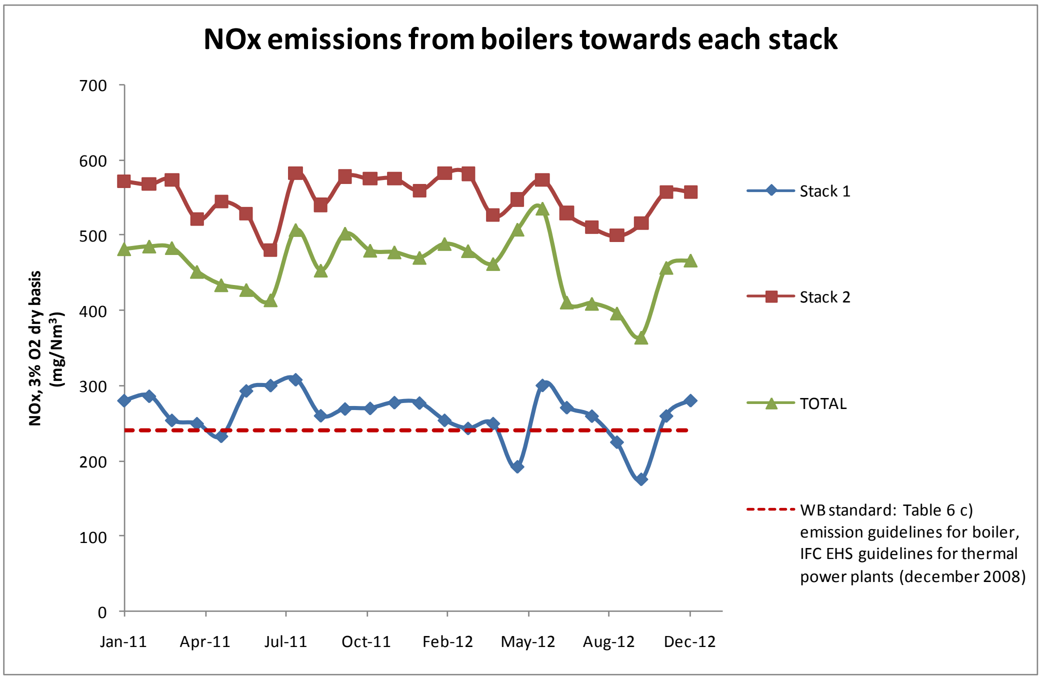


Figure 13. Comparison between total NO_x emissions (mg/Nm^3) from boilers to each stack and the World Bank limits.

Emissions when burning mazut as backup fuel have not been checked as emissions test were not provided. Nevertheless, this fuel has not been used since 2004 as it remains just as a provision of power supply guarantee.

There is no evidence of calculation of GHG emission at the TPP on an annual basis.

Regarding air quality measurements, they are not being undertaken by the TPP.

There are two existing air quality stations in Nukus and Kizketken settlement area which measures are conducted by the Main Hydrometcenter of the Republic of Uzbekistan.

- # 5 monitoring station located in Kizketken near Nukus.
- # 7 monitoring station located in Nukus.

Figure 14. Location of the air quality monitoring stations.

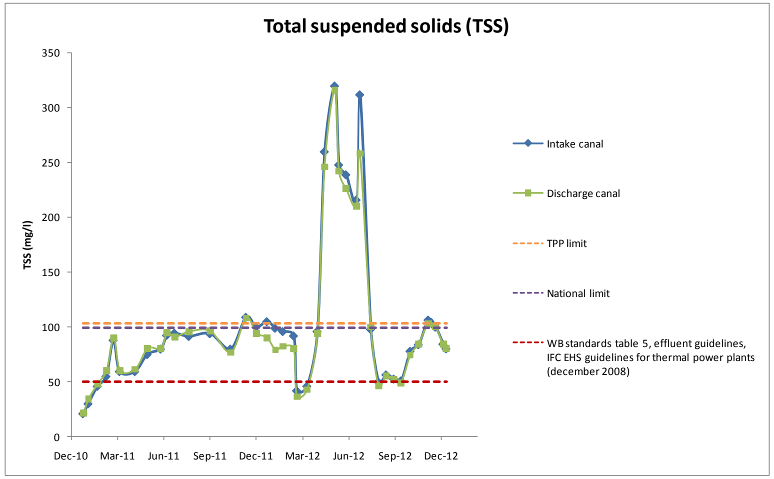
Location of these two air quality stations are far away and not in the wind direction from and of the TPP. Measures recorded by these two air quality stations are not being analyzed and assessed within the environmental annual reports by the TPP either.

As we dispose of the real air quality and also we have simulated the contribution of the current operation of the TPP to these air quality station (see Annex III of the EIA "Atmospheric dispersion simulation"), we can calculate the percentage of this contribution. This contribution for annual, monthly and daily averages of NO2 is not very significant. Nevertheless, for short periods (hourly results) the contribution can rise up to 69%. For NO the contribution is almost no perceptible and for CO is insignificant.

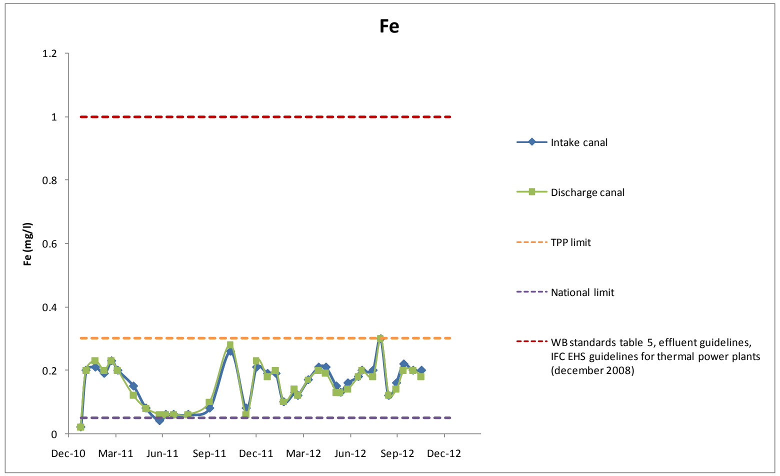
C. Waste water and ambient water quality:

Takhiatash TPP intake and discharge is located in Suenly canal. In order to reflect the water quality conditions of the Suenly channel, a number of parameters are measured in both Takhiatash TPP intake and discharge points to the channel in a bimonthly basis. Just the parameters that have also a limit in the World Bank guidelines have been represented in charts shown below in order to reflect the water quality all over the years 2011 and 2012 and compared with the World Bank standards for effluents and the national and specific TPP limits (Figure 15).

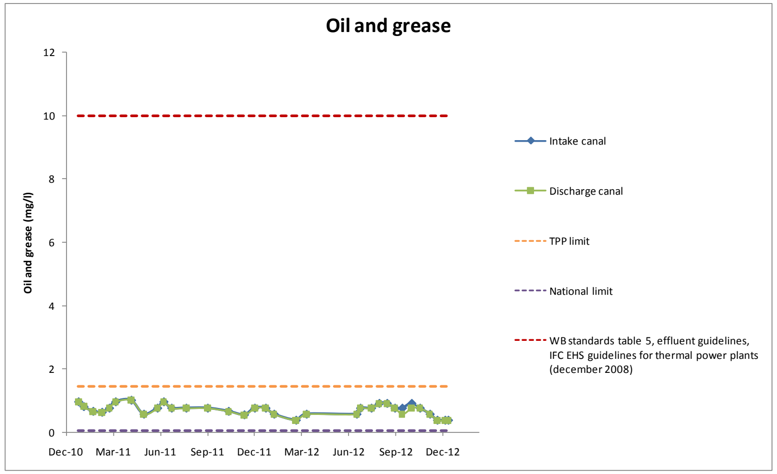
In order to find out the value concentration of the parameters included in the World Bank effluent standards (thermal power plants EHS IFC guidelines, 2007) that are not being currently monitored, an analysis was undertaken on the 6th of march of 2013 which results are shown in **Error! Reference source not found.**.



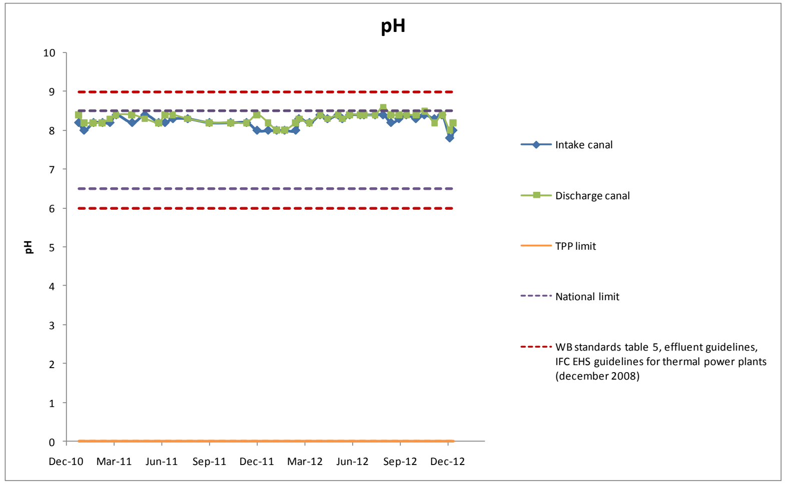
Total suspended solids (TSS)
TSS (mg/l)
350
300
250
200
150
100
50
0
Dec-10
Mar-11
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Intake canal
Discharge canal
TPP limit
National limit
WB standards table 5, effluent guidelines, IFC EHS guidelines for thermal power plants (december 2008)



Fe
Fe (mg/l)
1.2
1
0.8
0.6
0.4
0.2
0
Dec-10
Mar-11
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Intake canal
Discharge canal
TPP limit
National limit
WB standards table 5, effluent guidelines, IFC EHS guidelines for thermal power plants (december 2008)



Oil and grease
Oil and grease (mg/l)
12
10
8
6
4
2
0
Dec-10
Mar-11
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Intake canal
Discharge canal
TPP limit
National limit
WB standards table 5, effluent guidelines, IFC EHS guidelines for thermal power plants (december 2008)



pH
pH
10
9
8
7
6
5
4
3
2
1
0
Dec-10
Mar-11
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Intake canal
Discharge canal
TPP limit
National limit
WB standards table 5, effluent guidelines, IFC EHS guidelines for thermal power plants (december 2008)

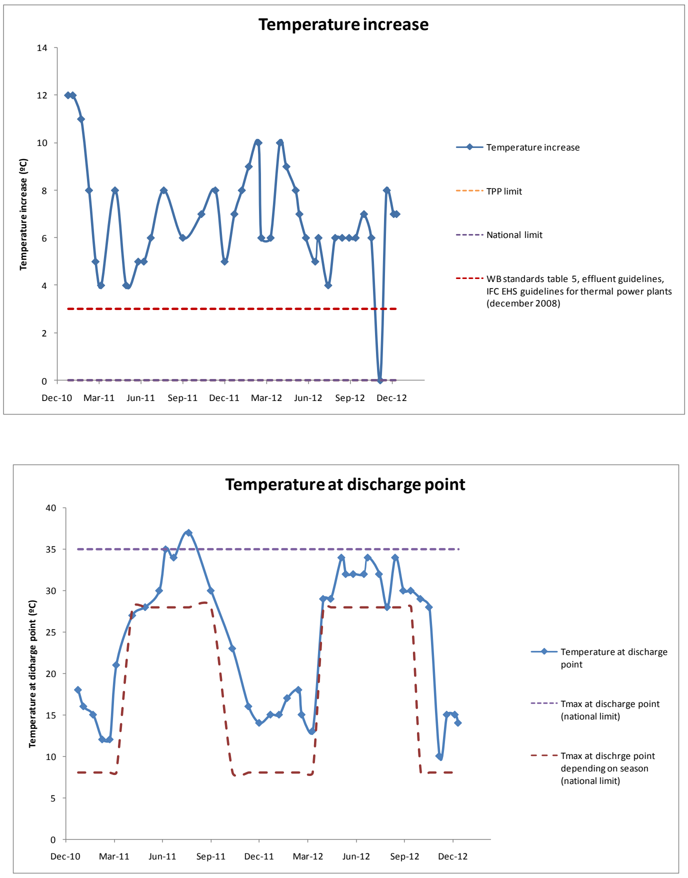


Figure 15. Results of surface water analysis conducted by the TPP.

Table 18. Results of surface water analysis conducted on the 6th of March

Parameter	Water intake canal	Water discharge canal	TPP limits	WB limits
	Measured concentration (mg/dm^3)		MAC (mg/dm^3)	MAC (mg/dm^3)
Pb	0.0001	0.0001	0.03	0.5
Cd	0.00032	0.00035	0.005	0.1
Cu	0.0065	0.0059	0.001	0.5
Zn	0.011	0.0096	0.01	1
Fe	0.6435	0.7155	0.3	1
Cr3+	0.007	0.0065	-	0.5
As	0.022	0.0126	0.05	0.5
Hg	Not detected	Not detected	-	0.005
pH	7.78	7.94	6.5-8.5	6-9
Suspended solids	10	120	103	50
Residual chlorine	Not detected	Not detected	-	0.2
Oil products	0.08	0.22	1.45	10

- **Total suspended solids**

The content of total suspended matter widely varies from one measurement to the next, having reached values above 300 mg/l.

The World Bank's standard is frequently exceeded at discharge point but this is because it is already exceeded at the intake point. The maximum allowable concentration of total suspended solids for the TPP (103 mg/land the national limit (100 mg/l) are less restrictive but they are also exceeded at certain points. It seems that in some periods TSS of the discharge point is lower than in the intake, as if the water process in the TPP operation would reduce this parameter.

Nevertheless, in the water analysis of the 6th of March, suspended solids World Bank standard is exceeded at the discharge and the value at the discharge is 12 times higher than at the intake.

- **Iron**

The concentration of iron in water at intake and discharge points is very similar and it ranges from 0.05 to 0.3 mg/l. These values are below both World Bank´s standard and the TPP's limits. However, the intake water quality exceeds the content of iron established by the national limits.

Nevertheless, in the water analysis of the 6th of March, iron TPP standard is exceeded both at the intake and discharge points being increased of 1.1. times.

- **Oil and grease**

The content of oil and grease is the same for intake and discharge water and it remains mainly constant between 0.4 and 0.9 mg/l, approximately. This value is below both World Bank´s standard and the TPP's limits. However, even the intake water exceeds the national limits which are more restrictive.

In the water analysis of the 6th of March, even if standards are fulfilled, there is an increase at the discharge of 2.75 times.

This increase could be caused by the oily waste water treatment facility being out of order (the audit visit day, 18th January, was out of order; see next picture)

Figure 16. Oil spot at the discharge point to Suenly canal, on January 18th 2013.

In this respect, if oily water is not discharged at Suenly canal, as explained by the TPP documents, this could not be the reason.

- **pH**

The water pH, at both intake and discharge points, hardly varies and is between 8 and 8.5. It meets World Bank's standards as well as the national and the TPP's limits.

- **Temperature increase**

As the cooling system of the TPP is an open circuit, the increase in temperature from intake to discharge points is quite high. The maximum allowable temperature increase defined by World Bank standards is set at 3ºC, value which is greatly exceeded by the TPP discharge.

According to surface water quality criteria in Uzbekistan standards establish a temperature increase limit for fishing purposes (Suenly canal is defined in this category) of 5ºC in comparing average monthly temperature of the hottest month. As in this period of measurements (2011-2012) maximum temperature has been 30ºC, increase allowed should not exceed 35ºC but, a maximum absolute temperature at the discharge point is established in 8 ºC for winter and 28 ºC for summer. Both standards are exceeding even at the intake point.

Regarding analysis of the 6th of March, other parameters are under TPP limits or World Bank standards (Pb, Cd, Cr, As, Hg, residual chlorine) except Cu which exceeds TPP limits at intake and discharge points (where de concentration is decreased); and Zn just at the intake point.

In relation to sewage effluents, as they are discharged to the Municipal Waste Water Treatment plant, this facility is the one that should fulfill World Bank standards. As we have not been provided with analysis of this municipal facility we don't have evidence of standards fulfillment. There is no evidence of a contract with the municipal facility either.

On the other hand, as previously explained, oily and acid waste water effluents are conducted to the evaporation sludge ponds. In the audit visit was observed that the conditions of these evaporation ponds was quite deficient with cracks and corrosion on the concrete layer as shown in the following pictures:

 Oily waste water evaporation pond	 Detail of the cracked concrete material of the evaporation ponds
 Detail of the cracked concrete material of the evaporation ponds	 Acid waste water evaporation pond cracked and corroded concrete

In order to confirm or rule out potential pollution of soil at the close area of the evaporation ponds, a comprehensive soil study has been carried out. On 2nd March 2013, 13 samples were taken in different places situated within Takhiatash TPP plot. Points 10 to 13 are located close to the existing evaporation ponds. They are marked in the image below.

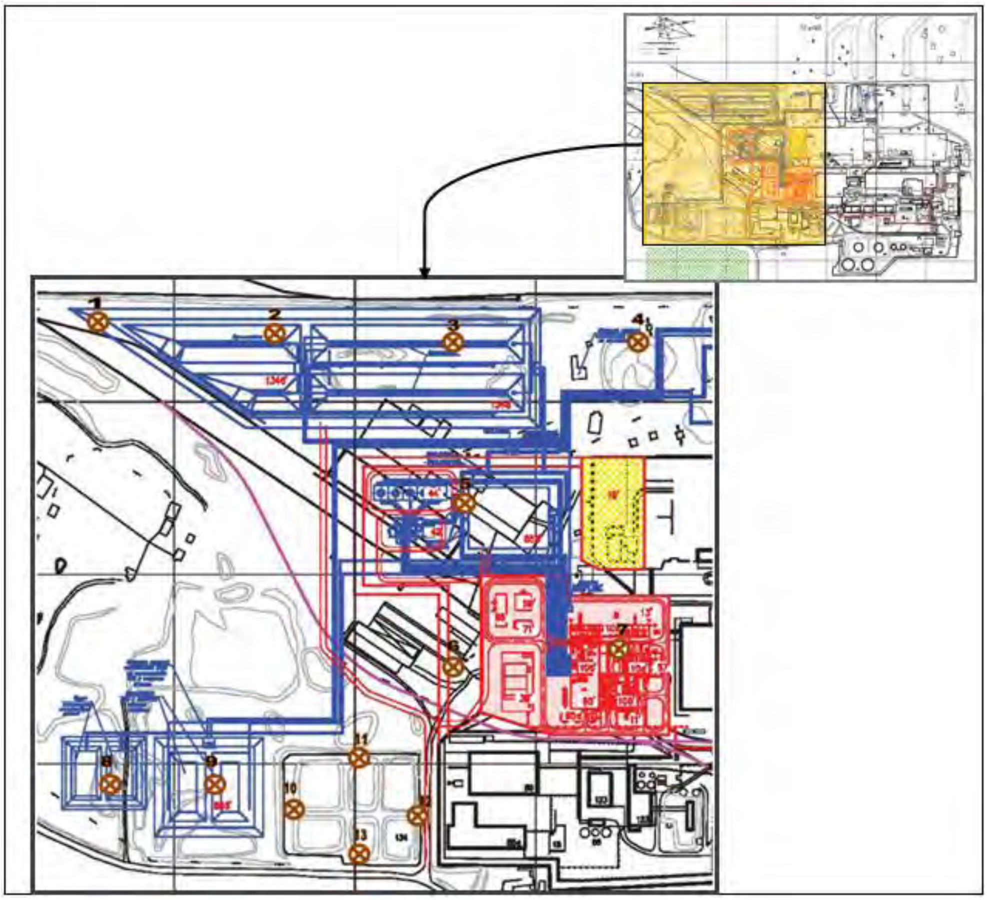


Figure 17. Soil sampling points within Takhiatash TPP plot.

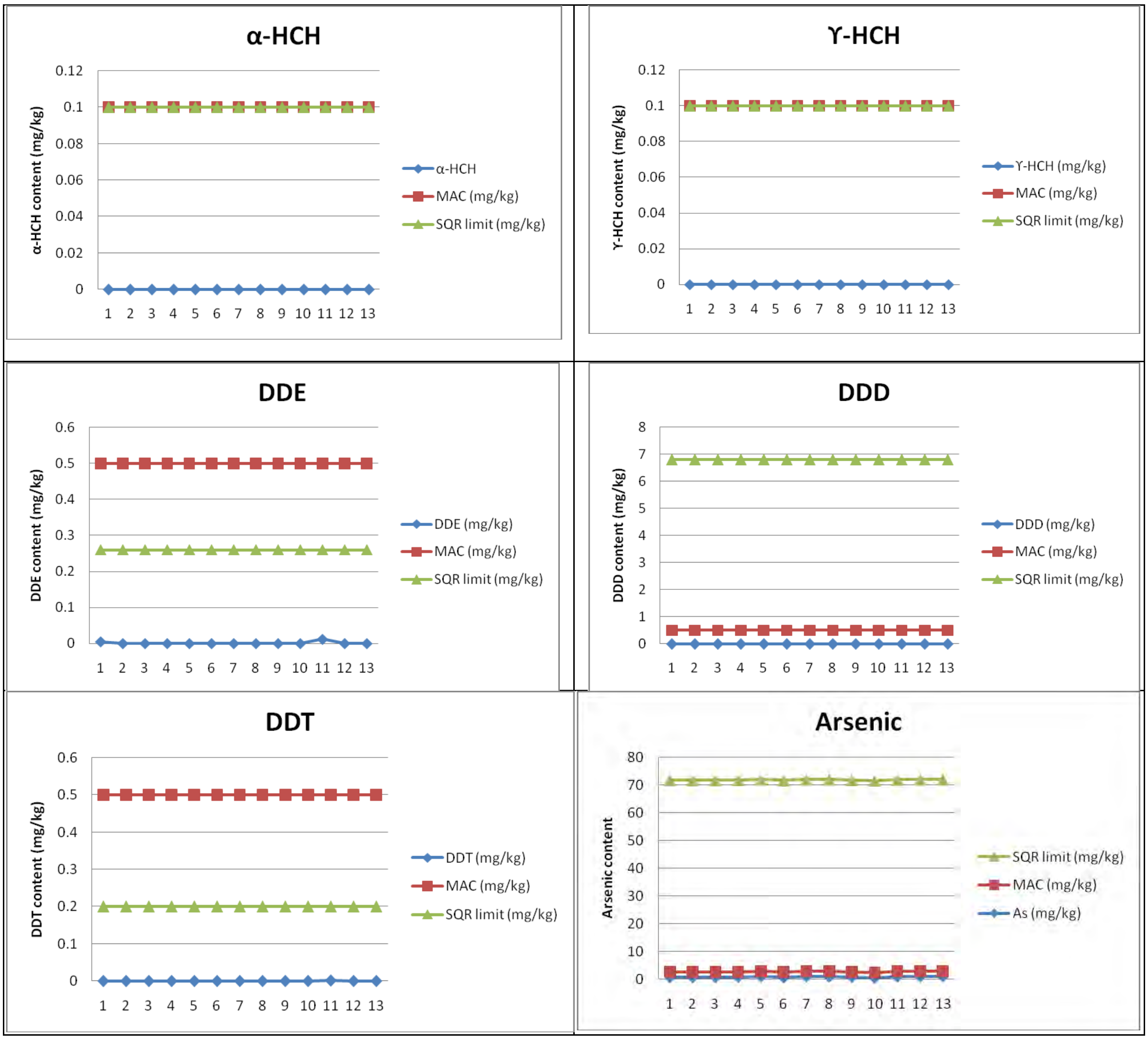
All soil samples have been analysed for the following parameters: Organochlorine Pesticides (α-HCH, ϒ-HCH, DDE, DD, DDT); Heavy Metals (lead, mercury, cadmium copper, zinc, cobalt, nickel, arsenic); Dry residue, moisture, phenol, humus, pH and oil products. In Annex V of the EIA, it can be found all the information related to soil sampling and analysis results and their interpretation and conclusions.

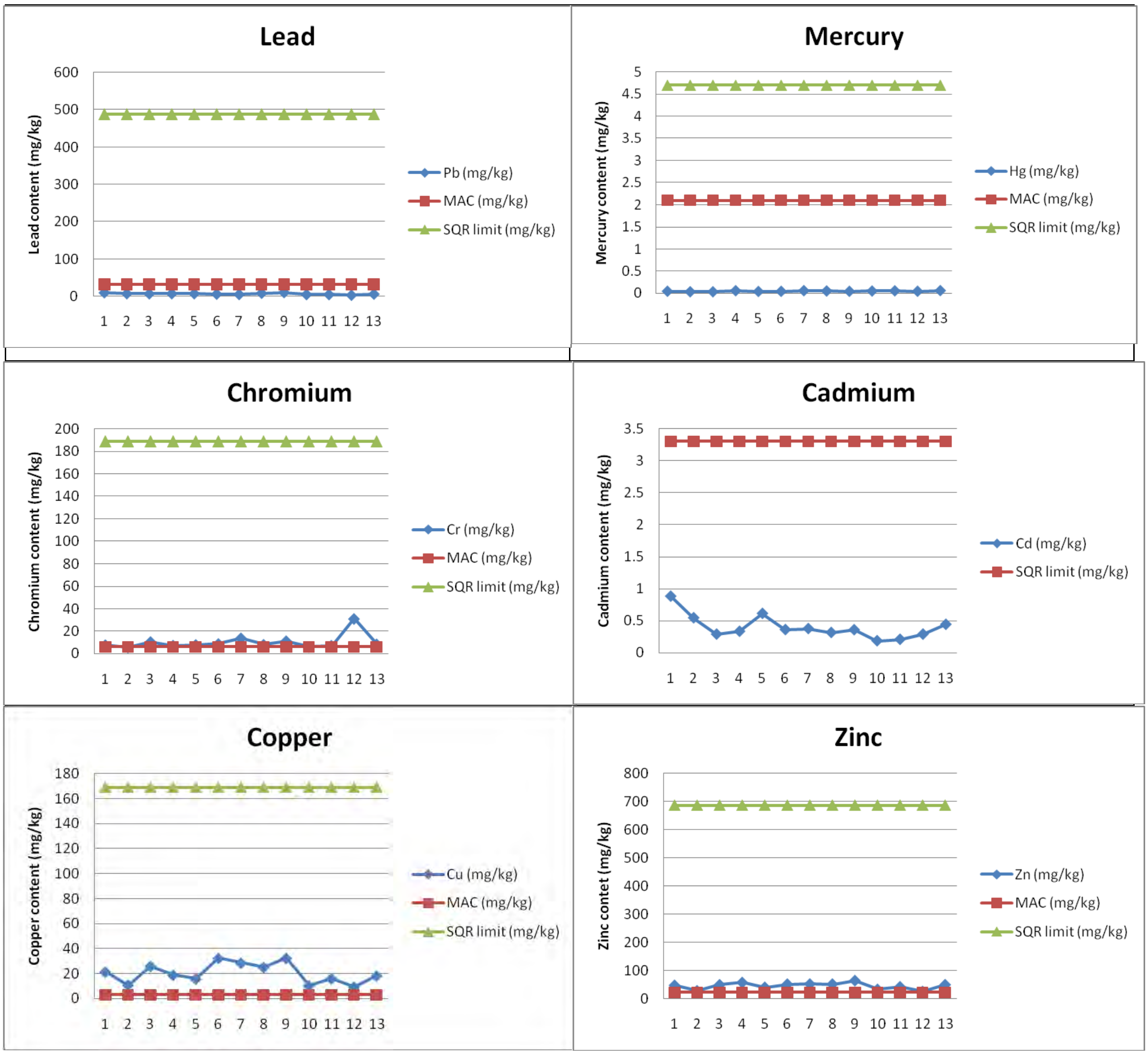
The results have been compared to the Uzbek MACs (Maximum Allowable Concentration) and international standards (maximum values for industrial soil quality class, established in the Soil Quality Regulation[4] (SQR) of The Netherlands)

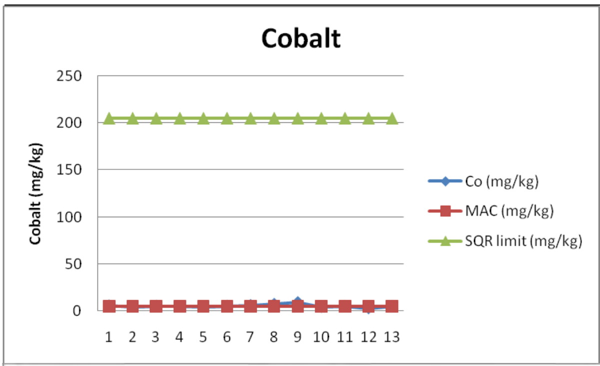
[4] *Soil Quality Regulation*. State Secretary for Housing, Planning and the Environment and State Secretary for Transport, Public Works and Water Management of The Netherlands (2006).

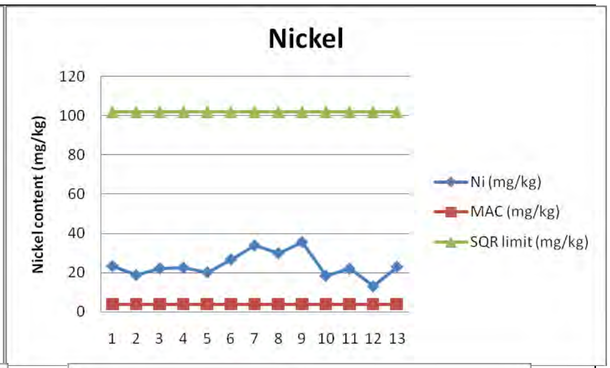
MACs, are based on the principle of a soil that would be fit for all possible functions, ranging from heavy industry to a domestic vegetable garden. Concentrations of contaminants exceeding the MACs do not necessary mean the likelihood of exposure to soil contamination at levels of potential concern to human health if this site is used for human activity. Therefore, the Dutch soil quality criterion is considered worldwide among the leading international approaches to setting soil screening values.

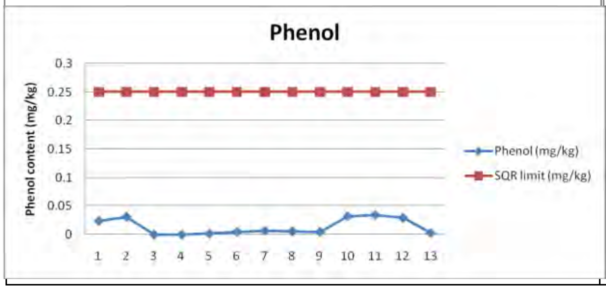
In order to draw conclusions, the results of the analyses carried out are shown in the following graphs.

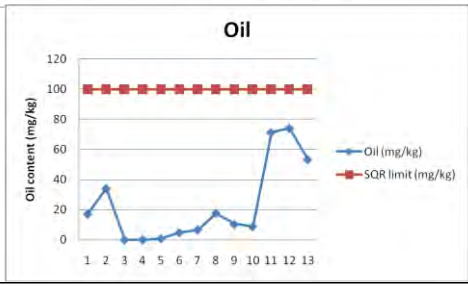



Lead
Lead content (mg/kg)
Pb (mg/kg)
MAC (mg/kg)
SQR limit (mg/kg)
Mercury
Mercury content (mg/kg)
Hg (mg/kg)
MAC (mg/kg)
SQR limit (mg/kg)
Chromium
Chromium content (mg/kg)
Cr (mg/kg)
MAC (mg/kg)
SQR limit (mg/kg)
Cadmium
Cadmium content (mg/kg)
Cd (mg/kg)
SQR limit (mg/kg)
Copper
Copper content (mg/kg)
Cu (mg/kg)
MAC (mg/kg)
SQR limit (mg/kg)
Zinc
Zinc contet (mg/kg)
Zn (mg/kg)
MAC (mg/kg)
SQR limit (mg/kg)









All detected contaminant concentrations in soil are much below their respective corrected maximum value for industrial soil quality class. Nevertheless, It should be pointed out that samples at the evaporation ponds (10 to 13) have a higher content in phenols and oil products that the rest of the points.

D. Hazardous materials management:

Hazardous materials as asbestos that are not allowed in industrialized countries are still been used as repairing materials for the isolation of the equipment. In 2012 131.1 tn (annual average is 94 tn) of asbestos and 2528 kg of paronite were purchased.

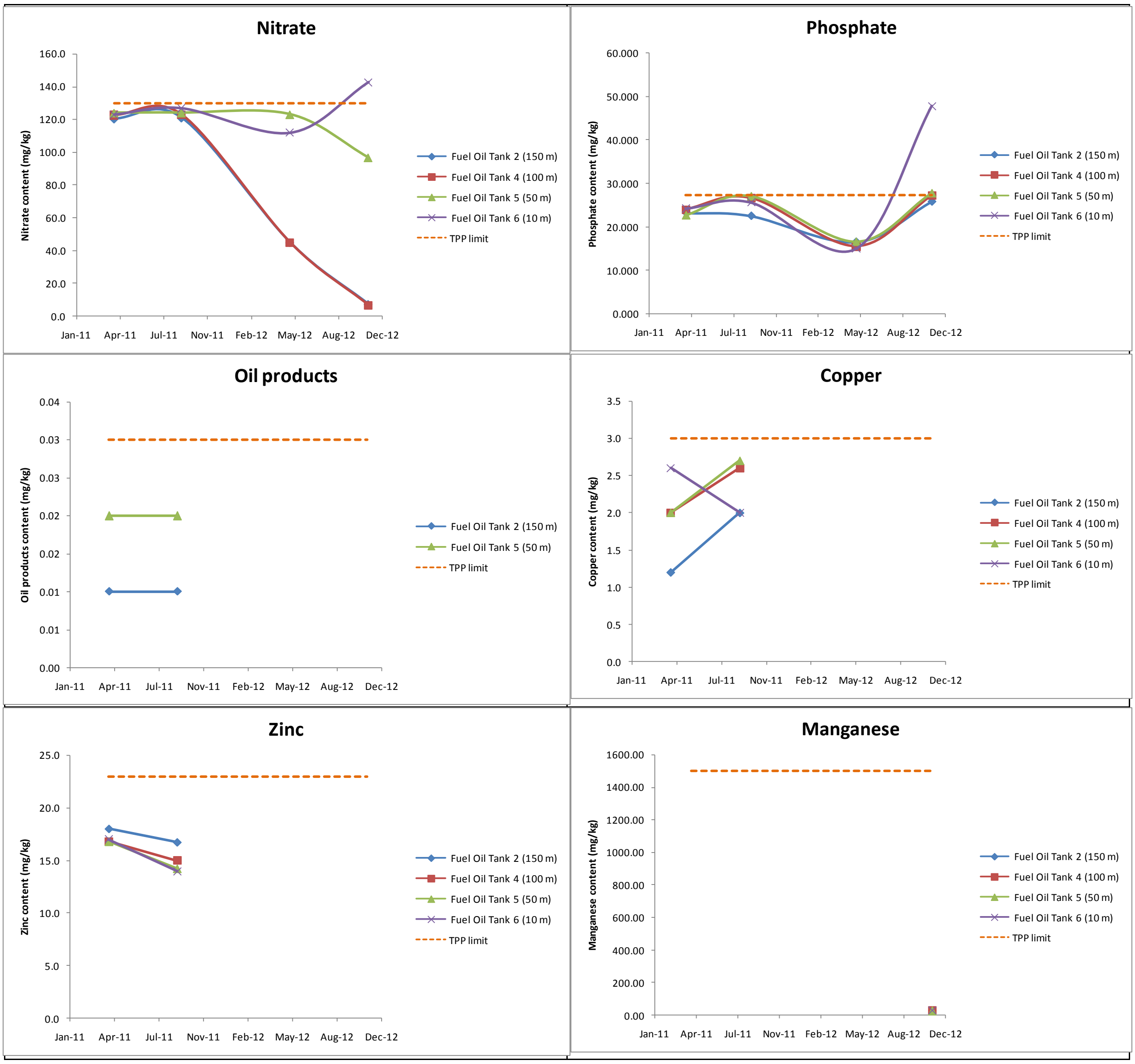
Bad condition of the pipe asbestos isolation that is exposed.

The mazut secondary containments are not made of impervious, chemically resistant material (which is a requirement of the World Bank guidelines) as shown in the following pictures:

Mazut secondary containment material is soil. No impervious material.

Potential mazut spot over the soil basement

At the Takhiatash TPP, samples from four different points are analyzed in a twice-a-year basis. These points are located in the vicinities of the Mazut tanks, at 10, 50, 100 and 150 m of distance. The sampling depth ranges from 0 to 30 m. In the following charts, measurements of years 2011 and 2012 can be observed. Comparison with national soil standards has been also included.



Nitrates and phosphates. The content of phosphates does not vary significantly and is very close to the national limits (27.2 mg/kg). The content of nitrates shows a wide variation and is also below the national MAC (130 mg/kg).

Oil products. Oil products appear in soil samples in a concentration between 0.01 and 0.02 mg/kg, which is below the national limit (0.03 mg/kg) and, logically, it decreases with the distance to the fuel tanks.

Metals. Copper was detected at levels ranging between 1.2 and 2.7 mg/kg, whereas the detected levels of zinc vary between 14 and 18 mg/kg. As it can be observed in the charts, the national MACs are not exceeded.

The above results show that there is not soil pollution outside the secondary containments of mazut tanks for those parameters. Nevertheless, visual inspection of basement of secondary containments shows potential mazut spots.

There is no evidence of the size of the secondary containments fulfilling volume required by the World Bank.

Tanks of chemical products are bounded with impervious and chemical resistant material.

There is a chemical storage consisting in a closed warehouse with a basement of concrete, a ventilation valve and roofed.

There is no evidence of proper labeling of hazardous materials.

There is no evidence of absorption devices that facilitate gathering chemical products in the event of a spill.

E. Waste management

During the audit site visit, the following evidences of solid waste storage and disposal were found:

Bin for communal wastes

Wood debris storage

Bin for oiled rags

Used oil bin

 Room for storage lamps	 Used batteries storage
 Used rubber storage	 Municipal landfill used by the TPP

No evidence of the following storage as defined by the TPP was found:

- Concrete covered storage for asbestos and thermo isolation materials
- Metal container for paronite

There is not specific hazardous waste storage but there are different storages for some of the hazardous wastes spread at the site. There are not evidences that for liquid wastes stored greater than 220 liters there is a secondary containment that should be at least 110% of the largest storage container or 25% of the total storage capacity (whichever is greater).

Generally speaking, there is not segregation between hazardous and non hazardous wastes at the current TPP waste management. Hazardous (used paronite, oil sludge, used cationite, used electric isolated materials) are mixed with domestic wastes and send to the municipal landfill. As shown in a previous picture, there is not an environmental design of the Municipal landfill which doesn't include features liners, geotextile, drainage, leachate treatment, etc. These mean that hazardous and non hazardous wastes are dumped directly into the soil which probably could cause soil and groundwater pollution and also health risks.

Asbestos, which are not allowed in industrialized countries, are being reused.

Oiled rags, which should be classified as hazardous wastes, are burned in boiler furnace which has not a proper exhaust gases treatment needed for hazardous wastes combustion which could cause introduction of hazardous materials into the atmosphere.

Only “Vtorchermet” waste collection contractor contract/waste records have been checked. There are no evidences of contract or waste records for the rest of the contractors: oil base storage, Artur LLC, Vtorsyrye, fluorescent lamps collection company, municipal landfill, etc.

There is a tracking of waste generation trends by type and amount of waste generated, carried out on an annual basis.

F. Noise:

At the TPP site, there is not background noise data as a noise campaign has never been performed.

With the purpose of knowing the currently background level noise in the surrounding areas of Takhiatash TPP, a background noise level measuring campaign was carried out on 4th and 5th March 2013 in the day and at night time. Noise measurements were conducted twice per day, always in accordance with appropriate national regulation GOST 12-1050-86 «Method of noise measurements at the working places”. Results of the campaign are shown in Annex IV attached to this EIA.

The measuring points were selected in certain places in order to be representative of the levels of noise at Takhiatash TPP site. Half of the points are located along the zone’s perimeter, bounding the current thermal power plant (points 1 to 4, located at industrial area); the other four are outside the plot of the power plant in order to be representative of the noise perceived by the population of the nearby settlements (points 5 to 8, located at residential areas).

These measuring points are included in the image below.

Figure 18. Location of monitoring points for noise measurements.

For sound level measuring a Noise meter -003-M2_No 2431 was used, tested on 9th September 2012 with number of certificate 786/05.

Residential areas noise standards are the same for the national and World Bank standards. Industrial areas noise standards are included just in the World Bank guidelines.

Results of the background campaign are shown in the table below. This is the final summery of all the data gathered by the campaign. They have been processed in order to obtain an average for day and night time, and draw conclusions about currently background level noise at Takhiatash TPP.

Table 19. Results of the pre-operational campaign.

<table>
<tr><th rowspan="2">Point</th><th rowspan="2">Receiver</th><th colspan="2">Monitoring campaign results (dB(A))</th><th colspan="2">Reference standard, by law (dB(A))</th></tr>
<tr><th>Day</th><th>Night</th><th>Day</th><th>Night</th></tr>
<tr><td>P1</td><td>Industrial area</td><td>55</td><td>62</td><td colspan="2" rowspan="4">70</td></tr>
<tr><td>P2</td><td>Industrial area</td><td>54</td><td>60</td></tr>
<tr><td>P3</td><td>Industrial area</td><td>55</td><td>62</td></tr>
<tr><td>P4</td><td>Industrial area</td><td>51</td><td>44</td></tr>
<tr><td>P5</td><td>Residential area</td><td>53</td><td>54</td><td rowspan="4">55</td><td rowspan="4">45</td></tr>
<tr><td>P6</td><td>Residential area</td><td>58</td><td>64</td></tr>
<tr><td>P7</td><td>Residential area</td><td>48</td><td>40</td></tr>
<tr><td>P8</td><td>Residential area</td><td>45</td><td>43</td></tr>
</table>

G. Contaminated land and groundwater

In order to study the groundwater composition, a piezometric network formed by 57 wells-piezometers was deployed at the TPP. The location of the wells where the analysis where performed is shown in the following figure.

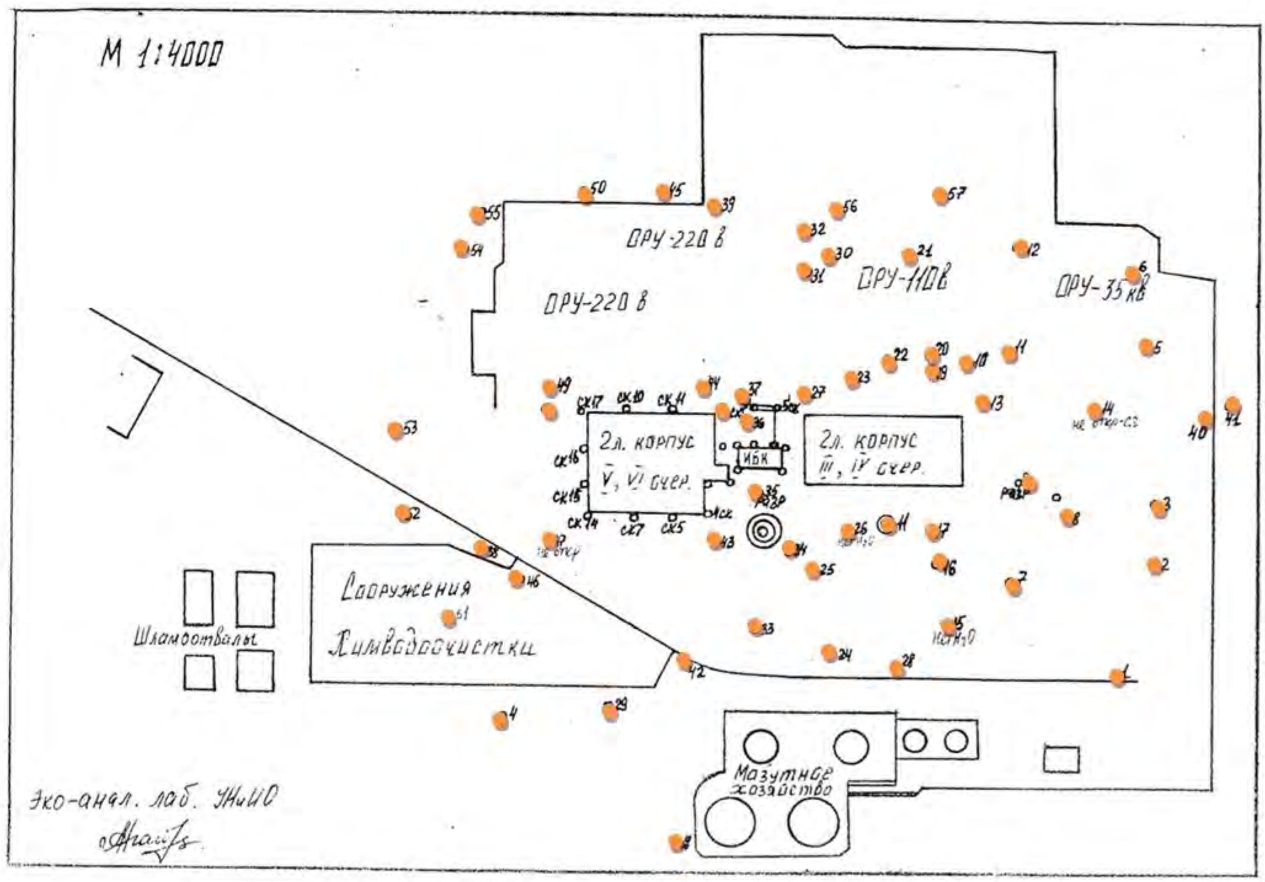


Figure 19. Groundwater sampling site.

