

# The Lower Reaches Of Zarafshan Region: Socio-Ecological Problems And Ways Of Their Solution

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## Abstract

The aggravation of the world's environmental situation in the XXI century raises questions of careful attitude to nature and the use of its resources. The primary task in solving this problem is the socio-cultural system of education and upbringing, which will lead to a radical transformation of the entire society. This requires the search for new approaches and methods to analyze the interaction of a person and the surrounding world, providing for reasonable management of natural factors. The link in this process is primarily a centralized state administration that regulates the regional level, interacting with environmental problems on the ground. The article historically analyzes the features of environmental problems characteristic of the lower reaches of Zeravshan region, which harm the flora and fauna of the oasis. The state of fresh underground and drinking water, emissions of harmful substances polluting the atmosphere, the unreasonable use of natural resources and the consequences are consistently highlighted. The unsatisfactory activity of environmental authorities and environmental commissions to attract enterprises' compensation payments for harmful substances into the atmospheric air in the cities of Prizaravshania, imperfect environmental quality management, is of an informational and advisory nature. The conditions for reducing environmental problems are studied, through the introduction of new technologies, management methods, and proposals are made to improve the quality of the environment to the peculiarities of the region.

**Keywords:** Ecology, emissions, flora, fauna, region, threat, degradation, resource, atmosphere, public health.

## Introduction

One of the strategic tasks of the national security of Uzbekistan, the most important aspect of protecting the vital interests of the people, is to improve the ecological condition of all regions of the republic since environmental pollution of individual regions has long gone beyond regional problems, and pose a serious threat to nearby areas and are the result of all kinds of diseases. In recent years, the analysis and assessment of the ecological state of the Bukhara and Navoi regions have caused great concern. In the studied region, there are strategically important enterprises of mining, chemical, oil refining, and gas production enterprises that negatively impact the environment of nearby regions. Intensive development of natural resources, oil, gas, non-

ferrous and rare earth metals in the region leads to degradation of land and water resources, pollution of the air basin. Limited sown land, its low-quality composition, the salinity of the soil, improper use of water resources, polluting industrial and household waste leads to a decrease in quality drinking water. The main water source is the Zeravshan River, subject to anthropogenic impact from ground, agricultural, domestic and industrial wastewater. The content of heavy metals in the Zeravshan River from 2008 to 2011 varied from 0.1 to 2.0 MPC; the mineralization did not exceed 0.3 g/l (0.3 MPC), the mineralization of the Amu Darya in the range of 0.6-0.7 g/l (Ashurova, 2014). The Amu-Bukharsky and Amu-Karakul machine channels are carried out through the Amu Darya to the Bukhara region. One of the main environmental

problems of the river is the waste of the uranium and gold mining industries, as well as chemical discharges of Navoiyazot JSC, Navoi region, which has a serious impact on the ichthyofauna of the Zeravshan River, leading to a reduction in fish stocks in the lower reaches of the river. Does not comply with the hygiene rules, the general rigidity indicators exceed the standard level of 7 mg-eq/l and are more than eight mg-eq/l. The water quality is also violated in the water intake section of the household and drinking water supply system.

The phenols and petroleum products concentration range from 4 to 9 MPC (Iskandarova, 2018). In 1992, the republic introduced a procedure for paying for environmental pollution exceeding the norms (Glantz, 2005). The mechanism of norms and conditions under which fines were imposed on enterprises were radically changed. According to the resolution of the Department of Ecology and Environmental Protection of the Navoi region of October 11, 2008, No. 20820 objects of the 1-2 category in the territory of the region, which includes the Navoi Mining and Metallurgical Combine, JSC Kizilkumcement, JSC Navoiyazot, Navoi Hydroelectric Power Station, Ore Management No. 5, ICB NMMC, SHKB NMMC in 2019, paid 1 billion 25 million soums of compensation payments that did not affect the value of the gross domestic product (GDP) by producers. For example, JSC "Navoiyazot" in 2019 produced 2548639 tons (21 types) of products for 2358.6 billion soums, and compensation payments amounted to only 66.7 million soums or 0.0000002% of the cost of products. JSC "Kyzylkumcement" produced 3,678,008 tons of products for three types and 13,2940 m<sup>3</sup> of reinforced concrete products. In the corresponding period, the revenue from sales amounted to 2119.9 billion soums, and the number of compensation payments - 81.0 million soums.

