

**THE STATE OF ATMOSPHERIC AIR IN THE REPUBLIC OF UZBEKISTAN**

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**СОСТОЯНИЕ АТМОСФЕРНОГО ВОЗДУХА В РЕСПУБЛИКЕ УЗБЕКИСТАН**

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**ЎБЕКИСТОН РЕСПУБЛИКАСИДА АТМОСФЕРА ҲАВОСИНИНГ ҲОЛАТИ**

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**Цель:** гигиеническая оценка состояния атмосферного воздуха в республике Узбекистан. **Материал и методы:** Центр гидрометеорологической службы Республики Узбекистан ведет мониторинг загрязнения атмосферного воздуха в городах Республики. Программа мониторинга охватывает 5 основных загрязнителей: пыль (твердые взвешенные частицы), оксид углерода (угарный газ), диоксид азота, диоксид серы, оксид азота. Информация, полученная с 63 стационарных постов наблюдений, позволяет судить о среднем уровне загрязнения атмосферного воздуха в целом по республике и рассчитывать индекс загрязнения атмосферы, который дает интегральную характеристику уровня загрязнения воздуха для города за год. **Результаты:** анализ данных показывает, что за исследованный период повышенная степень индекса загрязнения атмосферы отмечалась только в г. Ангрене: в 2014 г. – 5,12, в 2016 г. – 5,32, в 2017 г. – 5,30. **Выводы:** несмотря на снижение валовых выбросов загрязняющих веществ, оно не сопровождается стабилизацией и тем более улучшением качества атмосферного воздуха.

**Ключевые слова:** атмосферный воздух, загрязнение атмосферного воздуха, индекс загрязнения атмосферного воздуха.

**Мақсад:** Ўзбекистон Республикасида атмосфера ҳавосининг ҳолатини гигиеник баҳолаш. **Материал ва усуллар:** Ўзбекистон Республикаси гидрометеорология хизмати маркази Республика шаҳарлари атмосфера ҳавосини ифлосланишини мониторингини ўтказди. Мониторинг дастури 5та асосий ифлослантувчиларни ўз ичига олди: чанг (қаттиқ муаллақ моддалар), углерод оксиди (ис гази), азот диоксиди, олтингурут диоксиди, азот оксиди. 63 стационар назорат постларидан олинган маълумотлар, республика бўйича атмосфера ҳавосининг ўртача ифлосланиши даражани аниқлашга ва йил давомида шаҳар ҳавосини интеграл тавсифлашга имкон берадиган атмосфера ифлосланиши индексини ҳисоблашга ёрдам берди. **Натижа:** олинган натижалар шуни кўрсатдики, тадқиқ этилган йиллар давомида атмосфера ифлосланиши индексининг юқори даражаси фақат Ангрэн шаҳрида кузатишган: 2014й. – 5,12, 2016й. – 5,32, 2017й. – 5,30. **Хулоса:** ифлослантувчи моддаларнинг умумий ҳажми камайишига қарамасдан ҳавонинг ифлосланишининг пасайишига эришила олинмаётгани аниқланди.

**Калит сўзлар:** ҳаво, ҳаво ифлосланиши, ҳаво ифлосланиши индекси.

Pollution of atmospheric air determined by the intrusion of pollutants from natural and anthropogenic sources, as well as by the physical - geographical and climatic conditions of the territory significant part of Uzbekistan is a flat territory belonging to the Turan lowland, open to cold invasions, which forms sharply continental climate features. There are periodically observed western, northwestern intrusions of moist air from the temperate latitudes of the Atlantic Ocean, which also affects the formation of qualitative and quantitative characteristics of the atmosphere. The main natural pollutants of the flat territory are natural sources of aerosol emissions into the atmosphere, such as Karakum and Kizilkum deserts with their frequent dust storms, as well as the Aral Sea area, from the surface of which large masses of saline dust rise and transfer from the surface to the west. Sources of pollutants of anthropogenic origin are transport and enterprises of the leading industries of the Republic, in particular, oil and gas production and processing, energy, metallurgy, construction, chemical and others [4].