Uzbekenergo carries out regular monitoring (every three months) of underground water quality inside the wells.

The parameters measured provided are typical to assess quality of groundwater but not potential contamination.

During the audit visit, a snow layer didn’t allow to proper inspectorate potential soil visible spots or contamination.

There are no evidences of the previous use of the land on the TPP not to be industrial.

H. Health and safety:

Takhiatash TPP has several health and safety procedures which are designed to fulfill national legislation. After reviewing these procedures to compare them with the IFC EHS general guidelines (2007) the following conclusions have been gathered:

a) Occupational health and safety

Regarding "General facility design and operation":

1. Integrity of workplace structures: construction regulations require the design of the facilities in accordance with appropriate national sanitarian norms and standards. The TPP meet these requirements of work safety.
2. Fire precautions: All the departments are equipped with fire detectors and alarm system. A special department (fire protection) is responsible for fire precaution. The fire protection department is located outside of the TPP and it is equipped with necessary facility and staff for firefighting. Worker places defined as appropriate are equipped with fire protection facilities. Every department has a scheme of how to proceed in an evacuation or emergency situation. Trainings on fire safety are conducting by the fire protection department on a quarterly base. Staff from the fire protection department conducts a daily round trip. In addition, the special fire protection team supervises each department on a monthly base.
3. Potable water supply and lavatories and showers: Takhiatash TPP consumes drinking water form municipal water supply organization "Takhiatash vodocanal". This entity is responsible for providing drinking water quality, which meet national standards. There are lavatories in each department at the TPP.
4. Clean eating area: The TPP has its own eating facility – dining room located in the administrative building. The dining room is equipped with all necessary facilities to provide safe food.
5. First Aid: There is a medical center to provide first aid and initial medical treatment for workers on the TPP. Department dealing with chemicals materials has shower facilities and first aid set for accidents. The trainings and tests on providing first air are conducting by the Work safety department on a regular basis.
6. Air supply, Lighting, work environment temperature: Ventilation, work environment temperature and air supply in some work places are not complying with the established national and World Bank requirements.
7. Severe weather and facility Shutdown: There are several refuges on the territory of the Takhiatash TPP. They serve as safety places for emergency situations in cases of natural (earthquakes, hurricanes, flooding) and anthropogenic disasters. Activities undertaken during emergency situation and evacuation plan are provided in the Action Plan in Emergency Situations at the Takhiatash TPP. There are schemes of evacuation on every floor of each TPP's department. Regularly trainings and drills to practice the procedure and plan are undertaken annually. Such drills are conducting annually by a team composed by the engineer on civil safety, representatives of the Ministry on Emergency situations of the Karakalpakstan Republic and local government authority – hokimiyats.
8. Work places and exit: The space provided for each worker is designed in accordance with the appropriate national construction requirements and should be adequate for safe execution of all activities. Nevertheless, some works conducting in temporary manner are executing in uncomfortable positions. This is taking into the account during the work

place assessment and defining the special privileges (additional holydays, earlier retirement) for workers implementing such works. In accordance with TPP fire protection procedure, the passages to emergency exists should be unobstructed at all times. Every exit has a light with sing “Exit” supplied with autonomy energy sources. Special signs indicating direction of movement during emergency situation are placed at the walls.

Regarding “Communication and training”:

Training system at the TPP almost fully comply with World Bank standards on communication and training. Almost all topics are covered. Nevertheless, there is no visitor orientation, as it was checked in the day of the audit visit.

Regarding “Physical hazards”:

Equipment on the TPP has maintenance guideline describing work safety procedures.

Regarding “Chemical hazards”:

There is a procedure on handling hazardous chemicals, their storage and transportation. According to the regulation, special equipment is required to proper organizing this activity. Rooms and departments dealing with hazardous chemicals have a ventilation system and specific PPE. However, in some of the cases chemicals are not storage properly.

Regarding “Personnel Protective Equipment”:

According to procedures adopted at the TPP, workers have to be equipped with PPE such as helmets, eye and face protection, head protection, respiratory protection. Observation conducted at the TPP during the day of the audit visit showed that these requirements are not fully implemented at the TPP. There is no practice to provide PPE for visitors either.

Regarding “Special hazard environments”:

Confined space for electrical equipment at the TPP is designed in accordance with national construction requirements (Electrical Code). There are no places with special hazards environment at the TPP.

Regarding “Monitoring”:

Occupational health and monitoring programs at the TPP includes the following activities:

- Observing the equipment of work places on complying with work safety requirements and its execution by workers;
- Implementation of action plan on the training activities on work safety and fire protection;
- Preparing quarterly reports on the performed activities.

“Uzenergosozlash”’ experts conduct a surveillance of the work environment twice a year. This entity has the certificate on conducting evaluation. All equipment used during the surveillance must have certificates. The same organization conducts an assessment of work places at the TPP every five year. At the Tahkiatash TPP last evaluation of working conditions has been conducted in 2011.

Noise measurements for Takhiatash TPP have been done at 96 working places. Measurements showed exceeding of norms at the most of the reviewed places (around 80%). The biggest exceeding was at the generator - 23 dBA above norm.

Vibration measurements have been also conducted at the places with potential exceeding norms for vibration. 8 working areas have been observed. Vibration level at the most of the reviewed places also exceeds norms. The highest exceeding was observed at the area close to generator – PAN 8 a. Vibration exceeded norm on 8 dB

Microclimate measurements have been conducted for 82 working places. Relative humidity didn't exceed norms, but temperature of most of the work places exceeded norms (around 90% of observed areas).

Air quality has been assessed at 18 work places. Measurements were done for potential pollutants for each place. The maximum exceed has been observed for CO (measured concentration was 36 mg/m3 and allowed 20 mg/m3) at the boilers drum and lime dust (36 mg/m3 and 6 mg/m3 accordingly) at the chemical reagents storage house. Exceeding on asbestos dust have been observed during turbine repairing (14 mg/m3 and 6 mg/m3 accordingly).

Training activities for the employees are conducting at the regular base in accordance with approved work schedule plan. Information on conducted trainings, number of participants and themes of the topics are reported to the main H&S main department in Uzbekenergo on the quarterly and annually basis.

Reporting on occupational accidents and diseases are implementing in accordance with Resolution of Cabinet Ministries of RUz # 286 dated 6 June 1997 "Regulation on consideration and accounting of accidents and other damage of workers health at the production". This regulation almost fully complies with World Bank requirements on this matter.

b) Community health & safety

Regarding "Emergence preparedness and response":

Emergency response procedure has not been provided and therefore has not been possible to check the level of compliance of the World Bank guidelines.

I. Training:

Training system regarding health and safety issues almost fully comply with WB standards. Nevertheless, training in environmental management is not ongoing. There is no evidence of training materials.

J. Social management and communication:

There is not a support or collaboration program with the local communities.

There is not a grievance or complaints mechanism ongoing.

Local communities are not informed of the environmental management plan results and environmental reports are not available to the public.

Emergency plan of the TPP is not communicated to the local population.

5. Findings and areas of concern

The findings may refer to non-compliance with the requirements of the applicable reference standard. Findings and areas of concern arise when there are differences between the requirements and objective evidence.

Once the documentation review, interviews with EHS staff, site reconnaissance, and assessment of the environmental monitoring results have been carried out, the following findings and areas of concern were found:

A. General EHS management, monitoring and report:

There is not a specific environmental, health and safety team with a visible head. There are different tasks (monitoring) undertaken by different areas of the TPP organization structure but without a global perspective and management. An Environmental, Health and Safety Management Team should be appointed within the Takhiatash TPP organization structure with a visible head in order to gather, analyze, solve and report all the related issues from an integrated point of view. Even of number of staff dedicated to environmental, health and safety issues is apparently in correspondence with the TPP, an improvement and updating training program should be provided to the EHS team in order to gather the technical requirements needed. If after training is concluded that an extension of the team would be needed, this should be provided.

An analysis of national methods of the monitoring program should be undertaken in order to check if they comply with quality and strictness of the international methodological standards, such as those published by the International Organization of Standardization (ISO).

The automated and manual equipment should be strictly calibrated in accordance with exactness and requirements of international standards. A plan of calibration and maintenance should be implemented.

Sampling and analysis Quality Assurance/Quality control (QA/QC) plans should be implemented. Analysis and monitoring results should be recorded in automatic and electronic format to improve their assessment.

The annual reports should further summarize the activities undertaken onsite and provide a general idea of the environmental monitoring undertaken onsite in addition to noting compliance with applicable national and international standards. Annual reports include just quantity of emissions, water and waste water flow rates and quantity of waste generated. These annual reports should be completed with other aspects as GHG emissions, air quality and meteorology, noise, water and groundwater quality, soil quality, waste management, health and safety issues and grievance mechanism findings.

It turns out to be advisable the implementation of an Integrated Management System in the existing Takhiatash TPP in a short-term/medium-term period. This would allow the Power Plant to integrate all of organization's processes in to one compete framework, enabling an organization to work as a single unit with unified objectives, promoting a constant improvement in the performance of the entire Power Plant.

In addition, and as the essential point of this recommendation, developing a Management System in accordance with international standards would assure the fulfillment of all *Environmental*, *Health&Safety* and *Quality* requirements established by international legal framework. The implementation could be undertaken in several stages in order to gradually integrate EHS management into the normal operation of the power plant.

Moreover, an effective management system brings many benefits to the organization:

- More efficient resource use

- Improved risk management
- Increase customer satisfaction
- Lower costs

There are three international standards which could be followed:

- ISO 9001 (Quality Management System)
- ISO 14001 (Environmental Management System)
- OHSAS 18001 (Occupational Health and Safety Management System).

B. Air emissions and ambient air quality

In order to improve efficiency of the TPP and therefore to reduce emission of pollutants and GHG, replacement of the old inefficient units by a new and efficient one is highly advisable. Conventional TPPs run with an average thermal efficiency of 31%, compared with 55% of advanced combined cycle gas turbine (CCGT) technology.

As can be observed in the graphs of the previous section, the existing emission values in the TPP do not exceed the approved national MAEs. MAEs are based on flue mass rate units which could allow diluting the exhaust gas emitted to the atmosphere. These MAEs should be based in concentration units. Nevertheless, both stacks exceed World Bank emission standard for NOx. For stack 2, boilers 7 and 8 are the highest contributors. For stack 1 the contribution of the boilers 1 to 4 is quite similar. This conclusion is logical if we take into account age of existing technology at the TPP. In order to improve the emission standards fulfillment, replacement of the old technology by a new and more efficient one should be considered.

As indicated in the World Bank guidelines, “a continuously monitoring of emissions or indicative parameters” should be implemented. An annual emission test at stacks should be undertaken also.

Direct emissions of GHG from the facilities owned or controlled within the physical TPP boundary and indirect emissions associated with the off-site production of power used by Takhiatash TPP should be quantified. Quantification and monitoring of GHG emissions should be conducted annually in accordance with internationally recognized methodologies.

Regarding air quality monitoring, as location of the two existing air quality stations are far away and not in the wind direction from and of the TPP, air quality for parameters consistent with the relevant standards should be monitor either by passive samplers (monthly average) or by seasonal manual sampling (e.g. 1 week/season) at maximum ground level concentration point / sensitive receptors / background point). Measures recorded by the two existing air quality stations and their assessment could be included within the environmental annual reports in order to gather a more complete baseline. All air quality measures could be assessed with the correspondent emissions, speed and wind direction from the TPP in order to conclude the origin source direction that contribute to air pollution.

C. Waste water and ambient water quality

The increase in temperature from intake to discharge points is quite high. The maximum allowable temperature increase defined by World Bank standards is set at 3ºC, value which is greatly exceeded by the TPP discharge. In order to reduce this temperature increase, the conversion of the open cooling water system into a closed one would be highly advisable.

Regarding oil and grease concentration at the discharge point, the origin of the oil spot seen on the audit visit should be find out. In this respect, confirmation of oily effluents not being discharged to Suenly canal should be required to the TPP. Nevertheless, arrangement of the oily waste water treatment facility should be undertaken.

An agreement with the Municipal waste water treatment plant should be put in place to include World Bank indicative values for treated sanitary sewage discharges.

Evaporation sludge ponds should be improved to assure impermeability.

Water quality analysis undertaken by the TPP every 15 days should include World Bank standards for effluents also.

D. Hazardous materials management

Use of asbestos should be avoided or replaced by a non-hazardous material. Asbestos exposure should be not allowed.

Mazut secondary containments should be adapted to assure impervious and chemically resistant characteristics. Basement and walls should be covered by a material gathering these characteristics.

Evidence of the size of the secondary containments fulfilling volume required by the World Bank should be required to the TPP.

Hazardous materials should be correctly labeled and safety sheets visible.

Absorption devices and spill response procedure should be implemented.

E. Waste management

Basel Convention signed by Uzbekistan, general and waste management facilities EHS IFC guidelines (2007) should be fulfilled in the waste management system at the TPP. A waste management hierarchy that consider prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes should be considered. This includes an update of the waste management policy every time a new procedure for prevention, reduction, reuse, recovery, recycling and removal can be introduced in the process or operation management. When a new waste stream is generated, this must be fully characterised, periodic characterisation must be documented, and the waste must be properly handled, in particular hazardous waste. Final disposal must be undertaken in an environmentally sound manner.

Minimizing hazardous waste generation must be carried out by implementing stringent waste segregation to prevent the commingling of non-hazardous and hazardous waste to be managed. Hazardous wastes should be classified according to Basel Convention (see column 10 of table 10).

Takhiatash TPP should be equipped with drums and other suitable containers for collecting hazardous and non hazardous wastes. Their location should be conspicuously marked and made known to all site workers.

For hazardous wastes:

- There will be a temporary storage of hazardous wastes. Solid wastes contained asbestos should be storage into places where they will not be destroyed during period of storage as national legislation requires.
- Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. (sufficient space between incompatibles or physical separation such as walls or containment curbs)

- Store in closed containers away from direct sunlight, wind and rain
- Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110 % of the largest storage container, or 25 % of the total storage capacity (whichever is greater), in that specific location. Should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment
- Provide adequate ventilation where volatile wastes are stored.

The performance of regular audits on the waste segregation and collection practices shall be undertaken.

Types of wastes generated will be packaged and labeled in homologated containers.

After being collected, waste shall be processed depending on type. Sludge from waste treatment plant and water supply treatment needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste.

The current management of wastes of the TPP can be used but some of the procedures should be corrected to fulfill international good practices:

Non-hazardous wastes:

- Reuse

Solid precipitation of the settling tank and pulp dump will be use in agricultural needs as fertilizer only if analyses of the pulp characteristics conclude that there are not hazardous or toxic compounds that could cause a health risk. Should not be accepted a waste that contains organics that are contaminated by potentially hazardous chemicals and/or pathogenic substances and micro-organisms that will not be rendered harmless by the process or may constitute a health or environmental risk.

- Recycle

Iron, metal debris, stubs, wool debris, waste rubber and tires, waste paper and other recyclable waste fractions can be selling to the enterprises currently being used.

- Recover

Only non-hazardous wastes can be burned in existing boiler furnaces.

- Dispose

Rest of non-hazardous wastes that are not being recycled as household and similar waste should be transported to a properly designed, permitted and operated landfill. Municipal landfill currently being used by the TPP is not design in an environmentally sound manner. As an option, an improvement of the landfill to avoid soil and groundwater pollution is recommended. Following measures could be followed:

- Location of the municipal landfill further than 250 meters to residential areas and follow location recommendations of the IFC guidelines.
- Soil cover material, with base and side slopes designed o minimize infiltration and facilitate collection of leachate.
- Low-permeability landfill liners to prevent migration of leachate.
- Drainage and collection system and landfill cover (daily, intermediate, and final) to minimize infiltration.
- Leachate treatment on site and/or discharge to municipal wastewater treatment.

- Perimeter drains and landfill cell compaction, slopes and daily cover materials to reduce infiltration of rainfall into the deposited waste.
- Prevention system of the run-on precipitation into the active area of the landfill and a collection and control run-off system.
- Quantity and quality of leachate generated measured and recorded.
- Groundwater monitoring wells.

Hazardous wastes:

Hazardous waste storage, transfer, disposal and treatment will be done by an authorized waste management facility. The contractors handling, treating and disposing hazardous waste should be reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled (ensuring compliance with applicable local and international regulations).

- Recycled:

Fluorescent lights shall be delivered to a specialized organization on lamp utilization as it is being doing up to now.

- Recover:

Hazardous wastes cannot be burned at existing boiler furnaces as they are not provided with exhaust gas treatment. Hazardous wastes can be burned or incinerated just in approved installations with the proper treatment for exhaust gases in order not to introduce hazardous compounds into the atmosphere.

- Disposed:

If there is not a hazardous waste landfill or storage which have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment neither the permits, certifications, and approvals of applicable government authorities, an specific facility must be constructed or adapted to provide sound long-term storage of wastes on-site or at an alternative appropriate location up until external commercial options become available. In this respect, mazut storage tanks located at 35 km from the TPP can be used as long-term hazardous waste storage considering the following specific adaptation measures:

- Remaining mazut should be completely removed or stabilizated in such a way to avoid potential mixture with the hazardous waste to storage
- Reparation of the potential cracks and fissures that concrete wall, floor and roof could have.
- Divide the tanks into different cells to separate wastes with different properties
- Cement should have low-permeability and be chemically resistant. Otherwise a liner gathering these characteristics should be installed.
- Install a leachate collection and removal system if needed
- Install a groundwater monitoring wells network

Direct discharge will be never allowed on the ground.

The documentation concerning the delivery of waste and contracts/agreements with waste managers should be stored. Records tracking hazardous waste received, stored, or sent out should include: name and identification number, physical condition, quantity, method and date of storage, location of waste at the facility and amount deposited in each area.

F. Noise

As can be noticed in the table included in the previous chapter, where noise measurements of the campaign performed are compared with national and international noise standards, noise levels measurements exceed the limits in two cases. Night measures in points P5 and P6 do not comply with the limits established, as well as day noise levels for P6. This might be due to the proximity of Takhiatash TPP to residential areas which are considered as special sensitive places.

The highest level of noise was measured in point No 6. It is a residential settlement of a former army unit and the houses are located in close proximity to the fence of the plant (see below picture).

Figure 20. Closer houses to the TPP at the southeast area

Apart from the points already mentioned, measurements carried out in all the other points show that the background noise levels comply with the requirements established by the standards.

In order to decrease noise level at the surrounding residential areas, it is highly advisable that old and noisy units are replaced by new and more efficient technology with lower noise emission.

An annual noise campaign should be implemented in order to assess the fulfillment and evolution of noise standards. If complaints about noise arise, a study of noise mitigation measures should be carried out and the best solution implemented.

G. Contamination land and groundwater:

In order to properly assess soil and groundwater potential pollution caused by the operation of the TPP, some of the 57 wells located at the TPP require reconstruction as they are inactive. On top of that, the existing well network should be extended with new wells in areas where soil and groundwater pollution have a higher probability of occurrence by adding one well below each site in the direction of groundwater to surface waterways. These areas are:

- Within the secondary containments of the mazut, oil and chemicals tanks
- Hazardous storage areas
- Evaporation ponds area

Parameters to measure should be extended to include:

- pH
- Oil products
- Metals: arsenic, cadmium, cobalt, copper, chromium, lead, mercury (inorganic), nickel, zinc
- Organochlorine Pesticides
- Phenols

If soil contamination is found (for instance, within the mazut secondary containments) this should be removed and treated as hazardous waste.

H. **Health and Safety management**

Some of the procedures of the TPP are in compliance with international standards (World Bank Guidelines), nevertheless, other procedures are not fulfilling these standards or they even do not exist. Even in the case of the existence of a specific procedure, it doesn't mean that this procedure is ongoing. As an easy example detected in the audit visit, PPE are not used by workers on a regular basis and there is not a supervision to force their use. An update of the Health and Safety Plan and Procedures should be undertaken in order to ensure the World Bank guidelines (IFH EHS general and thermal power plants guidelines) implementation.

Surveillance of the work environment shows clear exceeds on health and safety standards. An improvement on the work environment should be conducted or obligation to use PPE to protect workers should be forced. For instance, management of asbestos at the TPP does not fulfill neither national nor international standards. National standards indicate that "during all process of operation on collecting and temporarily storage of wastes contained asbestos, all workers should wear appropriate wear and respirators"…"works related with wastes loading, transportation, unloading and disposal should be mechanized". Observation of the presence of asbestos at the open air and handling of them by workers shows that these standards are not been followed.

I. Training:

Training system should be improved and completed with a specific environmental management course for all the workers.

J. **Social management and communication:**

A grievance mechanism should be designed, communicated and implanted.

Local communities must be informed of the environmental management plan results by means of having access to the annual environmental reports.

The Emergency Plan of the TPP should be communicated to the local population. Only strategic plans should be confidential. Plans regarding safety of the personnel and population must be communicated and trained.

6. Corrective action plan, costs and schedule (CAP)

The Corrective Action Plan (CAP) must be considered as a set of recommendations to improve environmental performance of the Takhiatash TPP in order to achieve, step by step, an EHS management system at the level required by international institutions and good practices. It should be pointed out that this Corrective Action Plan should be agreed and budgeted by the TPP management unit in order to be implemented. Those corrective actions that only imply a management improvement could be implemented as soon as possible, taking advantage of the willingness of the TPP's staff. Other actions are included in the future project of modernization of the Takhiatash TPP.

The following table outlines the appropriate corrective actions proposed to solve the aforementioned remarks and non conformities along with a schedule for their implementation, the responsible parties and cost.

Table 20. Corrective action plan

(Where EA: Executing Agency Uzbekenergo; TPP EMT: Environmental Management Team of the TPP; EHS staff: Environmental, Health and Safety staff)

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
General EHS management					
1	There is not a specific environmental, health and safety team with a visible head. There are different tasks (e.g. monitoring) undertaken by different areas of the TPP organization structure but without a global perspective and management.	• An Environmental, Health and Safety Management Team should be appointed within the Takhiatash TPP organization structure with a visible head in order to gather, analyze, solve and report all the related issues from an integrated point of view. • A specific training course should be provided to this EMP in order to provide the technical requirements. If after training it is concluded that an increase of the team members is needed, the appropriate experts should be provided to cover the gaps identified.	Before the Commissioning of the new CCPU	TPP director	Staff of the TPP. (see mitigation measure nº 47 of chapter 7 (EMP) of the EIA)
2	There is not an integrated environmental,	• The implementation of an Integrated Management System is highly advisable. This would allow the TPP to integrate all the organization processes into	Short-term/medium-term period. The schedule of	TPP director	Included in the future project of

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
	health and safety management system ongoing.	one single and complete framework, enabling to work as a single unit with unified objectives, promoting a constant improvement in the performance of the entire TPP. The development of a Management System in accordance with international standards (e.g. IFC EHS general and thermal power plants guidelines) would ensure the fulfillment of all Environmental, Health&Safety and Quality requirements established by international legal framework.	implementation must be agreed by the Takhiatash TPP management unit. The implementation could be undertaken in several stages in order to gradually integrate the EHS management into the normal operation of the TPP.		modernization (see mitigation measure nº 1 of chapter 7 (EMP) of the EIA)
Monitoring program					
3	There is no evidence of national methods of the monitoring program complying with international methodological standards.	• A review of national methods of the monitoring program should be undertaken in order to check their compliance with quality and strictness of the international methodological standards, such as those published by the International Organization of Standardization (ISO).	As soon as the mobilization of implementation consultant	TPP EMT	Staff of the TPP. If an specific consultant needs to be hired for the analysis:

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
	Apart from the government requirements in terms of annual air emissions, effluent flow rate and quality and wastes quantities other parameters should be monitored: continuous monitoring of emissions (SO_2, NO, NO_2, CO, O_2, Temperature, pressure and water vapor); air quality (SO_2, NO_2, NO, TSP, PM_{10}, $PM_{2.5}$, CO); meteorological data (wind speed and direction, atmospheric				30000$US

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
	pressure, relative humidity and temperature); noise; effluents (total residual chlorine, Cr, Cu, Zn, Pb, Cd, Hg, As)				
4	There is no evidence of national requirements for calibration for automated and manual equipment being in accordance with exactness and requirements of international standards. There is no Calibration and Maintenance Plan.	• Automated and manual equipment should be strictly calibrated in accordance with exactness and requirements of international standards. • A calibration and maintenance plan should be implemented. Calibration should be normally undertaken annually, but this depends on the specific equipment.	As soon as the mobilization of implementation consultant	TPP EMT	Staff of the TPP. If an specific consultant needs to be hired for the analysis: 30000$US

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
5	There is no evidence of sampling and analysis Quality Assurance / Quality Control Plans. Monitoring results are recorded in hardcopy	• Sampling and analysis Quality Assurance/Quality control (QA/QC) Plans should be implemented. • Analysis and monitoring results should be recorded in automatic and electronic format to facilitate their assessment.	As soon as the mobilization of implementation consultant	TPP EMT	Staff of the TPP. If a specific consultant needs to be hired for the analysis. 30000$US
Report					
6	Annual reports only include data on the quantity of emissions, water and waste water flow rates and quantity of waste generated.	• Annual reports should further summarize the activities undertaken onsite and provide a general idea of the environmental monitoring undertaken onsite in addition to noting compliance with applicable national and international standards. Annual reports should be complemented with other aspects such as GHG emissions, air quality and meteorology, noise, water and groundwater quality, soil quality, waste management, health and safety issues and grievance mechanism findings.	Annually, after commissioning of the new CCPU	TPP EMT	Staff of the TPP
Air emission and ambient air quality					

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
7	The existing emission values in the TPP exceed World Bank emission standard for NOx.	• Replacement of the old technology by a new and more efficient one in order to fulfill with the emission standards and reduce the emission of pollutants and GHG. The project of the replacement of the old units III and IV by a new CCPU satisfies this requirement.	Commissioning of the new CCPU and decommissioning of the old units III and IV	EA	Included in the future project of modernization
8	There is not a continuous emission monitoring system. National MAEs standards are based on flue mass rate units. This could allow the dilution of the exhaust gas emitted to the atmosphere.	• As indicated in the World Bank Guidelines, "a continuously monitoring of emissions or indicative parameters" should be implemented. • Exhaust gas emission pollutants should be measured in a concentration basis, including the percentage of oxygen and indicating if these measurements have been made in dry or wet basis. In the latter case, the percentage of water should be also measured. (see mitigation measure nº 10 in chapter 7 (EMP) of the EIA)	Short-term/medium-term period. The schedule of implementation must be agreed by the Takhiatash TPP management unit.	TPP EMT	720500 $US
9	There is not an annual emission test undertaken at the stacks	• An annual emission test at stacks should be undertaken. (see mitigation measure nº 50 in chapter 7 (EMP) of the EIA)	As soon as the mobilization of implementation consultant.	TPP EMT	(see mitigation measure nº 50 in chapter 7 (EMP) of the EIA)

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
10	Calculation of GHG emission during the operation of the TPP is not being undertaken.	• Direct emissions of GHG from the facilities owned or controlled within the physical TPP boundary and indirect emissions associated with the off-site power production used by Takhiatash TPP should be quantified. Quantification and monitoring of GHG emissions will be conducted annually in accordance with internationally recognized methodologies (2006 IPCC "Guidelines for National Greenhouse Gas Inventories": Volume 1: General Guidance and Reporting and Volume 2: Energy)	As soon as the mobilization of implementation consultant.	TPP EMT	Staff of the TPP- (see mitigation measure nº 49 in chapter 7 (EMP) of the EIA)
11	Neither ambient air quality nor meteorology measurements are being undertaken at the TPP.	• Air quality for parameters consistent with the relevant standards should be monitored either by passive samplers (monthly average) or by seasonal manual sampling (e.g. 1 week/season) at maximum ground level concentration point / sensitive receptors / background point). The project of modernization includes a fixed air quality station and a meteorology station (see mitigation measure nº 11 in chapter 7 (EMP) of the EIA). • Measurements recorded by the two existing air quality stations and their assessment could be included within the environmental annual reports in	Before the commissioning of the new CCPU	TPP EMT	Included in the future project of modernization. (see mitigation measure nº 11 in chapter 7 (EMP) of the EIA).

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
		order to gather a more complete baseline. • All air quality measurements could be assessed with the correspondent data on emissions, wind speed and wind direction from the TPP in order to determine the source direction that contributes to air pollution.			
Wastewater and ambient water quality					
12	The maximum allowable temperature increase defined by World Bank standards is set at 3ºC, value which is greatly exceeded by the TPP's discharge effluent.	• In order to reduce this temperature increase, the conversion of the open cooling water system into a closed one would be highly advisable. The project of the replacement of the old units III and IV by a new CCPU with a closed cooling water system partially satisfy this requirement.	Commissioning of the new CCPU	EA	Included in the future project of modernization

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
13	An oil spot was visible in the discharge area on the audit visit day	• The origin of the oil spot should be found out. In this respect, confirmation of oily effluents not being discharged to Suenly canal is required. • Arrangement of the oily waste water treatment facility should be undertaken	Immediately	TPP direction	65000 $US
14	There is no evidence of fulfillment of the World Bank indicative values for treated sanitary sewage discharges at the Municipal Waste Water Treatment Plant.	• An agreement with the Municipal waste water treatment plant should be made in order to evaluate the fulfillment of World Bank indicative values for treated sanitary sewage discharges (see table 9). In case of Municipal Waste Water Treatment Plant not being fulfilling World Bank standards for sewage effluents, the TPP should implement the adequate treatment to comply with these standards.	Immediately	TPP director	N/A
15	Evaporation ponds are in bad condition (cracked and corroded)	• Evaporation sludge ponds should be improved to ensure impermeability. This can be done by adding another layer of concrete or a liner covering the current one. Concrete/liner should be resistant to extreme changes of temperature (winter-summer),	Short-term/medium-term period. The schedule of implementation must be agreed by	TPP director	74000 $US

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
		impervious and chemically resistant to the sludge to storage. Previously to the arrangements, sludge should be correctly disposed according to their characteristics (see waste management corrective actions).	the Takhiatash TPP management unit.		
16	Water quality analyses at the intake and discharge points do not take into account World Bank effluent standards.	• Water quality analysis undertaken by the TPP every 15 days should include the measurement of all the parameters regulated by the World Bank standards for effluents. (see mitigation measure nº 42 in chapter 7 (EMP) of the EIA).	As soon as the mobilization of implementation consultant. It should de undertaken from the beginning of the construction phase in order to gather a more extended baseline previously to the CCPU operation.	TPP EMT	Included in the future project of modernization. (see mitigation measure nº 42 in chapter 7 (EMP) of the EIA)
Hazardous materials management					
17	Use of asbestos still ongoing at the TPP. These hazardous materials are not	• Use of asbestos should be avoided and replaced by non-hazardous materials. The replacement material recommended is rockwool fiber or vermiculite without asbestos (or similar materials assuring that non hazardous materials are included in the	Immediately	TPP director	Considering: 1.- Asbestos = 1,365 $US/ton 2.- A regular annual

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
	allowed in industrialized developed countries	composition). • Asbestos exposure should not be allowed. • Handling (repair or removal and disposal) of existing Asbestos Containing Materials (ACM) in buildings should: 3. Be only performed by specially trained personnel. Training of specialized personnel and the maintenance and removal methods applied should be equivalent to those required under applicable regulations in the United States and Europe (examples of North American training standards are available at: http://www.osha.gov/SLTC/asbestos/training.html) 4. Follow host country requirements, or in their absence, internationally recognized procedures (Examples include the American Society for Testing and Materials (ASTM) E 1368 - Standard Practice for Visual Inspection of Asbestos Abatement Projects; E 2356 - Standard Practice for Comprehensive Building Asbestos Surveys; and E 2394 - Standard Practice for Maintenance, Renovation and Repair of Installed Asbestos			requirement of isolation material of 94 tons/year: Cost increase due to the isolation material replacement: a) Rockwool 110,000 $US/year (2,535 $US/ton) b) Local vermiculite = 9400 $US/year (1,465 $US/ton)

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
		Cement Products).			
18	The TPP's on-site mazut secondary containments are not impervious.	• Mazut secondary containments should be adapted in order to ensure conditions of imperviousness and chemical resistance. Basement and walls should be covered by a material gathering these characteristics.	Short-term/medium-term period. The schedule of implementation must be agreed by the Takhiatash TPP direction.	TPP director	65000 $US
19	There is no evidence of the actual volume design of mazut secondary containments	• Evidence of the fulfillment of the size of mazut secondary containments with the World Bank standards is required. This volume should be the larger of 110 % of the largest tank or 25% of the combined tank volumes	Immediately	TPP EMT	Staff of the TPP
20	There is no evidence of hazardous materials labels and safety sheets visible on hazardous storage places.	• Hazardous materials should be correctly labeled and safety sheets visible. Example of labeling:	Immediately	TPP EMT	Staff of the TPP

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
					
21	There is no evidence of absorption devices and spill response procedures implemented.	• Absorption devices and spill response procedures should be implemented in order to prevent hazardous materials or wastes spillage. (see mitigation measure nº 51 in chapter 7 (EMP) of the EIA)	Immediately	TPP EMT	Staff of the TPP (see mitigation measure nº 51 in chapter 7 (EMP) of the EIA)
Waste management					
22	Current waste management does not comply with international standards and good practices.	• A new waste management system should be implemented in order to adapt he procedures to international guidelines and good practices. The new waste management system should be based on the recommendations included in chapter 5 of this document.	Before the commissioning of the new CCPU	TPP EMT in close collaboration with local and national authorities	Included in the future project of modernization (see mitigation measure nº 54

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
		(see mitigation measure nº 54 in chapter 7 (EMP) of the EIA)			in chapter 7 (EMP) of the EIA)
Noise					
23	Noise standard in close residential areas is exceeded at some points	• It is highly advisable that old and noisy units are replaced by new and more efficient technology with lower noise levels. The project of replacement the old units (III and IV) by the new CCPU satisfies this requirement.	Commissioning of the new CCPU and decommissioning of the old units III and IV	EA	Included in the future project of modernization
24	There is not noise monitoring campaigns undertaken within the environmental management of the TPP.	• An annual noise campaign should be implemented in order to assess the fulfillment and evolution of noise standards. In case of complaints about noise, a study of noise mitigation measures should be carried out and the best solution should be consequently implemented. (see mitigation measure nº 41 in chapter 7 (EMP) of the EIA)	As soon as the mobilization of implementation consultant. It should be undertaken from the beginning of the construction phase in order to gather a more extended baseline previously to the CCPU operation.	TPP EMT	(see mitigation measure nº 41 in chapter 7 (EMP) of the EIA)
Contamination land and groundwater					
25	Potential soil and	• Some of the 57 wells located at the TPP are inactive	Short-term/medium-	TPP EMT	Option 1: If

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
	groundwater pollution is not well monitored and assessed within environmental management at the TPP.	and require reconstruction. The existing well network should be extended by adding one well below each site in the direction of groundwater to surface waterways at the following areas: - Within the secondary containments of the mazut, oil and chemicals tanks - Hazardous storage areas - Evaporation ponds area The following parameters should be also analyzed: - pH - Oil products - Metals: arsenic, cadmium, cobalt, copper, chromium, lead, mercury (inorganic), nickel, zinc - Organochlorine Pesticides - Phenols If soil contamination is found (for instance, within the mazut secondary containments), this should be removed and treated as hazardous waste.	term period. The schedule of implementation must be agreed by the Takhiatash TPP's direction.		new equipment is purchased for the new CCPU it can be used. Option 2: Cost for campaign for 4 wells 900 $US (3600 $US/yr)

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
26	Bad condition of sludge or evaporation ponds, tanks and pipelines.	• Implementation of an inspection program to maintain the mechanical integrity of pressurized containers, tanks, pipe systems, ventilation and dump valve systems, brace infrastructure, automatic emergency stop systems, controls, pumps and related process equipment. • Periodic monitoring should be carried out to maintain the structural integrity (coatings and retention systems) of sludge ponds, oil, fuel and chemical storages/containers in order to avoid leaks. Where applicable, adequate repairs will be carried out. • Spill response and emergency plans to address accidental spillages should be prepared and implemented (see mitigation measure nº 51 in chapter 7 (EMP) of the EIA)	Immediately	TPP EMT	Staff of the TPP
Health and safety management					
27	Some of the procedures of the TPP do not fulfill	• An update of the Health and Safety Plan and Procedures should be undertaken in order to assure the implementation of World Bank Guidelines (IFH			

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
	international standards (World Bank Guidelines), some other specific procedures are not being implemented and others do not even exist. Surveillance of the work environment shows clear exceeds on health and safety standards.	EHS general and thermal power plants guidelines). (see corrective action nº 2). • Some examples of procedures to de developed are: - Documentation Control - Recording Management - Risk Analysis - Legal Requirements - Internal Audit - Consultation & Communication - Management of Inspections and Control of Safety and Environmental Measures on the Site - Detection of Non-Conformities and AC/AP Monitoring - Sub-Contractor/Supplier Management - Training and Awareness - Accident and Incident Management - Definition of Structures and Responsibilities - PPE - Health and Safety Committee - EHS Performance Surveillance and Measurement - Confined Space			

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
		- Marking - Fire Authorization - Monitoring of Noise Measurements - Management and Use of Sealed Radioactive Sources - Warning Status and Response to an Emergency Situation - Housekeeping - Internal Operation Plan - Monitoring of Measurement Devices. - Near-Miss			
Training					
28	No training on environmental management is ongoing.	• Training system should be improved and completed with a specific environmental management course for all the workers. Training can be provided by the TPP EMT and must include all the procedures that workers should take into account to improve environmental behavior of staff, especially waste management procedures (hazardous and non hazardous segregation, use of containers, etc.). A brief explanation of the TPP's environmental impact and the mitigation and monitoring measures	Immediately	TPP EMT	Staff of the TPP

CORRECTIVE ACTION PLAN					
No.	**LTA remarks**	**Corrective Actions**	**Target date**	**Responsible Party**	**Estimated Cost**
		undertaken regarding emission to the air, air quality, meteorology, noise and effluents should be also included.			
Social management and communication					
29	There is not any grievance mechanism or complaints mechanism ongoing.	• A grievance mechanism should be design, communicated and implanted. (see point 7.4 and chapter 8 of the EIA)	Immediately	TPP EMT	Staff of the TPP
30	Local communities are not informed of the environmental performance of the TPP.	• Local communities must be informed of the Environmental Management Plan results by means of having access to the annual environmental reports.	Immediately	TPP EMT	Staff of the TPP
31	Local communities are not informed of the Emergency Plan of the TPP	• The Emergency Plan of the TPP should be notified to the local population. The mahala to be informed is, at least, the closest one (1 Brigada, Kolhoz “khamza”, Khodjeyli district).	Immediately	TPP EMT	Staff of the TPP

7. Conclusions

First of all, the audit team would like to acknowledge the assistance and good treatment received during the carrying out of this audit.

The audit team notes that this audit has been conducted based on a sample and therefore there might be other non-conformities not identified in the report.

The non-conformities detected are related to non-compliance with regulatory requirements, as set out in the scope of the audit work.

As a result of the audit carried out, it has been concluded that the operation of the existing units of Takhiatash TPP exceeds some international standards (World Bank Group EHS Guidelines) regarding emissions, thermal discharge of effluents, noise and waste management. This is a logical conclusion given the worn out and old existing equipment. In this case, suitable mitigation measures such as the implementation of cleaner and more efficient technologies is highly advisable. According to this strategy, the replacement of old and inefficient units by new and more efficient ones will reduce the emission of pollutants and GHG to the air improving air quality of the area and globally, will reduce the intake and discharge flue rate improving thermal effluent dispersion in the water body, will reduce the consumption of natural gas, etc. A global decrease in noise level would be also expected.

It has been also found that the adequacy of both the documentation and the implementation of the Takhiatash TPP's EHS management to the requirements of the World Bank Guidelines needs to be strengthened. Certain aspects of the procedures should be modified and new ones have to be developed, as indicated in the tables in chapter 6 (Corrective Action Plan), in order to improve the compliance with international requirements.

The corrective action plan must be taken into account as a set of recommendations to improve the environmental performance of the Takhiatash TPP in order to achieve, step by step, an EHS management system at the level required by international institutions and good practices. It must be pointed out that this Corrective Action Plan should be agreed and budgeted by the TPP's management unit, if decided to be implemented. Actions that just imply a management improvement could be put in place as soon as possible taking advantage of the good disposition of the Takhiatash TPP staff.

Given the sampling and punctual nature of this audit, it is necessary to remark to the Organization that the development of the Corrective Action Plan should be based on an investigation to determine the deviation extent. The actions taken should focus on solving the deviations detected instead of correctly the findings after having considered the degree of extension of the deviation.

G. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

G.1. Impact Identification

G.1.1. Introduction

706. In order to identify the impact of the construction and operation of the new CCPU as well as the decommissioning of the existing III and IV units, a cross-reference was made between the project activities that might have an effect on the environment and the environmental factors that might be affected by those activities. A two-dimensional matrix was used for this purpose (project activities or environmental factors potentially adversely affected), where the impacts were presented in a synthetic and visual form. The information presented in the matrix was obtained from the following sources:

- Detailed project analysis and the conclusions of the baseline
- List of project activities likely to cause impacts
- List of environmental factors likely to be affected
- Consultations with groups of experts
- Usage of compared scenarios

G.1.2. Project activities likely to have an effect on the environment

707. The following table summarizes the activities associated to the various components of the project under study.

Table 83. Summary of project activities for Modernization of Takhiatash TPP

PROJECT STRUCTURES	PROJECT ACTIVITIES		
	CONSTRUCTION PHASE	OPERATIONS PHASE	DECOMMISIONING
CCPU includes a Power Generation Block (gas turbine, heat recovery steam generator and steam turbine with a cooling system and all their auxiliaries), Water treatment facilities, oil & chemical produce storage facilities, etc.	• Occupation of land • Land and vegetation clearing • Earthmoving • Trench digging • Construction • Presence of equipment and stocks • Equipment operation (vehicle movement, gas emissions, sound emissions, maintenance) • Hiring personnel • Waste generation, transportation and management. • Mechanic and electrical assembly & commissioning	• Flue gas emissions to the atmosphere • Noise emissions • Water intake • Water consumption • Effluent discharge • Waste generation, transportation & management. • Physical presence of the Power Plant • Hiring personnel and services • Electricity generation • Steam plume from the cooling towers • Maintenance	

PROJECT STRUCTURES	PROJECT ACTIVITIES		
	CONSTRUCTION PHASE	OPERATIONS PHASE	DECOMMISIONING
EQUIPMENT OF THE EXISTING UNITS III AND IV OF TAKHIATASH TPP (oil-gas boilers, steam generators and steam turbines, smoke exhausters, condensers, etc)			• Earthmoving • Decommissioning • Presence of equipment and stocks • Equipment operation (vehicle movement, gas emissions, sound emissions, maintenance) • Hiring personnel • Waste generation, transportation and management.

G.1.3. Environmental factors likely to be affected

708. The baseline lists in a tabular format the environmental factors likely to be affected by the project activities. The table was created by breaking down the environmental subsystems into the lowest level of environmental subfactors. This table is shown on the following page.

Table 84. Environmental factors hierarchy for Modernization of Takhiatash TPP project

<table>
<tr><th>SUBSYSTEM</th><th>ENVIRONMENT</th><th>FACTOR</th><th>SUBFACTOR</th></tr>
<tr><td rowspan="14">NATURAL PHYSICAL SUBSYSTEM</td><td rowspan="8">PHYSICAL ENVIRONMENT</td><td rowspan="3">ATMOSPHERE</td><td>CLIMATE</td></tr>
<tr><td>NOISE COMFORT</td></tr>
<tr><td>AIR QUALITY</td></tr>
<tr><td rowspan="3">SOIL</td><td>RELIEF</td></tr>
<tr><td>SOIL AND SUBSOIL QUALITY</td></tr>
<tr><td>STRUCTURE</td></tr>
<tr><td rowspan="2">HYDROLOGY</td><td>WATER QUALITY</td></tr>
<tr><td>GROUNDWATER QUALITY</td></tr>
<tr><td rowspan="4">BIOTIC ENVIRONMENT</td><td rowspan="2">FAUNA</td><td>FAUNA HABITATS</td></tr>
<tr><td>BEHAVIOUR PATTERNS</td></tr>
<tr><td rowspan="2">FLORA</td><td>NATURAL VEGETATION</td></tr>
<tr><td>ANTHROPIC VEGETATION</td></tr>
<tr><td rowspan="2">PERCEPTUAL ENVIRONMENT</td><td rowspan="2">LANDSCAPE</td><td>LANDSCAPE QUALITY</td></tr>
<tr><td>VISUAL INTRUSION</td></tr>
</table>

<table>
<tr><th>SUBSYSTEM</th><th>ENVIRONMENT</th><th>FACTOR</th><th>SUBFACTOR</th></tr>
<tr><td rowspan="11">POPULATION AND ACTIVITIES SUBSYSTEM</td><td rowspan="3">LAND USE</td><td>RURAL</td><td>AGRICULTURE AND LIVESTOCK USE</td></tr>
<tr><td>PRODUCTIVE</td><td>INDUSTRIAL USE</td></tr>
<tr><td>NATURE CONSERVATION</td><td>PROTECTED LAND</td></tr>
<tr><td rowspan="2">CULTURAL HERITAGE</td><td rowspan="2">RESOURCES</td><td>ARCHEOLOGICAL</td></tr>
<tr><td>INDIGENOUS PEOPLE</td></tr>
<tr><td rowspan="4">POPULATION</td><td rowspan="2">OCCUPATION</td><td>EMPLOYMENT</td></tr>
<tr><td>HEALTH AND SAFETY</td></tr>
<tr><td rowspan="2">WELFARE</td><td>POPULATION WELFARE</td></tr>
<tr><td>DEVELOPMENT OF LOCAL ECONOMY</td></tr>
<tr><td rowspan="2">COMMUNICATION AND INFRASTRUCTURES</td><td rowspan="2">INFRASTRUCTURE</td><td>ENERGY INFRASTRUCTURE</td></tr>
<tr><td>NON-ENERGY INFRASTRUCTURE</td></tr>
</table>

G.1.4. Impact identification matrices

709. Finally, the cross-reference between project actions and environmental factors was generated, as the main item of the impact identification process. The matrix of identification is shown next, in which are included the potential interactions between the project actions and the environmental factors (potential impacts).