Compensation payments for the chemical composition of pollutants are included. Still, compensation payments for the initial water temperature after the thermal use of river water in the industrial sector are not made. The current market value of the treatment facilities is only 2.4

billion soums. It is necessary to allocate 0.05 - 0.1% of environmental compensation to implement measures to improve the environmental situation in the region. If this mechanism is launched, only Navoiyazot will pay 1.28 billion soums per year, NMMC-22.0 billion soums, Kyzylkumcement JSC-1.05 billion soums, Navoi Thermal Power Plant -1.55 billion soums.

In the studied region, the depletion of groundwater and the shortage of drinking water are of great concern. More than 85% of the consumed water resources are formed outside the republic. The main flow of the Amu Darya and Zeravshan rivers is formed on the territory of Tajikistan. Large reserves of fresh groundwater (mineralization up to 1 g / l) are concentrated in the Tashkent (28.5%), Samarkand (13.7%) regions, while in the Bukhara and Navoi regions of fresh groundwater is less than 0.3% (Kulmatov et al., 2015).

### **Background studies**

The natural resources of the Bukhara region are large and numerous deposits of natural gas and oil, deposits of metals: tungsten, silver, gold, iron, and minerals. The bulk of these concessions are located in the Alat, Karaulbazar, and Kagan districts. In the Alatsky district of gas and condensate-293.8 billion m<sup>3</sup>, technical salt-100 thousand tons; in the Karaulbazar district of gas-66,751 million m<sup>3</sup>, condensate-2104 thousand tons, oil-9119 thousand tons (Tazhibekova et al., 2020). The oil refining, gas chemical, petrochemical, construction, light and food industries, and non-ferrous metallurgy and energy are developing in the region. Industrial plants located on the territory, and especially the largest Bukhara oil refinery, have a negative impact on the pollution of the ecological state of the entire region. To improve the environmental situation in 2020, the management of the Bukhara Oil Refinery signed a memorandum with the American company "Honeywell UOP" and the South Korean company "SK E&C". As a result, the catalyst was replaced at the gas oil hydrotreating plant, the production of diesel fuel of the Euro-4 and Euro-5 environmental categories was launched. (Sultanov et al., 2019). Emissions of phenols and petroleum products

into the region's water resources exceed the MPC by 2-3 times. High content of petroleum products in the soil is observed in the village of Mubarek and on the territory of the Karaulbazar station. There is also a high level of pollution of watercourses chemical elements throughout the area of 27.2% ( in Kashkadarya region -64,3%, Surkhan-Darya region -34,5% Tashkent city is 42.2%) (Allaev & Makhmudov, 2019).

Active in the field of cotton ginning factories, obsolete existing ginning equipment emit a large amount of cotton dust. Along with enterprises that pollute the air, intensive construction of multi-story buildings, frequent replacement and repair of roads have a negative impact on the health of the population, vegetation and animal husbandry. In 2017-2018, 13 state unitary enterprises for sanitary cleaning were established in Uzbekistan with 172 branches in districts and cities and 9 clusters for integrated solid waste management (Normatova et al., 2014). Still, despite the efforts made by the state, construction waste has increased several dozen times in recent years.