The largest specific pollutant emissions are in the Tashkent region. Then the degree of load is distributed as follows:

- VOC emissions: increased - in the Andijan region, medium - in the Fergana and Khorezm regions, moderate in the Samarkand and Namangan regions, low in the rest of the Republic;

- Nitrogen oxide emissions: increased - in the Salrdarya region, medium - in the Andijan, Kashkadarya and Fergana, moderate - in the Andijan and Namangan and Khorezm regions, low in the rest of the Republic;

Particulate pollutants: increased - in Navoiy region, medium - in Djizak and Fergana, moderate - in Andijan, Namangan and Ferghana regions, low - in the rest of the Republic;

Thus, this analysis clearly shows the complete dependence on the location of industrial and transport facilities on the territory of the Republic,

In 1990, stationary industrial sources accounted for the largest share of pollutants in the atmosphere. With the acquisition of independence and the transition

to a market economy, heavy industry enterprises were restructured, a decline in production was noted, a number of factories were closed. At the same time, there was a transition to new technologies and products needed to maintain competitiveness and environmental standards. The level of industrial air pollution decreased. But the rapid growth in the number of cars has led to an increase in the number of road congestion and increased air pollution in major cities. In many localities, due to the deterioration of the public transport system, the car has become a more reliable means of transportation, and in areas with a high level of development, personal transport has also become a sign of social status. The contribution of mobile pollution sources, mainly cars, to total air emissions is less than 50% in Kazakhstan and Turkmenistan, up to 70% in Uzbekistan and reaches almost 90% in Tajikistan and Kirgizistan [1]. Gross emissions of pollutants into the atmosphere from stationary and mobile sources characterize the general anthropogenic load on the atmospheric air. In the total volume of pollutant emissions in Uzbekistan, the main share is energy (33%), oil and gas (31%) and metallurgy (22%). The main components of all atmospheric emissions in the republic in the first years of independence were carbon monoxide (50%) and hydrocarbons (15%), sulfur dioxide (14%), nitrogen oxides (9%) and particulate matter (8%).

In the structure of total gross emissions across Uzbekistan, there have been minor changes in the past twenty-five years. Thus, the content of carbon monoxide and hydrocarbon emissions increased by 2%. At the same time, the content of emissions of sulfur dioxide by 2% and solid particles by 3% decreased. The content of nitrogen oxides in the structure over a given period has not changed. It should be noted that as a result of the implementation of environmental measures in accordance with the "Program of Action for the Protection of the Environment in the Republic of Uzbekistan for 1999-2005" and other programs, as well as the annual implementation of the "Clean Air" operation in the Republic, total emissions into the atmosphere decreased to 2.1 million tons or 2.1 times compared with 1989 [2-4]. Despite the reduction in gross emissions of pollutants into the atmosphere, the state of atmospheric air is not accompanied by stabilization and, especially, improvement in its quality, which prompted the conduct of this study. The purpose of this work is a hygienic assessment of the state of atmospheric air according to the Center of Hydrometeorological Service of the Republic of Uzbekistan (UzHydromet).

Materials and methods. UzHydromet has been monitoring air pollution in the cities of the Republic for many years. Observations are being conducted in 25 cities and towns. In total there are 63 stationary posts in the Republic. The location for the installation of a stationary post is selected, as a rule, taking into account meteorological conditions for the formation of levels of air pollution. At the same time, a set of tasks is determined in advance, an estimate of the average monthly, seasonal, annual and maximum single concentrations, the

probability of occurrence of concentrations exceeding the MAC (Maximum allowable concentrations), etc.

The number of posts in the city depends on the population in the city, the area of the settlement, the terrain, the degree of industrialization.

For settlements with complex terrain and a large number of sources it is recommended to install one post for every 5-10 km<sup>2</sup>. To make information about air pollution take into account the peculiarities of the city, it is recommended to put observation posts in various functional areas - residential, industrial and residential. In cities with a high traffic intensity, posts are also established near motorways.