Table 85. Impact identification matrix – Works phase

IMPACT IDENTIFICATION MATRIX – WORKS PHASE																										
ENVIRONMENTAL FACTORS																										
PROJECT ACTIVITIES		**NATURAL PHYSICAL SUBSYSTEM**															**POPULATION AND ACTIVITIES SUBSYSTEM**									
		PHYSICAL ENVIRONMENT									BIOTIC ENVIRONMENT				PERCEPTUAL ENVIRONMENT		LAND USE			CULTURE HERITAGE		POPULATION				INFRA ST.
		Atmosphere		Geomorphology	Soil		Hydrology / Hydrogeology		Process		Flora		Fauna		Landscape		Rural	Productive	Nature Conservation	Resources		Occupation		Welfare		Infracts.
COMBINED CYCLE CONSTRUCTION	Land and vegetation clearing					■			■		■	■	■		■	■	■			■						
	Earthmoving	■	■	■		■	■		■	■				■						■						
	Trench digging	■	■	■		■	■		■	■				■						■						
	Occupation of land														■	■	■	■	■		■					
	Construction	■	■							■					■	■	■	■	■				■	■		
	Presence of equipment and stocks				■		■	■							■	■										
	Equipment operation	■	■			■								■									■	■		■
	Hiring personnel its activity	■					■							■								■	■	■	■	
	Waste generation				■			■															■			
EXISTING FACILITIES AND DECOMMISSIONING	Earthmoving	■	■			■																				
	Decommissioning	■	■		■		■	■							■	■		■					■	■	■	
	Presence of equipment and stocks				■		■	■																		
	Equipment operation	■	■			■																		■		■
	Hiring personnel and its activity	■					■															■	■	■	■	
	Waste generation				■			■															■			

Table 86. Impact identification matrix – Operation phase

IMPACT IDENTIFICATION MATRIX - OPERATION PHASE																						
		ENVIRONMENTAL FACTORS																				
PROJECT ACTIVITIES		NATURAL PHYSICAL SUBSYSTEM													POPULATION AND ACTIVITIES SUBSYSTEM							
		PHYSICAL ENVIRONMENT							BIOTIC ENVIRONMENT				PERCEPTUAL ENVIRONMENT		LAND USE			POPULATION				COMM. / INFRASTR.
		Atmosphere			Soil	Hydrology			Flora		Fauna		Landscape		Rural	Product.	Nature Cons.	Occup.		Welfare		Infrast.
		Climate	Noise comfort	Air quality	Soil and subsoil quality	Resource quantity	Water quality	Groundwater quality	Natural Vegetation	Anthropic Vegetation	Fauna habitats	Behavior patterns	Landscape quality	Visual Intrusion	Agriculture and livestock use	Industrial Use	Protected land	Employment	Health & Safety	Population welfare	Development of local economy	Energy infrastructure
CYCLE COMBINED	Flue gas emissions to the atmosphere	■		■													■			■		
	Noise emissions		■									■					■		■	■		
	Water consumption					■			■		■				■		■					
	Effluent discharge						■	■									■					
	Waste generation, transportation & management.				■		■	■											■	■		
	Steam plume from the cooling towers	■			■				■	■				■		■			■	■		
	Physical presence of the Power Plant												■	■								
	Hiring personnel and its activity																	■	■	■	■	
	Maintenance activities																	■	■		■	
	Electricity generation															■		■	■	■	■	■

Table 87. Impacts identified

IMPACTS IDENTIFIED	
CONSTRUCTION AND DECOMMISSIONING PHASES	**OPERATING PHASE**
- Potential discrete and local increase in particulate matter suspended in air. - Potential degradation of air quality due to exhaust emission from construction equipment. - Potential increase in the noise level of the construction sites. - Potential degradation of the local geomorphology. (*) - Potential soil compaction. - Potential increase of suspended solids in water, as a result of construction work. (*) - Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste. - Potential contamination of surface water by sanitary water from workers. - Potential increase of erosion risk due to construction work. (*) - Potential modification of natural drainage in the work area. (*) - Potential elimination of vegetation (*) - Potential reduction in the total area of fauna habitats in the work area. (*) - Impact on and potential discomfort to terrestrial fauna. - Potential modification of landscape during the construction and decommissioning - Potential impact on natural areas. - Potential impact on agriculture, livestock, etc, which take place in the work area due to changes in land use. (*) - Potential impact on historical and archaeological heritage. (*) - Hiring of personnel and reactivation of the local economy during construction and decommissioning phases. - Potential hazards for the health of the personnel and the population. - Increase in traffic. - Potential damage to road infrastructure owing to heavy duty construction traffic.	- Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology. - Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology. - Potential increase in noise levels. - Potential increase of soil salinity due to the cooling towers steam plume deposition - Potential soil and groundwater pollution by accidental spillages or improper waste management. - Water resources intake reduction - Potential effects on water resources due to the increase of water consumed for the new Unit. - Potential alteration of the water quality as a consequence of effluent discharge. - Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one. - Potential impact on the landscape due to the physical presence of the new unit - Potential impact on the landscape caused by the cooling water steam plume. - Potential impact on natural areas. - Potential hiring of personnel for operation of the new unit - Development of the local and regional economy. - Potential health risk for the operation of the cooling towers - Potential hygienic risks for the health and safety of personnel and the surrounding population. - Increase in installed electrical power.

(*) Only in construction phase

G.2. Impact Assessment

G.2.1. Assessment methodology

710. The evaluation of each effect includes the following steps:

A) Description of each impact

711. The impact is first described and analysed. If it is found INSIGNIFICANT, no assessment is performed. If it is found SIGNIFICANT, it is characterised and evaluated. The decision about the impact significance is based on a technique developed by an expert group.

B) Characterisation of effects according to their attributes

712. If the impact is significant, its characterisation is performed using the following attributes:

- Sign: **positive** if the effect is good compared to the previous state of the action, and **negative** if it is harmful.
- Immediacy : **direct** if the effect on an environmental factor is immediate, or **indirect** if the effect is a result of the interaction of multiple environmental factors.
- Accumulation: simple if the impact does not cause side effects, or **cumulative** if its severity increases when the action that generated it continues.
- Synergy: **non-synergistic** if the effect in question does not promote other effects, and **synergistic**, if it does.
- **Timing: short-term** if the effect occurs within one year, midterm if it occurs within five years, and **long-term** if it occurs after a longer time.
- Persistence: permanent if the effect results in a deterioration that is unlimited in time, and **temporary** if the deterioration has a limited term.
- Reversibility: **reversible** if the original conditions naturally reappear after an average period of time, and **irreversible** if the actions of natural processes are by themselves not sufficient to determine the recovery of the original conditions.
- Recoverability: **recoverable** if it is possible to conduct practices or take corrective actions that lower the severity or cancel the effect, and **non-recoverable** if such measures are impossible. It is important to consider whether the affected environment can be replaced.
- **Periodicity: periodic** if the effect is recurrent, or **non-periodic** if it is unpredictable.

- Continuity: continuous if the deterioration is constant in time, or discrete if it occurs intermittently or irregularly.

C) Impact incidence

713. The determination of the impact incidence is carried out in three steps:

714. A weight is assigned to the characteristic that can be taken by each attribute, lying between a maximum value for the most unfavourable and a minimum value for the most favourable.

715. The weight values assigned are as follows:

Table 88. Assigned values

ATTRIBUTE	TYPE	WEIGHT
NATURE	Positive Negative	-- --
IMMEDIACY (Inm)	Direct Indirect	3 1
ACCUMULATION (A)	Cumulative Simple	3 1
SYNERGY (S)	Synergistic Non-synergistic	3 1
TIMING (M)	Short-term Midterm Long-term	3 2 1
PERSISTENCE (P)	Permanent Temporary	3 1
REVERSIBILITY (R)	Reversible Irreversible	1 3
RECOVERABILITY (Rc)	Recoverable Non-recoverable	1 3
PERIODICITY (Pr)	Periodic Non-periodic	3 1
CONTINUITY (C)	Continuous Discrete	3 1

.

716. Applications of a weighted sum function of the attributes, according to their significance. The incidence of each impact is calculated in this manner.

INCIDENCE = Inm + 2A + 2S + M + 2P + 2R + 2Rc + Pr + C

717. This function enables to assess as more significant those attributes such as accumulation, synergy, persistence, reversibility, and recoverability of the impact, multiplying their effect by two when compared to others.

718. Normalization of the incidence values to values between 0 and 1, using the following formula:

$$I_s = \frac{I - I_{min}}{I_{max} - I_{min}}$$

Where:

I_s : impact incidence, normalized between 0 and 1

I : impact incidence, without normalization

I_{max} : maximum value of impact incidence

I_{min} : minimum value of impact incidence

719. The values I_{min} and I_{max} are 14 and 42, respectively, for all except the positive impacts, which are 10 and 30, respectively, to which the recoverability and reversibility attributes were not assigned, as not applicable.

D) Determining the magnitude

720. Compared scenarios and the expert group technique were used to determine the magnitude, assigning values of high, medium, and low. The magnitude of each impact is a function of the quality and quantity of the affected environmental factor. The quality reflects the factor value while the quantity is a measure of the impact extent or intensity.

E) Final value and assessment

721. Finally, the assessment of each impact was based on its incidence and magnitude:

a. **Compatible** impact, if the impact is of low severity and the environment recovers by itself without corrective actions, as soon as the action ceases.

b. **Moderate** impact, if the recovery takes some time, without intensive corrective actions.

c. **Severe** impact, if the recovery takes an extended amount of time, even when corrective actions occur.

d. **Critical** impact, if the environmental conditions are permanently altered, with no possible recovery, even when corrective practices or actions are implemented.

722. In the case of positive impacts, the above characterisation does not apply, as they are completely defined by their incidence and magnitude. he impacts defined in the previous sections are assessed below.

G.2.2. Impact assessment and mitigation measures

723. The assessment was performed separately for the construction, decommissioning and operation phases, to clearly distinguish the impacts generated by each phase and to be able to efficiently devise a series of preventive and corrective actions specific to each phase.

724. As it has been mentioned in the description of the project, the scope of the present assessment relates to the construction of 230-250MW CCPU at Takhiatash TPP as well as the decommissioning of the obsolete existing equipment of units III and IV.

725. No extension in the transmission line neither suenly canal are needed. Gas pipeline to the Gas Distribution Station has a 2 km length and will be traced parallel to the existing pipeline.

G.2.2.1. Construction an decommissioning phases

726. Despite the fact that construction and decommissioning works take place at different times of the project, impacts caused on the environment as a consequence of those activities are fairly similar. This is a logical statement since construction and decommissioning include analogous activities and it is just the sequence of them that is inverse. Therefore, both phases will be analyzed together.

727. In order to perform an appropriate assessment, some details related to the duration and development of the works will be helpful.

728. Regarding the new CCPU, its construction is planned to take place between 2014 and 2018 with a total length of 48 months plus 12 months of pilot test.

729. Once the CCPU completes all tests and it is declared in commercial operation, it will start the decommissioning of the units III and IV. The estimated duration of the main activities involved in the decommissioning is around 19 months which will be in 2018, according to the schedule.

<u>IMPACTS ON ATMOSPHERE</u>

Potential discrete and local increase in particulate matter suspended in air

730. <u>Description.</u> This impact is due to moving the earth during the levelling work for the construction of the new CCPU, such as excavation of foundations, digging trenches for pipes (water, gas and wiring), opening access paths, etc., and by the movement of equipment on non-paved areas. Moreover, demolition of buildings and structures of the units III and IV may also cause an increase of particulate matter in the air.

731. In the present case, since the project is located within an existing industrial facility (Takhiatash TPP), it will not be necessary to build new access routes and certain infrastructure, these are already in place for existing Units. This applies specially to the decommissioning site, which is already well communicated.

732. All the facilities are located within industrial land, including the 21 hectare plot required to establish the new CCPU, so that most land has already been leveled and the earthmoving to be performed will not be too extensive.

Figure 43. Location of the surrounding habited areas

733. Despite the fact that the closest inhabited areas are just around 300 meters far from Takhiatash new CCPU construction site, taking into account the characteristics of the project (usage of existing accesses, flat relief, paved ground, etc.) and the implementation of corrective measures to control dust generation included in the mitigation measures chapter (water sprinkling, trucks covered over with tarpaulins, speed control, etc.), this impact is assessed as **INSIGNIFICANT.**

734. **Potential degradation of air quality due to exhaust emissions from construction and decommissioning equipment.**

735. Description. To carry out all construction and decommissioning works, a considerable fleet of vehicles and equipment is required. Most of this equipment needs a constant consumption of fossil fuels to be burnt, so that exhaust gases are released to the atmosphere.

736. The works have been planned to require the use of various equipment for commissioning activities (cranes, excavators, transportation trucks, etc.) beside the typical decommissioning machinery. This should INSIGNIFICANTLY degrade the air quality considering that, as discussed in the

chapter on mitigation measures, all the vehicles and equipment will have their inspection certificates completed and will be maintain under the programs recommended by manufacturers, which will ensure and efficient consumption of fuel and, consequently, a reduction in their emissions. Therefore, this impact is assessed to be **INSIGNIFICANT**.

737. **Potential increase in the noise level of the construction and decommissioning sites**

738. Description. During the construction and decommissioning phases, the works will cause an increase in the sound pressure levels in the vicinity and surrounding areas, due to the very nature of the work (earthmoving, transportation of materials, equipment and vehicle traffic, etc.) as well as the presence and movement of the on-site personnel.

739. For the determination of the sound pressure level (SPL) generated during the construction phase and decommissioning, it was assumed that the sound wave would propagate through a homogeneous atmosphere, without losses due to attenuation. Therefore, the SPL is defined as follows:

$$SPL_1 = SPL_2 - 20 \times \log_{10} (r_1 / r_2)$$

Where SPL_1 is the sound pressure level at the distance r_1 and SPL_2 is the sound pressure level at the distance r_2.

740. The construction and decommissioning activities will vary according to the advancement of the work. For instance, in the case of construction works, the first stage consists of comprising the filling and preparation of the foundations, which will be the noisiest. The noise levels will change throughout a work day, according to the equipment in operation at a given moment in time.

741. The table below shows the levels of sound pressure generated by the equipment during the works, which are measured at a distance of 1 m from the emission source, correlated with the equipment utilization factors. This data was obtained from measurements performed during works of similar intensity, with variations of ± 3 dB(A).

Table 89. Levels of sound pressure generated by construction/decommissioning equipment

Equipment	Maximum level of noise	Utilisation factor
Air compressor	98 dB(A)	0.4
Backhoe	101 dB(A)	0.16
Concrete mixer	97 dB(A)	0.4
Concrete pump	100 dB(A)	0.4
Concrete vibrator	99 dB(A)	0.1
Crane	91 dB(A)	0.12
Crawler tractor	98 dB(A)	0.16

Equipment	Maximum level of noise	Utilisation factor
Generator	100 dB(A)	0.4
Grader	105 dB(A)	0.05
Drilling machine	102 dB(A)	0.1
Loader	92 dB(A)	0.16
Pneumatic tool	99 dB(A)	0.04
Pump	100 dB(A)	0.4
Saw	98 dB(A)	0.1
Truck	90 dB(A)	0.3
Excavator	97 dB(A)	0.2
Welding machine	90 dB(A)	0.3

742. The noise levels will vary over time, depending on the equipment that is in operation at each moment. The following graph represents the variation of the level of sound pressure generated by the noisiest piece of equipment (105 dB(A)) with distance.

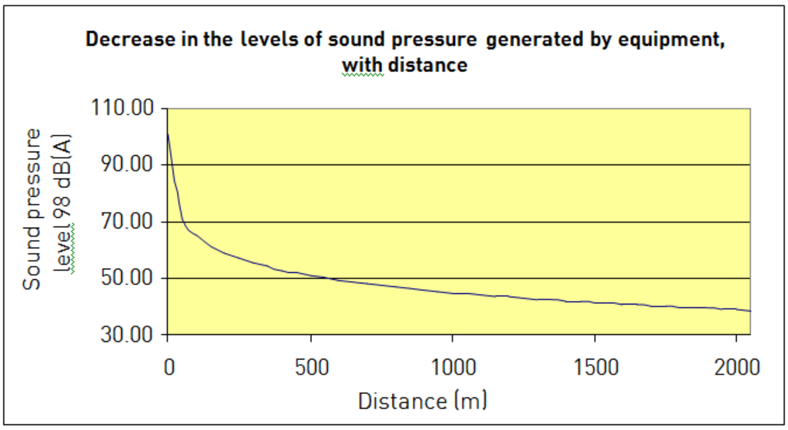


Figure 44. Decrease in the levels of sound pressure generated by equipment, with distance

743. It can be noticed in this graph that the noise falls rapidly with distance (as the emitting source moves farther away).

744. The Uzbek national construction noise norms that are relevant to all stages of the construction and decommissioning phase are provided by law KMK 2.01.08-96 —Protection from noise”.

745. The —Sanitarian Rules and Norms on providing allowed noise level into the living building, public building and territory of living area” (SanR&N No.0267-09) establish the maximum admissible noise level into the living areas, both inside and outside buildings, as next table shows.

746. For another hand, the project must observe World Bank Directives ("Environmental, Health and Safety General Directives, 2007 ") based on those of the WHO. As for the impact of noise beyond the perimeter, the EHS Guidelines stipulate that such noise shall not result in a greater increase of ambient noise than 3 dB at the nearest receiving area outside the site.

747. Residential areas noise standards are the same for the national and World Bank standards. Industrial areas noise standards are included just in the World Bank guidelines.

748. On 4th and 5th March 2013, a noise campaign was done around Takhiatash TPP in order to know the background level noise. Noise measurements were conducted in accordance with appropriate national regulation GOST 12-1050-86 «Method of noise measurements at the working places”. Results of the campaign are shown in Annex IV.

749. The next picture indicates the measured points in the campaign. Points 1 to 4 are classified as industrial area and points 5 to 8 as residential area.

Figure 45. Location of monitoring points for noise measurements

750. In the following table, results of the background measurements, noise produced by the noisiest equipment at the eight receptors considered in the noise campaign, and the total noise perceived in these points is calculated.

Table 90. Results of the background measurements

Point	Monitoring campaign results (dB(A))		Distance to the centre of the new Unit (m)	Equipment SPL at the measurement points (dB(A))	Total = Campaign SPL + Equipment SPL		Reference standard, by law (dB(A))		QUANTITATIVE ASSESSMENT = EQUIPMENT CONTRIBUTION (dB(A))		QUALITATIVE ASSESSMENT	
	Day	Night			Day	Night	Day	Night	Day	Night	Day	Night
P1	55	62	395	53	57	63	70	70	2	1	Without increase	Without increase
P2	54	60	400	53	56	61	70	70	2	1	Without increase	Without increase
P3	55	62	455	52	57	62	70	70	2	0	Without increase	Without increase
P4	51	44	386	53	55	54	70	70	4	10	Perceptible increase	Two times noisier
P5	53	**54**	460	52	55	**56**	55	45	2	2	Without increase	Without increase
P6	**58**	**64**	300	55	**60**	**65**	55	45	2	1	Without increase	Without increase
P7	48	40	623	49	52	**50**	55	45	4	10	Perceptible increase	Two times noisier
P8	45	43	555	50	51	**51**	55	45	6	8	50% noisier	50% noisier

751. According to the table above, the noise levels are already exceeded in the nearby residential area (points 5 and 6).

752. In practice the propagation of the sound waves in open space is affected by a very diverse range of factors and this also has to be considered. Therefore, at great distances the real sources can only be detected occasionally, since the atmosphere is not uniform and there are also topographical irregularities. In short, there are various factors that can affect the propagation of sound, and these can also occur both individually and simultaneously. Because of this, when works are carried out, it can be expected that the real sound pressure level values (SPL_1) will be less than those estimated by the calculations.

753. Analysing the calculations shown in the table below, it is noticeable the fact that points P7 and P8 will suffer the impact of the noise caused by construction and decommissioning works, especially during night time. Nevertheless, day levels are fulfilled. At points P5 and P6 there is not a noise increase.

754. Due to the estimation carried out, this impact is considered **SIGNIFICANT.**

755. Characterization and incidence. This impact is direct and negative, is simple and non-synergistic, as it does not facilitate the actions of other impacts. The impact is generated by construction of the new CCPU and the decommissioning of the existing units III and IV, and is thus considered temporary, periodic and discrete because it occurs intermittently during construction and decommissioning works. It is reversible, as the original conditions naturally reappear after a period of time when the works finish. It is recoverable, as corrective measures are planned, in order to reduce the impact. The impact is short-term, when works start.

756. According to the methodology previously described, numerical values will be assigned to the form taken by the attributes, as shown below:

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
SIGN	Negative	-
IMMEDIACY	Direct	3
ACCUMULATION	Simple	1
SYNERGY	Non-synergistic	1
TIMING	Short-term	3
PERSISTENCE	Temporary	1
REVERSIBILITY	Reversible	1
RECOVERABILITY	Recoverable	1
PERIODICITY	Periodic	3
CONTINUITY	Discrete	1
(I=Inm + +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		26
NORMALIZED INCIDENCE (IS=I-Imin/Imax-Imin)		0.43

755. Magnitude. It must be pointed out that in measurement points P7 and P8 the excess of noise reach 10 dB(A) and 8 dB(A) respectively over the level required at nights. It should be noted that the increase in the noise level for these zones due to the works required will be higher than the value of 3 dBA for the maximum increase in the ambient noise prescribed by the World Bank directives.

756. Construction and decommissioning works will last around 79 months but, as explained before, noise intensity will vary within this period depending on the work schedule.

757. In order not to impact in the surrounding population several measures have been included in the mitigation measures chapter. As a rule, the operation of heavy equipment shall be conducted in the time span 7am-7pm only and all events used during start up activities will be adequately silenced to avoid excessive noise. Activities such as steam blowouts and testing safety valves will be programmed for normal working hours.

758. It is expected, that the noise standards will not cause a significant increase in the background noise levels, due to necessary corrective measures. Therefore, the magnitude of the impact is estimated to be medium.

759. Final impact assessment/value. The medium magnitude and the moderate value of incidence (0.43) lead to assess the impact to be MODERATE, with the adoption of protective measures envisaged.

IMPACTS ON GEOLOGY AND EDAPHOLOGY

Potential degradation of the local geomorphology

760. Description. During construction works, it may be necessary to modify the local geomorphology through grading, foundation excavation, access path widening, etc.

761. Regarding surface conditioning, the land where the facilities are planned is classified as industrial use land and is already fairly leveled.

762. The planned construction work will be limited to the industrial site. Its land does not comprise significant geomorphological elements and therefore will not require major changes in the environment. Therefore, this impact is assessed to be **INSIGNIFICANT**.

Potential soil compaction

763. Description. The movement of equipment and the temporary storage of materials on the ground during the construction and decommissioning phases may cause the compaction of the soil. This compaction will take place in the area affected by the construction and decommissioning works, in its vicinity, in the access areas, pipelines, etc.

764. The compaction of the soil involves an increase in its impermeability through the reduction in porosity and the alteration of its capacity to support vegetation (by preventing a correct development of the root systems and the edaphic fauna).

765. The area involved in the construction of the new CCPU is located in an industrial site where the land is already highly modified. In any case mitigation measures are been proposed, with the objective of limiting the impact outside the works area and, where appropriate, restoring and revegetating any land that may be affected. Therefore, the impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON HYDROLOGY

Potential increase of suspended solids in water, as a result of construction work

766. Description. During the construction phase, an increase of suspended matter in the surface water (Suenly canal) close to the work area might occur. This impact would be caused by the drift of fine particles and particulate matter from the bare surfaces which are likely to experience washouts and landslides by run-off water from rain, determining an increase in water turbidity.

767. As mentioned previously, most Takhiatash CCPU site is located within the plot of the existing Takhiatash TPP, in a flat terrain, so there are not steeply sloping areas which make the drift of particulates easier.

768. In terms of climatic conditions, Takhiatash TPP site belongs to Central Asia zone of deserts and semideserts which is characterized by a very low level of precipitation. According to the observations of the meteorological stations, in long-term data, precipitation is in the amount of 80-100 mm per year that falls in the autumn-winter period.

769. By other hand, the construction of water intake station to be built within the existing water intake canal could increase level of particles. In this respect, it should be take into account that the construction work will be performed over a short period of time and that mitigation measures will be implemented to reduce the possibility of materials drift.

770. Despite of the proximity of Suenly canal, due to the high turbidity of its water, the possible contribution from TTP will not be relevant.

771. Taking into account the characteristics of the project described above, beside the fact that the rainfall of the area is low, the probability of fine particles drift does not become relevant. Therefore, this impact is assessed to be **INSIGNIFICANT**.

772. **Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste**

773. Description. The impacts by contamination of the soil and water in the immediate vicinity, which should be considered, are those caused by incorrect storage or handling of the products or waste generated as a consequence of construction and decommissioning works.

774. Waste resulting from construction and decommissioning phases will be classified as **harzadous** according to ―Basel Convention" (that which is made up of materials with certain hazardous characteristics to health and the environment) and **non hazardous** (that which by nature can be treated or stored on the same premises as household waste)

775. Non hazardous waste includes the group of household and similar waste (all domestic waste, waste generated in offices and toilets, packaging, plastics, paper, cardboard, wood, palettes etc.) and waste such as concrete, brick, rubble, iron scrap, steel etc.

776. Despite this kind of materials will be also found among waste generated during decommissioning works, there will be a couple of substances which will require specially exhaustive management: asbestos and PCBs. These two substances have an extraordinary harzadous nature; therefore specific measures for a proper handling and treatment will be undertaken.

777. The list of the main waste materials expected to be generated in the decommissioning of units III and IV is shown below:

Table 91. Main waste materials expected in the decommissioning

Materials	Total quantity (tons)	Hazard (according to Basel Convention)
Asbestos cement plaster	278.4	Harzadous (Annex I: A2050; Y36)
Basalt extra-thin fibre	37	Non-harzadous
Wire netting	16.95	Non-harzadous
Fire resistant concrete	1080	Non-harzadous
Thermo-isolated concrete	762	Non-harzadous (except if containing asbestos)

778. Incorrect storage or handling of these products, materials, and/or waste, may cause accidental spills (leaks and overflows), causing the contamination of soil and water as well as the possible effect on health of nearby population and ecosystems. In order to avoid these possible effects, prior to start of construction or decommissioning, an inventory of waste fractions expected to be generated should be developed for approval of disposal routes and sites. This information will be part of a comprehensive Decommissioning Plan which will provide all the information needed to implement a proper handling of waste and harzadous substances.

779. In light of the amount of waste which might be produced, the nature of those substances, this potential impact turns out to be relevant.

780. Nevertheless, considering the current situation of Takhiatash TPP waste management, there is still a high probability of small quantities of waste being released and causing serious effects. Therefore this impact is SIGNIFICANT.

781. <u>Characterization</u>.The effect is negative, direct, and short-term on the quality of the soil and water.

782. It is cumulative and synergistic, as it does not enable the actions of other effects. Nevertheless, it is also temporary.

783. It will be local to the area where the impact and the deposition occurred, it will be irreversible, because the environment cannot absorb the impact within a short time, and the original conditions will not recover.

784. The effect is also discrete and recoverable, taking into account the implementation of protective and corrective measures. Finally, it is non-periodic, manifesting itself only during the actions that cause it.

785. According to the methodology previously described, numerical values will now be assigned to the form taken by the attributes:

ATTRIBUTE	CHARACTERISATION	NUMERICAL VALUE
SIGN	Negative	-
IMMEDIACY	Direct	3
ACCUMULATION	Cumulative	3
SYNERGY	Synergistic	3
TIMING	Short-term	3
PERSISTENCE	Temporary	1
REVERSIBILITY	Irreversible	3
RECOVERABILITY	Recoverable	1
PERIODICITY (	Non-periodic	1
CONTINUITY	Discrete	1
INCIDENCE (I = Inm +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		30
NORMALIZED INCIDENCE (I_S=I-I_{min}/I_{max}-I_{min})		0.57

786. Magnitude. The storage areas for materials and wastes will be marked out and no materials or waste of any kind will be authorized outside the work areas. The waste management for the future Takhiatash TPP should be adapted to international guidelines and those wastes considered by the Basel Convention to be hazardous will under no circumstances be dumped on the terrain. A general guideline on waste management is included in the mitigation measure chapter.

787. Basically, waste shall be processed depending on type:

Non-hazardous wastes:

-Recycled:

Iron, metal debris, steel, stubs, wool debris, waste rubber and tires, waste paper and other recyclable waste fractions can be selling to the enterprises currently being used in the operation of the existing units.

-Disposed:

Rest of non-hazardous wastes that are not being recycled as household and similar waste and waste such as concrete, brick, etc. should be transported to a properly designed, permitted and operated landfill. Municipal landfill currently being used by the TPP is not design in an environmentally sound manner. An improvement of this landfill to avoid soil and groundwater pollution is advisable.

Hazardous

-Disposed:

The disposal of wastes should always done at an authorize agent. It there is not a hazardous waste landfill or storage which have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment neither the permits, certifications, and approvals of applicable government authorities, an specific facility must be constructed or adapted to provide sound long-term storage of wastes on-site or at an alternative appropriate location up until external commercial options become available.

788. In this respect, the TPP mazut storage located 35 km far away from the power plant, which is currently being emptied (see Project Description chapter), could be adapted to act as long-term hazardous storage. In the mitigation measures chapter several recommendations regarding the adaptation of the storage are included. If every one of the concrete tanks has a capacity of 10000 m3 it could be possible to fit all the decommissioning hazardous wastes in one of the units.

Figure 46. Location of the mazut storage to adapt as a hazardous waste storage

789. In conclusion, through compliance with that established in the waste management system there will be no possibility of contaminating the soil or groundwater. In addition, it has to be considered

that most of the waste generated will have an inert nature. The magnitude of the impact is assessed to be medium.

790. Final impact assessment/value. The medium magnitude of the impact combined with its incidence value of 0.57 results in the impact being assessed to be **MODERATE**.

791. **Potential contamination of surface water by sanitary water from workers**

792. Description. The activities of the construction of the new CCPU and decommissioning of units III and IV, personnel will generate sanitary water that may be released directly to the ground, determining a degradation of the quality of water sources close to the outfall as well as the contamination of soil, and groundwater.

793. During the construction work, the used sanitary water will under no circumstances be released directly into Suenly canal or different nearby streams. The workers will have access to portable toilet units or septic tanks. The tanks will be periodically cleaned and the effluents will be collected and properly processed (e.g. in the Takhiatash municipal waste water treatment plant). In any case, delivery note/receipt of the final treatment should be kept. Therefore, the impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON ENVIRONMENTAL PROCESSES

Potential increase of erosion risk due to construction work

794. Description. The emergence of these erosion phenomena is linked to the land and vegetation clearing, earthmoving, and trench digging activities and to the permanence of bare surfaces in the area occupied by the future Takhiatash CCPU.

795. As it has been previously mentioned, the new CCPU facility will be mostly located within a 21 hectare plot located on the southern border with the TPP which means that it will be still within the industrial zone, getting similar features.

796. Existing access and infrastructure will be used, thereby minimizing the construction area and erosion risks. Furthermore, the topography is relatively flat, therefore relevant erosion processes are not expected to take place as consequence of construction works. Under these circumstances, the impact is assessed to be **INSIGNIFICANT**.

Potential modification of natural drainage in the work area

797. Description. During the construction phase of the Takhiatash CCPU, earthmoving, trench digging, foundation excavations, and building construction activities are necessary. All these activities may alter the natural drainage of the work area, thus modifying the surface run-off due to the interruption of the regular stream lines.

798. This situation is limited to all the surroundings of the Takhiatash CCPU. Considering the fact that the new facility is situated beside existing Takhiatash TPP and in partially already constructed area (railway, buildings, etc), the natural drainage is already modified. No modification to the surface drainage is intended; therefore this impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON VEGETATION

Potential elimination of vegetation.

799. Description. This impact is due to the elimination of the vegetation during land and vegetation clearing of the areas to be occupied by expansion of the new CCPU.

800. The existing access roads will be used and, if the need occurs, new roads will be built within the designated site. The total area that potentially may require clearing will be 21 hectares.

801. In accordance with the environmental baseline carried out by the present environmental impact assessment, there is not a high density of specimens; vegetation is characterized by being mainly sparse. This is due to the high soil and water salinity, sunstroke, frequent dust storms and insufficient system. The presence of halophytic species (*Halostachus caspian, Aeluropus*) is a clear indicator of high soil salinity.

802. More specifically, the vegetation on the CCPU expansion site occurs on land designed for anthropogenic use. Most of the formations encountered throughout the site are anthropogenic (simple herbaceous formations, rarely complex, woody bottom herbaceous).

803. Given the scarcity of vegetation in this area and the low possibility of coming across special specimens, this impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON FAUNA

Potential reduction in the total area of fauna habitats in the work area

804. Description. This impact, due to the elimination of the vegetation during land and vegetation clearing of the areas to be occupied, may cause the displacement of the local animals and therefore a reduction in the fauna habitats of the species living in the area to be occupied.

805. Similar to the impact previously described, owing to the location of the new Takhiatash CCPU is on industrial land, the presence of fauna in this area is low, both in quantity and in value. Therefore, the fauna is already used to living in a no natural environment. Moreover the fauna has no particular value or uniqueness (no rare, endangered or protected species were identified within the study area).

806. Thus, the site surface is little in terms of fauna and the anthropogenic species that live there can move to adjacent areas of similar characteristics. Therefore, the impact is assessed to be **INSIGNIFICANT**.

Impact on and potential discomfort to terrestrial fauna

807. Description. During the construction phase of the Takhiatash TPP expansion, the increase in equipment associated with a stronger human presence may cause a change in regular behaviour of fauna and the temporary or permanent displacement of some individuals from the area.

808. In general, the conversion of the surrounding habitats from natural to anthropogenic, as a result of industrial activity, and the daily presence of the existing TPP workers cause the existing species to adapt to the Power Plant staff presence and operations. Therefore, their behaviour of the specimens living in the area is not affected.

809. Furthermore, mitigation measures will be implemented to minimize the impact, such as traffic control, vehicle speed limitation, restriction on movement of personnel to work areas, use of vehicles with their inspection certificates completed, etc. Therefore, this impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON LANDSCAPE

Potential modification of landscape during the construction and decommissioning

810. Description. The presence of infrastructure and equipment required by the construction of Takhiatash CCPU and decommissioning of the existing units III and IV, as well as the land and vegetation clearing and earthmoving activities will alter the landscape during the construction phase and decommissioning.

811. The landscape around the proposed location for Takhiatash CCPU is dominated by anthropogenic structures (Takhiatash TPP, construction industry enterprises, sintering plant, cereal products plant, etc.). Thus, the occurrence of construction work on a parcel of land which is mostly located within the existing Takhiatash TPP area, in a landscape already artificially altered, makes its intrinsic visual fragility rather low.

812. Both, construction and decommissioning sites are deeply anthropised and have already undergone the impact of industrial use. Therefore, it cannot be considered that the works of the project will mean a relevant alteration on the landscape. Keeping in mind all said above, this impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON LAND USE

Potential impact on natural areas

813. Description. During the construction works of the new Power Thermal Plant, natural areas may undergo the impact of using the land as part of the industrial facility.

814. According to the information compiled in the environmental baseline, Takhiatash TPP is not settled in a protected natural area, sensitive areas or any other level of protection land. Low Amudarya Biosphere Reserve is the closest protected area to Takhiatash CCPU, located on the territory of Amudarya, Berunity districts of Republics Karakalpakstan. That means a distance of around 75 km between Takhiatash CCPU and the Biospheric Reserve.

815. Considering the distance to the closest protected area, there are no expected impacts on natural areas. Therefore, this impact is assessed to be **INSIGNIFICANT**.

Potential impacts on agriculture, livestock, etc., which take place in the work area due to changes in the land use.

816. Description. The power plant will be mainly located within Takhiatash TPP plot, only 21 adjacent hectares will have to be obtained for supporting service buildings and various facilities. Therefore, only this surface of terrain could cause potential changes in the current use of land.

817. Nevertheless, in accordance with the environmental conditions described in the basline, there are no lands destined for agricultural or livestock uses. All the nearby terrains are planned to give service to industrial enterprises.

818. Moreover, as it is mentioned in preventive and corrective measures chapter, once the works are finished the fraction of land used temporally will be restored to its original condition. This impact is assessed as **INSIGNIFICANT**.

IMPACTS ON CULTURAL HERITAGE

Potential impact on historical and archaeological heritage

819. Description. The land and vegetation clearing, earthmoving, and land occupation activities during the construction of the new power thermal plant may affect the archaeological heritage in the area designated for the planned structures.

820. As said before, the new CCPU is planned to be placed in an area previously affected by the construction and operation of existing units of Takhiatash TPP. In the baseline chapter is concluded that, after studying the environment, no archaeological vestiges in the area under study have been found.

821. The closest archeological sites are the remains of Mizdakhan city and the Mausoleum Mazlumhon Suluv around 16 km far from Takhiatash CCPU.

822. In addition, considering that the area under study has no historical and archaeological value and that corrective measures will be taken in case an archaeological vestige is discovered during earthmoving, the impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON POPULATION

Hiring of personnel and reactivation of the local economy during construction and decommissioning works

823. Description. The construction phase of the new CCPU and the decommissioning of units III and IV will require personnel to perform the work. This is a positive impact, resulting in the creation of jobs.

824. The majority of the jobs created during the construction work, estimated to last approximately 60 months (4 years of civil works and one more to implement pilot tests) will need up to 1.000 people at a peak. In the case of decommissioning activities, it will be required up to 400 workers at a peak, during 19 months it lasts.

825. According to the baseline, regarding the percentage of population employed in different sectors, three major activity sectors can be distinguished: 61% other services (the economic activity in this sector is mainly focused on administration, internal affairs, community organizations and etc.), 11% in the industrial sector and 10% in agriculture.

826. The total population in Khodjeyli district is 134.4 thousand people and 47.5 thousand people is in Takhiatash city. From total population around 25 % is less than 16 years old.

827. The majority of the jobs created during construction and decommissioning activities will be temporary during these phases take place.

828. In addition to the direct effect of hiring staff on employment, the construction and decommissioning phases will create other indirect jobs to provide for the needs of housing, catering, petrol stations, etc.

829. Moreover, to purchase the new plot and operate the power plant, it will be required the payment of taxes to the public administration, which means a significant income for the nearby towns. This implies a positive impact on the local economy.

830. In the following graphic is shown the distribution of average incomes of workers in Takhiatash city by branches of national economy in the year 2012.

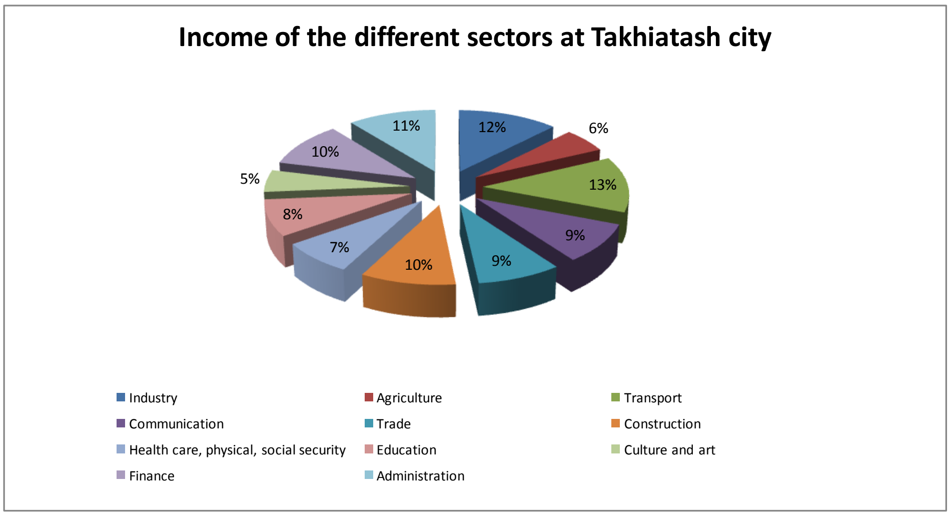


Figure 47. Income per sector at Takhiatash city

831. It can be notice that the contribution by the different sectors is quite equitable. The economic activity generated by the implementation of construction and decommissioning works will specially increase profits of industry, transport and construction.

832. The reactivation of the local economy might also bring a positive effect on national economy due to the importance role that Republic of Karakalpakstan has in the economy of Uzbekistan.

833. Given the high number of jobs created and the duration of construction and decommissioning phases, this impact is considered SIGNIFICANT and is evaluated below.

834. <u>Characterization.</u> The effect is positive and direct on employment. It is simple, as it does not induce secondary or synergistic effects and it enables other favorable effects.

835. It is temporary, as it is limited to approximately 79 months, the duration of the construction and decommissioning, and it is short-term. The effect is non-periodic and continuous, and the modification is constant over the duration of the project construction and decommissioning phase.

836. According to the methodology previously described, numerical values will now be assigned to the form taken by the attributes:

ATTRIBUTE	CHARACTERISATION	NUMERICAL VALUE
SIGN	Positive	+
IMMEDIACY	Direct	3
ACCUMULATION	Simple	1
SYNERGY	Synergistic	3
TIMING	Short-term	3
PERSISTENCE	Temporary	1
PERIODICITY	Non-periodic	1
CONTINUITY	Continuous	3
INCIDENCE (I = Inm + 2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		20
NORMALIZED INCIDENCE (I_S=I-I_{min}/I_{max}-I_{min})		0.50

837. Magnitude. This positive impact will be presented only for the duration of the construction work and decommissioning activities (approximately 79 months). This period will certainly contribute to improving employment in nearby villages, the unemployment rate in the area of Takhiatash being 11.79% (male) and 17.17% (female). In a basic calculation, if we consider population of Takhiatash city, a part of the 1400 workers could be hired from the 39900 people over 16 years.

838. Gender-inclusive core labor standards to promote female employment opportunities with non-discrimination, equal pay for work of equal value will be followed.

839. The number of jobs created and the rise in the wealth of the nearby cities makes this impact to be assessed to be of medium magnitude.

840. Final impact assessment/value. This **POSITIVE** impact is of medium magnitude and has an incidence of 0.50 points.

Potential hazards for health of the personnel and the population.

841. Description. Transboundary epidemic disease transmission is well known and has been observed in many settings. Many infectious diseases, such as cholera, influenza and meningitis, can rapidly and easily spread across national borders, particularly when a project attracts a large influx of potential job seekers during a construction and decommissioning phase. Similarly, a project may bring in large numbers of overseas workers for short-term specially construction work and decommissioning. In some situations, the disease spectrum of the imported workers may be quite different from the host country, e.g., multi-drug resistant tuberculosis, *vivax* versus *falciparum* forms of malaria. In some cases, it may be appropriate for very large scale transboundary projects to consider the potential for global or regional level disease epidemic transmission, e.g., avian influenza and SARS (*Severe Acute Respiratory Syndrome).*

842. Increased incidence of communicable and vector-borne diseases attributable to construction and decommissioning activities represent a potentially serious health threat to project personnel and residents of local communities.

841. Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. The communicable diseases of most concern during the construction phase due to labour mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS.

842. The HIV concerns 14 administrative districts of Uzbekistan, with a rate of prevalence between adults of less than 1 %. In January, 2010, there was calculated in 30.000 the number of persons who were living with HIV in the country.

843. Recognizing that no single measure is likely to be effective in the long term, successful initiatives typically involve a combination of behavioral and environmental modifications. Measures to prevent this issue that should be taken into account in the EHS manual for the activities during the construction and decommissioning phase includes the following recommended interventions at the project level:

- Providing surveillance and active screening and treatment of workers.
- Preventing illness among workers in local communities by:
- Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counselling addressing systemic factors that can influence individual behaviour.
- Training health workers on disease treatment.
- Conducting immunization programmes for workers in local communities to improve health and guard against infection.
- Providing health services.
- Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers.
- Promoting collaboration with local authorities to enhance access by workers' families and the community to public health services and promote immunization.
- Reducing the impact of vector-borne disease on the long-term health of workers. This is best accomplished through the implementation of diverse interventions aimed at eliminating the factors that lead to disease.