The Jeyran Nature Reserve, located near the village of Karaul-Bazar, contains up to 800 species of vertebrates, 300 species of invertebrates, 260 species of birds, and 21 species of reptiles that need to be strengthened by the state. The A-380 Guzar-Bukhara-Nukus - Beineu highway of international significance with a length of 1204 km passes nearby. For the reconstruction of the road, 138 fruit and 626 ornamental trees were cut down and transplanted at the roadside. In addition, when using motor vehicles and special equipment, pollutants such as carbon oxides, nitrogen oxides, hydrocarbons, sulfur dioxides, formaldehyde, benzopyrene and soot are released (Van Assche & Djanibekov, 2012). There is a question of the need to develop environmental standards for all environmental impacts during the construction and operation of residential buildings and roads.

The Navoi region has large reserves of natural gas and deposits of precious metals and raw materials for the production of construction materials. The economy of the region is based on

open-pit mining, metallurgical and chemical enterprises. Among them are the Navoi and Zeravshan open ore developments and metallurgical complexes, where gold is extracted from one of the purest samples in the world and the closed ore developments of Uchkuduk. The largest enterprise, Navoi Mining and Metallurgical Combine, which is one of the ten largest global companies, Navoiazot JSC, is the country's largest supplier of mineral fertilizers, Navoi Cement Plant, which produces about 4.8 million tons of cement, 25 thousand m<sup>2</sup> of marble slabs per year, as well as enterprises of the construction, pharmaceutical, cotton processing, silk spinning industry (Zarova & Tursunov, 2019).

In the production processes of the Navoi region, 898,528 thousand tons of harmful substances are produced, including 859,186 thousand tons of dust and gas. With the help of cleaning equipment, 48,859 thousand tons of harmful substances are emitted into the atmosphere. By 2030, this indicator is expected to increase by 1.5 times due to increasing the number of production enterprises. Because the volume of emissions is not established, they are reflected only in the annual statistical report or quarterly compensation payments. There is no unified air pollution monitoring system; each regulatory body conducts separate monitoring. This is one of the main reasons why the region is included in the zone of the most environmentally polluted areas of the republic (Xu, 2017). More than 30 legislative acts and about 100 by-laws adopted in Uzbekistan in the field of nature protection and use of natural resources "On nature protection", "On protected natural territories", "On State sanitary supervision", "On water and water use", "On subsoil", "On the protection and use of flora", "On the protection and use of wildlife", "On the protection of atmospheric air" (Shaumarov et al., 2012). The largest enterprises violate the appropriate measures for their modernization and technical re-equipment. In the study region, large factories are equipped with filtering devices, but cannot filter gaseous emissions. There are seven observation points of the hydrometeorological center in the cities of Bukhara and Navoi.

Using the positive experience of developed countries, it is necessary to increase the number of public inspectors, strengthen social advertising among the population, and organize a system of incentives for reporting offences. Taking into account the growth of the industrial potential of the cities of the Bukhara and Navoi regions, to maintain normal oxygen (that is, in industrialized cities, the amount of oxygen is 20.8% for a normal lifestyle), it is necessary to increase the planting of trees with the highest oxygen productivity, which includes: oak, deciduous trees (6.7 t / ha) and pine trees (4.8-5.9 t / ha). One hectare of medium-aged pine trees consumes 14.4 tons of carbon dioxide per year and emits 10.9 tons/ha of oxygen. 40-year-old oaks absorb 18 tons of carbon dioxide per 1 hectare and emit 13.9 tons of oxygen during the same period. One hectare of green spaces processes carbon dioxide emitted by 200 people in one hour, and large leaves protect six times more dust than smooth poplar leaves. For a year, 1 hectare of fir trees protects 32 tons of dust, and 1 hectare of oaks protects 56 tons of dust. Therefore, it is proposed to create exotic forests in the industrial zones of the region. Creating the necessary microclimate for human health will help ensure a favorable ecological environment in the cities and villages of the region.

### **Materials and methods**

The analysis of the state of the environment in the lower reaches of the Zeravshan region was carried out on the basis of initial materials, as well as annual reports of the environmental authorities of the region, statistical materials highlighting the main problems of the influence of industrial enterprises on the state of the environment, the ecozone of the regions, the state of irrigated lands and their impact on groundwater sources. The miscalculations affecting the socio-ecological problems of society are revealed. Based on scientific observations, proposals are made to revise compensation payments to industrial enterprises, using new technologies and methods to improve the ecological environment.