The monitoring program covers 5 main pollutants: dust (solid suspended particles), carbon monoxide, nitrogen dioxide, sulfur dioxide, nitric oxide. Other parameters are added to the measurement programs depending on the composition of industrial emissions and the characteristics of the nearest cities and adjacent areas (ammonia, phenol, formaldehyde, ozone, chlorine, solid fluorides, hydrogen fluoride). Observations on the state of atmospheric air are made daily with a frequency of 3 times a day [2-3].

The air quality assessment in the city is conducted according to the methodology outlined in RD 52.04.186-89 (Measurement of the mass concentration of nitrogen dioxide, Measurement of the mass concentration of oxide and nitrogen dioxide from one sample of air, Measurement of the mass concentration of sulfur dioxide), which is the fundamental guide for systems of hydromet in the territory of the CAC (Central Asia Countries) countries. According to UzHydromet, air pollution in Uzbekistan emissions of harmful substances from stationary and mobile sources, and also high (in most areas of the Republic) the climate potential of atmospheric pollution [3].

The information obtained from 63 stationary observation posts allows one to judge the average level of atmospheric air pollution in the whole of the country and calculate the atmospheric pollution index (hereinafter - API), which gives an integral characteristic of the air pollution level for the city for the year.

The complex index of air pollution (hereinafter - API 5) is calculated for five substances with the highest normalized MAC values, taking into account their hazard class. The API calculation does not include ozone values, since observations of this impurity are carried out for a year and not all cities and formaldehyde; because the technique determines the amount of aldehydes, (the definition of "formaldehyde" gives the concentrations of aldehyde sums without comparison MAC). Pollution of atmospheric air is determined from the values of impurity concentrations. The degree of contamination estimated by comparing actual concentrations with hygienic standards - the maximum permissible concentration of impurities in the ambient air. There are 4 grades of the degree of air pollution: from "low" to "very high" (Table 1).

Degree of air pollution	Indicator of air pollution	Assessment
Low	API	0-4
Increased	API	5-6
High	API	7-13
Very high	API	14

Results and its discussion. Analysis of the data shows that during the period studied, an increase in the atmospheric pollution index noted, only in Angren, (table 2). The integrated indicator of pollution was 5.12 in 2014, 5.32 in 2016 and 5.30 in 2017, which corresponds to the II degree, characterized by an increased level of atmospheric pollution, which leads to deterioration of living conditions of the population. -

**Table 2.**  
**Indexes of atmospheric pollution index (API) for cities of the Republic Uzbekistan for the last 5 years**

Small town	API				
	2013	2014	2015	2016	2017
Almalik	4,05	4,10	4	4,12	4,23
Angren	7,72	5,12	4,71	5,32	5,30
Andijon	3,35	2,94	3,80	3,32	3,62
Bekobod	2,79	2,88	3,20	3,67	3,92
Bukhara	3,22	3,38	2,98	3,58	4,32
Gulistan	2,18	1,85	1,89	2,33	2,37
Denov	1,49	1,49	1,32	1,45	1,22
Kagan	0,60	0,80	0,97	1,2	1,21
Karshi	1,32	1,30	1,30	1,26	1,25
Kitob	1,17	1,15	1,17	1,13	1,13
Kukan	3,04	2,29	2,36	2,62	2,79
Margilon	1	1,23	1,20	1,28	1,43
Muborak	0,32	0,33	0,33	0,34	0,35
Navoiy	3,17	2,93	3,59	3,90	4,06
Namangan	1,72	1,93	2,26	3	2,95
Nukus	4,31	4,01	3,95	4,43	4,55
Samarkand	1,62	1,83	1,90	1,74	1,55
Saraosiya	2,60	2	1,59	1,43	1,23
Tashkent	3,85	4,04	3,51	3,55	4,10
Urganch	1,82	1,9	2,02	2,11	1,24
Farghana	3,57	3,84	4,10	4,52	4,38
Chirchik	2,69	2,95	3,61	3,61	3,41
Shakrisabz	1,15	1,15	1,17	1,14	1,14
Yangiyul	0,54	0,54	0,57	0,43	0,41
Nurabad	0,68	-	-	-	1,41

In other cities of the republic, an increased API not observed. It can be assumed that these indicators were achieved because of measures to reduce harmful emissions into the atmosphere through the construction and reconstruction of capture and dust-cleaning systems of individual workshops and production.