844. Moreover, the maximum number of workers (1.000 for construction works and 400 for decommissioning) will only be onsite on isolated occasions, meaning a much smaller group will be present throughout most of the works, specially because decommissioning activities will take place once the construction of the new CCPU is finished.

845. Considering that workers will be medically supervised and will live in proper hygienic conditions, that the number of workers and size of the project are not large enough to easily pose disease epidemics or transmission problems and that, above all, a whole series of preventive measures should be included in the EHS manual, the impact is assessed as **INSIGNIFICANT**.

IMPACTS ON COMMUNICATIONS AND INFRASTRUCTURES

Increase in traffic

846. Description. The construction phase will generate increased traffic due to trucks used for construction work and vehicles used by staff to travel to the work areas. In the same manner, decommissioning activities will require an intense movement of materials and waste from the dismantling of units III and IV, as well as the raise in traffic due to the workers who take part in decommissioning activities. This could cause inconvenience to the population and therefore this impact is assessed to be **SIGNIFICANT**.

847. Characterization.This impact is direct and negative, is simple and non-synergistic, as it does not facilitate the actions of other impacts. The impact is generated by construction of the new CCPU and the decommissioning of the existing units III and IV, and is thus considered temporary, periodic and discrete because it occurs intermittently during construction and decommissioning works. It is reversible, as the original conditions naturally reappear after a period of time when the works finish. It is recoverable, as corrective measures are planned, in order to reduce the impact. The impact is short-term, when works start.

848. According to the methodology previously described, numerical values will be assigned to the form taken by the attributes, as shown below:

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
SIGN	Negative	-
IMMEDIACY	Direct	3
ACCUMULATION	Simple	1
SYNERGY	Non-synergistic	1
TIMING	Short-term	3
PERSISTENCE	Temporary	1
REVERSIBILITY	Reversible	1
RECOVERABILITY	Recoverable	1
PERIODICITY	Periodic	3
CONTINUITY	Discrete	1
(I=Inm + +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		26
NORMALIZED INCIDENCE (IS=I-Imin/Imax-Imin)		0.43

849. Magnitude. In all circumstances, traffic control measures will be implemented to reduce the potential inconvenience, as shown in the chapter on preventive and corrective measures.

850. Basically, a traffic management plan will be developed to include:

- Traffic control will be carried out, including observance of distances between transport vehicles on communication roads belonging to the power plant.
- Confine heavy construction related traffic to the least sensitive access roads to the construction sites to avoid accidents and nuisance to dwellers along the road and other road users.
- No transport or operation of heavy equipment at night. Driving will be only allowed on roads or paths which have been built for this purpose in order to avoid soil compacting.
- Require contractors to prepare and organize work implementation schedules and tasks for proper registration for the vehicles and heavy equipments, driving licenses, requires skills and experience.
- Strict adherence to regulations, especially regarding speeding and overloading
- Provide for contingency planning and rescue operations.
- Conduct regular safety awareness campaigns for both the workforce and the general public, particularly focusing on local schools.
- Traffic regulation measures will be implemented, including traffic signals, and personnel will be placed in charge of reporting hazardous situations

851. After the implementation of the traffic management plant, the magnitude is considered to be **MEDIUM**.

852. Final impact assessment/value. The medium magnitude of the impact combined with its incidence value of 0.43 results in the impact being assessed to be **MODERATE**.

853. **Potential damage to road infrastructure caused by heavy duty construction/decommissioning traffic**

854. Description. Both, construction and decommissioning phase of the project will produce a rise in heavy duty traffic, which may cause the deterioration of the existing road system.

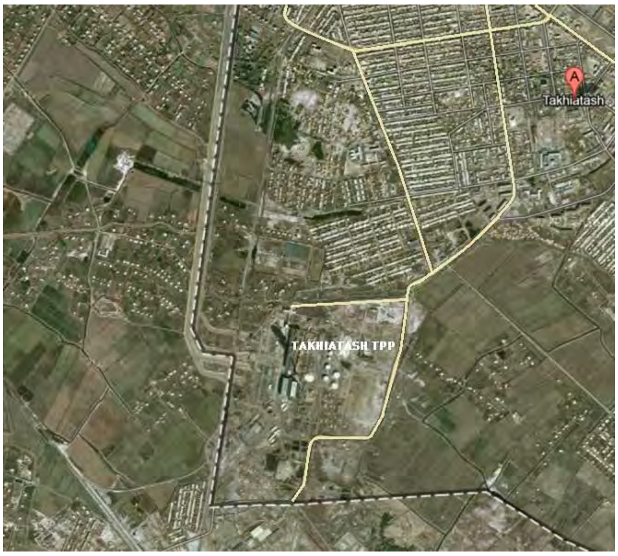


Figure 48. Main existing roads which connect Takhiatash city to the Thermal Power Plant

855. If during the works a deterioration of the communication network is caused by the heavy duty traffic, the damages will be repaired to return to their original condition the roads that might have been affected. Therefore, this impact is assessed to be **INSIGNIFICANT**.

Table 92. Impact assessment summary-construction/decommissioning phases

IMPACT ASSESSMENT SUMMARY - CONSTRUCTION/DECOMMISSIONING PHASES				
IMPACT	**SIGN**	**NORMALIZED INCIDENCE (BETWEEN 0 AND 1)**	**MAGNITUDE**	**FINAL IMPACT VALUE**
Potential discrete and local increase in particulate matter suspended in air.	-	INSIGNIFICANT		
Potential degradation of air quality due to exhaust emissions from construction and decommissioning equipment.	-	INSIGNIFICANT		
Potential increase in the noise level of the construction and decommissioning sites	-	0.43	Medium	MODERATE
Potential degradation of the local geomorphology	-	INSIGNIFICANT		
Potential soil compaction	-	INSIGNIFICANT		
Potential increase of suspended solids in water, as a result of construction work	-	INSIGNIFICANT		
Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste	-	0.57	Medium	MODERATE
Potential contamination of surface water by sanitary water from workers	-	INSIGNIFICANT		
Potential increase of erosion risk due to construction work	-	INSIGNIFICANT		
Potential modification of natural drainage in the work area	-	INSIGNIFICANT		
Potential elimination of vegetation	-	INSIGNIFICANT		
Potential reduction in the total area of fauna habitats in the work area	-	INSIGNIFICANT		
Impact on and potential discomfort to terrestrial fauna	-	INSIGNIFICANT		
Potential modification of landscape during the construction and decommissioning	-	INSIGNIFICANT		
Potential impact on natural areas	-	INSIGNIFICANT		
Potential impacts on agriculture, livestock, etc, which take place in the work area due to changes in land use	-	INSIGNIFICANT		
Potential impact on the historical and archaeological heritage	-	INSIGNIFICANT		
Hiring of personnel and reactivation of the local economy during the construction and decommissioning phase	+	0.50	Medium	---
Potential hazards for the health of the personnel and the population	-	INSIGNIFICANT		
Increase in traffic	-	0.43	Medium	MODERATE
Potential damage to road infrastructure owing to heavy duty construction and decommissioning traffic	-	INSIGNIFICANT		

G.2.2.2. Operations phase

IMPACTS ON ATMOSPHERE

Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology

855. Description.The greenhouse gases absorb a portion of the solar radiation reflected by the earth, the energy being retained in the atmosphere. Conventional wisdom states that rising greenhouse gas emissions could cause global climate changes, potential earth warming, and rising sea levels.

856. The emissions produced by humans during the last decade and their contribution to the global warming of the earth are: carbon dioxide (CO_2, 68%), methane (CH_4, 19 %), nitrous oxide (N_2O, 7 %) and chlorofluorocarbons (CFC, 6 %).

857. Trends in world CO_2 emissions show an accelerated increase during the last century (a trend that should continue unless we take action against it). The increase in world CO_2 emissions has led to a rising concentration of CO_2 in the atmosphere.

858. Uzbekenergo (UE) is the national company in charge of the electricity sector through joint-stock companies in which the State is the main shareholder. Uzbekenergo owns and operates 10 thermal power plants (TPPs) and 28 hydropower plants (HPPs), which represent 87.6% and 12.4% of the total generation capacity, respectively.

859. In 2010, Uzbekistan generated about 51,935 GWh of electric power. The major part of electricity generation was done by thermal power plants. The natural gas was used for 94% of thermal power generation.

860. Uzbekistan‘s energy intensity per unit of GDP is one of the highest in the world and significantly above other middle-income countries. As a result of intensive industrial use of energy, carbon emissions per unit of GDP in Uzbekistan are among the highest in the world. Lowering energy intensity and carbon emissions will increase the economy‘s competitiveness and mitigate climate change impacts.

861. Energy security, affordability, and efficiency are key priorities of the government‘s energy strategy. The government has adopted policy and legal frameworks with clear goals to reduce energy intensity and losses.

862. In this respect, power generation from burning gas in a CCPU is the cleanest method of generation using fossil fuels. The CCPU turbines burning natural gas produce significantly less greenhouse gases than traditional coal or oil fired thermal power stations, as a result of both the less greenhouse intensive nature of natural gas and the greater inherent energy conversion efficiency of CCPU technology. Its performance is much higher (approximately 55%) than a conventional power plant (around 32%). Replacing the existing power generation assets with the energy efficient

CCPU technology is a key strategy for Uzbekistan in order to save energy, secure reliable power supply and mitigate climate change impacts.

863. Within this framework, two of the main objectives for the energy sector in Uzbekistan settled by the ADB by 2016 are:

- Thermal power generation efficiency increased from current 31 % to 50%.
- Greenhouse gas emissions reduced from 4.1 to 2.7 mtCO_2e/GDP.

864. As mentioned in the Country Partnership Strategy 2012–2016 for Uzbekistan (August 2012), ADB will provide support for energy efficiency enhancement as this is closely aligned with Uzbekistan's emphasis on promoting energy security and affordability, and reducing energy intensity.

865. The implementation of this project will allow cutting operational expenses, increasing the efficiency and the reliability of the energy supply to consumers, as well as improving the environmental quality in its area of influence according with the Government and ADB strategies.

866. Uzbekistan is engaged in the fight against Climate Change (CC) at the international and national level. In 1999, it ratified the Kyoto Protocol. The Project will comply with all national standards for GHG emissions in order to contribute to Uzbek targets set in line with the adoption of the Kyoto Protocol.

867. From a global perspective, the replacement of the old conventional units III and IV with a new CCPU for the generation of electricity may play a key role in a global, integrated strategy to reduce greenhouse gas emissions. This impact is assessed as **SIGNIFICANT** and is evaluated below.

868. Characterization. The reduction in greenhouse gases has a direct and positive impact on the climate. It is cumulative and synergistic, because the reduction in greenhouse gases has varying degrees of effect, some reinforcing the effects of others. It occurs in the short term, although it is permanent because the effect is indefinite. Equally, it is periodic and continuous as it occurs recurrently and constantly.

869. Following the methodology described, numerical values were assigned to the attributes:

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
SIGN	Positive	+
IMMEDIACY (Inm)	Direct	3
ACCUMULATION (A)	Cumulative	3
SYNERGY (S)	Synergistic	3
TIMING (M)	Short-term	3
PERSISTENCE (P)	Permanent	3
PERIODICITY (Pr)	Periodic	3

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
CONTINUITY (C)	Continuous	3
INCIDENCE (I=Inm+2A+2S+M+2P+2R+2Rc+Pr+C)		30
STANDARDISED INCIDENCE (I_S=I-I_{min}/I_{max}-I_{min})		1

870. Magnitude. The CO2 emission per year for the new power unit CCPU will be:

Table 93. CO2 emission per year

UNITS	Installed Capacity (MW)	Electricity (GWh/yr)	Gas Usage (million m^3)	CO2 Emission (1,000 tCO_2e)
Existing Plants	730	2,700	1,260	2,400
A New Power Unit (CCPU)	*280*	*2,000*	*400*	*700*
Decomissioning (III and IV units)	310	1,100	540	1,000
Net Change	30	900	140	300
After New Project	700	3,600	1,120	2,100

Source Uzbekenergo and ADB estimates.

871. The reduction of emissions in frames of the project is defined as spread between avoided emissions due to decommissioning III and IV units and the emissions of the new CCPU: 1,000,000 – 700,000 = 300,000 ton CO2 equivalent/year.

872. Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology will be represented by 30% reduction of CO2 emissions per year.

873. If we consider electric power generated in 2010, the reduction the previous percentage between the thermal power plants production would mean a 2.4% national global reduction.

874. Therefore, given the power of the power plant, the impact on the global greenhouse effect is assessed as low.

875. Final impact assessment/value. This POSITIVE impact is low in magnitude and high in incidence (1).

Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology

876. Description. During the operation of the Takhtiatash TPP, the combustion gases will be emitted to the atmosphere, which can produce a degradation of the air quality nearby the facility.

877. To analyse this impact, the fact that air pollution is an integrated system with three basic components should be taken into consideration:
   a. Emission: all substances that pass to the atmosphere after leaving the sources from which they proceed.
   b. Dispersion: after the emission, the pollutants are distributed in the atmosphere via a dispersion process which depends on the characteristics of the pollutants and of the emission source, as well as of the actual weather conditions.
   c. Immission: existing levels of air pollution around the emitting source.

878. Modeling (see Annex III) of the dispersion of pollutants by AERMOD model has allowed study the contribution of different emissions of the combustion of natural gas on current and future scenario on levels of air quality in the region.

879. The aim of the study was to analyse the effect of two scenarios (scenario 1 (current existing units III, IV, V and VI) and scenario 2 (current units V and VI and the future CCPU)) on levels of CO, NO and NO2. SO2 and particulate matter are practically not emitted by the combustion of natural gas. For the scenario 2 the aim of the study was also to determine the optimum stack height for the new CCPU.

872. The simultaneous operation of blocks III, IV, V and VI and the new unit could be possible, however, taking into account the limited transmission capacity and the fact that at present the maximum demand being supplied by the TPP is about 550 MW, all these facilities would not be able to operate at full load simultaneously. Any possible combination of units at different levels of load with a maximum total output of 730 MW would produce in any case a lower level of emissions than those corresponding to the Scenario 1, because some of the current capacity of the units III and IV would be substituted by the same amount of power being generated by the combined cycle unit, with a much higher level of efficiency, thus releasing a lower amount of contaminants.

873. Within these two scenarios, worst case input data has been considered for the simulation:

- Continuous operation with a 100% load
- For the existing units, Maximum Allowed Emissions (MAE), which are the emission standards to be fulfilled in the operation of the TPP, have been taking into account as the emission concentration for the simulation. For the future CCPU, emission concentration levels for the simulation have been defined in compliance World Bank IFC EHS guidelines for Thermal Power Plants IFC Guidelines (December 2008): NOx emission standard has been took for the NO2 emission value for simulation. This is a very stringent hypothesis as NOx emitted is basically composed both of NO2 and NO. On top of that, an 84% of

NOx has been considered to be emitted as NO but, as we are taking all the NO2 as NOx, NO is overestimated also. In this way, we can guarantee than the considered emission values to simulate are the highest possible. For CO, a very conservative bibliographic data has been considered.

874. Regarding air quality baseline, data of years 2011 and 2012 from two air quality stations within the area of study have been analyzed. In summary, measurements indicate that neither national nor international NO2, NO and CO standards are exceed.

875. Due to the replacement of an obsolete technology (units III and IV) with an efficiently one (new CCPU), the emission rate per energy produced will be reduced and therefore it could mean an improvement in the air quality of the area. This impact is considered as **SIGNIFICATIVE** and assessed in the following paragraphs.

876. Characterization and incidence. The impact due to the release of flue gases to the atmosphere is direct and immediate (short-term) on air quality, permanent, as present over the lifetime of the facility, and negative.

877. It is reversible, because when the emission ends, over a short period of time the initial conditions naturally recover. It is recoverable, because corrective measures will be applied as planned (stack height, NOx low burners, etc.). The impact of occurring recurrently, it is thus periodic and continuous.

878. Being an impact whose severity increases if the action that generates it persists, it is considered cumulative. Finally, it is a synergistic impact because it promotes the action of other effects.

879. According to the methodology previously described, numerical values will now be assigned to the form taken by the attributes:

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
SIGN	Negative	-
IMMEDIACY	Direct	3
ACCUMULATION	Cumulative	3
SYNERGY	Synergistic	3
TIMING	Short-term	3
PERSISTENCE	Permanent	3
PERIODICITY	Reversible	1
RECOVERABILITY	Recoverable	1
PERIODICITY	Periodic	3
CONTINUITY	Continuous	3
INCIDENCE		34

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
(I=Inm + +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		
NORMALIZED INCIDENCE (I_S = I - I_{min}/I_{max} - I_{min})		0.71

880. Magnitude. In order to analyze if the air quality limits are being fulfilled, the results of the simulation in the air quality stations is added to the air quality measurements in these stations. The results show that in **neither case immissions from the scenarios exceed air quality limits established** in National Standards for Air Pollutants and the World Bank Group IFC guidelines 2007 even taking into account that:

- For Scenario 1 (current stage), air quality stations already take into account the contribution of the operation of the TPP and therefore, if we add the measurements of the air quality stations to the results of simulation on these stations, we are doubling the results. In any case, the current air quality (in which the contribution due to the operation of the existing units of the TPP is included) is being fulfilled.

- For Scenario 2 (future stage), air quality stations measurements already take into account the contribution of the operation of the remaining units (units V and VI). Therefore, if we add the measurements of the air quality stations to the results of simulation on these stations we are doubling the results. On the other hand, air quality station measurements include the contribution of the units that are going to be decommissioned (units III and IV). Therefore, the air quality measurements that we add to the results of the simulation will be higher than the future air quality. As a result of the two previous facts, forecast results are being overestimated.

881. Regarding the modeling emission values:

- For scenario 1 has been observed annual maximum values of 2.02 μgm-3 NO2 and 0.33 μgm-3 NO (national and World Bank limit 40 and national limit 60 μgm-3 correspondingly) ; for monthly values has been observed that maximum contribution to the levels of the NO2 is about 4.71 μgm-3 (national limit 50 μgm-3), 0.77 μgm-3 (national limit 120 μgm-3) for NO and 0.27 μgm-3 (national limit 3550 μgm-3) for CO. In the case of daily results, maximum values of 12.54 μgm-3 (national limit 60 μgm-3) has been observed for NO2, 2.04 μgm-3 (national limit 250 μgm-3) for NO and 0.72 μgm-3 (national limit 4000 μgm-3) for CO. The maximum hourly value observed for NO2 has been 61.64 μgm-3 (World Bank limit 200 μgm-3). In any case, results are away from the limit legislated.

- For scenario 2 it has obtained similar values, all far below the limits legislation. For example, 1.58 μgm-3 NO2 and 0.76 μgm-3 NO (national and World Bank limit 40 and national limit 60 μgm-3 correspondingly) has been obtained for annual maximum values. For monthly results 3.61 μgm-3 (national limit 50 μgm-3) has been observed as a maximum value of NO2, 1.74 μgm-3 (national limit 120 μgm-3) of NO and 0.76 μgm-3 (national limit 3550 μgm-3) of CO. In the case of NO2 has been observed 9.55 μgm-3 (national limit 60 μgm-3) for daily maximum values, 4.73 μgm-3 (national limit 250 μgm-3)

NO and 2.08 μgm-3 (national limit 4000 μgm-3) CO. Finally, 46.74 μgm-3of NO2 (World Bank limit 200 μgm-3) has been obtained for hourly values.

882. Comparing contribution to air quality baseline between the current and future stages, it can be concluded that NO2 inmissions will be decreased around 40%. Regarding NO and CO, we have to consider that the emission values included in the model for the new CCPU have been very overestimated and comparison with the existing situation (where emission values are fit to operation) would bring into not realistic conclusions.

883. Examination of the simulation maps leads to the conclusion that atmospheric pollution dispersion mainly occur as in the south-south-west direction. This diffusion direction is prevalent both in monthly and annual results. This means that the dispersion plume of the TPP operation affects the Turkmen side but, as the results conclude that the air quality is being improved and this is a positive environmental impact, not specific actions need to be taken into account.

884. The CCPU will be equipped with a continuous emission measuring system, whose task it is to ensure that the unit always remain within legal limits. In order to reduce atmospheric pollutant emissions as far as possible, the project includes a series of corrective measures: low NOx burners, stack of an adequate height to disperse gases, etc. In addition, there will be a monitoring and air quality control, ensuring that limit values for air quality in force are observed, or when necessary, reading off measures for that purpose.

885. Ultimately, the contribution brought by the operation of the new CCPP to the background pollution will be decreased around 40% for NO2, and both national and international air quality standards are fulfilled. Therefore, the magnitude of the impact is assessed to be medium.

886. Final impact assessment/Value. This **POSITIVE** impact is medium in magnitude and high in incidence (0.71).

Potential increase in noise levels

887. Description. Much of the equipment in the new CCPU will create high noise levels during operation. In order to reduce noise levels both inside and outside the premises, there are several mitigation noise and vibration measures included in the project and described in the mitigation measures chapter.

888. The ―Sanitarian Rules and Norms on providing allowed noise level into the living building, public building and territory of living area” (SanR&N No.0267-09) establish the maximum admissible noise level into the living areas, both inside and outside buildings, as next table shows.

889. For another hand, the project must observe World Bank Directives ("Environmental, Health and Safety General Directives, 2007 ") based on those of the WHO. As for the impact of noise beyond the perimeter, the EHS Guidelines stipulate that such noise shall not result in a greater increase of ambient noise than 3 dB at the nearest receiving area outside the site.

890. Residential areas noise standards are the same for the national and World Bank standards. Industrial areas noise standards are included just in the World Bank guidelines.

891. On 4th and 5th March 2013, a noise campaign was done around Takhiatash TPP in order to know the background level noise. Noise measurements were conducted in accordance with appropriate national regulation GOST 12-1050-86 «Method of noise measurements at the working places". Results of the campaign are shown in Annex IV.

892. The next picture indicates the measured points in the campaign. Points 1 to 4 are classified as industrial area and points 5 to 8 as residential area.

Figure 49. Location of monitoring points for noise measurements

893. For the new unit, the weighted acoustic pressure A, measured at 1.5 m from the floor or from the ground, at a distance of 1 m from the noise source, will not exceed 80 dB (A) under normal operating conditions.

894. In order to calculate which could be the increase of noise due to the operation of new CCPU at the receptors, it has been supposed taking a very conservative hypothesis into account, that seven sources of 80 dB(A) can be working at the same point. The sum of these sources would result in 88.45 dB(A)[14].

[14] $SPLt = 10x\log (10 \text{^}(SPL1/10)+\ldots+ 10 \text{^}(SPLn/10))$

895. In addition, it will be considered that the noisiest sources are continuous and constant for 24 hours per day and the noise will be concentrated in a single point (center of CCPU unit).

896. For the receptors, the sound pressure level (SPL) deriving from the operation of the plant, can be estimated with the most adverse scenario ($SPL_2$88.45 dB(A)) assuming that the sound wave is propagated through an atmosphere free of losses through attenuations.

897. Therefore the SPL can be defined by the following equation:

$$SPL_1 = SPL_2 – 20*\log_{10}(r_1/r_2)$$

SPL_2 being the sound pressure level due to the functioning of the CCPU (88.45 dB(A)) at a distance r_2 of 1 m and SPL_1 being the sound pressure level in the receptor at a distance of r_1 in m:

$$SPL_1 = 88.45- 20*\log_{10}(\text{distance}/1)$$

The table below indicates the total noise levels compared to the standards set in reference legislation.

Table 94. Total noise levels compared to the standards

Point	Monitoring campaign results (dB(A))		Distance to the centre of the new Unit (m)	Equipment SPL at the measurement points (dB(A))	Total = Campaign SPL + Equipment SPL		Reference standard, by law (dB(A))		QUANTITATIVE ASSESSMENT = EQUIPMENT CONTRIBUTION (dB(A))		QUALITATIVE ASSESSMENT	
	Day	Night			Day	Night	Day	Night	Day	Night	Day	Night
P1	55	62	395	37	55	62	70	70	0	0	Without increase	Without increase
P2	54	60	400	36	54	60	70	70	0	0	Without increase	Without increase
P3	55	62	455	35	55	62	70	70	0	0	Without increase	Without increase
P4	51	44	386	37	51	45	70	70	0	1	Without increase	Without increase
P5	53	54	460	35	53	54	55	45	0	0	Without increase	Without increase
P6	58	64	300	39	58	64	55	45	0	0	Without increase	Without increase
P7	48	40	623	33	48	41	55	45	0	1	Without increase	Without increase
P8	45	43	555	34	46	43	55	45	0	0	Without increase	Without increase

.

906. As observed, points where standards are exceeded (marked in red), are exceeded because background noise is already over the limits. The contribution of the new CCPU in those points is 0 and in the rest of the points is less than 1 dB(A), therefore not perceptible.

907. We should point out that background level noise campaign includes contribution of units III and IV that will be decommissioned. Therefore, a noise campaign should be done after de decommissioning of units III and IV and operation of CCPU to assess real statement without the contribution of the old units. It is expected that the global background noise will decrease due to the replacement of old and noisy equipment by a new and less noisy one.

908. As it is not expected, during the normal operation, an increase in the noise levels, and because necessary corrective measures will be taken to ensure the reference standards, this impact is assessed as **INSIGNIFICANT**.

IMPACTS ON SOIL AND GROUNDWATER

Potential increase of soil salinity due to the cooling towers steam plume deposition

909. Desciption. Small water droplet carry-over will occur due to the operation of the cooling tower. These water droplets, which can precipitate in the surroundings, contain concentrations of solids, especially dissolved salts that can potentially increase ground salinity.

910. The towers are equipped with droplet elimination systems to minimise droplet carry-over. These devices are placed inside the tower and prevent the droplets from exiting the stack with the air.

911. Most of the droplets evaporate in the surrounding air, giving rise to steam plumes. Only the largest droplets can avoid total evaporation and precipitate to the ground.

912. On the other hand, intense winds can cause interaction between the air, the structures and the cooling tower emissions that can cause three phenomena:

(1) Favour recirculation of the air emitted by the towers and subsequent low performance of the towers.
(2) Cause interaction between the emissions (plumes), nearby structures and the terrain.
(3) Produce whirlwinds, especially at the ends of the towers that can extract water through the tower air entries.

913. The three phenomena above can increase the precipitation of salty water and favour the formation of ground mist if the temperature and humidity conditions are adequate.

914. A series of measures will be taken in this regard (See chapter on measures); the tower will be oriented to minimise air outlet recirculation phenomena, reducing loss of performance and avoiding possible increases in precipitations near the tower.

915. On the other hand, it should be noted that the composition of the soil in the area under study presents a high degree of saline content due to salt precipitation influenced by the Aral sea, located to the north of the area under study. As a result the use of the soil in the study area for agricultural purposes is very limited.

916. Considering all of the above, the type of cooling tower chosen and the measures taken into consideration, it is considered that the increase in salinity due to water droplet carry-over from the tower will be insignificant versus the current level of salinity present in the soils of the area; whereby the impact is estimated to be **INSIGNIFICANT**.

Potential soil and groundwater pollution by accidental spillages or improper waste management

917. Description. The areas of handling, storage and management of equipment lubricating and cooling oil, fuels, chemicals and generated waste are potential sources of contamination of soil and water, in case of non-compliance with minimum safety requirements.

918. The same kinds of solid waste as in the current operation will be produced after the commissioning of the CCPU at Takhtiatash. Nevertheless, for the construction of the CCPU asbestos will be not permitted as it use is forbidden by the good international practice. Therefore, waste asbestos will not be produced in the operation of the new unit.

919. After being collected, waste shall be processed depending on type. Sludge from waste treatment plant and water supply treatment needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste.

920. The current management of wastes of the TPP can be used but some of the procedures should be corrected to fulfill international good practices:

921. Non-hazardous wastes:

-Reuse:

Solid precipitation of the settling tank and pulp dump will be use in agricultural needs as fertilizer only if analyses of the pulp characteristics conclude that there are not hazardous or toxic compounds that could be a health risk.

-Recycled:

Iron, metal debris, stubs, wool debris, waste rubber and tires, waste paper and other recyclable waste fractions can be selling to the enterprises currently being used in the operation of the existing units.

-Recover:

Only non-hazardous wastes can be burned in existing boiler furnaces.

-Disposed:

Rest of non-hazardous wastes that are not being recycled as household and similar waste should be transported to a properly designed, permitted and operated landfill. Municipal landfill currently being used by the TPP is not design in an environmentally sound manner. An improvement of this landfill to avoid soil and groundwater pollution is advisable.

Figure 50. Location of Takhiatash city municipal landfills and WWT plant

922. Hazardous:Hazardous waste storage, transfer, disposal and treatment will be done by an authorized waste management facility. The contractors handling, treating and disposing hazardous waste should be reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled (ensuring compliance with applicable local and international regulations).

-Recycled:

Fluorescent lights shall be delivered to a specialized organization on lamp utilization as it is being doing up to now.

-Recover:

Hazardous wastes cannot be burned at existing boiler furnaces as they are not provided with exhaust gas treatment. Hazardous wastes can be burned or incinerated just in approved installations with the proper treatment for exhaust gases in order not to introduce hazardous compounds into the atmosphere.

-Disposed:

If there is not a hazardous waste landfill or storage which have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment neither the permits, certifications, and approvals of applicable government authorities, an specific facility must be constructed or adapted to provide sound long-term storage of wastes on-site or at an alternative appropriate location up until external commercial options become available. In this respect, solution found for the construction and decommissioning phases can continue during operation phase.

923. The waste management for the future Takhiatash TPP should be adapted to international guidelines and those wastes considered by the Basel Convention to be hazardous will under no circumstances be dumped on the terrain. A general guideline on waste management will be included in the mitigation measure chapter.

924. In addition, during the operation of the power plant there could be accidental leaks from the oil tank which could lead to the contamination of the soil and subsoil. The tank will have the obligatory safety tank (or if undergrounded a double wall design), which will be enough to contain the total capacity of all the tanks. Any possible accidental spills will be collected in this safety tank. Therefore the possibility of the soil or waters becoming contaminated through fuel leaks is very slight.

925. In the same way, each of the storage tanks for chemical products for the treatment of the water supply, chemical treatment, etc that will be installed will in every case have an obligatory safety tank.

926. A maintenance program to detect any structural or functional problem in the tanks will be implemented. Also, groundwater test will be undertaken to check the condition of the soil and subsoil to early detect any problem.

927. In conclusion, all the waste generated in the power plant will be adequately and appropriately managed. There will be no effect on the environment as a consequence of mismanagement. Through compliance with that established in the waste management system there will be no possibility of contaminating the soil or groundwater. Regarding leaks, the project will incorporate the necessary safety measures to avoid spillages into the environment. Therefore, given the safety and management measures planned, the impact is assessed as **INSIGNIFICANT**.

IMPACTS ON HIDROLOGY

Water resources intake reduction

928. Description. During the operation of the power plant the water necessary for the operation of the power plant will be taken from the Suenly Canal. Service and drinking water will be taken from pipeline supply system of Takhiastah city.

929. The following table summarise the current and future water requirements for the TPP according to their destination:

Parameter	Units	Current (before CCPU commissioning)		Future (after CCPU commissioning)	
Operating units	-	Units III-IV	Units V-VI	Units V-VI	New CCPU
Operating hours	h	3,084	5,525	4,994	8,000
Drinking and service water consumption (from pipeline supply system of Takhiastah city)	million m^3/yr	3.460		3.460	
Hourly technical water requirements for each unit	m^3/h	50,145	54,000	54,000	916
Total hourly technical water requirements for the TPP	m^3/h	104,145		54,916	
Annual water requirements	million m^3/yr	154.6	298.3	269.7	7.3
Total annual water requirements	**million m^3/yr**	**453.0**		**277.0**	
Water requirements reduction	**million m^3/yr**	**0**		**175.9**	

Figure 51. Current and future technical water requirements from Suenly Canal

930. Therefore, the annual water intake volume from Suenly Canal in the current situation amounts to 451.0 million m^3, whereas the future water requirements have been estimated at 277.4 million m^3. Therefore, the decommissioning of units III-IV and the commissioning of the new CCPU will lead to an annual reduction in the water intake from Suenly Canal estimated at 173.6 million m^3.

931. For drinking purposes the intake volume will not change as the number of workers will remain the same.

932. The change from the open once-through cooling system of units III-IV towards a closed circuit with cooling towers of the CCPU will lead to the reduction of the large water intakes and, at the same time, it will reduce the discharge of large amounts of warm cooling water to the canal and may also reduce the consumption and emission of chemicals. Therefore, this impact is assessed as SIGNIFICANT and is evaluated below.

933. Characterization. The water resources intake reduction has a direct and positive impact on the water resources. It is cumulative and synergistic, because the reduction in water intake has varying degrees of effect, some reinforcing the effects of others. It occurs in the short term, although it is permanent because the effect is indefinite. Equally, it is continuous as it occurs recurrently and constantly and non- periodic.

934. Following the methodology described, numerical values were assigned to the attributes:

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
GN	sitive	+
MEDIACY (Inm)	rect	3
CCUMULATION (A):	umulative	3
NERGY (S)	nergistic	3
MING (M)	ort-term	3
RSISTENCE (P)	rmanent	3
RIODICITY (Pr)	n-periodic	1
NTINUITY (C)	ntinuous	3
CIDENCE Inm + +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		28
RMALIZED INCIDENCE (I_S=I-I_{min}/I_{max}-I_{min})		0.5

935. Magnitude. Given the current reduction of the water intakes in 173.6 million m3/yr due to the change from the open once-through cooling system of units III-IV towards a closed circuit with cooling towers of the CCPU, that suppose a reduction of 38.8%, the magnitude of the impact is assessed to be high.

936. Final impact assessment/Value. This **POSITIVE** impact is of high magnitude and has a medium incidence (0.5 points).

Potential effects on water resources due to the increase of water consumed for the new Unit

937. Description. Regarding actual water consumption terms, the net technical water consumption of the TPP will increase due to make-up water needs for evaporation losses in the cooling towers of the CCPU. The explanation lies within the net water consumption of the current open cooling circuit, which is almost zero because all the intake water is subsequently discharged back to the canal.

938. Considering as an approximation a cooling tower cycles of concentration of 1.5, blow down flue rate would be 515 m^3/h and therefore, water consumed in evaporation process would be 225 m3/h (0.0625 m^3/s). Considering 8000 operation hours for the CCPU, the annual consumption would be 1.8 million m3.

939. Suenly canal has a depth of 7 meters and a width of 20 meters. In a basic calculation,. as Amudarya river speeds is 1.1 m/s and it is not supposed to increase when enters into Suenly canal as there is not a forced flow, Suenly canal would have a flow rate of 154 m^3/s. Comparing this flow rate with the consumption of the CCPU in evaporation process it would result a 0,04%. Even in the case that the water depth in Suenly canal would decrease to 1 m, percentage of consumed water would represent just a 0.28 %.The maximum volume consumed (1.8 m^3/yr) represents just a 0.65% of the total volume flowing in the canal (277 million m^3/yr) also.

940. Furthermore, it must be noted that combined cycle technology consumes approximately one third of the water consumed by a thermal power plant with a steam cycle of equal power which is refrigerated by the same system. This helps achieve a more rational use of such a precious resource. In addition, the use of natural gas reduces the need for water and reduces the amount of effluent compared to power plants that use other fossil fuels.

941. Due to the very low consumed flue rate compared to the Suenly canal one, the impact is assessed as **INSIGNIFICANT**.

Potential alteration of the water quality as a consequence of effluent discharge

942. Description. The discharge of effluents generated from the exploitation of the new Unit may degrade the quality of water through the presence of pollutants.

943. As discussed in the chapter on the Project Description, the expected effluents generated by operation of the new facilities of CCPU will be:

- **Domestic effluents:** Domestic wastewater or sanitary effluents is discharged though pipe line to the Takhiatash Municipal Waste Water Treatment Plant.
- **Rainfall effluents:** Rainwater will be collected along the territory and discharged into existing storm water sewer system.
- **Oil and Chemical effluents:** A new treatment of effluents will be provided for the new CCPU without using the existing effluent treatment installation. From the effluent treatment effluents are driven to the chemical treatment plant slime lagoons and then into the TPP waste channel.
  Circulation system blowdown: in the open cooling water circuit a constant evaporation of the water takes place. As a result, the remaining water has a high concentration in solids and dissolved salts, what makes it necessary to bleed it periodically. Blowdown water from cooling tower is relatively clean so that it is directly discharged into the outlet channel with no treatment.

944. The water treatment for the cooling system of the new CCPU shall be designed with a biocide (sodium hypochlorite) dosage performed by a control and global monitoring equipment with automatic dosage calibration. Total residual chlorine should be measured at the discharge point continuously. This will lead to process optimization and, therefore, a minimum requirement of chemicals additives, achieving a minimum concentration at discharge with consequent environmental benefits.

945. Project includes automatic measurement of pH and temperature in the cooling water system. These measurements should be located at the intake and discharge points. Other parameters included in the effluent standards on the Thermal Power Plants EHS IFC guidelines (2008) area measured in a monthly basis.

946. In addition, the temperature of the effluent discharge from the cooling water would be decrease due to partial replacement of the open cooling water system (III and IV units) to a closed one (new CCPU).

947. Therefore, effluent treatment system and cooling water system of the new CCPU will be designed in order to fulfill new MAD for the CCPU and Thermal Power Plants EHS IFC guidelines (2008) effluent standards, whichever is more stringent. If natural water quality intake already excess standards, effluent treatment system and cooling water system will be designed in order not to increase levels of pollution.

948. In conclusion, all waste water is properly treated according to its nature, prior to final disposal, in order to meet the discharge standards set by the World Bank. Therefore, this impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON FAUNA AND VEGETATION

Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one

949. Description. The discharge of effluent from the cooling due to the operation of the TPP could increase the ambient temperature, which may affect the ecological balance and the aquatic habitat in the area. The conservation of the ecological balance is achieved through many factors among which are, basically, temperature, nutrients, sunlight and water movement. The occasional variations of these parameters in the water ecosystem are generally assumable, given the existence of a dispersal area which varies according to the release.

950. An increase in temperature or in nutrients in the biological system may induce:

- An acceleration of certain biological processes (growth in fungi population, etc.) against others (disappearance of species that reproduce at a given temperature, etc..). Indirect changes may occur in the biotic factors of the environment in the area influenced by the discharge, due to changes in food chains of flora and fauna, which may alter the composition of the affected ecosystem and the exchanges between its various species.

- Compromising the ability of water to retain dissolved oxygen. At higher temperatures, the saturation level of oxygen in water decreases and the availability of oxygen to the process of respiration of fish and other living organisms are lower. Oxygen is also necessary for an effective bacterial decomposition of organic matter and chemical oxidation.

- Influence in the growth cycles of aquatic plants and in the growth and physiology of fish and other aquatic animals (reproductive rate, respiration rate, digestion, etc.), in the area under study.

951. However, in this project, partial replacement of an open cooling water system to a closed one will be undertaken:

- Existing situation: The cooling circuit existing is of the open type. After being used for the refrigeration of the condenser, cooling water increases its temperature (8-10 ºC) (see figure 52) and is discharged into the Suenly canal. The effluent discharge from the open cooling water is 104145 m3/h (5014 m3/h for units III and IV + 54000 m3/h for units V and VI).

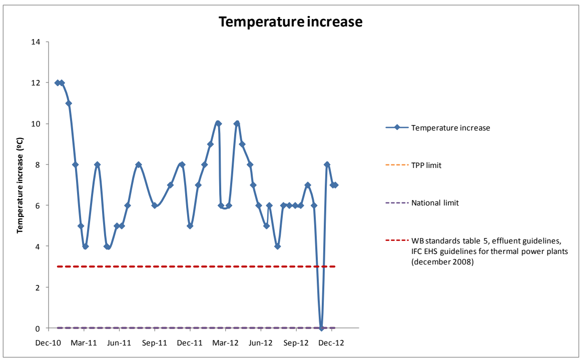


Figure 52. Delta T between intake and discharge

- Future situation: The effluent discharge from the open cooling water would be decreased from 104145 m3/h (before decommissioning of old units III and IV) to 54115 m3/h (after decommissioning of old units III and IV). The estimated intake for the new CCPU of make-up water is 916 m^3/h, including 110 m^3/h for make-up water pretreatment unit for auxiliaries, 770 m^3/h for replenishment of losses in water cooling tower for evaporation and blow down of circulatory system, and 36 m^3/h to makeup CCPU's water-steam cycle. Considering as an approximation a cooling tower cycles of concentration of 1.5, blow down flue rate would be 515 m^3/h. Effluent coming from the waste water treatment plan is discharged (once treated) to the cooling water canal and from there to Suenly canal. This flow will be 115 m3/h.

952. The change from the open once-through cooling system of units III-IV towards a closed circuit with cooling towers of the CCPU will lead to the reduction of the large water intakes and, at the same time, it will reduce the discharge of large amounts of warm cooling water to the canal and may also reduce the consumption and emission of chemicals.

953. In order to find out the new temperature of the discharge a mathematical or physical hydrodynamic plume model is not required because the steam generating capacity <1,200MWth[15]. Therefore, impact of thermal discharge can be estimated in accordance with the next thermal balance in the discharge point:

[15] IFC EHS Thermal Power Plants guidelines (pag 10)

$Q_{V,VI}{}^{*}T_1 + Q_{CCPU\ (blow\ down)}{}^{*}T_2 + Q_{CCPU(water\ treatment\ plant)}{}^{*}T_3 = (Q_{V,VI} + Q_{CCPU\ (blow\ down)} + Q_{CCPU\ (water\ treatment\ plant)}{}^{*}T_{discharge\ point}$

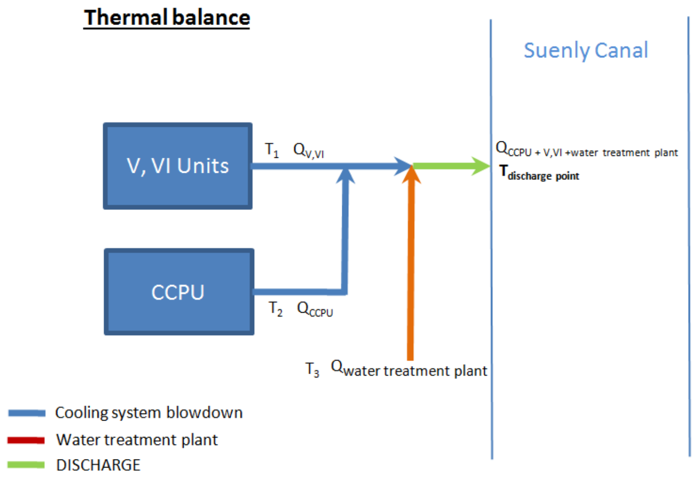


Figure 53. Thermal balance diagram

954. The following temperatures have been considered in order to consider worst case scenarios:

- For T2, the maximum air ambient temperature (45ºC) has been introduced in the thermoflow software program in order to simulate which would be the blow down temperature for the water balance designed resulting 30,95ºC.
- For T1 the highest discharge temperature measured in last two years (2011 and 2012) has been considered (see figure 54)
- For T3, the correspondent T1 intake temperature has been considered.

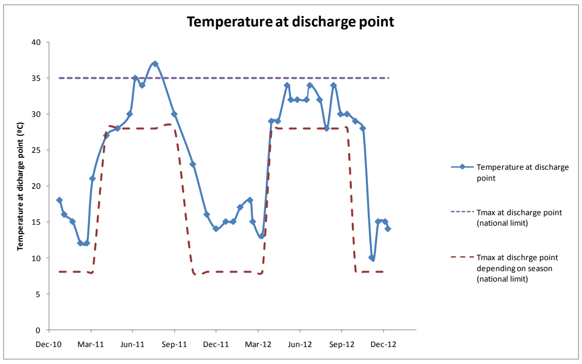


Figure 54. Absolute temperature at discharge point

955. In the following table 95, a summary of the flow rates and temperatures considered in the calculation are shown.

Table 95. Calculation data summary

<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Units</th><th colspan="2">Current (before CCPU commissioning)</th><th colspan="3">Future (after CCPU commissioning)</th></tr>
<tr><td>Units III-IV</td><td>Units V-VI</td><td>Units V-VI</td><td colspan="2">New CCPU</td></tr>
<tr><td>Cooling system</td><td>m^3/h</td><td>50,145</td><td>54,000</td><td>54,000</td><td>515
Blow down</td><td>115
Water treatment</td></tr>
<tr><td>Effluent temperature in the most adverse scenario</td><td>ºC</td><td>T_1=37</td><td>T_1=37</td><td>T_1=37</td><td>T_2=30.95</td><td>T_3=29</td></tr>
</table>

$$(54{,}000\ t/h*37ºC+515\ t/h*30.95ºC+115\ t/h*29)=(54{,}000\ t/h+515\ t/h+115\ t/h)*T_{discharge\ point}$$

$$\mathbf{T_{discharge\ point\ future}=36.9ºC}$$

$$\mathbf{\Delta T_{current\ vs.\ future}=37-36.9ºC=0.1}$$

956. The influence of the decrease in temperature in the discharge point, due to partial replacement of an open cooling water system to a closed one, will not be appreciated (0.1 ºC) because the huge difference between flow rate of the closed cooling system blowdown (CCPU) and the opened

cooling system efluent (V, VI units). However, the water of the effluent discharge from the open cooling water would be decreased from 104145 m3/h (29 m3/s) to 54115 m3/h (15 m3/s) in almost a 50%, so the thermal effluent dispersion would be faster and the mixing zone would be extended over a smaller distance in the Suenly canal. Therefore, this impact is assessed as SIGNIFICANT and is evaluated below.