### **Results and discussion**

Located on the territory of the lower reaches of Zeravshan - Bukhara region with an area of - 40,320 km<sup>2</sup> and Navoi region-110,800 km<sup>2</sup> is 90 percent occupied by the sands Kyzylkum, with frequent dust storms that are the main natural pollutants of the plain territory, releasing aerosol emissions into the atmosphere.

The influence of the population on the banks of the Zeravshan River is growing every year, including cattle grazing, the burial of various household and construction waste leads to the proliferation of *E. coli* bacteria, which is 5.8 times exceeds the established norms. Fishing with prohibited weapons, hunting of birds listed in the Red Book, illegal mining, lack of control of the right and left banks of the Zeravshan River at a distance of 110 km has led to an increase in the number of poachers (Bobur & Mashkhura, 2019). In the country, the provision of tap drinking water to the urban population is 89.1 percent, rural-78.1 percent. The centralized provision of clean drinking water in the Bukhara region is 53 %, in Navoi-64%. Cholera vibrios are constantly detected in the Zeravshan, Amu Darya and the Syr Darya rivers (Gafurov, 2020). In some areas, the population uses water from open reservoirs due to unsatisfactory supply. Tap water, in many cases, especially in the summer, does not meet hygienic standards. The analysis of statistical data indicates that the processes of agricultural pollution are most intensively marked in the Bukhara region. Irrigated agriculture is the largest consumer of water, taking more than 90% of the volume of water resources used. This is even though the share of irrigated land from the total area of agricultural land is only 9 %, in Navoi – 3 %, while in Khorezm-96.1 %; in Ferghana -95 %, etc. (Kuziev, n.d.). Of the total area of 40,320 km<sup>2</sup>, the area of irrigated land in the Bukhara region is 274.9 hectares (in 2013), 64% is pastures, 4.7 is agricultural land, 2.4% is lakes with drainage water. Abandoned agricultural airfields where organochlorine pesticides are stored harm the environment. The irrigated lands of the Bukhara region need the removal of groundwater, which leads to waterlogging and salinization of irrigation lands. Although the removal of groundwater began in 1932, and the total length of the collector and drainage network

was increased from 1956 to 1979, this problem has not been completely solved to date (Sultanov et al., 2019).

The use of underground leaching in the extraction of uranium and gold leads to local contamination of groundwater. The main causes of pollution of artesian waters are spills of technological solutions, a violation of the balance of injection and pumping, leading to their spreading into adjacent horizons. Low technological discipline led to contamination of groundwater with cyanides and ore solution. For example, in Gijduvan, Zafarabad and other adjacent territories, the mineralization of drinking water level reached 10-11 g/l. The pH of groundwater has decreased to one. This explains the growth of cancer and endocrine diseases among these areas (Chekmarev et al., 2004). As a result of nitrate contamination of drinking water supply sources, the region's population has a high level of liver, kidney, and nervous system morbidity.

**Table 1** explains the average annual concentrations of harmful substances in the atmospheric air in the cities of Prizaravshan from 2008 to 2011 (in fractions of MPC) looked as follows.

In 2019,

**Table 2.** Shows, in Navoi, there was an excess of the maximum permissible emissions (MPI) standards established for the enterprise.