957. Characterization. The water discharge reduction has a direct and positive impact on the aquatic ecosistem. It is cumulative and synergistic, because the reduction in water discharge has varying degrees of effect, some reinforcing the effects of others. It occurs in the short term, although it is permanent because the effect is indefinite. Equally, it is continuous as it occurs recurrently and constantly and non- periodic.

958. Following the methodology described, numerical values were assigned to the attributes:

X	CHARACTERIZATION	NUMERICAL VALUE
SIGN	Positive	+
IMMEDIACY (Inm)	Direct	3
ACCUMULATION (A):	Cumulative	3
SYNERGY (S)	Synergistic	3
TIMING (M)	Short-term	3
PERSISTENCE (P)	Permanent	3
PERIODICITY (Pr)	Non-periodic	1
CONTINUITY (C)	Continuous	3
INCIDENCE (I=Inm + +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		28
NORMALIZED INCIDENCE (I_S=I-I_{min}/I_{max}-I_{min})		0.5

959. Magnitude. The project includes automatic continuous measurement of temperature in the cooling water system to control effluent discharge and the water treatment for the cooling system of the new CCPU shall be designed with a biocide (sodium hypochlorite) dosage performed by a control and global monitoring equipment with automatic dosage calibration.

960. Total residual chlorine should be measured at the discharge point continuously. This will lead to process optimization and, therefore, a minimum requirement of chemicals additives, achieving a minimum concentration at discharge with consequent environmental benefits.

961. If we compare estimated Suenly canal flue rate (154 m3/s) with the discharged effluent, percentage will decrease from a 19% of the current situation to a 9.7%. The magnitude of the impact is assessed to be medium.

962. Final impact assessment/Value. This **POSITIVE** impact is of medium magnitude and has a medium incidence (0.5 points).

IMPACTS ON LANDSCAPE

Potential impact on landscape caused by the physical presence of the new unit

963. Description. The landscape in the immediate surroundings of the Plant can be defined as highly affected by human activity.

964. The new CCPU facility will add the following infrastructures to the previous Takhiatash, which may affect the landscape:

- A 60-metre high stack
- A turbine building 40-metre height
- A mechanical draft cooling tower with approximate dimensions of: 16 m high and a rectangular base measuring 16 m x 114 m

965. The impact on the landscape depends on both the changes that are produced and the visible changes that are a result of those changes for the nearest receptors.

966. It should be taken into account that the location of the CCPU inside the existing installations of the Takhiatash TPP, and the small size of the former versus the latter, favor the integration of the new project in a medium with a high degree of human activity and accustomed to this large power infrastructure. The infrastructure already has the most visible elements, such as the 150-metre high stack of Units V and VI, the 20-metre high fuel oil (mazut) storage tanks and the buildings of the Takhiatash TPP (Units V and VI) that are 40 metres high (See image below).

967. On the other hand, it has to be considered that the buildings and facilities belonging units III and IV of the existing Takhiatash TPP are going to be decommissioned. This gains special importance when assessing the effect of removing the 80 meters high stack because (even if a new one is going to be built for the CCPU, this one is planned to be 20 meters shorter) and the turbine building of the units III and IV.

Figure 55. 80 Meter stack and turbine building of units III and IV to be dismantled

968. As a result of this analysis, it can be concluded that the location chosen is the most suitable from the point of view of the landscape, since the area is highly affected by human activity and the quality of the landscape is poor. It is located on the industrial terrain of Takhiatash TPP, which already has large, very visible structures that will hide the CCPU structures halfway and thus not affect the industrial landscape, whereby the impact is considered to be **INSIGNIFICANT**.

Potential impact on landscape caused by the cooling water steam plume

969. Description. The operation of the mechanical draft cooling tower will produce water vapour carry-over which will cause the formation of steam plumes. These plumes could partially block the view of the project area.

970. Emissions of moist air from the cooling tower could occasionally form visible plumes due to water vapour condensation, which could alter the landscape and characterise cooling towers in industrial facilities. The visible dimensions of the plumes may vary according to the rate of operation of the Plant and the weather conditions at the site.

971. It is estimated that the largest steam plumes will be visible at dawn, especially on cold months, coinciding with periods of low ambient temperatures and high humidity.

972. Spatially, the impact of visible plumes is largest near the tower, where they develop vertically under normal circumstances and float over the plant site less frequently due to the effect of the wind.

973. The impact is considered to be **SIGNIFICANT** and is evaluated below.

974. Characterisation and incidence. The impact is indirect and negative. The impact is simple and synergic. It is considered transient and continuous. It is reversible and recoverable, since the original conditions will reappear naturally when the Plant stops operating.

975. The impact is short-term, as soon as the Plant starts operation, and periodical.

976. Included below are the numerical values assigned to the attributes, according to the methodology presented:

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
SIGN	Negative	-
IMMEDIACY	Indirect	1
ACCUMULATION	Simple	1
SYNERGY	Synergistic	3
TIMING	Short-term	3
PERSISTENCE	Temporal	1
PERIODICITY	Reversible	1
RECOVERABILITY	Recoverable	1
PERIODICITY	Periodic	3
CONTINUITY	Continuous	3
INCIDENCE (I=Inm + +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		24
NORMALIZED INCIDENCE ($I_S = I - I_{min}/I_{max} - I_{min}$)		0.36

977. Magnitude. Visible plumes are not formed during most of the year. In addition, the plumes will normally dissipate completely during the day and their visible dimensions will be only a few metres or negligible.

978. On the other hand, it should be noted that the operation of the Takhiatash TPP makes the presence of plumes in the area part of the normal landscape due to stack gas emissions.

Figure 56. Exhaust gas plume of stack 150 m height

979. Considering the occasional formation of plumes, their rapid dispersion, the distance they can be seen from and the nearest receptors being located at 400 metres, the magnitude can be considered medium.

980. Evaluation /Final Value of the Impact. The medium magnitude of the impact and its incidence (0.36) indicate that the impact should be considered **COMPATIBLE**.

IMPACTS ON NATURAL AREAS

Potential impact on natural areas

981. Description. During the operation phase, the impact on the nearby natural spaces may be due to the effects that noise, air emissions, discharges, waste, and potential leaks are likely to have on it.

982. According to the information compiled in the environmental inventory, Takhiatash CCPU is not settled in a protected natural area, sensitive areas or any other level of protection land. The nearest natural area is Low Amydarya biospheric reserve locates, on the territory of Amudarya, Beruniy districts of Republics Karakalpakstan, around 75 km on the east-south from Takhiatash city.

983. Due to the long distance to the closes protected area, this impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON POPULATION

Potential hiring of personnel for operation of the new unit

984. Description. During the operation phase of the new CCPU, new jobs will be created which will last over the life of these facilities. For normal operating conditions, the planned staff will be a fixed number of 110 people. Nevertheless, the major part of this workforce is expected to be covered by the staff of the decommissioned equipment of III-IV units of TPP; therefore, this impact is considered **INSIGNIFICANT**.

Development of the local and regional economy

985. Description. Takhiatash TPP is the main power supply source for the Karakalpakstan and Khorezm regions with over 3 million people, located in the western part of Uzbekistan. The power demand outlook is strong with a number of industrial development projects envisaged for the region, exceeding currently available capacity. Furthermore, Takhiatash TPP not only provides the North-West region of the country with electricity but also heats water to supply the consumers in Takhiatash town and for its own needs.

986. According to the baseline, regarding the percentage of population employed in different sectors, three major activity sectors can be distinguished: 61% other services (the economic activity in this sector is mainly focused on administration, internal affairs, community organizations and etc.), 11% in the industrial sector and 10% in agriculture.

Figure 57. Employment Takhiatash city chart

987. Thus, the analysis of the socio-economic aspects of the region shows that the implementation of the proposed activity is relevant and has a number of advantages in the social sphere of the Republic of Karakalpakstan in general. The impact is considered to be SIGNIFICANT and is evaluated below.

988. Characterization. The effect is positive and direct on the economic environment, as well as cumulative.

989. The impact is synergistic because it can promote the action of other effects, and permanent, throughout the life of the new CCPU.

990. It occurs in the short term, is continuous, and non-periodic, because the alteration is constant during the operating time of the new CCPU.

991. According to the methodology previously described, numerical values will be assigned to the form taken by the attributes, as shown below:

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
SIGN	Positive	+
IMMEDIACY (Inm)	Direct	3
ACCUMULATION (A):	Cumulative	3
SYNERGY (S)	Synergistic	3
TIMING (M)	Short-term	3
PERSISTENCE (P)	Permanent	3
PERIODICITY (Pr)	Non-periodic	1
CONTINUITY (C)	Continuous	3
INCIDENCE (I=Inm + +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		28
NORMALIZED INCIDENCE (I_S=I-I_{min}/I_{max}-I_{min})		0.5

992. Magnitude. The potential primary beneficiaries of the project would be the general population in urban and rural areas and industries from improved power supply reliability through the national grid, especially in the Karakalpakstan and Khorezm regions. In addition, more reliable power supply is expected to benefit firms and industries, which will provide increased economic and job opportunities for households, including the poor and socially excluded. Thus, the stable heat an electricity production will increase the industrial sector development, living standards of people, residing in the capital of Karakalpakstan, in Tahkiatash town and directly of Takhiatash TPP staff.

993. Therefore, the magnitude of the impact is assessed to be medium.

994. Final impact assessment/Value. This **POSITIVE** impact is of medium magnitude and has a medium incidence (0.5 points).

Potential health risk for the operation of the cooling towers

995. Description. Legionella is an environmental bacteria capable of surviving in a wide range of physico-chemical conditions. It can reproduce at between 20 ºC and 45 ºC and can be destroyed at 70 ºC. Its optimal growth temperature is between 35 ºC and 37 ºC. Its natural ecologic niche are surface waters, such as lakes, rivers and pools, where it forms part of the bacterial flora.

996. Water systems created by man are a very adequate habitat for this bacteria. These systems provide the conditions for the bacteria to expand and spread. It disperses in the air and penetrates respiratory systems, causing infections in humans. The prevention and control of legionella growth and spread in man-made facilities has become very important recently because of the various cases of legionella outbreaks in recent years. The spread of the bacteria in cooling towers takes place via carry-over microdroplets.

997. It should be noted that most of the outbreaks have taken place in urban settings, and mainly in facilities equipped with small cooling towers. On the contrary, the absence of outbreaks in cooling systems located in large evaporation towers associated with power installations is remarkable. The possible causes include:

Greater stability of the ecosystem in the cooling circuits and the difficulties posed for growth of legionella.
- Greater control of water quality using water treatments (i.e.: decarbonation, biocides, anti-corrosion agents) and continuous water purging which prevents accumulation of dirt in the condensers and fills of the tower basins.
- Location of the cooling systems far from population centres along with the altitude of tower emissions and the time needed for the aerosols (microdroplets) to reach long distances with the conditions of ambient humidity required for legionella to survive

998. However, it should also be noted that the fact that large towers have not been found to be the source of legionella outbreaks could also be due to the fewer number of large systems in operation.

999. Given the characteristics of the impact and considering the prevention system to control legionella included in the project (see chapter on mitigation measures), among which are adding a biocide, the estimated impact is assessed to be **INSIGNIFICANT**.

Potential hygienic risks for the health and safety of personnel and the surrounding population

1000. Description. During the operations phase, impacts likely to be generated by the operation of Takhiatash CCPU on the health of the population in the area may be due to the effects of air emissions, noise, discharges, waste, and potential leakages in the equipment. In this respect, the following should be considered:

- In the chapter on the impact "Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology", it was analyzed whether the air quality standards for health are observed. It was concluded that NO2 inmissions will be decreased by the replacement of an obsolete with an energy efficient technology up to a 40%.

- Regarding the noise, the proposed measures forecast an insignificant increase. It is expected that the global background noise will decrease due to the replacement of old and noisy equipment by a new and less noisy one.

1001. Regarding the effluents and waste generated by the new power plant, they will be managed correctly which will ensure that no negative impacts occur on the surroundings.

1002. Therefore, given the measures to reduce emission of pollutants included in the project and those considered with reference to air quality, noise, waste, and effluents, and the Environmental Health and Safety Plan based on national and international standards that will be implemented (which includes emergency plan, personnel training on safety, health and environment, etc.) the estimated impact is assessed to be **INSIGNIFICANT**.

IMPACTS ON COMMUNICATIONS AND INFRASTRUCTURES

Increase in installed electrical power

1003. Description. The total installed capacity for power generation in the country is about 12,400 MW. However, the available capacity is less than 10,000 MW. In 2010, Uzbekistan generated about 51,935 GWh of electric power.

1004. Uzbekistan's power generation plants are generally old and inefficient, requiring urgent **replacement and/or modernization**. More than 75% of the power plant units are over 30 years old, reaching or exceeding their economic life. Since 1991, only two power capacity expansion projects have been completed: (i) rehabilitation of two 300 MW steam cycle units at Syrdarya TPP and (ii) construction of an 800 MW steam cycle unit at Talimarjan TPP.

1005. In this respect, the installation of the new CCPU contribute to an increase in the country's electricity production, satisfying part of the anticipated demand and reducing losses deriving from the transportation of electrical energy. In addition, the technology used has the highest performance out of all the available fossil fuel based electricity generation technologies. Its performance is much higher (approximately 55%) than a conventional power plant (around 32%) The attraction of this new technology comes from its capacity to use heat, which would otherwise be lost, to generate additional electrical energy which represents a saving of fuel and a reduction in associated emissions.

1006. Replacing the existing power generation assets with the energy efficient CCPU technology is a key strategy for Uzbekistan in order to save energy, secure reliable power supply and mitigate climate change impacts.

1007. This impact is considered positive and **SIGNIFICANT** and is discussed below.

1008. Characterisation. The effect is positive and direct on the economic environment, as well as cumulative.

1009. The impact is synergistic because it can promote the action of other effects, and permanent, throughout the life of the new power plant.

1010. It occurs in the short term, is continuous, and non-periodic, because the alteration is constant during the operating time of the new CCPU.

1011. According to the methodology previously described, numerical values will be assigned to the form taken by the attributes, as shown below:

ATTRIBUTE	CHARACTERIZATION	NUMERICAL VALUE
SIGN	Positive	+
IMMEDIACY (Inm)	Direct	3
ACCUMULATION (A):	Cumulative	3
SYNERGY (S)	Synergistic	3
TIMING (M)	Short-term	3
PERSISTENCE (P)	Permanent	3
PERIODICITY (Pr)	Non-periodic	1
CONTINUITY (C)	Continuous	3
INCIDENCE (I=Inm + +2A + 2S + M + 2P + 2R + 2Rc + Pr + C)		28
NORMALIZED INCIDENCE (I_S=I-I_{min}/I_{max}-I_{min})		0.5

1012. Magnitude. Power outcome of the project is summarized in the following table:

Table 96. Power outcome of the project

	Installed capacity (MW)	Electricity (GWh/yr)
Existing plant	730	2700
New CCPU	280	2000

	Installed capacity (MW)	Electricity (GWh/yr)
Decommissioning of III and IV units	(310)	(1100)
Net change	(30)	900
After project	700	3600

1013. Taking into account the energy power generated in 2010, the project will allow an increase of 900 GWh/yr which would mean an increase at national level of 1.73%. Nevertheless, this project will generate more electricity with less gas, water, and GHG emission, thus contributing to climate change mitigation. In addition the implementation of this project will allow increasing the efficiency and the reliability of the energy supply to consumers, as well as improving the environmental quality in its area of influence according with the Government and ADB strategies. Therefore, the magnitude of the impact is assessed to be medium.

1014. Final impact assessment/Value. This **POSITIVE** impact is of medium magnitude and has a medium incidence (0.5 points)

Table 97. Impact Assessment Summary - Operation Phase

IMPACT ASSESSMENT SUMMARY - OPERATION PHASE				
IMPACT	SIGN	NORMALIZED INCIDENCE (BETWEEN 0 AND 1)	MAGNITUDE	FINAL IMPACT VALUE
Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology.	+	1	Low	---
Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology.	+	0.71	Medium	---
Potential increase in noise levels.	-	INSIGNIFICANT		
Potential increase of soil salinity due to the cooling towers steam plume deposition	-	INSIGNIFICANT		
Potential soil and groundwater pollution by accidental spillages or improper waste management.	-	INSIGNIFICANT		
Water resources intake reduction	+	0.5	High	---
Potential effects on water resources due to the increase of water consumed for the new Unit.	-	INSIGNIFICANT		
Potential alteration of the water quality as a consequence of effluent discharge.	-	INSIGNIFICANT		
Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one.	+	0.5	Medium	---
Potential impact on the landscape due to the physical presence of the new unit	-	INSIGNIFICANT		
Potential impact on the landscape caused by the cooling water steam plume.	-	0.36	Medium	COMPATIBLE
Potential impact on natural areas.	-	INSIGNIFICANT		
Potential hiring of personnel for operation of the new unit	+	INSIGNIFICANT		
Development of the local and regional economy.	+	0.5	Medium	---
Potential health risk for the operation of the cooling towers	-	INSIGNIFICANT		
Potential hygienic risks for the health and safety of personnel and the surrounding population	-	INSIGNIFICANT		
Increase in installed electrical power	+	0.5	Medium	---

H. ENVIRONMENTAL MANAGEMENT PLAN

H.1. Overview

1012. The EMP compiles comprehensive information gathering together a succinct summary of impacts previously identified, the actions required to mitigate those impacts in accordance with the laws of Uzbekistan and the ADB safeguard policy, and the monitoring activities that are to be undertaken as part of the project in order to confirm that they have been effective in reaching their objectives.

1013. The EMP also details the institutional arrangements and capacities that currently exist, or that will be put in place during project implementation, to ensure that the EIA (including the EMP) has (i) comprehensively considered both Uzbek and ADB requirements for environmental protection, (ii) identified all likely environmental impacts, (iii) proposed appropriate mitigation measures, and (iv) put in place the necessary systems to ensure that effective procedures for environmental monitoring and control of the project impacts, and mitigation measures are implemented throughout the life of the project.

1014. Mitigation measures required to address the impacts identified by this EIA have been consolidated in the following draft EMP.

1015. In order to evaluate the actual impacts arising from the implementation of the project, and to monitor compliance with the requirements of this EIA and EMP, specific monitoring activities are required. The environmental monitoring plans detail the measurements needed, the locations where they are needed, the frequency with which they need to be made, and the responsibilities associated with each monitoring task.

1016. In accordance with the structure of the project, mitigation measures and their monitoring are proposed, as described further, and these are differentiated by their execution during the design and preconstruction, construction, operations and decommissioning phases.

1017. On top of that, Takhiatash TPP will put in place a grievance mechanism for recording and answering proposals, comments, suggestions, complaints, etc. that will be made available to the public throughout the life of the project.

H.2. Potential Environmental Impacts

1018. Despite the fact that this EIA includes an entire section where potential impacts are comprehensive identified and assessed, it is interesting to bear in mind all of them in order to describe appropriately the actions needed and the monitoring program to implement them properly.

1019. For this purpose, potential impacts are shown in the following list:

Table 98. Potential Environmental Impacts

IMPACTS IDENTIFIED	
CONSTRUCTION AND DECOMMISSIONING PHASES	OPERATING PHASE
- Potential discrete and local increase in particulate matter suspended in air. - Potential degradation of air quality due to exhaust emission from construction equipment. - Potential increase in the noise level of the construction sites. - Potential degradation of the local geomorphology. (*) - Potential soil compaction. - Potential increase of suspended solids in water, as a result of construction work. (*) - Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste. - Potential contamination of surface water by sanitary water from workers. - Potential increase of erosion risk due to construction work. (*) - Potential modification of natural drainage in the work area. (*) - Potential elimination of vegetation (*) - Potential reduction in the total area of fauna habitats in the work area. (*) - Impact on and potential discomfort to terrestrial fauna. - Potential modification of landscape during the construction and decommissioning - Potential impact on natural areas. - Potential impact on agriculture, livestock, etc, which take place in the work area due to changes in land use. (*) - Potential impact on historical and archaeological heritage. (*) - Hiring of personnel and reactivation of the local economy during construction and decommissioning phases. - Potential hazards for the health of the	- Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology. - Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology. - Potential increase in noise levels. - Potential increase of soil salinity due to the cooling towers steam plume deposition - Potential soil and groundwater pollution by accidental spillages or improper waste management. - Water resources intake reduction - Potential effects on water resources due to the increase of water consumed for the new Unit. - Potential alteration of the water quality as a consequence of effluent discharge. - Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one. - Potential impact on the landscape due to the physical presence of the new unit - Potential impact on the landscape caused by the cooling water steam plume. - Potential impact on natural areas. - Potential hiring of personnel for operation of the new unit - Development of the local and regional economy. - Potential health risk for the operation of the cooling towers - Potential hygienic risks for the health and safety of personnel and the surrounding population. - Increase in installed electrical power.

IMPACTS IDENTIFIED	
personnel and the population. - Increase in traffic. - Potential damage to road infrastructure owing to heavy duty construction traffic.	

(*) Only in construction phase

H.3. Institutional Arrangements

Project Institutional Framework

1020. The project will be implemented by the Executing Agency (EA), Uzbekenergo. It will be under the control of a Project Management Unit (PMU), headed by a Project Director appointed by the EA.

1021. The PMU will work closely with the corresponding departments within the existing TPP organization to achieve the necessary coordination and integration of the two projects with the ongoing operation of Takhiatash TPP. In particular, the PMU will include a Safeguards Unit that will work closely with the existing environmental monitoring team of TPP to ensure consistency of approach and an appropriate level of understanding by the PMU team of existing conditions and systems within the TPP and its current impact on the surrounding area. The PMU will also ensure that the TPP environmental team understands the expected impacts of the CCPU and the systems that will be needed to mitigate them. The Safeguards Unit will include environmental, social and gender specialists to address the requirements of the project as detailed in the EMP.

1022. ADB will appoint (a) design and supervision consultant(s) (DSC), who will protect the interests of ADB and provide oversight of project implementation activities during the process of specification, tendering, tender evaluation, detailed design, construction, commissioning and acceptance testing, and initial commercial operation. The DSC will include environmental, social, and gender specialist(s), who will monitor the implementation of the project, and provide technical assistance and capacity building to the Safeguard Unit and TPP environmental monitoring team as required.

1023. The detailed design, construction and commissioning of the CCPU project and the detailed decommissioning of the existing units III and IV will be undertaken through an EPC CCPU & decommissioning turnkey contract. The EPC CCPU & decommissioning contractor will have primary responsibility for ensuring compliance with the EMP during construction and decommissioning, and for also ensuring that any significant changes to the design and processes are subject to environmental assessment to be reviewed by ADB.

Institutional Responsibilities

1024. The following responsibilities are allocated under this EMP.

1025. **Project Director.** The project director is the main responsible for the work of the whole PMU. Among the principal responsibilities is to ensure the effective implementation of the environmental and social safeguard policy guidelines and statutory requirements during project implementation.

1026. The **PMU** is responsible for the overall implementation for the CCPU project in accordance with all project technical and safeguard requirements. The organization of the PMU will be clearly defined in the chart underneath.

1027. **Power Plant Project Safeguard Unit**. The Safeguard Unit within the PMU has to deal with the following obligations:

- Ensuring that all environmental and social safeguard requirements and all statutory requirements of the Republic of Uzbekistan, are incorporated into relevant specifications.
- Ensuring that tenders for the EPC CCPU & decommissioning contract include appropriate commitments to comply with safeguard and statutory requirements.
- Ensuring that the EPC CCPU & decommissioning contractor complies with all safeguard and statutory requirements during construction, and specifically the EMP, through a comprehensive program of monitoring the EPC CCPU & decommissioning contractor's activities and performance.
- Undertaking monitoring according to the EMP or ensuring that monitoring is undertaken by the EPC CCPU & decommissioning contractor or other agency, as required.
- Reviewing the results of all monitoring programs to identify non-compliance issues or adverse trends in results, and putting in place programs to correct any problems identified.
- Cooperate to ensure that the future environmental management systems and procedures are made consistent across the existing units as well as the new CCPU.
- Preparing procedures for the environmental management and monitoring of the new CCPU to ensure ongoing compliance with the requirements of this EMP.

1029. **TPP Environmental Monitoring Team (EMT).** The TPP EMT is responsible for:

- Ongoing monitoring of units V and VI operations during construction of the new CCPU.
- Undertaking monitoring of CCPU construction activities where appropriate for the Safeguards Unit.
- Undertaking monitoring of decommissioning activities of units III and IV where appropriate for the Safeguards Unit.
- Collaborating with the Safeguards Unit to ensure that a future environmental management systems and procedures are made consistent across all the units.
- Integrating the monitoring of the CCPU into units V and VI monitoring programs following commissioning of the new plant.
- Ongoing environmental management and monitoring of existing units V and VI and future CCPU during lifetime operation

1030. Design and supervision consultant (DSC). The DSC is responsible for protecting the interests of the Bank by providing technical engineering, environmental and social expertise to oversee and assist the activities of the PMU on behalf of the ADB, and providing capacity building and other technical assistance to the PMU in accordance with ADB policies and programs.

1031. DSC environmental, social, and gender specialists (ESGS). The DSC environmental, social, and gender specialists will:

- oversee the activities of the PMU,
- ensure that the appropriate safeguard and statutory requirements are incorporated into the EPC CCPU & decommissioning specification (it will have to check all the claims from contractor before payment), including the requirement to prepare an EMP and requirements for environmental performance guarantees on relevant equipment,
- oversee the EPC CCPU & decommissioning tender evaluation process to ensure that appropriate commitments regarding environmental and social safeguards are included, and in particular ensure that the contractor prepares a construction EMP for approval by the Safeguard Unit, and
- review the results of the PMU Safeguards Unit's monitoring of the EPC CCPU & decommissioning contractor's performance against the requirements of the EMP.

1032. EPC CCPU & Decommissioning Contractor. The EPC CCPU & Decommissioning Contractor will be required to:

- Prepare a construction & decommissioning EMP conforming to this draft EMP, the EPC CCPU & Decommissioning specifications and any relevant statutory requirements.
- Comply with all commitments made in the construction & decommissioning EMP, and ensure that all subcontractors similarly comply.
- Undertake periodic monitoring and monthly reporting to the PMU of performance against the construction & decommissioning EMP and this draft EMP.
- Complete all environmental performance guarantee testing required under the EPC CCPU & decommissioning contract to demonstrate the capability of the plant to meet environmental guidelines and limits.

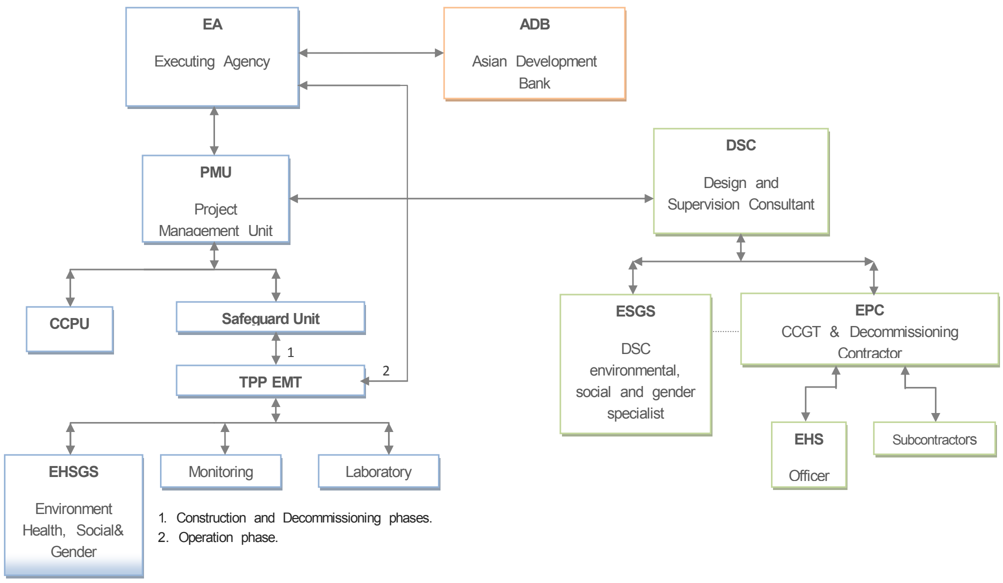


Figure 58. Organization of the PMU.

1033. The TPP EMT within Uzbekenergo will be strengthened by building staff capacity through technical support, equipment, and financial resources. The capacity building will:

- assist TPP EMT in supervising and implementing the EMP, which will comprise supervision and evaluation of the work to be undertaken by or on behalf of the EA, with respect to mitigation measures and monitoring requirements;
- provide on-the-job training to TPP EMT officials to build technical expertise on environmental and social aspects of environmental management;
- instruct TPP EMT personnel on proper techniques of project inspection, monitoring, use of field monitoring equipment, and data collection; and
- assist TPP EMT in coordinating and consulting with other government agencies, local communities, NGOs, and other stakeholders concerned with environmental aspects of the project.

1034. To ensure public disclosure and maintain the right of involvement on decisions and control of the appropriate implementation of the EMP and monitoring, a nongovernment organization (NGO), Independent Ecological Expertise, should work in close cooperation with other parties.

1035. The TPP EMT will include an environmental management expert as project manager with overall responsibility for implementation and monitoring of all proposed measures. The project manager, who will enforce the EMP through project implementation, will be assisted by an environmental management and public health specialist (EHSGS) and laboratory staff.

H.4. Information disclosure, consultation and participation. Grievance redress mechanism.

1036. Grievances and complaints by stakeholders will be addressed through the following mechanism:

- The following facilities will be provided for the lodging of complaints:
    a) Complaint receptacle at the CCPU entrance gate.
    b) Publication of a contact number and a contact email address at public consultation events and the CCPU entrance.
    c) Public consultation events.
- Complaints received at the entrance gate or by phone or electronically will be logged and forwarded to the EHSGS as soon as possible.
- Complaints will be reviewed and investigated by the EHSGS. The EHSGS will record the response and the actions arising. Any efforts to resolve the complaints have to be done as soon as possible.
- Complaints will be reviewed by the TPP EMT as part of each audit.

H.5. Mitigation Measures

1037. After identifying and evaluating significant impacts that produces the project on the environment, it is necessary to consider the required preventive and corrective measures.

1038. These measures are intended to prevent, reduce or compensate as far as possible, adverse effects, in order to reach levels which may be considered compatible with the maintenance of environmental quality. Preventive measures are always preferable over corrective ones, both in terms of environmental and economic standpoint.

1039. These measures were developed during the design, construction, operation phases of the new CCPU and decommissioning phase of the old units III and IV according to the time of their application. In this sense, some protective measures are intended to avoid or minimize impacts during the operational phase, however, their construction or installation is done during the design or construction phase, and they are also included in this phase. Specific measures included in this EMP will need to be updated prior to expiring the life time of the facility as it is considered more appropriate to conduct a specific study for this phase (final decommissioning) when the time comes so as to incorporate the most recent advances as far as material recycling and waste management available at that time. To this respect, a specific measure is included.

1040. It turns out to be advisable the implementation of an Integrated Management System in the existing Takhiatash TPP as well as in the new CCPU in a short-term/medium-term period. This would allow the Power Plant to integrate all of organization's processes in to one compete framework, enabling an organization to work as a single unit with unified objectives, promoting a constant improvement in the performance of the entire Power Plant.

1041. In addition, and as the essential point of this recommendation, developing a Management System in accordance with international standards would assure the fulfillment of all *Environmental*, *Health&Safety* and *Quality* requirements established by international legal framework. The implementation could be undertaken in several stages in order to gradually integrate EHS management into the normal operation of the power plant.

1042. Moreover, an effective management system bring many benefits to the organization:

- More efficient resource use
- Improved risk management
- Increase customer satisfaction
- Lower costs

1043. There are three international standards which could be followed:

- ISO 9001 (Quality Management System)
- ISO 14001 (Environmental Management System)
- OHSAS 18001 (Occupational Health and Safety Management System)

1044. As an option, the municipal landfill could include the following improvement measurements that are recommended:

- Location of the municipal landfill further than 250 meters to residential areas and following location recommendations of the IFC guidelines.
- Soil cover material, with base and side slopes designed to minimize infiltration and facilitate collection of leachate.
- Low-permeability landfill liners to prevent migration of leachate.
- Drainage and collection system and landfill cover (daily, intermediate, and final) to minimize infiltration.
- Leachate treatment on site and/or discharge to municipal wastewater treatment.
- Perimeter drains and landfill cell compaction, slopes and daily cover materials to reduce infiltration of rainfall into the deposited waste.
- Prevention system of the run-on precipitation into the active area of the landfill and a collection and control run-off system.
- Quantity and quality of leachate generated measured and recorded.
- Groundwater monitoring wells

1045. The mitigation measures proposed for the project are presented in Appendix I of Annex VIII.

H.6. Monitoring and Reporting Program

H.6.1. Monitoring

H.6.1.1. Takhiatash TPP current monitoring program

1046. Currently, Takhiatash TPP EMT monitors/calculate the following output:

- ✓ Annual amount of emissions discharged into the atmosphere: NOx, NO2, NO, CO, SO2, Benzopyrene
- ✓ Water use and effluents:
  - ✓ Monthly distribution of water intake and discharge (m^3/year) from and to Suenly canal.
  - ✓ Annual consumption of drinking water from municipal water supply system and amount of sewage water discharged to the municipal waste water treatment plant.
  - ✓ Annual amount of re-used water at the TPP (treated and reused water at the water treatment plant).
  - ✓ Water quality at intake and discharge points every 15 days of the following parameters: TPP, Fe, oil and grease, pH, temperature, mineralization, Cl^-, SO_4^{2-}, NO_3^-, NO_2^-, NH_4^+, BOD_5.
- ✓ Groundwater quality: a piezometric network formed by 57 wells-piezometers is deployed at the TPP. Some of them are inactive and require reconstruction. Nine parameters are analyzed: content of cations (Ca2+, Mg2+, Na+), chlorides (Cl-), sulphates, carbonates (HCO3-), pH, hardness and temperature
- ✓ Annual amount of disposed hazardous and non hazardous wastes disposed at the municipal landfill.
- ✓ Annual financial report on environmental taxes calculated in accordance with Resolution of Cabinet Ministry of RUz #199 dated 2003 ―On improvement of payment system for environment pollutions and wastes disposal at the territory of Republic of Uzbekistan".

1047. In parallel, Goskompriroda conducts monitoring of:

- ✓ Monthly air emissions samples of exhausted gases from TPP and analysis at the Goskompriroda ―Air monitoring" laboratory. Based on the results of these analyses annual discharge of pollutants from TPP is calculated.
- ✓ Soil analysis two times per year at the places, which have been defined as a potentially polluted. These points are located in the vicinities of the fuel tanks, at 10, 50, 100 and 150 m of distance from the tanks. The sampling depth ranges from 0 to 30 m. The analyzed parameters are: content of humus, pH, dry residual, nitrates, phosphates, oil products and three metals (copper, zinc and manganese)
- ✓ Water quality monitoring at the discharge canal: According to the National Regulation on Conducting of Environmental Monitoring, every 5 years surface water monitoring is revised. If during a monitoring period, pollution of water courses have not been observed, during the next 5 years there is no need to continuous with the monitoring. Due to the above reason, Goskompiroda is not monitoring water quality currently.

H.6.1.2. Takhiatash TPP future monitoring program

1048. The current monitoring program of the TPP should be extended and adapted to include the new CCPU operation. For category A projects, qualified and experienced external experts or qualified NGOs must verify monitoring findings.

1049. Monitoring program should apply national or international methods for sample collection, preservation and analysis, such as those published by the International Organization of Standardization (ISO). National methods will be always recognized on condition that they comply with quality and strictness of the international methodological standards. Samplings should be conducted by, or under, the supervision of qualified personnel. Analysis should be conducted by entities permitted or certified for this purpose.

1050. In order to control and improve the trustworthiness of all the data gathered by the monitoring system all the automated and manual equipment will be strictly calibrated in accordance with exactness and requirements of international standards and maintained properly and periodically through a **plan of calibration and maintenance**.

1051. **Sampling and analysis Quality Assurance/Quality control (QA/QC) plans** should be applied and documented to ensure that data quality is adequate for the intended data use. Monitoring reports should include QA/QC documentation.

1052. As mentioned above, and respecting the structure of the EIA, the Monitoring Program has been developed following the same framework: construction phase, operation phase and decommissioning activities.

1053. With the exception of general information, the most exhaustive and specific instructions to clarify how to implement the monitoring program are provided in the Appendix 2 of Annex VIII. There, several matrices will gathered all details about monitoring methods to be used, parameters, thresholds or performance indicators, locations, frequency, responsibility, etc. In this monitoring plan, only quantitative items have been included as it is understood that in the final EMP visual or other qualitative monitoring would be included in order to check the proper management and implementation of the mitigation measures.

1054. Prior to monitoring tasks are defined for construction phase, it turns out necessary that the activity areas shall be supervised, including the verification of proper marking and signage of all the work areas and any ancillary areas and access routes that support the work.

H.6.2. Reporting

H.6.2.1. Takhiatash TPP current reporting

1055. The Takhiatash TPP EMT annually submits two kinds of reports:

1056. Air emissions, generated wastes and disposal and financial report on environmental taxes. This information is submitted to the Goskompriroda of Karakalpakstan and Statistical Department of Karakalpakstan.

1057. Water use and effluents flues. This information is submitted to the following relevant organizations:

- ✓ Low Amudarya authority of irrigation system (responsible for management of surface water, under the Ministry of Agriculture and Water Resources Management).
- ✓ Goskompriroda
- ✓ Takhiatash ―Vodocanal" – organization responsible for drinking water supply and domestic waste water treatment
- ✓ Department of Environmental protection in Uzbekenergo.

H.6.2.2. Takhiatash TPP future reporting

1058. The report monitoring results to internal (project management) and external (authorities, local people, ADB) audiences is required to verify compliance with regulatory and other requirements. For projects which category is A, semiannual reporting is required as a minimum during construction or decommission and annually during operation. In these report compliance of the TPP is to be undertaken. During the second public consultation, a representative of the State Protection Committee of the Republic of Karakalpakstan requested to increase this frequency to a quarterly basis during the construction and decommissioning phases, therefore, environmental reports during these phases should be undertaken on a quarterly basis. Monitoring reports will be made available for public consultation at the TPP Medical Service (200 meters outside of the TPP gate)

1059. Details of the actions, including timeframe for completion, taken as part of the project in order to rectify noncompliance, if any, will be presented in a Corrective Action Plan.

1060. The annual report of the operation phase shall include aspects such as:

- Significant environmental impacts.
- Greenhouse gases control.
- Air quality control: air quality and conformity of stack emissions.
- Water quality control: effluents.
- Soil quality control
- Groundwater control.
- Waste management.
- Noise level control.

- Health & Safety control
- Grievance mechanism findings

1061. In order to improve the current environmental reporting, collection of data and redaction of reports should be in electronic format.

ENVIRONMENTAL MITIGATION MEASURES AND MONITORING PLAN

Appendix 1: Mitigation measures

A. Design and Preconstruction Phase

MITIGATION MEASURE N° 1	
IMPACT CONCERNED	Hazards for health and safety of the personnel and the surrounding population.
DEFINITION OF THE MEASURE	Development of an Environmental, Health and Safety (EHS) Plan for the construction, operation and decommissioning phases.
OBJECTIVE	Reduce potential impact in environment and risks to personnel and population
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The EHS plans will be based on the general (April, 2007) and Thermal Power Plants (December, 2008) EHS IFC guidelines and in the national legislation (Law about Labor (1993), Law about Industrial Safety of dangerous industrial bodies(2006) of RUz and existing regulation on Fire safety (2004), Safety standards for operation of electrical devises (2006), Rules for appliance and test of security facilities used in electrical devises (2002), Safety standards for operation of heat-mechanic thermal-trans mission equipment. (1991), the Order of Uzbek Supervision Agency of RUz in Power industry “Uzgos nadzor” “About confirmation of rules for personal work organizing (2002);KMK, “KMK 3.01.02-00”, “Safety engineering during construction”), whichever is more stringent. For the EHS decommissioning plan, especial attention should be paid to the handling and management of asbestos materials. In this regard, handling should: 1. Be only performed by specially trained personnel. Training of specialized personnel and the maintenance and removal methods applied should be equivalent to those required under applicable regulations in the United States and Europe (examples of North American training standards are available at: http://www.osha.gov/SLTC/asbestos/training.html) 2. Follow host country requirements, or in their absence, internationally recognized procedures (Examples include the American Society for Testing and Materials (ASTM) E 1368 - Standard Practice for Visual Inspection of Asbestos Abatement Projects; E 2356 - Standard Practice for Comprehensive Building Asbestos Surveys; and E 2394 - Standard Practice for Maintenance, Renovation and Repair of Installed Asbestos

MITIGATION MEASURE N° 1	
	Cement Products). EHS will include an emergency or contingency plan and rescue operations.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU (construction and decommissioning phases) TPP EMT (operation phase)
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Construction, operation and decommissioning phases EHS construction plan EHS decommissioning plan EHS operation plan
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None.
MAINTENANCE	None.
COST	25000 $US per EHS construction plan. Cost should be covered by contract sum. 25000 $US per EHS decommissioning plan. Cost should be covered by contract sum 40000 $Us per EHS operation plan

MITIGATION MEASURE N° 2	
IMPACT CONCERNED	All impacts during Decommissioning.
DEFINITION OF THE MEASURE	Design a Decommissioning Plan for the existing units III and IV at Takhiatash TPP.
OBJECTIVE	Reduce potential impact in environment and risks to personnel and population
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	A detailed Decommissioning Plan will be thought and carefully designed in order to define every single point of this activity. The demolition and deconstruction work has to be carefully planned and executed. In order to cover all the points related to these kind of works, the following points must be taken into account: - Legal framework related to decommissioning. - Description of the location of the project. - Description of all the existing facilities to be decommissioned. - Scope of the Decommissioning Plan. - Decommissioning strategy/works. - Description of the works. - Environmental assessment of the project. - Relevant environmental factors. Regarding environmental issues of the Decommissioning project, the following points must be considered in the Plan: • Hazardous Materials Management.

MITIGATION MEASURE N° 2	
	• Spill Prevention. • Emergency Response. • Stormwater pollution prevention. • Revegetation. • Noise Control. • Traffic control. • Fugitive Dust Control. • Water conservation. Specific consideration should be paid to hazardous waste materials. Close Hazardous waste storage is 30 km far away from the TPP and existing bunkers are full. Construction of new bunker in the existing hazardous waste storage or construction of new hazardous waste storage on or off site the TPP must be considered.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EPC CCPU & Decommissioning Contractor
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Decommissioning phase
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	97500 $US. Cost should be covered by contract sum

MITIGATION MEASURE N° 3	
IMPACT CONCERNED	All the impacts.
DEFINITION OF THE MEASURE	Contractual environmental requirements
OBJECTIVE	Assurance that sufficient environmental management will be followed by contactors.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	PMU will provide the successful contractor with the translated EIA, including the EMP. As specified by law, the contractor will be required to retain an ecologic safeguard expert with EIA experience to prepare a Construction Environmental Action Plan (CEAP) and obtain all relevant permits. The contractor will not be permitted to mobilize the workers without an approved CEAP and the appropriate permits in place. Contractual environmental requirements that must be included in contracts are: Ensure specific contractual requirement, e.g. withholding of payment or penalty clauses, to ensure contractor's

	implementation of environmental mitigation measures. Contracts to require contractor to have designated staff to oversee environmental issues and mitigation. Contracts to include the requirement for the contractor to provide environmental induction to all staff.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS EPC CCPU & Decommissioning contractor
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Construction and Decommissioning phases. Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	Environmental safeguard expert: 57000 $US/year. Cost should be covered by contract sum.

MITIGATION MEASURE N° 4	
IMPACT CONCERNED	All the impacts.
DEFINITION OF THE MEASURE	Institutional strengthening program
OBJECTIVE	Assurance that sufficient environmental management will be followed by the institutions (SNPC).
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The Project Director will provide the SNPC inspectors with the EMP and any supporting reports for use in their inspection process. PMU will organize a 1-2 day workshop and provide special training on environmental compliance monitoring and reporting, focusing on gaps indentified in this EIA. For this purpose PMU will hire an international and national consultant supervision staff (safeguards expert). In the consulting phase the establishing of an environmental management team and a management program will be provided.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Training documentation
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	5000 $US for workshop

MITIGATION MEASURE N° 5	
IMPACT CONCERNED	Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology.
DEFINITION OF THE MEASURE	Carbon financing
OBJECTIVE	Carbon reduction strategy
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	As an improving efficiency project, GHG emission will be reduced by the replacement of the obsolete units III and IV with the new combine cycle unit. This will allow undertaking a Clean Development Mechanism procedure for the project under the United Nations Framework Convention on Climate Change. This mechanism allows improvement of the emission performance to be reflected in carbon credits, which can then be sold. This fact open the possibility of securing a contribution to the cost of installation A PDD will have to be developed and approved previously to commissioning.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	PMU
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Preconstruction phase PDD
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None.
MAINTENANCE	None.
COST	Included in the project

MITIGATION MEASURE N° 6	
IMPACT CONCERNED	Hazards for health and safety of the personnel and the surrounding population.
DEFINITION OF THE MEASURE	Structural safety of the buildings
OBJECTIVE	Reduce potential risks to workers and public during access to project facilities.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The following measures should be taken into account to ensure the structural safety: • Physical separation methods around the project site in order to protect the public against hazards arising from dangerous substances or process failures, as well as nuisance caused by noise levels, odors and various emissions. Integration of technical establishment criteria and safety criteria to prevent from failures due to natural hazards. To this end, all project structures must be designed in accordance with technical and study criteria determined by risks specific to the site, including, among others, seismic activity (in accordance with Uzbek Constructions Norms and Regulations), slope stability, the wind

MITIGATION MEASURE N° 6	
	load, and various other dynamic loads. • The use of asbestos, PCBs and ozone depleting substances in refrigeration systems will not be permitted. • Application of locally or internationally recognized construction standards [ILO-OSH (2001), International Code Council (ICC)] in order to ensure that the buildings are designed and constructed in accordance with solid architectural and technical practices, including certain aspects for intervention in the case of fire. • Ensure unhindered access to the facilities and availability of roads to them in case of emergencies. • The entities in charge of researching and building the plants must certify the applicability and relevance of structural criteria used. Moreover, the new plant will be built according to international standards. Universal Design would apply to all types of common places (ramps, elevators, bathroom for people with disabilities, etc.).
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None.
MAINTENANCE	None.
COST	Included in the project

MITIGATION MEASURE N° 7	
IMPACT CONCERNED	Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste
DEFINITION OF THE MEASURE	Installation of transformers without PCB.
OBJECTIVE	Avoid the installation of transformers that contained PCB.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The insulating oil shall comply with the international standard IEC 60296 and shall free from PCB. The reference method is IEC 61619. The detection limit for a single peak is 0,1 mg/kg In accordance with the Stockholm Agreement, it is recommended to install transformers with zero contain of PCB.

ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	The transformer shall have an oil conservator tank that shall have an oil level gauge with maximum and minimum oil level and alarms.
MAINTENANCE	None
COST	Good practice. No cost.

MITIGATION MEASURE N° 8	
IMPACT CONCERNED	Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology
DEFINITION OF THE MEASURE	Construction of a 60 m stack.
OBJECTIVE	Minimize contaminating gas emissions and make sure that national and World Bank (World Health Organization) air quality standards are fulfilled.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The project includes the construction of a 60 m stack, in accordance with the result obtained which in accordance with the Environmental Protection Agency (EPA) atmosphere pollutant dispersion model (AERMOD). Stack height calculated with the Good International Industry Practices (GIIP) formula is 112,5 m. Constructor should analyze if with a 60 m stack height, excessive ground level concentrations due to downwash, wakes and eddy effects is avoided as current design stack location is close to the existing TPP buildings. If the ground level concentration is in excess, mitigation measures, including increasing stack height, should be adapted (see mitigation measure # 11) The stack will be provided with sampling doors, platforms, access routes, lighting and supports, etc. placed at correct height for manually sampling emission gases. Particularly stack should be constructed taking into account EN: 15259:2007 “Stationary source emission requirements for the measuring sections and sites and for the measurements objective, plan and report” or similar.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.

MITIGATION MEASURE N° 8	
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Application of appropriate marking systems to ensure proper visibility of the facility and avoid potential aircraft accidents.
MAINTENANCE	None.
COST	Included in the project

MITIGATION MEASURE N° 9	
IMPACT CONCERNED	Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete with an energy efficient technology
DEFINITION OF THE MEASURE	Use of low NO_x emission technology
OBJECTIVE	Minimization of NO_x emissions
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The project includes use of low NO_x emission burners. Design will be take into account compliance with emission limits contained in the World Bank Thermal Power Plant Guidelines (2008) for combustion turbines (51 mg/Nm3, dry basis, 3% O2).
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None.
MAINTENANCE	Regular maintenance of installations.
COST	Included in the project

MITIGATION MEASURE N° 10	
IMPACT CONCERNED	Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete to an energy efficient technology Hazards for health and safety of the personnel and the surrounding population..

MITIGATION MEASURE N° 10	
DEFINITION OF THE MEASURE	Installation of a Continuous Emissions Monitoring System (CEMS) and recording equipment.
OBJECTIVE	Monitoring and continuous recording of atmospheric emissions produced by the CCPU to guaranty emission standards fulfillment.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The project includes the installation of a Continuous Emission Monitoring System (CEMS) to check compliance with the emissions national and international (World Bank Thermal Plants IFC Guidelines 2008) standards. At national level, emissions are approved by SNPC licenses on “Maximum allowed discharge of pollutants in air”. This license should be re-approved every 3-5 years. Considered pollutants to analyze and record continuously and automatically are: SO2, NOx and CO. NOx should be measured in NO2 and NO in accordance with national emission standards. The continuous measurements carried out will include the measurement of the oxygen content, and should also include temperature, pressure and water vapor content of the exhaust gases. The continuous measurement of the water vapor content of the exhaust gas shall not be necessary, provided that the sampled exhaust gas is dried before the emissions are analyzed.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Sample and analysis methods should apply national or international methods, such as those published by the ISO.
MAINTENANCE	Maintenance and calibration specified by the manufacturer of the equipment.
COST	Included in the project

MITIGATION MEASURE N° 11	
IMPACT CONCERNED	Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete to an energy efficient technology Hazards for health and safety of the personnel and the surrounding population.
DEFINITION OF THE MEASURE	Air quality levels will be controlled by means of an air quality and a meteorological station
OBJECTIVE	Measuring levels of air pollutants inmission. Collection of data to know the local weather system for the interpretation of air pollution data collected in monitoring station. Monitoring the current impact of emissions in the values of inmission of pollutants emitted.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The project includes an air quality and a meteorological station. Air quality station includes SO2, NOx, and Particulate Matter. In order to include both national and international air quality standards the following parameters should be measured: • Particulate matter should be measured as TPM, PM10 and PM2,5. • NOX should be measured as NO2 and NO. • CO should be measured also. Air quality station should be located in the predicted maximum ground level concentration point. To locate this point a specific study should be carried out taking into account results of the atmospheric dispersion model, power supply, location within the national territory, etc. Meteorological station includes relative humidity, wind direction/speed, barometric pressure. Monitoring station should be located within the TPP terrains in order to gather information of the meteorological dispersion conditions of the exhaust gas. Air quality and meteorological stations must be installed and in operation in the pre-construction phase in order to gather air quality baseline data prior to construction of the stack. Assessment of the data recorded will be used to check if the height of the stack complies with air quality standards. In case of exceeding air quality standards, mitigation measures should be undertaken (e.g. stack height increase). Data will be saved by the recording device integrated into analyzer case and transferred to Main Control Room panels. The database compiled in there could be transfer to UES TSO (Unified Energy System Transmission System Operator of the Republic of Uzbekistan).
ORGANISATION	Safeguard unit of the PMU

MITIGATION MEASURE N° 11	
RESPONSIBLE FOR ITS MANAGEMENT	DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Implementation of national and international methods of collection and analysis of samples. Check that the measuring instruments are set and approved by a competent body, and properly calibrated and contrasted by organizations authorized by it. Check the correct operation and calibration of equipment installed and the state of the computer systems.
MAINTENANCE	Maintenance and calibration specified by the manufacturer of the equipment.
COST	Included in the project Air quality station location study: 25000 $US

MITIGATION MEASURE N° 12	
IMPACT CONCERNED	Increase in noise levels as a result of operating the new Takhiatash CCPU.
DEFINITION OF THE MEASURE	Building and/or Installing noise attenuation devices.
OBJECTIVE	Eliminate or reduce the noise transmitted to the outside through the operation of new plant and associated facilities.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	In accordance with the project, the following acoustic noise and vibration reduction measures have been included: Fans, smoke exhausters and pumps will be installed on resiliently supported base. Pumps, pie-lines, fans and air conduits will be separated by flexible joints. Cases of air conduits will be covered with special vibro-acoustic plaster. Also, the following measures will be installed in the ventilation units - Installation of vibration absorbers under centrifugal fans of input, extraction systems and air conditioning system - Installation of splitter silencers and sound traps at air pipelines - Connection of fans to the grid via flexible connectors - Speed of air flow in air pipelines will depend on facility type and number of personnel there in order to prevent aerodynamic noise - Air ventilation chamber structures installed in buildings with low permissible noise level, will be covered with heavy sound

MITIGATION MEASURE N° 12	
	insulation Also the following measures should be taken into account: - Boilers: they will have the elements required to reduce noise. Thermal sealing will be designed so as to reduce noise. - Air intake conduits will be coated with noise-reducing materials. - Steam by-pass conduits and the super heater will be coated with acoustic noise reducing materials. - The safety valves and pipes for purge recovery will have silencers. - For all fluids discharged into the atmosphere under pressure (gas and steam) noise reduction silencers should be planned. For the new unit, the weighted acoustic pressure A, measured at 1.5 m from the floor or from the ground, at a distance of 1 m from the noise source, will not exceed 80 dB (A) under normal operating conditions. Noise and vibration mitigation measures will fulfil whichever is more stringent between: 1) SanR&N No 0120-01 “Sanitarian norms for noise level at the working places”; 2) Table 2.3.1. Noise limits for various working environments of the World Bank IFC general EHS guidelines (2007). If any of the equipment exceeds the values prescribed, necessary measures will be taken.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	Regular maintenance of installations.
COST	Included in the project

MITIGATION MEASURE N° 13	
IMPACT CONCERNED	Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste.
DEFINITION OF THE MEASURE	Double-walled composite for underground storage tanks.
OBJECTIVE	Avoid contamination or alteration of groundwater and soil from spills of oil.

MITIGATION MEASURE N° 13	
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Underground emergency drain oil tank in the engine room of the turbine building must be design double-walled composite, o specially coated storage and piping systems. A mean of detecting leaks between the two walls should be provided.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	Checking the state of preservation of tanks and their water tightness.
COST	Included in the project

MITIGATION MEASURE N° 14	
IMPACT CONCERNED	Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste.
DEFINITION OF THE MEASURE	Hazardous materials and wastes storage design to avoid spillages or overflowing
OBJECTIVE	Avoid contamination or alteration of groundwater and soil from spills of oil or chemicals.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	In the project, the design characteristics for the storage facilities (chemical and materials storage; drummed oil storage) are: external wall three-layer cladding “sandwich-panel”; rolled roofing material; asphalt-concrete perimeter works with the width of less than 1 m around the buildings. Hazardous materials or wastes (chemicals, oil, etc) will be carried out in sealed holding tanks with a secondary containment with sufficient capacity to retain the discharge caused by the rupture of the 110% largest container or 25% of the combined tank volumes stored. These secondary containments will be made of impervious, chemically resistant material and should also consider means to prevent contact between incompatible materials in the event of a release Adequate ventilation where volatile hazardous materials or wastes are stored should be provided. The holding tanks will also ensure the containment of flows due to loading and unloading of hazardous materials and products. Oil tanks will include pumps shutting off devices to prevent

MITIGATION MEASURE N° 14	
	overfilling and oil level will be monitored in a continuous basis.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	Checking the state of preservation of tanks and their water tightness.
COST	Included in the project

MITIGATION MEASURE N° 15	
IMPACT CONCERNED	Water resources intake reduction Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one.
DEFINITION OF THE MEASURE	Design of a closed cooling water system for the new CCPU
OBJECTIVE	To reduce water intake flow and temperature increase impact
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	In accordance with the “Law on water and water use” of Uzbekistan the process water supply of the new CCPU will in accordance with the closed cooling water system. Therefore, the option for open cooling water system for the new CCPU is not considered as it is not an environmentally friendly solution.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	Included in the project

MITIGATION MEASURE N° 16	
IMPACT CONCERNED	Potential increase of soil salinity due to the cooling towers steam plume deposition Potential hygienic risks for the health and safety of personnel and the surrounding population.
DEFINITION OF THE MEASURE	Cooling tower design.
OBJECTIVE	Minimize the drift loss rate in cooling towers
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	In order to minimize the entrainment of drops in the exhaust air, cooling towers shall incorporate drift eliminators, which are devices placed inside the tower to prevent drops from going out with the air. The drift eliminator system's performance will be such as to ensure drift loss rate of 0.001%. A proper design of the cooling tower shall be applied in order to reduce soiling. The location and direction of the cooling towers should be carried out taking into account wind direction and speed in order to have an optimum efficiency and therefore reducing size of cooling steam plume.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	The specific maintenance conditions for the cooling towers
COST	Included in the project

MITIGATION MEASURE N° 17	
IMPACT CONCERNED	Alteration of the water quality as a consequence of effluent discharge.
DEFINITION OF THE MEASURE	Design of effluent treatment system to fulfill discharge standards.
OBJECTIVE	Avoid surface water contamination.

MITIGATION MEASURE N° 17	
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The effluents generated by operation of the new facilities of CCPU are: ▪ **Domestic effluents** Domestic wastewater or sanitary effluents is discharged, without treatment, though pipe line to the Takhiatash Municipal Waste Water Treatment Plant. This plant should fulfill sewage effluent standards of the general IFC EHS guidelines (2007) and otherwise the necessary facilities should be included in order to fulfill these standards previously to the discharge to the Municipal Waste Water Treatment Plant. ▪ **Rainfall effluents** Rainwater will be collected along the territory and discharged into existing storm water sewer system. ▪ **Oil and Chemical effluents** A new treatment of effluents will be provided for the new CCPU without using the existing effluent treatment installation. From the effluent treatment effluents are driven to the chemical treatment plant slime lagoons and then into the TPP waste channel. This pond will be made of impervious, chemical resistant material. Material used for the construction will have to resist high differences of temperature between stations in order not to crack. ▪ **Circulation system blowdown** Cooling tower blowdown water as relatively clean is discharged into the outlet channel of Takhtiatash TPP without treatment. Effluent treatment system and cooling water system of the new CCPU will be designed in order to fulfill new MAD for the CCPU and Thermal Power Plants EHS IFC guidelines (2008), whichever is more stringent. If natural water quality intake already excess standards, effluent treatment system and cooling water system will be designed in order not to increase levels of pollution.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE COST	Regular maintenance of installations. Included in the project

MITIGATION MEASURE N° 18	
IMPACT CONCERNED	Water resources intake reduction Potential effects on water resources due to the increase of water consumed for the new Unit. Alteration of the water quality as a consequence of effluent discharge. Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one.
DEFINITION OF THE MEASURE	Implementing an effluent continuous control system
OBJECTIVE	Comprehensive control of effluent to avoid pollution of surface waters due to poor operation of effluent treatment at the power plant.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Project includes automatic measurement of pH and temperature in the cooling water system. These measurements should be located at the intake and discharge points. Conductivity and flow should be measured on the same basis also. Check that the global monitoring and recording equipment works properly and that the discharge limits are met at any time.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Check that the global monitoring and recording equipment works properly.
MAINTENANCE	Regular maintenance of equipment
COST	Included in the project

ITIGATION MEASURE N° 19	
IMPACT CONCERNED	Alteration of the water quality as a consequence of effluent discharge. Potential improvement of the aquatic ecosystems as a consequence of partial replacement of an open cooling water system to a closed one.
DEFINITION OF THE MEASURE	Implementation of an optimized chemical dosing system for cooling water treatment and control.
OBJECTIVE	Avoidance of altering water quality and aquatic habitat conditions in the vicinity of the discharge point.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The water treatment for the cooling system of the new CCPU shall be designed with a biocide (sodium hypochlorite) dosage performed by a control and global

ITIGATION MEASURE N° 19	
	monitoring equipment with automatic dosage calibration. Total residual chlorine should be measured at the discharge point continuously. This will lead to process optimization and, therefore, a minimum requirement of chemicals additives, achieving a minimum concentration at discharge with consequent environmental benefits.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Check that the global monitoring and recording equipment works properly.
MAINTENANCE	Regular maintenance of equipment
COST	Included in the project

MITIGATION MEASURE N° 20	
IMPACT CONCERNED	Potential effects on, and disturbances to, the aquatic ecosystem through the installation of the water extraction system.
DEFINITION OF THE MEASURE	Water intake system environmental design
OBJECTIVE	Avoid impact on aquatic habitat.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Water intake mouth will be provided with two constructions for trash racks and screens, which will act as fish protection structures. Maximum through-screen design intake velocity should be reduced to 0,1524 m/s
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	Good practice. Not specific cost but to include this recommendation on the design.

MITIGATION MEASURE N° 21	
IMPACT CONCERNED	Potential impact on the landscape due to the physical presence of new CCPU.
DEFINITION OF THE MEASURE	Landscape design for the new unit and auxiliary installations.
OBJECTIVE	Minimize the impact on the landscape caused by the physical presence of the new plant.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Materials, colors and shapes shall be selected for their ability to integrate harmoniously into the surrounding landscape. Care should be taken over the finishing of fronting structures for buildings, so that they integrate into the landscape, avoiding colors and shapes that are reflective or conspicuous. The new buildings will be made on the same patterns as existing ones. Particular attention will be given to corrosion protection of plant, equipment and buildings particularly where exposed to the elements. All plates for fabrication will be their surfaces protected from further corrosion after fabrication.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU DCS
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts. Bidding documents have to include assurance that EMP will be followed. The EIA including EMP must be attached as part of bidding documents.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Use of materials, colors and shapes respecting the environment
MAINTENANCE	Checking the adaptation to the environment of the selected solution. The maintenance and preservation facilities will be done correctly.
COST	Included in the project. Good practice. Not specific cost but to include this recommendation on the design.

B. Construction of CCPU and Decommissioning of units III and IV

MITIGATION MEASURE N° 22	
IMPACT CONCERNED	All the impacts
DEFINITION OF THE MEASURE	The Safeguard unit of the PMU for the site will be the highest ranking team in charge of all environmental aspects both in the construction and decommissioning phases. EMT will be in charge of: - File control of contractors. - Check of the list of documents and environmental conditions provided to contractors. - Monitoring the progress and control the environmental behavior of contractors. - Supervision of compliance with the EMP, EHS plan and Non Compliance annotation reported. - Proposal for corrective or preventive measures corresponding to the resolution of non-compliance.
OBJECTIVE	Controls performed during the actual work development which ensures the implementation of the mitigation measures detailed in the EMP.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	A communication and evaluation procedure will be developed to oversee contractors' environmental behavior. Supervision of contractors' activity and verification that procedures and requirements are properly applied. Supervision observance of measures set out by the EMP under applicable legal conditions. Ensure that contractor liaises with local community on approach to mitigation.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU.
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction plan EMP decommissioning plan.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	The activities of the Safeguard unit of the PMU will be supervised by the EHSGH that will conduct a review of all documentation.
MAINTENANCE	None.
COST	Included in the project

MITIGATION MEASURE N° 23	
IMPACT CONCERNED	Hazards for health and safety of the personnel and the surrounding population.
DEFINITION OF THE MEASURE	Continuous execution of the EHS plan for construction and decommissioning phases
OBJECTIVE	Avoid environmental impacts, health and safety risk.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Special precautionary provisions to be taken into account in relation with contamination risks of air, water and soils and work safety prescriptions. • Specify waste management • Specify lay-out and function of latrines or chemical toilets, and detail clean-up operations. • Implementation of rodent control measures and monitoring. • Providing essential personal protective equipment • Implement accident reporting and investigation procedures with reporting of the root cause of individual cases, and analysis of weekly and monthly statistics. • Periodic audit of accident reports and safety system. • Carry out regular awareness campaigns among work staff, The staff involved in the construction of new CCPU as well as the decommissioning of the units III and IV will be aware of safety, health and environment so they understand the risks associated with the activity undertaken and realize how to do their tasks with the least possible risk to their health and the environment. For this purpose a Training Program will be developed considering: • Education and training of workers on regulations on environment, work safety and risk prevention and to obey them. • Conduct regular safety awareness campaigns for both the workforce and the general public, including specific hazards associated with the spread of HIV/AIDS.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction plan EMP decommissioning plan.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Particular emphasis will be laid on site worker training.
MAINTENANCE	None
COST	Cost should be covered by contracts sums

MITIGATION MEASURE N° 24	
IMPACT CONCERNED	All impacts during Decommissioning.
DEFINITION OF THE MEASURE	Implementation of the Decommissioning Plan for the existing units III and IV at Takhiatash TPP.
OBJECTIVE	The Decommissioning Plan will include the best available decommissioning management procedures and technologies.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The equipment of the existing units III and IV, will be decommissioned in accordance with an agreed Decommissioning Plan. This will provide for the protection so as not to pose an unacceptable risk to human health, safety, and the environment due to the presence of pollutants
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Decommissioning contractor
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Decommissioning Plan
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	Cost should be covered by contracts sums

MITIGATION MEASURE N° 25	
IMPACT CONCERNED	Potential hygienic risks for the health and safety of personnel and the surrounding population.
DEFINITION OF THE MEASURE	Contractor’s grievance mechanism development
OBJECTIVE	Avoid nuisances and impacts to neighboring activities and households.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	• Include in contract clauses contractor’s responsibility to mitigate nuisances, noise, vibration, and dust impacts and other nuisances to neighbors. • Ensure that contractor incorporates good construction management practices • Ensure that contractor liaises with local community on approach to mitigation. • Clarify by signboards on construction sites and/or stickers on equipment outlining how affected parties can lodge complaints. • Ensure that contractor records complaints and responses, conducts resolution monitoring, and includes information on complaints in regular progress reports. • Audit complaint files and verify closeout
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU EPC CCPU & Decommissioning contractor

MITIGATION MEASURE N° 25	
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Grievance mechanism within EMP construction and decommissioning plans
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	Included in the Environmental Safeguard Expert tasks

MITIGATION MEASURE N° 26	
IMPACT CONCERNED	Potential hygienic risks for the health and safety of personnel and the surrounding population.
DEFINITION OF THE MEASURE	Determining the necessary measures for dealing with potential risks arising from soil contamination
OBJECTIVE	Avoid environmental, health and safety risk due to the management of contaminated soil
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	When ground contamination is suspected during any phase of the project, or that this contamination is confirmed, the cause must be identified and rectified. If when starting the construction of new CCPU, soil pollution is observed, the contaminated land should be managed in order to avoid risks to human health and ecological receptors. The objective will be to reduce the level of contamination on the site to prevent human exposure to contamination. For determining the necessary measures for dealing with potential risks, the method specified in paragraph"1.8. "Polluted sites and soils" in the Health and Safety Environmental Guidelines of the World Bank (December 2008) shall be applied. This method of assessment will determine if the three risk factors named "contaminants", "receptors" and "ways of contamination", co-exist or are likely to co -exist on the project site within the current or future use of the land. When it is determined that the three risk factors are present, the following measures must be taken : 1. Risk identification: • Place identification. • Sampling and testing of contaminated materials in accordance with the set up technical procedures. • Evaluation of analytical results in accordance with local and national regulation concerning contaminated sites. In the absence of such regulations or standards on the environment, other sources of standards or guidelines may be consulted

MITIGATION MEASURE N° 26	
	• Examination of potential human and / or ecological receptors , and ways of exposure 2. <u>Temporary risk management:</u> Temporary measures of risk management must be taken at all levels of the project life cycle, when the presence of soil contamination could be an immediate danger, for example: • Presence of an explosive atmosphere caused by a contaminated site. • The accessible and excessive contamination, due to the power of contaminants, could give rise in case of short-term exposure to an acute toxicity, with long-term irreversible effects, to a sensitization or also to the accumulation of bio accumulative and toxic persistent substances. • Concentrations of pollutants higher than Risk Based Concentrations of Risk (RBC, USEPA). 3. <u>Detailed risk assessment</u> This evaluation will facilitate decisions on risk management in contaminated sites. Among the specific objectives of risk assessment, the following will be indicated : • Identification of receptors • Determine whether the presence of contaminants are in proportions that are potentially harmful to health • Determine how the receptors are exposed to contaminants • Identify the types of adverse effects arising from exposure to contaminants • Quantify the extent of health risks based on a quantitative analysis of exposure to contaminants and toxicity • Determine how current and future land use affects expected risks. • Quantify the potential risks to the environment and / or health arising from the migration of contaminants off-site • Determine the likely stability, increase or decrease of risk over time in the absence of any rehabilitation measure 4. <u>Permanent measures to reduce risks</u> • Risk mitigation strategies for sources of contamination and exposure levels (examples): – For soil, sediment, sludge, groundwater, surface water and leach ate: Biological / physical / chemical / thermal treatment in situ or off site, containment,

MITIGATION MEASURE N° 26	
	– natural attenuation, depending on different situations. – For the soil vapour intrusion: Vapour extraction, depressurization under the foundations, installation of a waterproof barrier, etc.. • Risk mitigation strategies for exposure course (examples): – Provision of alternative access to water when needed. – Recovery of soil contaminated by a minimum of 1 m of uncontaminated soil to prevent any contact with humans, and the penetration in contaminated soil of plant roots and small mammals. – Paving of contaminated soil as a temporary measure to prevent a path allowing direct contact, or the production and inhalation of dust. – Use of a ditch system to intercept and pump and treatment technologies to prevent the discharge of contaminated groundwater from affecting other sites. Precautions for health and safety will always have to be considered to minimize exposure to risks. Furthermore, staff working on contaminated land must be specially trained on health and safety, for activities related to contaminated soil.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Safeguard unit of the PMU EPC CCPU & Decommissioning contractor
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Specific procedure of the EHS construction and decommissioning plans
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Organize periodic servicing in accordance with predetermined plan.
MAINTENANCE	None.
COST	To be estimated if soil pollution is found out

MITIGATION MEASURE N° 27	
IMPACT CONCERNED	Potential elimination of vegetation during land and vegetation clearing. Potential soil compaction.
DEFINITION OF THE MEASURE	Topsoil stripped and safely stockpile where it is available for re-use.
OBJECTIVE	Top covering layer of soil available when reaching completion of the project.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Top soil coming from earthmoving will be properly stockpiled and preserved in order to be re -use in recovering works. This material will be spread out and cover areas to revegetate after finishing civil works.

	The shape of these piles won't be higher than 2 meters, 5,5 meters width on the base. Neither the height of these piles, nor the width on the base will exceed 2 and 5,5 meters respectively. The slope of heaps will be never higher than 1/1 proportion.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction Construction plan
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	In order to avoid damage, the dimension of the piles will be strictly respected as well as the fact that top soil won't be mixed with different kind of materials. The location of the heaps will be never close to riverbeds or strong wind areas.
MAINTENANCE	To preserve the quality of this land it could take place fertilizing, seeding and watering works. Complementary irrigation will take place when especially dry conditions.
COST	Good practice. Not specific cost.

MITIGATION MEASURE N° 28	
IMPACT CONCERNED	Discrete and local increase in particulate matter suspended in air.
DEFINITION OF THE MEASURE	Dust control
OBJECTIVE	Maintain air and surface vegetation free of dust. Avoid alteration of air quality. Avoid the visible presence of dust.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Water sprinkling for establishing dust and preventing dust dispersal over wind exposed areas that contain heaps of earth or other substances; excavated or stockpiled soil and sand before loading; terrain or areas which vehicles frequently access, and in neighboring sensitive areas which could be affected. Trucks carrying sandy materials/waste should be covered over with tarpaulins or any other means for avoiding particle dispersion. The device must cover the entire truck. Speed of vehicles shall be limited particularly on unpaved areas Provide for wheel washing at site exit Provide for road cleaning to remedy an spread due to site traffic
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases. Construction plan
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Taking as a threshold to do the watering, the visible presence of dust by simple visual observation. Pay attention when filling and emptying buckets of trucks to avoid raising dust.
MAINTENANCE	Maintain in good preservation the tarpaulins used to cover dump trucks. Use an appropriate cover, making sure not to leave any openings.
COST	Included in the project.

MITIGATION MEASURE N° 29	
IMPACT CONCERNED	Degradation of air quality due to exhaust emissions from construction and decommissioning equipment.
DEFINITION OF THE MEASURE	Control of gas emissions generated by construction and decommissioning vehicles.
OBJECTIVE	Maintain good air quality in terms of air pollutants in the construction phase and decommissioning.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	In order to control and reduce gas emissions as far as possible, the engines of on-site vehicles should be serviced and tuned by a competent entity. All heavy equipment and machinery shall be fitted in full compliance with the national SNPC and local regulations with regards to emissions and noise.

MITIGATION MEASURE N° 29	
	Application of mechanical maintenance programs recommended by manufacturers. Inform drivers of the benefits of good driving practices that reduce vehicle fuel consumption and the risk of accidents. Emphasize the importance of avoiding sudden accelerations and respect the speed limits.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Check that all licenses of machines are up to date and that they have been through the appropriate inspections and that only properly registered and well-maintained vehicles are used. Check that all the machines meet the standards on emissions of pollutants, noise and vibration. The authorized service is responsible for servicing.
MAINTENANCE	The site manager will make sure that all machinery is in good condition and will ensure they have the corresponding certificates.
COST	Good practice. Not specific cost

MITIGATION MEASURE N° 30	
IMPACT CONCERNED	Potential increase in the noise level
DEFINITION OF THE MEASURE	Mitigation of noise emissions.
OBJECTIVE	Minimize inconvenience to staff and population by noise coming from action on the site.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	In order to reduce noise emission, the following criteria should be adapted: 1) Construction and decommissioning activities which cause excessive noise will be programmed for normal working hours. As a rule, the operation of heavy equipment shall be conducted in the time span 7am-7pm only, unless otherwise agreed with local residents (enforce speed limits, and restrict operation hours through roadside villages and settlements). All events used during start up activities will be adequately silenced to avoid excessive noise. Activities such as steam blowouts and testing safety valves will be programmed for normal working hours. 2) For machine and personnel movement on site: - When site operations begin, verify that construction

MITIGATION MEASURE N° 30	
	vehicles have undergone the corresponding technical inspections. For any vehicle with mechanical engine, transmission, body and any other element capable of producing sounds and vibrations and, in particular, the silencing of exhaust gases, must be in good operating condition. - All the equipment, which generates excessive noise, such as compressor, jackhammers shall be enclosed to prevent noise nuisance. -As far as possible, drivers of all the vehicles on site should adapt their speed so as to reduce noise. -Workers should be informed of measures for minimizing noise emissions. 3) For the loading and unloading: -Sand, brickbats, gravel etc. should be carried out low and as close as possible to the ground. -Site activities should be scheduled so as to avoid combined action of several equipment types that cause high noise levels over prolonged periods.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	To inform and educate site personnel on the obligation to respect other employees, the surrounding population and possible wildlife area. Respect of servicing periods of equipment used.
MAINTENANCE	None.
COST	Good practice. Not specific cost

MITIGATION MEASURE N° 31	
IMPACT CONCERNED	Potential soil compaction Potential reduction in the total area of fauna habitats in the work area Potential elimination of vegetation
DEFINITION OF THE MEASURE	Marking off and beaconing of activity areas.
OBJECTIVE	Minimizing of the ground area affected by the building work, avoiding acting on other sectors.

MITIGATION MEASURE N° 31	
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Scheduling and planning of access points and occupation areas should be carried out for site machinery and personnel. For this purpose, the following criteria should be followed: - Action areas should be scheduled and marked off. - The parcel of land to be used for hosting the new unit should be marked with beacons, as well as the areas to be used for storing materials, the site yard and the areas set aside for vehicle and equipment maintenance so that workers will not be confused as to boundaries. - Out of the work area, moving machinery, the deposit of materials or any type of waste will not be allowed.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases. Construction and Decommissioning plans.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	EMT will check at any time that actions take place only in areas marked for work.
MAINTENANCE	EMT will conduct periodic servicing of the roads, ensuring that they retain the characteristics of the initial width and signaling.
COST	Good practice. Not specific cost

MITIGATION MEASURE N° 32	
IMPACT CONCERNED	Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste.
DEFINITION OF THE MEASURE	Waste management
OBJECTIVE	Avoid contamination of soil and groundwater, by discharge and improper management of waste generated by staff and machinery used for carrying out the work.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	A waste management hierarchy that consider prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes should be considered. Final disposal must be undertaken in an environmentally sound manner. Prior to start of construction or decommissioning, develop an inventory of waste fractions expected to be generated during construction or decommissioning for approval of

MITIGATION MEASURE N° 32	
	disposal routes and sites. Minimizing hazardous waste generation must be carried out by implementing stringent waste segregation to prevent the commingling of non-hazardous and hazardous waste to be managed. This classification should be based in the Basel Convention signed by Uzbekistan. Areas where construction and decommissioning work are carried out, labor camps also should be equipped with drums and other suitable containers for collecting hazardous and non hazardous wastes. Their location should be conspicuously marked and made known to all site workers. For hazardous wastes: • Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. (sufficient space between incompatibles or physical separation such as walls or containment curbs) • Store in closed containers away from direct sunlight, wind and rain • Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location. Should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment • Provide adequate ventilation where volatile wastes are stored. After being collected, waste shall be processed depending on type. The current management of wastes of the TPP can be used but some of the procedures should be corrected to fulfill international good practices: • Non-hazardous wastes: -Recycled: Iron, metal debris, steel, stubs, wool debris, waste rubber and tires, waste paper and other recyclable waste fractions can be selling to the enterprises currently being used in the operation of the existing units. -Disposed: Rest of non-hazardous wastes that are not being recycled as household and similar waste and waste such as concrete, brick, etc. should be transported to a properly designed, permitted and operated landfill.

MITIGATION MEASURE N° 32	
	One option is to improve Municipal landfill currently being used by the TPP to avoid soil and groundwater pollution. Hazardous -Disposed: ✓There will be a temporary storage of hazardous wastes. ✓Hazardous wastes will be properly separated and not mixed, avoiding difficult mixtures of hazardous wastes that do complicate their management. ✓Types of wastes generated will be packaged and labeled in homologated containers. ✓Incineration of hazardous wastes is prohibited in facilities without flue gas treatment system for control of acid gases, particulate matter, and other air pollutants. ✓The disposal of wastes is always done at an authorize agent. It there is not a hazardous waste landfill or storage which have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment neither the permits, certifications, and approvals of applicable government authorities, an specific facility must be constructed or adapted to provide sound long-term storage of wastes on-site or at an alternative appropriate location up until external commercial options become available. In this respect, mazut storage tanks located at 35 km from the TPP can be used as long-term hazardous waste storage considering specific adaptation measures (see “precautions for implementation and management”) ✓The documentation concerning the delivery of waste to the manager will be stored. ✓A record of the produced and managed wastes will be made, and of their destination. ✓Direct discharge will be never allowed on the ground.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases. Construction and decommissioning plans.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	To take into account IFC Waste Management Facilities Environmental, Health and Safety Guidelines (December, 2007). Verifying the absence of debris, garbage or losses along the project areas or in any other unauthorized place. Daily check of the status of collection elements, by emptying them if necessary.

MITIGATION MEASURE N° 32	
	All elements of waste collection will be positioned as far as possible from waterways. Ensure that all personnel are informed of standards and guidelines for responsible handling of materials and waste. EMT must have a traceability of all documents. If a malfunction is found, a form of non-compliance will be written. For the disposition of hazardous wastes in the mazut storage the following measures should be followed: • Remaining mazut should be completely removed or stabilizated in such a way to avoid potential mixture with the hazardous waste to storage • Reparation of the potential cracks and fissures that concrete wall, floor and roof could have. • Divide the tanks into different cells to separate wastes with different properties • Cement should have low-permeability and be chemically resistant. Otherwise a liner gathering these characteristics should be installed. • Install a leachate collection and removal system if needed • Install a groundwater monitoring wells network (see mitigation measure nº 55)
MAINTENANCE	Presence of appropriate quantity and quality of collection elements, from their exchange in case of loss of initial conditions for tightness.
COST	Hazardous temporary storage on site: 25000$US Mazut storage adaptation (long-term hazardous waste storage) 100000 $US/tank. It is estimated that just one tank will be needed for the construction and decommissioning phases

MITIGATION MEASURE N° 33	
IMPACT CONCERNED	Potential soil, subsoil, groundwater and surface water pollution by accidental spillages or wrong waste management. Hazards for the health and safety of the surrounding population.
DEFINITION OF THE MEASURE	Proper transporting methods for hazardous materials
OBJECTIVE	Avoid risks of Transportation for the prevention or minimization of the consequences of catastrophic spills of hazardous materials.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public.

MITIGATION MEASURE N° 33	
	It must be ascertained that the officers in charge of dangerous residue management apply procedures in order to ensure compliance with local hazardous materials transport laws and applicable international requirements (such as United Nations and other international standards as well as local requirements for overland transport etc). These officers must fulfill the Transport 3.5 condition in World Bank Directives (April 2007) and shall include in their methodology transport procedures of hazardous matters (Hazmat), which must include : - Proper labeling of containers, including the identity and quantity of content, hazards, and details of the sender - Ensure that the volume, nature, integrity and protection of packaging and containers used to transport appropriate for the type and quantity of hazardous materials and modes of transport involved - Ensure the proper specifications for transportation vehicles - Training of employees involved in transporting dangerous goods on transport procedures and emergency procedures - Using the labeling and posters (external signs on transport vehicles), as required - Provide the required emergency response on call 24 hours/day.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases. This procedure will be extended to the operation phase.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Organize periodic servicing in accordance with predetermined plan.
MAINTENANCE	Maintenance specific to the operational phase.
COST	Good practice. Included in the Environmental Safeguard Expert task.

MITIGATION MEASURE N° 34	
IMPACT CONCERNED	Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste.
DEFINITION OF THE MEASURE	Spill prevention measures and arrangement of impervious areas for fueling, maintenance and repair of machinery
OBJECTIVE	Avoid contamination of factors water and soil by spills and discharge generated by fueling, maintenance and repair of the machinery.

MITIGATION MEASURE N° 34	
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	A special specific area should be set aside for site vehicle servicing, washing, filling, oil changing and other operations. This area should be conspicuously marked and made known to all site workers. The area shall possess a paved ground surface, or where applicable, an impermeable surface along with an effluent collecting system to avoid soil contamination (oil spill catch basins or oil catch pans provided at all service areas). Setting up suitable secondary retention systems for the storage and temporary storage of fuel and other fluids such as lubricating oils and hydraulic fluids. All fuel use areas where spills and leakage are possible, e.g. the generator, must have drip basins installed to prevent any leakage. Fueling equipment must be fitted with proper fuel nozzles and devices to avoid accidental spills. Solid and liquid waste (fuel substances, used parts) will be properly managed. A spill response procedure shall be developed: In the case of an accidental spill, if the ground is paved, an absorbent will be used (for example sawdust) in order to capture the waste substance. The absorbent when gathered up must be processed as a hazardous waste substance. If the ground is not paved, it will be immediately removed, and the terrain affected will be cleaned up. Spill response kits at all storage areas and work sites must be provided. Workers will need to be trained in transport techniques and the correct manipulation of fuel substances and chemical products, as well as how to deal with spills.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases. Construction and decommissioning plans.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Strict control of workers on machines for them to perform maintenance tasks in the appropriate areas and provided for this purpose. Periodic inspections and revisions "without notice" to verify that the tasks described are performed in areas specifically provided for this purpose.
MAINTENANCE	Periodic review of the state of the water tightness and drainage systems.
COST	15000 $US for secondary containments and special specific area for machinery.

MITIGATION MEASURE N° 35	
IMPACT CONCERNED	Potential soil and groundwater pollution by accidental spillages or wrong waste management.
DEFINITION OF THE MEASURE	Proper oil management existing transformer to be moved
OBJECTIVE	Avoid risks of oil spills in the relocation of the existing transformer.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Power output of the new generator will be connected to the existing substation which will be adapted. For the adaptation of the substation to the new unit, existing transformer could be moved. If so, transformer oil must be managed in an environmental friendly way and taking good international practice in order not to cause soil pollution.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	In case of spill, spill response procedure should be applied and used oil, as well as absorbent used in order to capture oil, should be managed as hazardous waste.
MAINTENANCE	None.
COST	Good practice. Included in the construction waste management

MITIGATION MEASURE N° 36	
IMPACT CONCERNED	Potential soil and water contamination due to improper storage or manipulation of the work materials and/or waste
DEFINITION OF THE MEASURE	A washing area will be provided for concrete truck chutes with mobile equipment for cleansing and containing waste.
OBJECTIVE	Avoid the generation of equipment cleaning leftover concrete and other waste in the work zone and in the surroundings.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	A washing area for concrete truck chutes and other equipment cleansing waste will be set up, where concrete trucks will cleanse chutes of concrete residue. Personnel will be trained in the proper use of this equipment.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction Construction plan.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None

MITIGATION MEASURE N° 36	
MAINTENANCE	When the wash rack is full of chutes, removal and shipment of concrete to an authorized landfill.
COST	18000 $US

MITIGATION MEASURE N° 37	
IMPACT CONCERNED	Potential contamination of surface water by sanitary water from workers
DEFINITION OF THE MEASURE	Black waste water generated by the workers will be controlled through the installation of adequate sanitation systems.
OBJECTIVE	Avoid discharge of non purified sanitary water and ensure their proper management.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Relevant sanitary and hygiene services will be implemented. These services will be in charge of collecting and treating black waste water.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	The effluent will be managed by approved enterprises. Discharge of black waste water to water bodies without treatment will be prohibited. These effluents should be treated at the Takhiatash municipal waste water treatment plant. A delivery note/receipt must be keept.
MAINTENANCE	Check that the collection and /or management system finally selected works properly.
COST	5000 $US/year

MITIGATION MEASURE N° 38	
IMPACT CONCERNED	Increase of suspended solids in water as a result of construction works.
DEFINITION OF THE MEASURE	Controlling suspended solids to surface waters.
OBJECTIVE	Avoid increasing suspended solids in Suenly canal.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	During construction works close to the Suenly canal, barriers drain systems and decantation areas should be implemented in order to minimise suspended solids in overflows. During construction of the new intake pump station and discharge pipeline within the existing intake and discharge canals, an environmental appropriate method for construction and dredging will be implemented. Rigorous controls will be implemented on the site during construction of the pumping station.
ORGANISATION	EMT

MITIGATION MEASURE N° 38	
RESPONSIBLE FOR ITS MANAGEMENT	
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction Construction plan.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Checking the efficiency of these systems during the completion of building works and after completion analyzing measurements carried out in the water intake area on the operation of the existing units.
MAINTENANCE	None.
COST	Good practice to consider into the construction design.

MITIGATION MEASURE N° 39	
IMPACT CONCERNED	Potential degradation of the local geomorphology. Potential increase of erosion risk due to construction works.
DEFINITION OF THE MEASURE	Verifying sources of materials of the site.
OBJECTIVE	Avoid extracting mineral resources of rivers and side of the road nearby to use as building materials.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	No mineral resources and fill material will be extracted from nearby watercourses or side roads. Mineral resources from the outside will be regulated by the authorities. Ensure good landscaping and erosion control practices, including proper site re-contouring and replacement of topsoil.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	PMU
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Purchase specifications and contracts Construction plan
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Check that suppliers of building materials have the relevant authorizations in order.
MAINTENANCE	None.
COST	Good practice. No specific cost.

MITIGATION MEASURE N° 40	
IMPACT CONCERNED	Potential soil compaction. Potential elimination of vegetation Hazards for safety of the personnel and the surrounding population
DEFINITION OF THE MEASURE	Traffic management plan.
OBJECTIVE	Prevent the increase in traffic from producing discomfort to the surrounding population.

MITIGATION MEASURE N° 40	
	Minimize the surface affected by works.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Development of a traffic management plan, to mitigate impact on local traffic conditions during construction. • Traffic control will be carried out, including observance of distances between transport vehicles on communication roads belonging to the power plant. • Confine heavy construction related traffic to the least sensitive access roads to the construction sites to avoid accidents and nuisance to dwellers along the road and other road users. • No transport or operation of heavy equipment at night. Driving will be only allowed on roads or paths which have been built for this purpose in order to avoid soil compacting. • Require contractors to prepare and organize work implementation schedules and tasks for proper registration for the vehicles and heavy equipments, driving licenses, requires skills and experience. • Strict adherence to regulations, especially regarding speeding and overloading • Provide for contingency planning and rescue operations. • Conduct regular safety awareness campaigns for both the workforce and the general public, particularly focusing on local schools. • Traffic regulation measures will be implemented, including traffic signals, and personnel will be placed in charge of reporting hazardous situations.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT in close consultation with local authority
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Control and constant updating required.
MAINTENANCE	None.
COST	Included in the Environmental Safeguard Expert task.