According to the Law "On the Environmental Protection Program in the Republic of Uzbekistan for 1999-2005", measures were taken to build special workshops and installations of equipment containing dust and gases in order to reduce emissions into the atmosphere. This program for the Navoi region includes a machine-building plant at the NMMC. If the emissions of harmful substances into the atmosphere after installing the PVM-20 amounted to 24.8 tons, then after installing the PVMS-40, it decreased by 48 tons. High-tech gas analyzers "MAG" and "GAOP" were installed at the Navoi Cement Plant. With the acquisition of automatic gas analyzers "GIAM", emissions into the atmosphere decreased by 80 tons (Botman21,

2009). But the cleaning equipment of Navoiazot JSC still does not meet the relevant requirements. Perhaps that is why in 2007, the highest incidence of the population with a newly diagnosed diagnosis was registered in the region in 72275.4 people out of 100,000 (Kholikulova, 2021). In the Navoi region, 381.5 thousand people live in an ecologically suitable climate; 324.4 thousand live where the ecological condition is critical; 298.8 thousand people live in areas with an extremely critical ecological condition (Ibragimova, n.d.).

**Table 3** explains the results of a comprehensive assessment of the ecological state of the Navoisk region. Results of a comprehensive assessment of the ecological state of the Navoisk region. The main part of the region consists of sandy deserts, where more than 600 plant species are found. Of the thousands of wild plants in the Navoi region, 250 are medicinal, 453 are dyes, and 60 are essential oils. In the desert areas of Uchkuduk, Tomdi, Kenimeh, Nurata, the shrubs of saksaul, yuzgun, kandym, cherkez and chala are used, such as ok boyalich, tuyakorin, yantok, adraspan, kizilcha, selin, utlardan ilok, ok jusan, bayrgun. In particular, the territory of the Uchkuduk district is 4 million 663 thousand hectares, the main type of vegetation is saxaul, and 90-95% of the district's territory is covered with vegetation, that is, 0.2-2.5 kg of grass per hectare, on average 700-1200 wild saxaul grows on the territory of the district per hectare. But from year to year, vegetation and wildlife in the areas are severely degraded due to the impact of industrial enterprises on groundwater. In the region, much attention is paid to the expansion of water areas, creating conditions for the development of fishing. There are three large water areas in the region: Aidarkul with a total area of 145503 hectares, with a water capacity of 41.5 billion cubic meters; Tudakul with a total area of 21673 hectares, with a water capacity of 1.75 billion cubic meters; Shurkul with a total area of 2516 hectares, with a water capacity of 0.22 billion cubic meters. Currently, observation wells have been installed around the reservoirs to study the impact of industrial enterprises on the region's groundwater, and water analysis obtained by enterprises from groundwater wells shows the

presence of pollutants. Illegal use of groundwater in the national economy for various purposes affects land reclamation and causes secondary land pollution. Liability for cases of illegal use of underground water is limited only by the imposition of administrative fines.

### **Conclusions and suggestions**

This monitoring system provides an early forecast of emergency emissions into nature and an accurate calculation of compensation payments and environmental control of the company's production processes. When the system is put into operation, specialized laboratories will be required to carry out instrumental measurements, additional chemical reagents, and additional costs will arise. Thus, a unified monitoring system will be created; it will be possible to take immediate measures to eliminate problems. Thus, over the past decades, the intensive increase in the production potential of the regions, improper management of water resources, the use of pesticides in agriculture, automobile emissions have begun to have a detrimental impact on the environment. This indicates a low level of equipment of production facilities with modern technologies, reflecting the low competitiveness of economic sectors in terms of energy costs and environmental impact. Nature protection authorities have limited powers to combat environmental offences. Currently, due to the work of many new industrial enterprises, the location of many production facilities in sanitary protection zones, the construction of new cultural, social and multi-storey residential buildings, the placement of these posts does not meet modern requirements. These posts mainly control the amount of dust, nitrogen, carbon, sulfur oxides, ammonia, phenol. Heavy metals in the air, some toxic substances (lead, mercury compounds) are not controlled, there is no complete data on air pollution. It is advisable to install electronic meters, i.e. sensors on sources formed during the production of harmful substances, providing communication between the dispatcher of the enterprise with the control panel to the electronic environmental management system.