MITIGATION MEASURE N° 41	
IMPACT CONCERNED	Potential increase in the noise level of the construction sites.
DEFINITION OF THE MEASURE	Noise measurement campaign
OBJECTIVE	Noise level measurement in order to include mitigation measures if needed
DESCRIPTION OF THE MEASURE / ISSUES THAT IT	As there are residential receptors of noise close to the plant boundary (within 100 m), a noise campaign will be

MITIGATION MEASURE N° 41	
INCLUDES	undertaken every 6 months in continuation of the campaign carried out in this EIA during construction and decommissioning phases, in order to check fulfillment of noise standards (Uzbek construction noise norms (KMK 2.01.08-96 “Protection from noise”); Admissible noise level into the living area, both inside and outside the buldings (SanR&N No.0267-09); and general EHS IFC guideline (2007) standards). Noise campaign will continue in operation phase every year. If noise mitigation measures considering in construction, operation and decommissioning phases and are not enough to fulfill noise standards, other mitigation measures will be considered.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction, operation and decommissioning phases.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	An approved measuring enterprise should be in charge of the noise measurements campaign. Noise monitoring program must be conducted by trained specialists. Monitors should be located approximately 1.5 m above the found and no closer than 3 m to any reflecting surface.
MAINTENANCE	Noise monitoring should be carried out using a Type 1 or 2 sound level meter meeting all appropriate IEC standards. Sound level meter should be calibrated every year.
COST	Option 1: Cost of a new noise measurement equipment: 3000-15000 $US Option 2: Cost of measuring campaign: 2000 $US/year (construction and operation)

MITIGATION MEASURE N° 42	
IMPACT CONCERNED	Alteration of the water quality as a consequence of effluent discharge.
DEFINITION OF THE MEASURE	Extension of the current water quality monitoring
OBJECTIVE	Water quality monitoring in order to check if effluents fulfill standards.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Currently, water quality monitoring is carried out every 15 days at the intake and discharge points. Not all the World Bank effluent standards (Thermal Power Plants EHS IFC guidelines, 2008) are measured and in order to have a background water quality of these parameters, a water quality analysis has been carried out within the baseline of

	this EIA. Nevertheless this measurement is not sufficient and an extension of the baseline should be undertaken. For this purpose, the inclusion of the following parameters in the current measurements within the construction phase should be considered in order to gather information to conclude a baseline previously to the operation of the new CCPU: total residual chlorine, Cr, Cu, Zn, Pb, Cd, Hg and As. The water quality measurements will continue during the operation phase in order to check if standards (national MAD for the TPP or World Bank, whichever is more stringent) are being fulfilled. If there is no variation between intake and discharge points observed after one year, the monitoring of these new parameters could be discontinued.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and operation phases.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Monitoring programs should apply national or international methods for sample collection and analysis, such as those published by the International Organization of Standardization. Samplings should be conducted by, or under, the supervision of trained individuals.
MAINTENANCE	Analysis equipment should meet all appropriate IEC standards and should be calibrated at least once a year.
COST	Option 1: Cost of a new equipment: 57000 $US Option 2: Cost of analysis of the new parameters in the intake and discharge points: 500 $US/analysis (12000 $US/year) (construction and operation phases)

MITIGATION MEASURE N° 43	
IMPACT CONCERNED	Potential impact on historical and archaeological heritage
DEFINITION OF THE MEASURE	Archaeological follow-through during construction phase.
OBJECTIVE	Detect and avoid the impact on archaeological deposits
EFFICIENCY	High.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	If Physical Cultural Resources (PCR) are encountered during construction, they will suffer no additional disruption until they have been evaluated by a competent expert and avoidance, minimization or mitigating measures are developed. The type and level of detail of the assessment should be proportionate to the nature and scale of the project´s potential adverse impact on the chance find. In this case, a chance finds procedure should be developed that outline the roles, responsibilities and response times required by project staff and any relevant heritage authority; agreed consultation procedures; record keeping and expert verification procedures; chain of custody instructions for movable finds; and clear criteria for temporary work

	stoppages. ADB environmental safeguards should be followed on this purpose.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT where appropriate, an archaeologist expressly authorized.
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	In case of appearance of archaeological remains during construction, it shall be notified, in order to achieve its proper evaluation before continuing with the project in the sector concerned.
MAINTENANCE	None.
COST	To be estimated in case of PCD findings

MITIGATION MEASURE N° 44	
IMPACT CONCERNED	Hiring of personnel during construction works and decommissioning. Reactivation of the local economy.
DEFINITION OF THE MEASURE	Economic impact on the municipality and the region affected by the project.
OBJECTIVE	Sharing positive fallout of the construction/decommissioning project with the region.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	During the construction of the new CCPU facility as well as the decommissioning of the existing units III and IV, as far as possible and depending on availability, work positions created by the project will be filled by local personnel. Similarly, materials, machines and services will be purchased in the area surrounding Takhiatash TPP. The project should include gender-inclusive core labor standards to promote female employment opportunities with non-discrimination, equal pay for work of equal value. All this will be carried out without delaying works, nor affecting quality.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	PMU by agreements with equipment suppliers and contractors.
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP construction and decommissioning phases
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None. As much as possible to recruit unskilled worker from local areas
MAINTENANCE	None.
COST	Good practice. No cost

MITIGATION MEASURE N° 45	
IMPACT CONCERNED	Potential damage to road infrastructure caused by heavy duty construction and decommissioning traffic.
DEFINITION OF THE MEASURE	Any services interrupted or modified will be returned to their initial status.

OBJECTIVE	Restoring the original conditions of services and easements affected by the construction or decommissioning phases, especially roads and paths.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Services that were interrupted or modified by the project's construction or decommissioning works will be returned to their initial status, and any damage incurred will be made good.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	PMU in close consultation with local authority
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Construction Plan Decommissioning Plan.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	If it is necessary to temporarily change the easements or infrastructure, they will remain operational with the necessary temporary alternatives. If it is necessary to move an item during the site building, it will have to be stored properly for its repositioning at the end of the construction work that concerns it. During the restoration of paths and roads and repositioning of affected items, care must be taken not to dump any type of discharge outside the areas marked for this purpose by ensuring its correct repositioning and management.
MAINTENANCE	Check the proper functionality of the infrastructure, service or damaged item after its recovery.
COST	390000 $US

MITIGATION MEASURE N° 46	
IMPACT CONCERNED	Potential modification of landscape during the construction and decommissioning
DEFINITION OF THE MEASURE	Removal of temporary installations and revegetation when construction and decommissioning phases are over.
OBJECTIVE	Avoid impact on the landscape caused by the temporary facilities on the site.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	All the temporary structures required in the course of construction operations and decommissioning, or their vestiges will be removed as soon as the works are over. After that the following steps will be undertaken: • Respread saved topsoil • Revegetate areas • Complete stabilization before onset of rains It is recommended to include a green area in the vicinity of the TPP terrains. For this aim, an assessment of which is the most suitable area should be done. Species of trees/bushes/grasses to be planted will depend of soil and climate characteristics. Endemic species should be considered in order to guarantee the good development of the green area.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT

PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	Construction Plan. Decommissioning Plan.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None.
MAINTENANCE	There will be maintenance of the overall state of preservation of all equipment necessary for the operation, especially posters, signs, lights and fencing.
COST	Revegetation within TPP terrains: 13000 $US/hectare (26000 $US estimated in total) Green area at the vicinity of the TPP: 20000$US/hectare (40000$US estimated in total)

C. Operating phase

MITIGATION MEASURE N° 47	
IMPACT CONCERNED	All the impacts
DEFINITION OF THE MEASURE	Continuous execution of the EMP Plan during operation phase
OBJECTIVE	An Environmental Management Team in charge of the continuous execution of the EMP during the operating phase of the TPP must be included in the Takhiatash TPP organization structure.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The staff of the EMT of the TPP will responsible and will be in charge of monitor, control, supervise and report all the environmental aspects of the operation of the power plant in order to ensure implementation of the EMP.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Control and constant updating required. A specific training course should be provided to this EMP in order to gather the technical requirements.
MAINTENANCE	None.
COST	Staff of the TPP. Design of materials and providing training course: 30000$US

MITIGATION MEASURE N° 48	
IMPACT CONCERNED	All the impacts
DEFINITION OF THE MEASURE	Continuous execution of the EHS Plan during operation phase
OBJECTIVE	Strongly follow regulation on environment, health and safety plan. Establish comprehensive safety regulations; • Install proper alarm systems. • Ground all electrical equipment and provide circuit breakers. • Provide back-up water supplies for fire fighting. • Provide fire extinguishers at strategic locations around the site and monitor them for functionality. • Follow existing regulations on safety.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The staff be trained in environment, health and safety, so that they understand the risks associated with the activity they perform and are aware of how to perform their tasks with the least possible risk to their health and the environment. It is recommended to conduct a consulting and training program for key personnel of Takhiatash CCPU. This will ensure that highly qualified staff will take over the

MITIGATION MEASURE N° 48	
	responsibility and will work on environmental, health and safety management and monitoring. The training program should be performed in coordination with the responsible local authorities. In the training phase the following items could be included: Environmental monitoring of thermal power plants and potential mitigation measures; emissions equipment (requirements, specifications, operation, and maintenance); wastewater analysis and waste management; worker safety and health aspects; etc.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EHS operation EMP operation.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Control and constant updating required.
MAINTENANCE	None.
COST	Staff of the TPP. Design of materials and providing training course: 30000 $US

MITIGATION MEASURE N° 49	
IMPACT CONCERNED	Greenhouse gases emission reduction by the replacement of an obsolete with an energy efficient technology.
DEFINITION OF THE MEASURE	Greenhouse gases annual quantification
OBJECTIVE	Control of greenhouse gases emissions
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Direct emissions from the facilities owned or controlled within the physical project boundary and indirect emissions associated with the off-site production of power used by Takhiatash TPP will be quantified. Quantification and monitoring of GHG emissions will be conducted annually in accordance with internationally recognized methodologies. There are many internationally recognized methodologies that can be used to estimate and monitor a project’s direct GHG emissions, with the most authoritative methodologies found in the 2006 IPCC “Guidelines for National Greenhouse Gas Inventories”. To take into account the following guidelines: Volume 1: General Guidance and Reporting Volume 2: Energy

MITIGATION MEASURE N° 49	
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	Staff of the TPP

MITIGATION MEASURE N° 50	
IMPACT CONCERNED	Outdoor air quality improvement due to the emission reduction by the replacement of an obsolete to an energy efficient technology Hazards for health and safety of the personnel and the surrounding population..
DEFINITION OF THE MEASURE	Annual stack emission testing
OBJECTIVE	An annual emission test will be undertaken in order to have direct measurement of emission levels to counter check the CEMS.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	At least an annual stack emission testing will be carried out. If annual stack emission testing results show constantly (3 consecutive years) a significantly (less than 75%) better than the required levels, frequency of annual stack emission testing can be reduced from annual to every two or three years.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	An approved measuring enterprise should be in charge of the stack emissions test. International methodologies to measure pollutants must be followed (EN 15259:2007; ISO 10498 for SOx; ISO 7996 for NOx; ISO 10473 for particulate matter; ISO 4224 for CO; or similar level)
MAINTENANCE	Test equipment should be calibrated under international standards.

MITIGATION MEASURE N° 50	
COST	Currently on going in the boiler. This practice could be extended to the stack at the indicated place and methodologies on the international standards.

MITIGATION MEASURE N° 51	
IMPACT CONCERNED	Potential soil, subsoil, groundwater and surface water pollution by accidental spillages or wrong waste management.
DEFINITION OF THE MEASURE	Maintain good state of preservation of the sludge ponds, fuel, oil or other chemicals storages/containers.
OBJECTIVE	Avoid contamination or alteration of soil and groundwater resources from licks and spills.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Implementation of an inspection program to maintain the mechanical integrity of pressurized containers, tanks, pipe systems, ventilation and dump valve systems, brace infrastructure, automatic emergency stop systems, controls and pumps and related process equipment. Periodical monitoring will be carried out to maintain the structural integrity (coatings and retention systems) of sludge ponds, oil, fuel and chemical storages/containers to avoid leaks. Where applicable, adequate repairs will be carried out. Spill response and emergency plans to address accidental releases should be prepared and implemented
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Organize periodic servicing in accordance with predetermined plan.
MAINTENANCE	Maintenance specific to the operational phase.
COST	Staff of the TPP

MITIGATION MEASURE N° 52	
IMPACT CONCERNED	Potential increase of soil salinity due to the cooling towers steam plume deposition
DEFINITION OF THE MEASURE	Monitoring of soil salination levels at spray locations coming from the cooling towers plume steam
OBJECTIVE	Control of the soil salination effects
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Initial check of water and salt precipitation rates in the cooling towers. The measurements would be made along the area in which, after the observation of the steam plume, deposition is more likely to occur. Measurements shall be preferably carried out during spring and summer seasons. This check would be also made after significant changes

	in the towers, such as changes in components or in the operating system, which may lead to a substantial increase in the salts emission rate finally adopted. The first measures, to be implemented during the first two years of operation of the plant, would be gathered in a report, which would also establish: 1) Comparison of the results with the reference levels 2) Need for corrective actions 3) New scope of the Environmental Monitoring Plan
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation A baseline campaign should be done previously to the commissioning of the CPU.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	Organize periodic servicing in accordance with predetermined plan.
MAINTENANCE	None
COST	4000 $US/campaign

MITIGATION MEASURE N° 53	
IMPACT CONCERNED	Alteration of the water quality as a consequence of effluent discharge
DEFINITION OF THE MEASURE	Control of the composition of the cooling water treatment additives
OBJECTIVE	Avoid discharge to harmful substances to the water bodies
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Elimination of metals such as chromium and zinc from chemical additives used to control scaling and corrosion in cooling towers Use the minimum required quantities of chlorinated biocides in place of brominated biocides or alternatively apply intermittent shock dosing of chlorine as opposed to continuous low level feed
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation Purchase specifications and contracts
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None
COST	Good practice. No cost

MITIGATION MEASURE N° 54	
IMPACT CONCERNED	Potential soil, subsoil, groundwater and surface water pollution by accidental spillages or wrong waste management.
DEFINITION OF THE MEASURE	Management of waste generated by operation of the plant.
OBJECTIVE	Prevent contamination of soil and water due to improper management of waste generated by the new plant.

MITIGATION MEASURE N° 54	
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Waste is to be managed according to the procedures contained in the law about Wastes of RUz (No.362-II of 05.004.2002), follow approved by SNPC licenses on “Wastes Disposal limits”. Also, Basel Convention signed by Uzbekistan and general and waste management facilities EHS IFC guidelines should be fulfilled, whichever is more stringent. A waste management hierarchy that consider prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes should be considered. Final disposal must be undertaken in an environmentally sound manner. Prior to start operation a waste inventory procedure as specified in Guideline O’z RH 84.3.15:2005 must be completed. This document will also serve as a basis for Waste Data Sheets. For this purpose, waste classification should be based in national legislation and Basel Convention signed by Uzbekistan, whichever is more stringent. Minimizing hazardous waste generation must be carried out by implementing stringent waste segregation to prevent the commingling of non-hazardous and hazardous waste to be managed. Takhiatash TPP should be equipped with drums and other suitable containers for collecting hazardous and non hazardous wastes. Their location should be conspicuously marked and made known to all site workers. For hazardous wastes: • Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. (sufficient space between incompatibles or physical separation such as walls or containment curbs) • Store in closed containers away from direct sunlight, wind and rain • Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location. Should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment • Provide adequate ventilation where volatile wastes are stored. After being collected, waste shall be processed depending

MITIGATION MEASURE N° 54	
	on type. Sludge from waste treatment plant and water supply treatment needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste. The treatment method and the disposal location will be decided by the administrative unit in addition to the disposal fee. The current management of wastes of the TPP can be used but some of the procedures should be corrected to fulfill international good practices: Non-hazardous wastes: -Reuse: Solid precipitation of the settling tank and pulp dump will be use in agricultural needs as fertilizer only if analyses of the pulp characteristics conclude that there are not hazardous or toxic compounds that could be a health risk. Should not be accepted a waste that contains organics that are contaminated by potentially hazardous chemicals and/or pathogenic substances and micro-organisms that will not be rendered harmless by the process or may constitute a health or environmental risk. -Recycled: Iron, metal debris, stubs, wool debris, waste rubber and tires, waste paper and other recyclable waste fractions can be selling to the enterprises currently being used in the operation of the existing units. -Recover: Only non-hazardous wastes can be burned in existing boiler furnaces. -Disposed: Rest of non-hazardous wastes that are not being recycled as household and similar should be transported to a properly designed, permitted and operated landfill. One option is to improve Municipal landfill currently being used by the TPP to avoid soil and groundwater pollution.. Hazardous: Hazardous waste storage, transfer, disposal and treatment will be done by an authorized waste management facility. The contractors handling, treating and disposing hazardous waste should be reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled (ensuring compliance with applicable local and international regulations).

MITIGATION MEASURE N° 54	
	-Recycled: Fluorescent lights shall be delivered to a specialized organization on lamp utilization as it is being doing up to now. -Recover: Hazardous wastes cannot be burned at existing boiler furnaces as they are not provided with exhaust gas treatment. Hazardous wastes can be burned or incinerated just in approved installations with the proper treatment for exhaust gases in order not to introduce hazardous compounds into the atmosphere. -Disposed: - There will be a temporary storage of hazardous wastes. - Hazardous wastes will be properly separated and not mixed, avoiding difficult mixtures of hazardous wastes that do complicate their management. - Types of wastes generated will be packaged and labeled in homologated containers. - The documentation concerning the delivery of waste to the manager will be stored. - A record of the produced and managed wastes will be made, and of their destination. - Direct discharge will be never allowed on the ground. - If there is not a hazardous waste landfill or storage which have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment neither the permits, certifications, and approvals of applicable government authorities, an specific facility must be constructed or adapted to provide sound long-term storage of wastes on-site or at an alternative appropriate location up until external commercial options become available. Mazut storage adapted as hazardous wastes storage for the construction and decommissioning phases can be used for the operation phase if recommendations indicated in mitigation measure nº 32 have been undertaken.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	A waste management hierarchy that consider prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes should be considered. This includes an update of the waste management policy every time a new procedure for prevention, reduction, reuse, recovery, recycling and removal can be introduced in the process or operation management. The trends in waste generation by type and quantity of waste shall be monitored.

MITIGATION MEASURE N° 54	
	When a new waste stream is generated, this must be fully characterised, periodic characterisation must be documented, and the waste must be properly handled, in particular hazardous waste. The performance of regular audits on the waste segregation and collection practices shall be undertaken. Records tracking hazardous waste received, stored, or sent out should include: name and identification number, physical condition, quantity, method and date of storage, location of waste at the facility and amount deposited in each area.
MAINTENANCE	The storage site of waste must be big enough to store the waste until they are properly managed and must include an appropriate number of containers (in quantity and quality). These will be exchanged in case of detection of loss of initial conditions for tightness. Regular visual inspections of all the waste storage and collection areas shall be conducted to ensure that the waste management is appropriate, the number of containers is sufficient, and the containers are properly sealed.
COST	Long-term hazardous waste storage (mazut storage adapted): 100000 $US/tank.

MITIGATION MEASURE N° 55	
IMPACT CONCERNED	Potential soil, subsoil, groundwater and surface water pollution by accidental spillages or wrong waste management.
DEFINITION OF THE MEASURE	Extension and improvement of the existing groundwater monitoring network.
OBJECTIVE	Comprehensive groundwater control to early detection of potential licks or spillages in order to avoid soil and groundwater pollution
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Improve functioning of the existing wells established at TPP and provide additional network of observation wells in areas which could mean risks on the quality of groundwater and soil as it would be sludge ponds, oil and chemicals storage tanks, hazardous waste storage by adding one well below each site in the direction of groundwater to surface waterways. Parameters to measure are: • pH • Oil products • Metals: arsenic, cadmium, cobalt, copper, chromium, lead, mercury (inorganic), nickel, zinc • Organochlorine Pesticides • Phenols

MITIGATION MEASURE N° 55	
	The schedule recommended for sampling and analyzing activities will be flexible depending on the environmental expert judgment; however it would be never less often than once a year. If there is no variation in results of metalls organochlorine pesticides observed after one year, the monitoring of these parameters could be discontinued.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	The monitoring equipment will be calibrated and maintained properly and periodically through a plan of calibration and maintenance, compliance with which will be included in a document. The sampling will have to follow the methods of sample collection, preservation and analysis internationally agreed. The samples must be conducted under the supervision of qualified personnel. The analysis will be carried out by organizations with appropriate permissions and certificates.
MAINTENANCE	Check that the global monitoring and recording equipment works properly. Check the state of maintenance and preservation of measuring devices.
COST	Option 1: If own equipment is used, cost is included in mitigation measure nº 42 Option 2: Cost for campaign for 4 wells 900 $US (3600 $US/year)

MITIGATION MEASURE N° 56	
IMPACT CONCERNED	Potential soil and groundwater pollution by accidental spillages or wrong waste management.
DEFINITION OF THE MEASURE	Specific storage of chemical products
OBJECTIVE	Avoid contamination of soil and groundwater due to discharges and mismanagement of chemicals.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	Chemical products whether received will be labeled and stored in suitable places and registered and recorded by the chemical products department. At the time of each delivery, it must be ascertained that all environmental and safety measures are applied.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation

MITIGATION MEASURE N° 56	
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	It must be ascertained that there are safety and environmental information sheets concerning all products present on the site, and that they are easily accessible and available to all chemical Department operators or any other Power Station personnel.
MAINTENANCE	Maintenance specific to the operational phase.
COST	Good practice. Staff of the TPP

MITIGATION MEASURE N° 57	
IMPACT CONCERNED	Potential health risk for the operation of the cooling towers
DEFINITION OF THE MEASURE	O&M program for the cooling towers in order to prevent legionella.
OBJECTIVE	Legionella prevention by the application of health and safety measures.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	An O&M program will be undertaken for the legionella prevention. This program will ensure that typical cooling system diseases as a consequence of bacterial outbreaks will not take place in the CCPU cooling system. The program will include: - Drawing of the cooling towers with water sampling points. - Check and inspection of all parts of the installation to ensure proper operation, establishing the critical points, the parameters to be measured and the procedures to follow, as well as the frequency of each activity. - Water treatment plan, to ensure its quality. This program shall include products chemicals, doses and procedures as well as physical, chemical and biological control parameters, their measurement methods and the frequency of testing. - Cleaning and sanitizing program for the whole facility to ensure that it works according to safety conditions, clearly establishing the procedures, the chemicals to be used and their dosage, the prevention measures to be considered, and the frequency of each activity. - Existence of a maintenance record for each facility to collect all incidents, activities, results and dates of technical stops and start-ups of the facilities, including their reasons.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	EMT
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	EMP operation
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	The following documentation can be used as a guidelines: • LEGIONELLA and the prevention of legionellosis (WHO) • ISO/TS 12869:2012 Water quality -- Detection and

	quantification of Legionella
MAINTENANCE	Recommended by the equipment supplier.
COST	Staff of the TPP

D. Decommissioning of the TPP

MITIGATION MEASURE N° 58	
IMPACT CONCERNED	All the impacts during the decommissioning phase
DEFINITION OF THE MEASURE	Design a Decommissioning Plan at the time of TPP closure.
OBJECTIVE	The Decommissioning Plan will include the best available decommissioning management procedures and technologies at the time when the power plant is closed.
EFFICIENCY	High.
DESCRIPTION OF THE MEASURE / ISSUES THAT IT INCLUDES	The facilities will be decommissioned in accordance with an agreed Decommissioning Plan. The environmental aspects of the decommissioning stage should be also considered, both during initial design and during periodic reviews undertaken as part of the management system. Risk and impacts will be analyzed for the decommissioning or closure phase. The Decommissioning Plan will provide for the protection of the quality of soil and water as well as other natural resources such as fauna and flora, woodlands, forest products and marine resources so as not to pose an unacceptable risk to human health, safety, and the environment due to the presence of pollutants. For the purpose of achieving the aforementioned, the preventive and corrective measures needed to mitigate, eliminate or compensate for any impacts will be proposed once these impacts have been assessed.
ORGANISATION RESPONSIBLE FOR ITS MANAGEMENT	Operation Manager
PERIOD AND DOCUMENT IN WHICH IT IS SPECIFIED	At the end of the power plant life.
PRECAUTIONS FOR IMPLEMENTATION AND MANAGEMENT	None
MAINTENANCE	None.
COST	To be estimated at the end of the life of the plant previously to the decommissioning phase.

Appendix 2: Environmental monitoring plan

<table>
<tr><th>Aspect to be monitored or Mitigation Measure.</th><th>Monitoring Methods</th><th>Parameters to be measured</th><th>Assessment Criteria</th><th>Locations</th><th>Monitoring Frequency</th><th>Responsibility</th><th>Cost</th></tr>
<tr><td colspan="8">CONSTRUCTION AND DECOMMISSIONING PHASES</td></tr>
<tr><td>Air emission and noise</td><td>To keep a record book with the official inspection certification of the vehicles and machineries as evidence to ensure that are serviced and tuned by a competent entity.</td><td>Vehicle and machinery Inspection certification.</td><td>Compliance with the national SNCP and local regulations with regards to emission and noise</td><td>Competent entity
Record book at the safeguard unit of the PMU office</td><td>Every time a new machinery or vehicle is hired</td><td>Safeguard unit of the PMU</td><td>Included in the Environmental Safeguard Expert tasks.</td></tr>
<tr><td>Noise</td><td>Noise monitoring campaign
Monitors should be located approximately 1.5 m above the found and no closer than 3 m to any reflecting surface. A type 1 or 2 sound level meter should be used.</td><td>Ambient noise levels (dBA)</td><td><table><tr><th>Name of area</th><th>Sound level, (dBA)</th></tr><tr><td>Residential areas (inside) (SanR&N No.0267-09):
Day time
Night time</td><td>

40
30</td></tr><tr><td>Residential areas (outside) (SanR&N No.0267-09 and IFC EHS general guidelines (2007)):
Day time
Night time</td><td>

55
45</td></tr><tr><td>Industrial areas (IFC EHS general guidelines (2007))</td><td>70</td></tr></table></td><td>See Figure 1 at the end of this table
Points 1 to 4: Industrial area
Points 5 to 8: Residential area</td><td>Every 6 months.
If noise perception is high or nuisances from the population are registered, frequency should be increased</td><td>Safeguard unit of the PMU</td><td>See mitigation measure nº 41</td></tr>
<tr><td rowspan="2">Waste management</td><td>To keep:
a) Permits and certifications of the waste management and recycling enterprises
b) Contracts of the authorized waste management and recycling enterprises. In the contract it should be included the management and final disposal of wastes under an environmental sound manner.</td><td>Waste manager's permits and certifications.

Contracts with the waste managers</td><td>Uzbek Law on wastes and IFC EHS general guidelines (2007)</td><td>Waste management and recycling enterprises
Safeguard unit of the PMU office</td><td>Every time a new waste management or recycling enterprise is hired</td><td>Safeguard unit of the PMU</td><td>Included in the Environmental Safeguard Expert tasks.</td></tr>
<tr><td>The documentation concerning the delivery of waste will be stored to serve as evidence of their appropriate treatment.
Produced and managed wastes, as well as its destination shall be addressed and recorded</td><td>Waste delivery notes

Waste receipts</td><td></td><td>Waste management and recycling enterprises
Safeguard unit of the PMU office</td><td>Monthly</td><td>Safeguard unit of the PMU</td><td>Included in the Environmental Safeguard Expert tasks.</td></tr>
<tr><td>Waste water</td><td>A check shall be made to ensure that sanitary effluents from site personnel are appropriately managed.

The documentation concerning the delivery of effluents for their treatment in the Takhiatash municipal waste water treatment plant will be stored to serve as evidence of their appropriate treatment.</td><td>Effluents delivery notes and receipts</td><td>Municipal waste water treatment plant should fulfill SanR&N No 0172-04 Hygiene requirements for the protection of surface waters and table 1.3.1. of the IFC EHS general guidelines (2007)</td><td>Takhiatash municipal waste water treatment plant
Safeguard unit of the PMU office</td><td>Every time the sanitation systems need to be emptied.</td><td>Safeguard unit of the PMU</td><td>Included in the Environmental Safeguard Expert tasks.</td></tr>
</table>

<table>
<tr><th>Aspect to be monitored or Mitigation Measure.</th><th>Monitoring Methods</th><th>Parameters to be measured</th><th>Assessment Criteria</th><th>Locations</th><th>Monitoring Frequency</th><th>Responsibility</th><th></th></tr>
<tr><td colspan="7">CONSTRUCTION AND DECOMMISSIONING PHASES</td><td></td></tr>
<tr><td rowspan="2">Surface water Quality.</td><td>Observation and report of the results of the current water quality monitoring of the TPP done every 15 days to analyze the variation of the suspended solids parameter during the works to be done at the intake and discharge areas</td><td>Suspended solids</td><td>Suspended solids:
Norms for pollutants into the discharging water (for Takhiatash TPP)= 103 mg/l
Table 5 of Thermal Power Plants IFC EHS guidelines = 50 mg/l</td><td>Intake and discharge areas</td><td>Every 15 days during the construction works at the intake and discharge areas</td><td>Safeguard unit of the PMU
TPP EMT</td><td>Analysis already on going on the TPP current management. Assessment included in the Environmental Safeguard Expert tasks.</td></tr>
<tr><td>Extension of the current water quality monitoring of the TPP done every 15 days to include more parameter in order to achieve a broader water quality baseline that includes IFC EHS general guidelines (2007)</td><td>New parameters: Total residual chlorine, Cr, Cu, Zn, Pb, Cd, Hg and As

Current parameters: Suspended solids, mineralization, Cl-, SO4, NO3, NO2, NH4, Fe, BOD-5, Oil products, pH, temperature.</td><td>Norms for pollutants into the discharging water (for Takhiatash TPP) and Table 5 of Thermal Power Plants IFC EHS guidelines
<table>
<tr><th rowspan="2">Parameter</th><th>TPP limits</th><th>WB limits</th></tr>
<tr><th>MAC
mg/dm^3</th><th>MAC
mg/dm^3</th></tr>
<tr><td>Pb</td><td>0.03</td><td>0.5</td></tr>
<tr><td>Cd</td><td>0.005</td><td>0.1</td></tr>
<tr><td>Cu</td><td>0.001</td><td>0.5</td></tr>
<tr><td>Zn</td><td>0.01</td><td>1</td></tr>
<tr><td>Fe</td><td>0.3</td><td>1</td></tr>
<tr><td>Cr (total)</td><td>-</td><td>0.5</td></tr>
<tr><td>As</td><td>0.05</td><td>0.5</td></tr>
<tr><td>Hg</td><td>-</td><td>0.005</td></tr>
<tr><td>pH</td><td>6.5-8.5</td><td>6-9</td></tr>
<tr><td>Suspended solids</td><td>103</td><td>50</td></tr>
<tr><td>Residual chlorine</td><td>-</td><td>0.2</td></tr>
<tr><td>Oil products</td><td>1.45</td><td>10</td></tr>
<tr><td>Temperature Increase (ºC)</td><td></td><td>3ºC (1)</td></tr>
<tr><td>Mineral content</td><td>785</td><td>-</td></tr>
<tr><td>Cl-</td><td>300</td><td>-</td></tr>
<tr><td>SO_4</td><td>265</td><td>-</td></tr>
<tr><td>NO_3</td><td>9.1</td><td>-</td></tr>
<tr><td>NO_2</td><td>0.026</td><td>-</td></tr>
<tr><td>NH_4^+</td><td>0.5</td><td>-</td></tr>
<tr><td>BOD_5</td><td>3</td><td>30(2)</td></tr>
</table>
(1) In the mixing zone
(2) Table 1.3.1. IFC EHS general guidelines (2007)</td><td>Intake and discharge areas</td><td>Every 15 days.</td><td>Safeguard unit of the PMU
TPP EMT</td><td>See mitigation measure nº 42</td></tr>
</table>

Aspect to be monitored or Mitigation Measure.	Monitoring Methods	Parameters to be measured	Assessment Criteria	Locations	Monitoring Frequency	Responsibility	
CONSTRUCTION AND DECOMMISSIONING PHASES							
Traffic management	Register of vehicles site entry/exit hours and route to control observance of distances between transport vehicles fulfilling schedule planned to avoid nuisances to the population.	Vehicles schedule and route	No complaints of the surrounding population	Site entry/exit	Monthly	Safeguard unit of the PMU	Included in the Environmental Safeguard Expert tasks.
Social management	Register of the local workers and enterprises hired to analyze the percentage of local resources vs external or overseas resources. This will allow to analyze the positive impact on the municipality and region.	Workers and enterprises origin		Human Resources office at the site	Monthly	Human Resources unit	Included in the Environmental Safeguard Expert tasks.
Occupational Health and Safety	Monitoring of: ✓ Safety inspection, testing and calibration ✓ Surveillance of the working environment ✓ Surveillance of workers health ✓ Training Accident and diseases monitoring: Implement accident and diseases reporting of the root cause of individual causes, cause patterns and analysis of weekly and monthly statistics.	Check that parameters indicated in the EHS construction and decommissioning plans are being monitored. For accident and disease monitoring: Number of fatal and non fatal injuries and duration of the incapacity to work.	Uzbek health and safety legislation Point 2.9. (Monitoring) of the IFC EHS general guidelines (2009)	Construction/Decommissioning site.	The indicated in the EHS construction and decommissioning plans. For accident and disease monitoring: Weekly and monthly reports	Safeguard unit of the PMU	Included in the H&S expert tasks
	Periodic audit of the EHS construction and decommissioning plans .	Check that parameters indicated in the EHS construction and decommissioning plans are achieved	Uzbek health and safety legislation Point 2. (Occupational Health and Safety) of the IFC EHS general guidelines (2009)	Constructions/Decommissioning site	Monthly	Safeguard unit of the PMU	Included in the H&S expert tasks
Implementation of mitigation measures	Overall EMP construction and decommissioning and CEAP performance. Audit to ensure performance and adherence.	Check that all the requirements agreed are achieved.	-	Construction/Decommissioning site.	Monthly	Safeguard unit of the PMU	Included in the Environmental Safeguard Expert tasks.

<table>
<thead>
<tr><th>Aspect to be monitored or Mitigation Measure.</th><th>Monitoring Methods</th><th>Parameters to be measured</th><th>Assessment Criteria</th><th>Locations</th><th>Monitoring Frequency</th><th>Responsibility</th><th></th></tr>
</thead>
<tbody>
<tr><td colspan="8">OPERATION PHASE</td></tr>
<tr><td rowspan="2">Air emissions</td><td>Greenhouse gases quantification</td><td>Greenhouse gases: Direct emissions and indirect emissions associated with the off-site production of power used by the TPP</td><td>2006 IPCC “Guidelines for National Greenhouse Gas Inventories”:
Volume 1: General Guidance and Reporting
Volume 2: Energy</td><td>TPP and off-site production of power</td><td>Annual</td><td>TPP EMT</td><td>Staff of the TPP (see mitigation measure nº 48)</td></tr>
<tr><td>Monitoring and continuous recording of emissions from the stack with a CEMS (Continuous Emissions Monitoring System)</td><td>Emissions of SO_2, NO, NO2, CO, O_2, temperature, pressure and water vapor
(shall not be necessary, provided that the sampled exhaust gas is dried before the emissions are analyzed).</td><td>Currently, Maximun Allowed Emission (MAE) has not been determined for the new CCPU. Therefore, at the time of writing this EMP, the standardization taken into account is the one shown underneath:
<table>
<tr><th colspan="3">Table 6-C of the IFC EHS Thermal Power Plants guidelines (2008)</th></tr>
<tr><th>Combustion technology /fuel</th><th>NO_x concentration level (mg/Nm^3)</th><th>Excess O_2 content, dry basis (%)</th></tr>
<tr><td>Natural Gas Turbines › 50 MW_{th}</td><td>51 (25 ppm)</td><td>15</td></tr>
</table>
Future MAD should not be more permissive than the above one.</td><td>Stack of the new CCPU</td><td>Continuous</td><td>TPP EMT</td><td>Included in the project (See mitigation measure nº 10)</td></tr>
</tbody>
</table>

<table>
<tr><th>Aspect to be monitored or Mitigation Measure.</th><th>Monitoring Methods</th><th>Parameters to be measured</th><th>Assessment Criteria</th><th>Locations</th><th>Monitoring Frequency</th><th>Responsibility</th><th></th></tr>
<tr><td colspan="7">OPERATION PHASE</td><td></td></tr>
<tr><td></td><td>Stack emission testing in order to have direct measurements of emission levels to counter check the CEMS</td><td>Emissions of SO_2, NO, NO2, CO, O_2, temperature, pressure and water vapor</td><td>Currently, Maximun Allowed Emission (MAE) has not been determined for the new CCPU. Therefore, at the time of writing this EMP, the standardization taken into account is the one shown underneath:
<table>
<tr><th colspan="3">Table 6-C of the IFC EHS Thermal Power Plants guidelines (2008)</th></tr>
<tr><th>Combustion technology /fuel</th><th>NO_x concentration level (mg/Nm^3)</th><th>Excess O_2 content, dry basis (%)</th></tr>
<tr><td>Natural Gas Turbines › 50 MW_{th}</td><td>51 (25 ppm)</td><td>15</td></tr>
</table>
Future MAD should not be more permissive than the above one.</td><td>Stack of the new CCPU</td><td>Annual.
If results show constantly (3 consecutive years) a significantly (less than 75%) better than the required levels, frequency can be reduced to every two or three years</td><td>TPP EMT</td><td>See mitigation measure nº 50</td></tr>
</table>

<table>
<tr><th>Aspect to be monitored or Mitigation Measure.</th><th>Monitoring Methods</th><th>Parameters to be measured</th><th>Assessment Criteria</th><th>Locations</th><th>Monitoring Frequency</th><th>Responsibility</th><th></th></tr>
<tr><td colspan="7">OPERATION PHASE</td><td></td></tr>
<tr><td rowspan="2">Air quality</td><td>Monitoring and continuous recording of ambient air quality through a fixed air quality monitoring station.</td><td>SO_2, NO2, NO, TSP, PM10, PM2.5, CO.</td><td>
<table>
<tr><th></th><th></th><th>µg/m^3</th></tr>
<tr><td>SO_2</td><td>10 min.
30 min.
24-hour
1 month
1 year</td><td>500 (2)
500 (1)
200(1); 20 (2)
100 (1)
50 (1)</td></tr>
<tr><td>NO_2</td><td>30 min.
1-hour
24-hour
1 month
1 year</td><td>85
200 (2)
60(1)
50 (1)
40 (1) (2)</td></tr>
<tr><td>NO</td><td>30 min.
24-hour
1 month
1 year</td><td>600 (1)
250 (1)
120 (1)
60 (1)</td></tr>
<tr><td>Dust (TSP)</td><td>30 min.
24-hour
1 month
1 year</td><td>150-500 (1)
100-350 (1)
80-200 (1)
50-150 (1)</td></tr>
<tr><td>PM1 0</td><td>1 year
24-hour</td><td>20 (2)
50 (2)</td></tr>
<tr><td>PM2. 5</td><td>1 year
24-hour</td><td>10 (2)
25 (2)</td></tr>
<tr><td>CO</td><td>30 min.
24-hour
1 month
1 year</td><td>5000 (1)
4000 (1)
3500 (1)
3000 (1)</td></tr>
</table>
(1) National standards (SanR&N No 0293-11 Hygienic requirements, the list of MAC for pollutants in atmosphere in Republic of Uzbekistan”)
(2) WHO Ambient Air Quality Guidelines (General IFC Guidelines ,2007)

From (1) and (2) whichever is more stringent.</td><td>Air quality station should be located in the predicted maximum ground level concentration point. To locate this point a specifi study should be carried out takiint into account results of the atmospheric dispersion model, (see Annex III), power supply, location within the national territory.</td><td>Continuous</td><td>TPP EMT</td><td>Included in the project (see mitigation measure nº 11)</td></tr>
<tr><td>Monitoring and continuous recording of meteorological data through a fixed meteorological monitoring station.</td><td>Wind speed and direction, atmospheric pressure, relative humidity and temperature.</td><td>-</td><td>Meteorologica station should be located within the TPP terrains in order to gather information of the meteorological dispersion conditions of the exhaust gas.</td><td>Continuous</td><td>TPP EMT</td><td>Included in the project (see mitigation measure nº 11)</td></tr>
</table>

Aspect to be monitored or Mitigation Measure.	Monitoring Methods	Parameters to be measured	Assessment Criteria	Locations	Monitoring Frequency	Responsibility	
OPERATION PHASE							
Noise	Noise monitoring campaign Monitors should be located approximately 1.5 m above the found and no closer than 3 m to any reflecting surface. A type 1 or 2 sound level meter should be used.	Ambient noise levels (dBA)	**Name of area** / **Level of sound, (dBA)** Residential areas (inside) (SanR&N No.0267-09): Day time: 40 Night time: 30 Residential areas (outside) (SanR&N No.0267-09 and IFC EHS general guidelines (2007)): Day time: 55 Night time: 45 Industrial areas (IFC EHS general guidelines (2007)): 70	See Figure 1 at the end of this table Points 1 to 4: Industrial area Points 5 to 8: Residential area Two other points should be located at the new CCPU fence once the final layout would be decided	Annually.	Safeguard TPP EMT	See mitigation measure nº 41
Waste management	To keep: c) Permits and certifications of the waste management and recycling enterprises d) Contracts of the authorized waste management and recycling enterprises. In the contract it should be included the management and final disposal of wastes under an environmental sound manner.	Waste manager's permits and certifications. Contracts with the waste managers	Uzbek Law on wastes and IFC EHS general guidelines (2007)	Waste management and recycling enterprises TPP EMT office	Every time a new waste management or recycling enterprise is hired	TPP EMT	Staff of the TPP
	The documentation concerning the delivery of waste will be stored to serve as evidence of their appropriate treatment. Produced and managed wastes, as well as its destination shall be addressed and recorded	Waste delivery notes Waste receipts		Waste management and recycling enterprises TPP EMT office	Annual estimation	TPP EMT	Staff of the TPP

<table>
<tr><th>Aspect to be monitored or Mitigation Measure.</th><th>Monitoring Methods</th><th>Parameters to be measured</th><th>Assessment Criteria</th><th>Locations</th><th>Monitoring Frequency</th><th>Responsibility</th><th></th></tr>
<tr><td colspan="7">OPERATION PHASE</td><td></td></tr>
<tr><td>Effluents</td><td>Intake and discharge continuous and automatic monitoring and recording of temperature, pH and conductivity</td><td>Temperature, pH, conductivity</td><td>Currently, Maximun Allowed Concentration (MAC) has not been determined for the new CCPU. Therefore, at the time of writing this EMP, the standardization taken into account is the one shown underneath:
<table><tr><th>Parameter</th><th>Table 5 of the IFC EHS Thermal Power Plants guidelines mg/dm^3</th></tr><tr><td>pH</td><td>6-9</td></tr><tr><td>Temperature Increase (ºC)</td><td>3ºC (1)</td></tr></table>(1) In the mixing zone. Considered 100 m from the point of discharge.

These levels should be achieved, without dilution, at least 95% of the time that the plant or unit is operating, to be calculated as a proportion of annual operation hours.

Future MAC should not be more permissive than the above ones and the existing TPP MAC.</td><td>Intake and discharge points from and to Suenly canal
Temperature at 100 meters from the discharge</td><td>Continuous</td><td>Plant engineers</td><td>Included in the project (see mitigation measure nº 18)</td></tr>
</table>

<table>
<tr><th>Aspect to be monitored or Mitigation Measure.</th><th>Monitoring Methods</th><th>Parameters to be measured</th><th>Assessment Criteria</th><th>Locations</th><th>Monitoring Frequency</th><th>Responsibility</th><th></th></tr>
<tr><td colspan="7">OPERATION PHASE</td><td></td></tr>
<tr><td></td><td>Intake and discharge continuous and automatic monitoring and recording of the biocide used for the cooling water treatment (sodium hypoclorite) with an automatic dosage calibration.</td><td>Total residual chlorine</td><td>Currently, Maximun Allowed Concentration (MAC) has not been determined for the new CCPU. Therefore, at the time of writing this EMP, the standardization taken into account is the one shown underneath:
<table><tr><th>Parameter</th><th>Table 5 of the IFC EHS Thermal Power Plants guidelines mg/dm³</th></tr><tr><td>Total residual chlorine</td><td>0.2</td></tr></table>
These levels should be achieved, without dilution, at least 95% of the time that the plant or unit is operating, to be calculated as a proportion of annual operation hours.

Future MAC should not be more permissive than the above ones and the existing TPP MAC.</td><td>Discharge point to Suenly canal</td><td>Continuous</td><td>Plant engineers</td><td>Included in the project (see mitigation measure nº 19)</td></tr>
</table>

<table>
<tr><th>Aspect to be monitored or Mitigation Measure.</th><th>Monitoring Methods</th><th>Parameters to be measured</th><th>Assessment Criteria</th><th>Locations</th><th>Monitoring Frequency</th><th>Responsibility</th><th></th></tr>
<tr><td colspan="7">OPERATION PHASE</td><td></td></tr>
<tr><td></td><td>Effluent quality monitoring</td><td>Cr, Cu, Zn, Pb, Cd, Hg;, As, Suspended solids, mineralization, Cl-, SO4, NO3, NO2, NH4, Fe, BOD-5, Oil products.</td><td>Currently, Maximun Allowed Concentration (MAC) has not been determined for the new CCPU. Therefore, at the time of writing this EMP, the standardization taken into account is the one shown underneath:
<table>
<tr><th>Parameter</th><th>Table 5 of the IFC EHS Thermal Power Plants guidelines mg/dm³</th></tr>
<tr><td>Pb</td><td>0.5</td></tr>
<tr><td>Cd</td><td>0.1</td></tr>
<tr><td>Cu</td><td>0.5</td></tr>
<tr><td>Zn</td><td>1</td></tr>
<tr><td>Fe</td><td>1</td></tr>
<tr><td>Cr (total)</td><td>0.5</td></tr>
<tr><td>As</td><td>0.5</td></tr>
<tr><td>Hg</td><td>0.005</td></tr>
<tr><td>pH</td><td>6-9</td></tr>
<tr><td>Suspended solids</td><td>50</td></tr>
<tr><td>Mineral content</td><td>-</td></tr>
<tr><td>Cl-</td><td>-</td></tr>
<tr><td>SO_4</td><td>-</td></tr>
<tr><td>NO_3</td><td>-</td></tr>
<tr><td>NO_2</td><td>-</td></tr>
<tr><td>NH_4^+</td><td>-</td></tr>
<tr><td>BOD_5</td><td>30 (1)</td></tr>
</table>
(1) Table 1.3.1. IFC EHS general guidelines (2007)

Future MAC should not be more permissive than the above ones and the existing TPP MAC.</td><td>Intake and discharge point from and to Suenly canal</td><td>Every 15 days. If there is no variation between intake and discharge points observed after one year, the monitoring of heavy metals could be discontinued.</td><td>TPP EMT</td><td>Included in the project (see mitigation measure nº 42)</td></tr>
</table>

Aspect to be monitored or Mitigation Measure.	Monitoring Methods	Parameters to be measured	Assessment Criteria	Locations	Monitoring Frequency	Responsibility	
OPERATION PHASE							
Water Consumption	Continuous flue rate monitoring at the intake and discharge point to calculate water consumption rate	Water intake and discharge flue rate		Intake and discharge point from and to Suenly canal	Continuous.	Plant engineers	Staff of the TPP. Currently on going
Groundwater.	The TPP existing groundwater monitoring plant will be extended and improved. Samples and analysis of the proposed parameters in the proposed frequency will be undertaken. .	New parameters: Ph, oil products, metals (cadmium, cobalt, copper, chromium, lead, nickel, zinc, arsenic, mercury), organochloride pesticides, phenols, Current parameters: pH, C_A^{2+}, Mg^{2+}, N_A^{+}, Cl, SO_4^{2-}, HCO_3^{-}, Hardness, Temperature.	Due to the absence of national standards for groundwater quality, surface water quality standards can be used as reference. -	New wells will be located in areas which could mean risks on the quality of groundwater and soils as: sludge ponds, oil and chemicals storage tanks, hazardous waste storage by adding one well below each site in the direction of groundwater to surface waterways. Location of wells should be approved once the final project layout is decided an under the supervision of a specialist. .	Quarterly. If there is no variation observed after one year for heavy metals and organpchloride pesticides, the monitoring of these parameters could be discontinued.	TPP EMT	See mitigation measure nº 55
Soil	Monitoring of soil salination levels	Salt deposited on soil	Value for the potential salination of the ground= 0.01 $g/m^2/h$,	Along the area in which, after the observation of the steam plume, deposition is more likely to occur.	Preferably during spring and summer seasons. This check would be also made after significant changes in the towers, such as changes in components or in the operating system, which may lead to a substantial increase in the salts emission rate finally adopted.	TPP EMT	See mitigation measure nº 52
Fuel Usage	Continuous natural gas flue rate monitoring	Natural gas flue rate		Gas intake station	Continuous	Plant engineers	Staff of the TPP
Power output	Continuous power output monitoring	Power output		Main Control Room	Continuous	Plant engineers	Staff of the TPP

Aspect to be monitored or Mitigation Measure.	Monitoring Methods	Parameters to be measured	Assessment Criteria	Locations	Monitoring Frequency	Responsibility	
OPERATION PHASE							
Occupational Health and Safety	Monitoring of: ✓ Safety inspection, testing and calibration ✓ Surveillance of the working environment ✓ Surveillance of workers health ✓ Training Accident and diseases monitoring: Implement accident and diseases reporting of the root cause of individual causes, cause patterns and analysis of weekly and monthly statistics.	Check that parameters indicated in the EHS operation plan are being monitored. For accident and disease monitoring: Number of fatal and non fatal injuries and duration of the incapacity to work.	Uzbek health and safety legislation Point 2.9. (Monitoring) of the IFC EHS general guidelines (2009)	TPP	The indicated in the EHS operation plan.	TPP EMT	Staff of the TPP
	Periodic audit of the EHS operation plan	Check that parameters indicated in the EHS operation plan are achieved	Uzbek health and safety legislation Point 2. (Occupational Health and Safety) of the IFC EHS general guidelines (2009)	TPP	The indicated in the EHS operation plan	TPP EMT (supervised by qualified and experienced external experts or qualified NGOs)	40000 $US/audit
Implementation of mitigation measures	Overall EMP operation plan. Audit to ensure performance and adherence.	Check that all the requirements agreed are achieved.	-	TPP.	The indicated in the EMP	TPP EMT (supervised by qualified and experienced external experts or qualified NGOs)	30000 $US/audit

Figure 1: location of noise measuring points

J. INFORMATION DISCLOSURE, PUBLIC CONSULTATION AND PARTICIPATION. GRIEVANCE MECHANISM AND REPORTING TO THE POPULATION

J.1. Overview

1062. This section outlines the information disclosure, consultation and participation activities that have been undertaken as part of the EIA process and the outcomes of these activities, as well as those planned throughout the lifecycle of the Project.

1063. The section consists of the following items:

- Relevant host country laws and regulations
- Methodologies/means used to inform and involve the public in the environmental assessment process
- Discussion of issues raised by various stakeholders
- Response to affected people on how the project might address their concerns raised during consultation
- Documentation of public meetings including dates, names, topics and summary details of discussion, and important outcomes
- Establish measures for continuous consultation during the environmental management program;

J.2. Principles of Consultation

1064. Early and ongoing consultation, disclosure and meaningful stakeholder engagement is a key requirement for projects financed by the ADB. The EIA will be informed by the outcomes of consultation activities.

1065. Specific objectives of the public disclosure and consultation are:

- Ensure all legal and international finance requirements related to consultation are addressed;
- Involve a full range of stakeholders in the planning of the project to improve the acceptability of the project design, implementation and monitoring;
- Encourage an open dialogue with local neighboring communities and especially project affected persons where the project is located;
- Keep all interested and affected stakeholders informed of project progress; and
- Provide a grievance mechanism to raise complaints that are appropriately addressed by the Project.

1066. The public disclosure and consultation is underpinned by the principles that community engagement should be free of external manipulation, interference, coercion and intimidation and conducted on the basis of timely, relevant, understandable and accessible information.

Consultation activities should always be well planned and based on principles of respectful and meaningful dialogue.

J.3. Consultation Requirements

1067. This sub-section provides an overview of the consultation, disclosure and stakeholder engagement requirements of the ADB and the national requirements contained within the Uzbek EIA procedures.

J.3.1. ADB Consultation Requirements

1068. ADB's Safeguard Policy Statement (2009) explains that the ADB is committed to working with borrowers/clients to put meaningful consultation processes into practice. For policy application, the ADB see meaningful consultation as a process that:

i. Begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;

ii. Provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;

iii. Is undertaken in an atmosphere free of intimidation or coercion;

iv. Is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and

v. Enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

1069. ADB requires borrowers/clients to engage with communities, groups, or people affected by proposed projects, and with civil society through information disclosure, consultation, and informed participation in a manner commensurate with the risks to and impacts on affected communities.

1070. ADB's Safeguard Requirement (SR) 1: Environment, specifies that projects must:

- Carry out meaningful consultation with affected people and facilitate their informed participation;
- Ensure women's participation in consultation;
- Involve stakeholders, including affected people and concerned nongovernmental organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account;
- Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment;
- Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance;

- Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders;
- Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders; and
- Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.

1071. Public consultation needs to be carried out during the early stage of EIA preparation and throughout the project implementation to address any environmental issues that affect the local communities, NGOs, governments, and other interested parties. For all Category A projects, the Environmental Policy requires public consultation at least twice.

J.3.2. National Consultation Requirements

1072. There are two non-mandatory mechanisms for public participation in the EIA assessment procedure: the public environmental review (PER) and public hearings. While the Law stipulates that PER might be organised by independent expert groups, its outcomes are non-mandatory. There are no legal provisions for public hearings, though the EIA assessment procedure Manual provides some procedural guidance. It recommends the organisation of public hearings in the course of draft EIA preparation and suggests some forms of organising them and potential participants. Even the existing limited opportunities for public involvement in the EIA process are not used because of the absence of strict legal provisions for public participation in EIA.

1073. Provision # 6 of Law on Environmental Expertise (2000) states, that ―The promoter of a project who undertakes an EIA assessment procedure could publish an announcement informing of this fact. In this case, after finishing the EIA, the conclusions or results should be published in a month period time at the latest. The list of the projects which should conduct publish announcement as a mandatory request it is meant to be defined in the legislation but there is not a specific legislation that gather this information or procedure.

1074. In accordance with the requirements of Uzbekistan (Decree of the Cabinet of Ministers of Uzbekistan on Approval of the Regulations on the State Environmental Expertise in the Republic of Uzbekistan No.491 of 31.12.2001 as amended on 05.06.2009) results of public hearings and disclosure of information should be included in the set of documents, presenting for review and getting clearance from Glavgosekoexpertisa).The ‗Statement on Environmental Consequences' should detail, among other items, the comments received through the public hearings if undertaken.

1075. The approach to planning the public meetings for the Project has been guided by typical local practice and international best practice embodied by the standards summarised below.

J.4. Project stakeholders

1076. Stakeholders are defined as persons and entities who are interested in, are affected by, or can affect the outcome of the Project.

1077. The public disclosure activities have included meetings with the following groups of stakeholders to inform of the public consultations to be hold:

- Representatives from State Nature Protection Committee (SNPC) of the Republic of Karakalpakstan,
- Representatives from state institutions (water supply organization —Vodocanal”, gas supply —Gastrest” and electricity network —Electroset”)
- Specialists of the main body of —Uzbekenergo”, its entities and local branches
- Non-Government Organizations (—Intellekt”, Nimfogo”, —Resources Centre”)
- Representatives of local Hokimiyat
- Residents of the local communities/civil society

1078. These stakeholder groups were invited to the public consultations through various media and other means in the most appropriate way in each case so as to attain the greatest possible dissemination as indicated in the following point.

J.5. Information disclosure

1079. The public consultations were preceded by extensive dissemination of this event and were disclosed via:

- Official invitations:

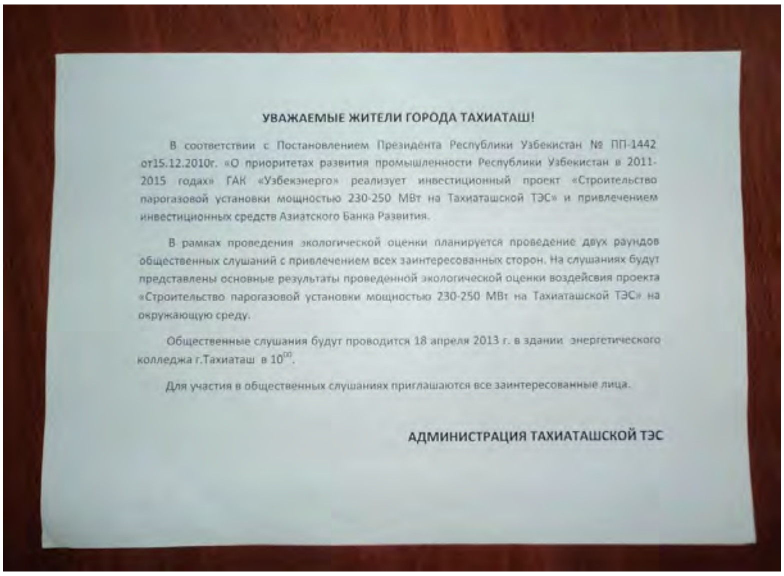
1080. As part of the public consultations preparation, a letter with information on planning activities on the project's disclosure was sent to the Takhiatash city's governmental authority (Khokimiyats), State Nature Protection Committee and Non-Government Organizations located in the Karakalpakstan Republic. Appendix 1 of Annex IX includes de information letters from the Takhiatash TPP to these institutions. In these letters Takhiatash TPP request collaboration in the dissemination of the public consultations of the project between the communities.

- Information to the local population:

1081. The Takhiatash Khokimiyat, worked closely with the smallest administrative units (makhallas) to disseminate the information on public consultations from makhalla's to residents of Takhiatash city. The project consultants informed of the planning activities of public consultations to the residents living close to the TPP.

- Announcements signs:

1082. Moreover, around 10 announcements were placed at public places such as market, shops, bus stops, etc.



УВАЖАЕМЫЕ ЖИТЕЛИ ГОРОДА ТАХИАТАШ!

В соответствии с Постановлением Президента Республики Узбекистан № ПП-1442 от15.12.2010г. «О приоритетах развития промышленности Республики Узбекистан в 2011-2015 годах» ГАК «Узбекэнерго» реализует инвестиционный проект «Строительство парогазовой установки мощностью 230-250 МВт на Тахиаташской ТЭС» и привлечением инвестиционных средств Азиатского Банка Развития.

В рамках проведения экологической оценки планируется проведение двух раундов общественных слушаний с привлечением всех заинтересованных сторон. На слушаниях будут представлены основные результаты проведенной экологической оценки воздейсвия проекта «Строительство парогазовой установки мощностью 230-250 МВт на Тахиаташской ТЭС» на окружающую среду.

Общественные слушания будут проводится 18 апреля 2013 г. в здании энергетического колледжа г.Тахиаташ в 10^{00}.

Для участия в общественных слушаниях приглашаются все заинтересованные лица.

АДМИНИСТРАЦИЯ ТАХИАТАШСКОЙ ТЭС

Figure 59. Announcement about the 1st Public Consultation placed into different public places in Takhiatash city

Announcement placed at the city market (Takhiatash city)

Announcement placed at the bus station (Takhiatash city)

Figure 60. Announcement places at different places in Takiatash city

- Public in newspapers:

1083. Announcement on public consultations were published into the local newspaper ―Erkin Karakalpakstan" on local language (Karakalpak) on 13 April 2013 for the 1st public consultation round (hold on the 18 April 2013) and on Karakalpak and Russian languages on the 27 April 2013 for the second round (hold on the 29 April 2013). In Appendix 2 of Annex IX are shown newspaper announcements.

J.6. Public Availability

1084. During the 1st round of public consultation, an initial version of the Environmental Management Plan (EMP) in Uzbek was distributed among the participants. During the 2nd public consultation the updated version of EMP including suggestions and recommendations proposed by 1st public consultations participants was also distributed.

1085. In order to disseminate the project information, copies of the EIA in Russian were made available in the 2nd public consultation. One copy of the EIA is also available to the public for consulting at the Takhiatash TPP through the life of the project. The place in where the EIA can be consulted is at the medical services of the TPP (200 meters outside of the TPP entrance).

Figure 61. Medical services of the Takhiatash TPP

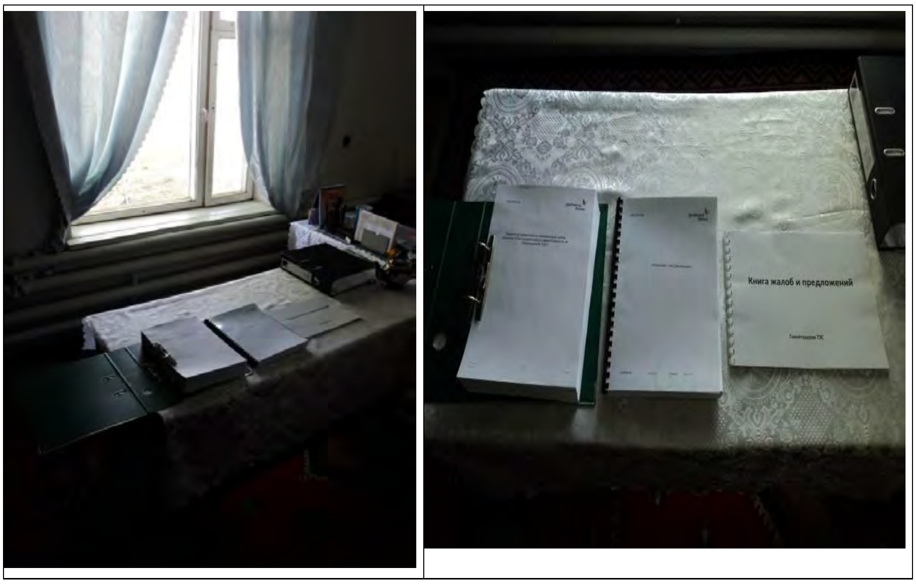


Figure 62. Place within the Medical Service in where the EIA and Grievance logbook are located

1086. Place within the Medical Service in where the EIA and Grievance logbook are located Three hard copies of EIA have been delivered to the Takhiatash TPP's manager, Nature Protection Committee of Republic Karakalpakstan and Takhiatash city government authority.

1087. Moreover, final version of EIA will be published on the Uzbekenergo (Russian and English versions) and ADB's websites (English version) no later than 120 days prior to the Board considerations. The electronic EIA version will be also made available to interested parties upon request through download procedure.

J.7. Public presentation and consultation

1088. After having announced the days of the public consultations of the project in the media and at the appropriate frequency for the population characteristics, as part of the environmental assessment process for the project, two public consultations took place on 18 and 29 April 2013 at the Energy college of Takhiatash (at the door, announcement of public consultation can be observed).

Figure 63. Energy College entrance and announcement placed on the entrance

1089. These consultations were an opportunity to associate all of the parties involved and stakeholders concerned to the project: provincial and local authorities, non-central government services, NGOs and civil society, especially representatives of the local population.

1090. These consultations were also an opportunity to disseminate pertinent information which helped the general public understand the project risks, impacts and opportunities. In addition, the public consultations organised were a time for: (i) all of the stakeholders involved to express their opinions on the project risks, impacts and mitigation measures and (ii) Takhiatash TPP to study and respond to them.

1091. The procedure carried out consisted of an initial registration of the people who attended (Appendix 3 of Annex IX: list of participants) after which a dossier was handed out which included the initial version of EMP in the 1st public consultation and a reviewed version of the EMP in the 2nd public consultation.

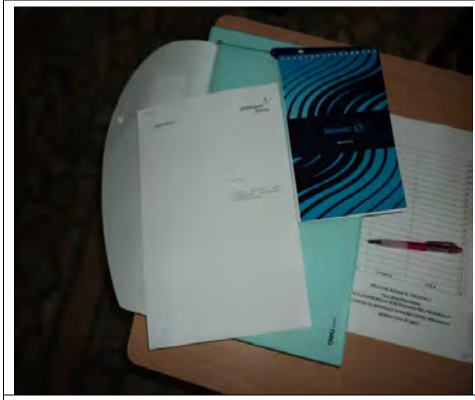
	
Folders with notebook, pens and EMPs have been distributed to each PC participant	All participants were registered

Figure 64. Registration process

1083. As can be verified by the attendance records, 32 people participated in the 1st public consultation and 56 in the 2nd public consultation including local community leaders, representatives of public institutions, nature protection committee, politicians, the press, NGOs, etc. More than half of them were females in the 1st public consultation and almost the half of them in the 2nd public consultation.

1084. After all people attending were registered, the opening remarks were given by Tagekeev A., representative of Takhiatash TPP who emphasis, that this Project is very important for the economical development and electricity supply of the region.

1085. Amaya Yoldi, International Environmental Expert and EIA project manager, then took the floor to underline the importance of the project, the importance of its environmental assessment and the purpose of the consultation in an effort to consider environmental issues through a participatory approach encouraging everyone present to participate

1086. Further, Madina Khalmirzaeva, the National Environmental Expert and part of the EIA team, presented the main findings of the EIA in a Power Point in Uzbek language. She informed those present that they could communicate their remarks at the meeting. The Russian and English versions of the presentation are attached to this report (Appendix 4 of Annex IX).

Figure 65. From left to right: Madina Khalmirzaeva, Amaya Yoldi and Tagekeev A.

Figure 66. Madina Khalmirzaeva giving the oral presentation of the EIA

1083. During the presentation, the public was told that Takhiatash TPP has put in place a process for recording proposals, comments, suggestions, complaints, etc. that will be made available to the public throughout the life of the project. Public were informed that the grievance logbook and the EIA are accessible at the medical service of the Takhiatash TPP (200 meters outside of the entrance to the TPP, see Figure 62).

1084. Finally, the public was informed that the results of the annual environmental report (which include the grievance mechanism findings) will be made available for public consultation through the aforementioned means.

1085. The floor was then given to those present who asked several questions and made remarks and comments on the project. Several questions, remarks, comments and suggestions related to the project EIA were also expressed.

1086. In Appendix 5 of Annex IX a photographic report of the public consultations is included.

1087. What follows is a summary of the questions and answers at the two public consultations.

Table 99. Table of questions and answers and arised during Public Consltations

1st PUBLIC CONSULTATION (18 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
1	Gandullaeva M.	Currently we use water from Suenly canal for irrigation. Will the new unit impact on the quality of water into the Suenly canal? Could we use this water for irrigation as we do it now?	The replacement of the old units with the new CCPU will not change water quality of Suenly canal. In any case, thermal effluent will be reduced due to implementation of close cooling water system instead open system that is being used currently.
2		Is possible to plant trees at the area surround to the Takhiatash TPP?	The Project does not cover this type of activity. Proposed EMP includes measures which have to be undertaking to recover soil after finishing construction works, but this activity will be done within TPP territory. (Note: after clarification with Takhiatash TPP they agree to include a green area on the vicinity of the TPP terrains. Therefore, this community suggestion has been incorporated into the EMP (mitigation measure nº 46)
3	Babajanova, Makhalla leader	Will it be any resettlement within this project? If yes, has any economic compensation included?	There is not expected any resettlement as the territory for the new CCPU is attached to the existing TPP in industrial area. Anyway, the Project includes the consultancy of an independent expert who will work on resettlement issues. In any case, there is a special ADB's Safeguard Policy (2009) which describes the requirements on this issue. All activity related with resettlement will be implemented in accordance with local legislation and ADB's requirements.

1st PUBLIC CONSULTATION (18 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
4	Ataniyazova Sapargul, State nature Protection Committee, air quality monitoring department	Your project is very important for our region. Also I am glad that you are talking about decreasing on 40% the contribution of the TPP to NO2 pollution. I understood that it's planning to conduct monitoring of different pollutants in air. Are you going to measure during construction stage level of soot, heavy metals, SO_2?	Emission of these kind of pollutants is insignificant in construction. The main air pollutant at this phase normally is dust and we have included the necessary measures to mitigate this type of pollution into the EMP as watering of dusty surfaces and areas, proper maintenance of the equipment and machinery in order to reduce emissions at the minimum, etc.
5	Gumamuratova M., Representative of Hokimiyat	There is an energy college preparing experts for energy production into the Takhiatash city. You explain that an Automatic Control System is going to be implanted in the new CCPU. Which is the impact on the TPP as source of employment for our graduated students?	We will clarify Uzbekenergo employment policy regarding graduated students with the PIU and will answer back on the 2nd Public Consultation. (Note: after clarification with the PMU we can conclude that the Uzbekenergo employment policy regarding graduated students will not change with the new project. Takhiatash TPP has an agreement with the energy college to provide practice training to students during the summer season and also to hire around 30 students per year this policy will continue on going.)
6	Tagekeev A. Takhiatash TPP, leader of ~~-K~~amolot" young generation union	I am also concerning about people who currently work at Units III and IV. Decommissioning of these units is planned also. What is going to be done with the staff working on these Units after decommissioning?	There is a special training program within the project to update these people in order them to work at the new CCPU. Dismissal of current workers is not expected as they will be moved from the old to the new units.

1st PUBLIC CONSULTATION (18 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
7		What about emissions of CO? Are they expected?	In any fuel combustion process CO2 is emitted. When the combustion is not perfect emission of CO is also produced. In this case, emission of CO expected will be lower than the one produced in the old units to be replaced as the technology is more efficient and provides a better combustion process. CO emissions have been simulated with an atmospheric dispersion model getting to the conclusion that CO ambient air quality levels are low and always further under the national standards.
8		How much water the new unit will take from the Suenly canal and how you are going to monitor quality of water discharged into the canal?	Water intake and discharge flue rate will be significantly reduced due to the replacement of part of the existing open cooling water system for a closed one for the new CCPU. In accordance with suggested environmental monitoring plan, water quality monitoring into the water intake and water discharge canals will continue but in expended format. Some of the parameters will be monitored in a continuous and automatic way and other parameters will be monitored manually at the laboratory. For this last item, several new parameters (which normally are controlled in international standards) have been included. The philosophy of the measurement of the water quality parameters is to control the fulfillment of national and international parameters and to make sure that there is not a decrease of the baseline water quality.

1st PUBLIC CONSULTATION (18 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
9	Gapakova G, Resources Center of National Association of Non-governmental organizations of Republic Karakalpakstan	Republic of Karakalpakstan locates at the downstream of Amudarya river. Water quality in this river significantly impacts on the health of people especially of women. Will you Project impact on the water quality in the Seunly canal?	Water from Suenly canal is used mainly for cooling system which means that the water returned has the same characteristics as the water intake but with a thermal increase. In this respect, as mentioned before, thermal effluent will be reduced due to implementation of close cooling water system instead open system that is being used currently. Water used for other uses within the power generation process will be treated to fulfill the most stringent standards between the national and international ones. Waste water treatment plant design requirements have to fulfill with these standards. As a conclusion, there not will be an impact on the water quality due to the implementation of the new project.
10		There are fan energy cutoffs during the whole year in our region. Could we expect that after the Project implementation these energy cutoffs will not happen?	We can confirm that after CCPU commissioning energy production will increase and as consequence energy supply will improve as well. Nevertheless, the completely stop of the energy cutoffs cannot be guarantee. In this sense, Uzbekenergo is trying to improve energy supply but this procedure is going to be implanted step by step.

1st PUBLIC CONSULTATION (18 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
11		How the work with the non-governmental organizations sector will be organized?	In the presentation we have provided contact details (persons in charge, address, telephone number, email) in where suggestions, proposals, concerns, complaints can be send. During the life of the project, environmental annual reports will be available to the public. ADB's environmental policy encourage to the Takhiatash TPP to have a more open and transparent communication with local communities. In that sense, we are expecting your involvement both into the project implementation and along the operation phases.
12		We are concerned about the conditions of the roads We have experienced than after a Project completion the used roads become in a very bad condition which created a lot of difficulties to the local communities.	Mitigation measures on road maintenance are included into the EMP. In accordance with proposed measures, the condition of the used roads should be at least at the same level as it was before construction and decommissioning works were started.
13	Madreimova G. Makhalla #6	Is it possible to use the steam produced from the new CCPU for heating greenhouses?	No, it is not technically possible. All the steam produced will be used into the closed CCPU system.
14		As an expert, what do you about the possibility to grow citrus fruits in our climatic conditions?	Well, to get to a conclusion about this subject a specific study about the conditions of soil, water and climate for this purpose should be undertaken. Unfortunately, the project ongoing is nothing to do with this matter and therefore these item has not been studied in the EIA..

1st PUBLIC CONSULTATION (18 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
15	Hojanazarov A. Chief editor of the ―Aqmagat" local newspaper	Will installation of the new CCPU impact on the heating water produced at the TPP?	After CCPU commissioning, heating water supply will remain with the same capacity.
16		Do you have experience working in other similar projects? If yes, what is the main difference between these projects and Takhiatash?	Yes, ―GasNatural fenosa" has a wide experience on implementation this kind of technology, but not in Uzbekistan. The national environmental expert worked at the Talimarjan CCPP Project in 2010. The main difference between both projects is that Takhiatash Project has a decommissioning phase that will require a special procedure.

Table 100. Table of questions and answers and raised during Public Consultations

2nd PUBLIC CONSULTATION (29 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
1	Berdiev Z. State Protection Committee of the Republic Karakalpakstan	It was mentioned during the presentation that the project passed Stage II (‗Statement on Environmental Impact') of the national EIA process. What kind of 'Statement on Environmental Impact' has been conducted? Public or private?	A public (Government) EIA procedure has been conducted for this project. The endorsement from State Nature Protection Committee was received in November 2013. Private EIA procedure has not been conducted.

2nd PUBLIC CONSULTATION (29 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
		What kinds of analyses or surveys have been conducted during your EIA and Environmental Audit to gather information about the environmental baseline?	The following analysis have been conducted within this EIA: surface water quality from intake and discharges points, soil quality and a noise measuring campaign. Analyses itself were conducted in Tashkent city.
		State Nature Committee on Nature Protection would like to request providing environmental monitoring reports during construction phase on a quarterly basis	As it is required by ADB procedure, the environmental monitoring reports will be submitted on a semiannual basis. As per your request we can increase this frequency to a quarterly basis. We will include this request in the EMP.
		EMP includes monitoring on water, soil and air quality. Some of the analyses need to be done in 2 - 6 hours. It would be better to conduct those analyses into the Nukus laboratory.	We agree that these analyses can be done into the local laboratories if they have the required facilities and equipment needed to conduct the specific analysis indicated into the EMP.
		Takhiatash city is located in an environmentally impacted area due to due to the drying out of Aral Sea which caused an ecological crisis in the region. Is it possible to include within the project the construction of a new clinic to improve the health condition of the local population?	The implementation of this project will improve the environmental quality in its area of influence (as we are replacing old equipment by new and more efficient one). Unfortunately, the construction of a clinic is not covered within the project.
2	Jumaniyazov K., Student of Takhiatash energy college	What kind of pollutants will be emitted to the air from the proposed cooling towers?	Cooling towers emissions, being used to refrigerate the cooling water used In the condenser to convert steam again into water, just emit water vapor (steam)..

2nd PUBLIC CONSULTATION (29 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
3	Tursinbaev A, Student of Takhiatash energy college	There is a hospital in Takhiatash city. I am concerned that during construction and operation phases noise impact will increase and negatively influence on the patients, especially on pregnant women.	Some increasing of noise level is expecting during the construction phase but just in the close vicinity. Noise rapidly decreases with distance. The EMP defines several measures to mitigate this issue (e.g. use noisy equipment only during the daytime, etc.). Regarding the operation phase and as it has been explained in the presentation, it is expected that global background noise will decrease due to the replacement of old and noisy equipment by a new and less noisy one.
4	Tursinbaev A. Resident of Takhiatash city	Could we expect that in the operation phase we will not have shortage of energy supply and electricity cuts offs?	We couldn't promise that you will not have electricity cuts offs. As we told before, the energy production will increase and therefore the energy supply will improve.
5	Kaliyeva M. secondary school #12	Did you check heating water quality supplied for the Takhiatash city?	No within this EAI we didn't check quality if this water.
6	Tajekeev A. Takhiatash TPP	I participated at the first public consultation. Question that I made during this first public consultation have been included and answered in this second public consultation. Several colleagues and myself we've searched combined cycle power technology and we agree that this is the best technology for now among conventional technologies. We really support this Project and we are waiting for its earliest implementation.	

2nd PUBLIC CONSULTATION (29 APRIL 2013)			
Quest. No.	**Speaker**	**Questions**	**Responses given by environmental team**
7	Otajonov R. Takhiatash TPP	I am concerned about water quality into Suenly canal. There is a settlement close to Takhiatash TPP which uses water from the canal for irrigation and drinking purposes. I think that water is polluted because the TPP is discharging the boiler washing waste water to Suenly canal.	We have assessed measurements of the discharge to Suenly canal done by the TPP every 15 days for the last two years (2011 and 2012). They don't show any additional pollution caused by the operation of the TPP. Water quality in the intake and discharge points is similar except for temperature which is increased after being used in the open water cooling system. In accordance with existing water scheme provided by the TPP, the only effluent discharged into Suenly canal is water from the cooling system. This water is not polluted within the process of refrigeration (just un increase of temperature). The developed EMP includes monitoring of water quality into the Suenly canal on a permanent base and, if bad practices as boiler washing waste water discharged to Suenly canal are undertaken these will be detected and corrected to fulfill national and international standards. If water from Suenly canal do not have the required quality for irrigation and drinking purposes it should not be used. The solution of this issue is related with other kind of projects like safe water supply for the area. Anyway, the implementation of the project, as mentioned in the presentation, will not decrease the water quality of Suenly canal. Actually, an improvement is expected because of the reduction of the amount of warm water discharged to the canal.

Previous to the 2nd public consultation, a meeting with some representative staff of Takhiatash city hokimiyats was hold. In the following table a summary of the questions and answers of the meeting is included:

Meeting with the Takhiatash city hokimiyats (29 April 2013)			
Quest. No.	Speaker	Questions	Responses given by environmental team
1	Gumamuratova, F Women committee	Should we expect a decrease in the number of staff working at the TPP? New technology will require higher qualified staff.	We have clarified this question from the PMU. There is a special training program within the project to update these people in order them to work at the new CCPU. Dismissal of current workers is not expected as they will be moved from the old to the new units.
2		Your EMP mentions about hazardous materials. How these materials will impact on the people living close to the TPP area?	During conducting EIA, a special attention was paid to waste management issues. The proper measures have been included in the EMP to provide safe work condition for workers and residents living on the surround area. Waste management will be adapted to international standards in order to avoid any pollution to the environment. TPP Mazut storage locatd at 35 km of the TPP will be conditioned to be used as an storage for hazardous materials (such as asbestos of the old units III and IV to be decommissioned). As an option, additional improvement of municipal landfill is advised to storage non-hazardous materials.

3	Deputy Governor of Takhiatash city	I live almost in the center of Takhiatash city. Even there I feel noise impact from TPP. What will be happened after new unit installation?	In accordance with conducted noise measurements, just close residents can feel noise caused by the current operation of the TPP. Noise decrease rapidly with distance and it is improbable that noise from the operation of the TPP can be notice at 3 km distance (which is the distance between the TPP and the center of the city of Takhiatash). In any case, it is expected that global background noise will decrease due to the replacement of old and noisy equipment by a new and less noisy one.
4		In a previous meeting with the project social expert, the construction of a laundry and sauna service center was proposed. Is it possible to locate this service center at the area close to the center of Takhiatash city? In this case the center will provide services not only for residents living on the vicinity to the TPP area but for all Takhiatash city population.	We will forward your concern to our social expert for taking this suggestion into account.
5	Head of Takhiatash city ~~"~~Vodokanal"	In addition, for the location of the proposed laundry you have to take into account the existence of sewage network. I think there is not a sewage network at area located close to the TPP.	We will forward your concern to our social expert for taking this suggestion into account.

J.8. Grievance Mechanism

1088. The Takhiatash TPP includes a process for recording and answering suggestions, complaints, proposals, etc. This process is included in section 7.4 of the EIA. The register set up via a physical logbook register which is available at the medical service of the Takhiatash TPP (200 meters outside the entrance of the TPP) throughout the life of the project. The structure of the logbook (Russian language and translation into English) is included in Appendix 6 of Annex IX.

1089. Grievances received and responses provided should be documented and reported back to the complainant. Response time will extend up to one month. The complainant can ask for reconsideration by a higher authority if not happy with the outcome.

1090. In this regard, the organizational structure for the grievance resolution is as follows:

- 1st level: Takhiatash TPP
  Responsible person: Kutlimuradov Pulat,engineer of PIU:
  - Address: Republic of Karakalpakstan, Takhiatash, Takhiatash TPP, post office № 1 TPP
  - Telephone: +998982796871
  - Email: piu_tps@mail.ru

- 2nd level: Uzbekenergo
  Responsible person: Abdullaev Nurulla, PIU manager:
  - Address: 6, Istiqlol str. Tashkent, PIU —akhiatash TPP”,
  - Telephone: 83712363452
  - Email: piu_tps@mail.ru

- 3rd level: ADB
  www.adb.org

1091. 1st level of the organization can be also employ to communicate complaints instead the physical register located at the TPP medical service if the complainant consider this way more suitable.

J.9. Monitoring and reporting

1092. The result of the Grievance Mechanism will be included in the environmental and social surveillance plan follow-up reports which will be prepared annually during the TPP operation. These reports will be made available to the public at the medical service of the Takhiatash TPP (200 meters outside of the entrance of the TPP).

K. CONCLUSIONS

1093. The project of the construction of 230-250 MW Combine Cycle Power Unit (CCPU) and decommissioning of 310 MW existing units III and IV at Takhiatash TPP is a priority project identified by Uzbekenergo, which is the national company in charge of the electricity sector.

1094. Takhiatash TPP, with the installed capacity of 730 MW, is the main power supply source for the Karakalpakstan and Khorezm regions with over 3 million people located in the western part of Uzbekistan. The power demand outlook is strong with a number of industrial development projects envisaged for the region, exceeding currently available capacity. Furthermore, operational lifetime of the Takhiatash TPP's equipment is 22-43 years, resulting in its degradation and the increasing in the probability of accidental risk with potential negative consequences for the environment.

1095. In this respect, power generation from burning gas in a CCPU is the cleanest method of generation using fossil fuels. The CCPU turbines burning natural gas produce significantly less greenhouse gases than traditional coal or oil fired thermal power stations, as a result of both the less greenhouse intensive nature of natural gas and the greater inherent energy conversion efficiency of CCPU technology. Replacing the existing power generation assets with the energy efficient CCPU technology is a key strategy for Uzbekistan in order to save energy, secure reliable power supply and mitigate climate change impacts. The project will increase energy efficiency from 20-30% to 50-60% increasing the power output from 2700 GWh/year to 3600 GWh/year.

1096. This project will allow cutting operational expenses, increasing the efficiency of energy transformation and the reliability of supply of energy to the consumers, and improving the environmental situation in its area of influence according with Government and ADB strategies.

1097. Because the project is planned attached to the existing Takhiatash TPP, the overall environmental impact will be far less significant than it would be had the project been set in a pristine area, taking into consideration the fact that it is the power station's existing infrastructure that will be used (natural gas supply, water intake and discharge canals, transmission line, etc).

1098. In compliance with the Cabinet Ministers' Decree of the Republic of Uzbekistan (RUz) No. 491, thermal power stations with capacity of 300 MW and more belong to Category 1 and therefore must undertake national EIA procedure.

1099. The ‗Concept Statement on Environmental Impact' (Stage I of the national EIA approval process) was developed as part of Takhiatash TPP pre-feasibility study and submitted to the State Environmental Expertise Appraisal which approved the draft environmental impact statement in November 2012 (#18/963). In this approval is mentioned that the ‗Statement of Environmental Impact' (Stage II of the national EIA approval process) was not needed due to the considered complete information presented in Stage I. ‗Statement on Environmental Consequences' (Stage III and last of the national EIA approval process) will be achieved previously to the commissioning of the project. This report will detail the modifications to the project design made from the the *Glavgosecoexpertiza/Gosecoexpertise* review at the first two stages of the EIA process, the comments received through the public consultation, the environmental norms applicable to the project and environmental monitoring requirements associated with the project and principal conclusions.

1100. The present Environmental Impact Assessment was drawn up by GAS NATURAL FENOSA ENGINEERING Company on behalf of the Asian Development Bank (ADB). This EIA present the information from the original Russian EIA and includes some additional sections required to meet ADB environmental policy requirements. With reference to ADB's Safeguard Policy Statement SR1 on Environment, this Project is considered to be a ‗Category A' project and therefore a complete EIA is requested.

1101. Throughout the project (starting from design, construction, decommissioning and through to unit operation) all requirements in RUz environmental legislation and ADB's safeguards policy statement, including World Bank Group Environmental, Health and Safety guidelines (specific Guides concerning thermal power stations published in December 2008, and general guides published in April 2007) and international conventions were incorporated into the study.

1102. It should be pointed out that limit values concerning gas emissions, noise, waste, air quality etc, were based on [whichever was] the more restrictive of the two regulation sources (national or international).

1103. For purposes of incorporating all necessary measures so as to stay within emission limits, the following environmental elements have been taken into account for the design of the project:

- Use of low NOx emission burners so as not to exceed World Bank 51 mg/Nm^3 standard (15% O_2, dry base)
- Building a 60 m stack, in accordance with the result obtained in accordance with the Environmental Protection Agency (EPA) atmosphere pollutant dispersion ―AERMOD" model.
- Installing noise attenuation devices to comply with national and international standards
- Installing an effluent treatment system (a system for separating greases, oils and chemical pollutants from effluents assuring compliance with national and international standards)
- Installing an optimized chemical dosing system for cooling water treatment and control for a minimum requirement of chemical additives, achieving a minimum concentration at discharge with consequent environmental benefits
- Safety tanks for retaining any leaks that may occur from any storage tank for hazardous materials or wastes.

1104. After detailed analysis of the project and environmental baseline status of the area of interest, we conclude than the environmental and social benefits from the project implementation are:

- Reduction of natural gas consumption on 321.4 mln.m3/year
- 30% emission reduction of CO2 (greenhouse gas) to the atmosphere, which will contribute to climate change mitigation
- 30% emission reduction of NOx to the atmosphere
- In accordance with the result obtained from the dispersion model of pollutants in the atmosphere using the EPA's "AERMOD" it can be stated that:
- A 40% reduction of NO2 in ambient air quality is achieved
- Current and future scenarios comply with air quality standards both at national and international level
- It is expected that global background noise will decrease due to the replacement of old and noisy equipment by a new and less noisy one
- The change from the open cooling system of units III and IV towards a closed circuit of the CCPU will lead to:
  a) 40% reduction of water intake
  b) Almost a 50% reduction of thermal effluent returned to the canal which will allow a better and faster dispersion. This fact would probably improve the environmental condition of the aquatic ecosystem.
  c) Increase of 225 m^3/h of water consumption to replace evaporated water and blow down in the cooling towers. This is a negative impact but the magnitude is insignificant as it would represent less than 1% of Suenly canal flow rate.
- Decrease of accidental risk by means of using Automatic Control System;
- Increase in power supply will promote industrial development projects envisaged for the region; Consequently this will promote socio-economic development
- During the construction phase workforce demand will be highly increased

1105. **Environmental Management Plan (EMP)** includes 58 mitigation measures and a specific monitoring plan to control the implementation and effectiveness of these mitigation measures. A summary of the most representative aspects of the EMP are presented as follows:

- Development of an Environmental, Health and Safety Plan for the construction, decommissioning and operation phases.
- As far as possible and depending on availability, work position created by the project will be filled by local personnel.
- Implementation of a CEMS (Continuous Emissions Monitoring System) which will guarantee that emissions are always within legal limits, and which will analyse and record pollutants on a continuous and automatic basis: SO_2, NO, NO_2, CO, O_2, temperature, pressure and water vapour.
- Yearly quantification and monitoring of Greenhouse Gases emissions in accordance with internationally recognized methodologies (IPCC, etc.)
- Implementation of air quality and meteorological monitoring stations on a continuous basis of SO_2, NO_2, NO, TSP, PM_{10}, $PM_{2.5}$, CO; wind speed and direction, atmospheric pressure, relative humidity and temperature, which ensures observance of air quality limit values in force.
- Yearly campaign for measuring noise levels using a sound level meter.
- Extension of the current monitoring system for water intake and discharge points in order to comply with national and international effluent standards:

d) Continuous monitoring of: Tª, pH, conductivity, and total residual chlorine.
e) By-month basis monitoring of: suspended solids, mineralization, Cl-, SO4, NO3, NO2, NH4, Fe, BOD-5 and Oil products; the project will extend monitoring to heavy metals: cadmium, cobalt, copper, chromium, lead, nickel, zinc, arsenic, mercury

- Extension of the current monitoring system for subterranean water: quarterly monitoring of: pH, CA2+, Mg2+, Na+, Cl, SO42-, HCO3-, Hardness, Tª; the project will extend monitoring to pH, oil products, heavy metals (cadmium, cobalt, copper, chromium, lead, nickel, zinc, arsenic, mercury), organochloride pesticides and phenols. Wells network will be extended also to include areas which could mean risk on the quality of groundwater and soils as sludge ponds, oil and chemicals storage tanks, hazardous waste storage.
- Yearly campaign for measuring soil salination along the area in which deposition of steam plum from the cooling towers is more likely to occur.
- Soil monitoring campaign twice per year
- Waste management adapted to good international practices and standards: Prevention, reduction, reuse, recovery, recycling, removal and finally disposal; segregation and separate management of hazardous and non-hazardous wastes with the inclusion of a proper final landfill or storage.

1106. As part of the environmental assessment process, Takhiatash TPP organised two rounds of **public consultations** on 18 and 29 of April 2013 at the Energy college of Takhiatash. These consultations were an opportunity to associate all of the parties involved and stakeholders concerned to the project: provincial and local authorities, non-central government services, NGOs and civil society, especially representatives of the local population, etc.

1107. This consultation was also an opportunity to disseminate pertinent information which helped the general public understand the project risks, impacts and opportunities. In addition, the public consultation organised was a time for: (i) all of the stakeholders involved to express their opinions on the project risks, impacts and mitigation measures and (ii) Takiatash TPP to study and respond to them.

1108. The public consultations meeting were mainly based on:

- prior communication of useful and pertinent information (concise, well-developed environmental assessment documents prepared up to that date) via dissemination of the EMP and EIA,
- a focus on the social and environmental risks and impacts and on the measures and actions planned to reduce and mitigate them,
- **public continued consultation and information** period throughout the duration of the project via a grievance log and via public access to the annual and the environmental monitoring report (which includes result of the **Grievance Mechanism** put in place) made permanently available to Takhiatash TPP at the medical services, 200 meters outside of the TPP gate.

1109. In conclusion: In view of the Environmental Impact Assessment concerning construction of 230-250 MW Combine Cycle Power unit and decommissioning of 310 MW existing units III and IV at

Takhiatashs TPP, and after having analysed all the types of impact that may be generated by the project, we find that **the project will produce an overall positive environmental and social impact** that will be compatible with, controllable by, and that fits perfectly into, the sustainable development policy framework maintained by the Uzbek authorities and the ADB environmental requirements policy.

1110. The entire project can therefore be considered to be viable on condition that the Environmental Management Plan as laid out in the present assessment will be implemented. Therefore, if there is any change in the design of the project, the EMP needs to be updated.