To reduce the emissions of boiler gases and pollutants into the atmosphere, it is necessary to establish the production of cheap and convenient filters and dust and gas cleaning equipment for light and construction industry enterprises. It is necessary to ensure the replacement of the equipment of cotton gins with modern dust-free and dust-collecting equipment with a cleaning efficiency of at least 99%. This, in turn, will improve the quality of atmospheric air and the creation of a healthy environment for the population. Review the observation posts of the Hydrometeorological Center, depending on the city's expansion, the location of industrial enterprises, increase the number of observation posts, use the PE-5300 VI Spectrophotometer at the posts, which allows you to determine the optical parameters of various components in chemical liquids. It will be possible to determine the amount of harmful substances in a short time and take appropriate measures.

In Uzbekistan, 9 tons of solid household waste are generated annually. The immense production of polymers and the consumption of resources lead to a crisis of waste disposal. It is necessary to increase the number of enterprises that process specific solid household waste - mercury-containing waste, tires, batteries, used oils, packaging waste, etc.

Taking into account the growth of the industrial potential of the cities of the Bukhara and Navoi regions, to maintain normal oxygen (that is, in industrialized cities, the amount of oxygen is 20.8% for a normal lifestyle), it is necessary to increase the planting of trees with the highest oxygen productivity, which includes: oak, deciduous trees (6.7 t / ha) and pine trees (4.8-5.9 t / ha). One hectare of medium-aged pine trees consumes 14.4 tons of carbon dioxide per year and emits 10.9 tons/ha of oxygen. 40-year-old oaks absorb 18 tons of carbon dioxide per 1 hectare and emit 13.9 tons of oxygen during the same period. One hectare of green spaces processes carbon dioxide emitted by 200 people in one hour. Large leaves protect six times more dust than smooth poplar leaves. For a year, 1 hectare of fir trees protects 32 tons of dust, and 1 hectare of oaks protects 56 tons of dust.

Therefore, it is proposed to create exotic forests in the industrial zones of the region. Creating the necessary microclimate for human health will help ensure a favorable ecological environment in the cities and villages of the region.

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**Table 1.** The average annual concentrations of harmful substances in the atmospheric air in the cities of Prizaravshan from 2008 to 2011 (in fractions of MPC)

Cities	Pollutants	2008	2009	2010	2011
Bukhara	Solid substances	-1	1,3	1,3	1,3
Navoi city		0,7	0,7	0,7	0,7
Bukhara	Nitrogen dioxide	0,5	0,5	0,8	0,8
Navoi,		1,3	1,3	1,0	1,0
Bukhara	Of ammonia	-1	0,5	0,5	0,3
Navoi		1,3	1,0	1,0	1,0
Bukhara	Sulfur dioxide	0,4	0,3	0,2	0,1
Bukhara	Phenol	-1	0,5	0,5	0,3
Navoi		1,0	0,7	0,7	0,7

**Table 2.** In Navoi, there was an excess of the maximum permissible emissions (MPI) standards established for the enterprise

<b>In the atmosphere</b>	By dust	2.5 times
	For sulfur dioxide	3.1 times
	For nitrogen oxides	up to 2.84 times up
	For ammonia	to 1.17 times up
<b>In natural and wastewater</b>	For ammonium nitrogen	to 3 times
	By nitrate nitrogen	up to 2 times up
	By nitrite nitrogen	to 5 times up



	By copper	to 1.9 times
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**Table 3.** Results of a comprehensive assessment of the ecological state of the Navoisk region

<b>Ecological zones</b>	<b>Territory thousand hectares</b>	<b>Including irrigation. lands</b>	<b>Population thousand people.</b>	<b>Number of districts (cities, Nah. As part of the region)</b>
O-suitable environmental comp.	2243,1	9,9	381,5	3
1-Critical environmental comp.	8436,9	67,9	324,4	5
2-Extreme. Crete ecological comp.	257,4	46,3	298,8	3
3-ecological crisis	-	-	-	-
Total by region:	10937,4	1241,1	1004,7	11