Over the past twenty-five years there has been a trend of reducing harmful substances from stationary sources (from 1.3 to 0.7 million tons) [4]. These indicators were achieved as a result of measures to reduce harmful emissions to the atmosphere at the largest enterprises of the Republic in the cities of Almalik (AMMC), Bekobod, Navoiy (cement plant, NMMC) through the construction and reconstruction of capture and dust-cleaning systems of individual workshops and production in accordance with the decision of the Government of October 20, 1999 No. 469 "On the Program of Actions for the Protection of the Environment of the Republic of Uzbekistan for 1999-2005", according to which:

- work was carried out to introduce oxygen-bubble melting at OJSC "AMMC", as a result of which it is expected to reduce emissions of pollutants by 119,033 thousand tons;
- Reconstruction of dust collection and cleaning systems from electric arc furnaces at "Uzmetkombinat" APO. The new electric arc furnace DSP-100 UMK was commissioned in cooperation with the complex steel processing unit. As a result, emissions of pollutants were reduced by more than 900 tons;
- Reconstruction and modernization of air-cleaning systems of casthouse production at the machine-building

plant of NMMC Navoi, in the foundry shop, dust and gas cleaning equipment was put into operation.

Annual emissions of pollutants into the atmosphere decreased after installation of PVM-20 by 24.8 tons per year, and PVMS-40 by 48 tons per year;

- a system for monitoring fuel combustion in rotary kilns at the Navoi cement plant with the installation of gas analyzers for carbon monoxide, sulfur and nitrogen oxides. As a result, the emission of pollutants into the atmosphere has been reduced by 80 tons per year.

Also in the Republic, work is continuing on the transfer of motor vehicles to alternative fuels. Currently, the conversion of vehicles to compressed natural gas and liquefied petroleum gas has been successfully carried out.

The natural conditions of the Republic, such as a small amount of precipitation, temperature inversions, dryness of the underlying surface, contribute to the formation of high levels of atmospheric pollution of natural origin in the Republic of Karakalpakstan, Khorezm, Bukhara, Navoiy, Kashkadarya and Serdarya regions. In the cities of Bukhara and Nukus, the excess of the Threshold Level Value continuous exposure was recorded at 1.3 and 2.7 times, respectively.

### Conclusion

The analysis of the UzHydromet data on the state of atmospheric air shows that at present:

- In almost all cities of the country, the atmospheric pollution index is characterized as "low" (API is less than 5). Elevated API values (more than 5) were noted only in 2014, 2016-2017 in the atmospheric air of Angren;
- the average content of sulfur dioxide and carbon monoxide in all localities of the Republic of Uzbekistan does not exceed Threshold Level Value continuous exposure (TLVCE);
- Throughout the analyzed period, the level of atmospheric dust pollution was noted in the cities of Bukhara, Nukus, which is associated with natural and climatic conditions;
- as a result of taking air protection measures carried out by enterprises and organizations of the Republic, emissions of pollutants in the country, as a whole, were reduced by 34,876 thousand tons. Due to the implementation of measures on stationary sources of emissions into the atmosphere, emissions decreased by 13,439 thousand tons, on mobile sources - by 21,439 thousand tons.

Assessing the sanitary condition of the air in populated areas of Uzbekistan, it should be noted that, despite the reduction in gross emissions of pollutants, it is not accompanied by stabilization and, especially, improvement in the quality of atmospheric air.

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**Purpose:** *hygienic assessment of the state of atmospheric air in the Republic of Uzbekistan.*

**Material and methods:** *The Center of the Hydrometeorological Service of the Republic of Uzbekistan monitors air pollution in the cities of the Republic. The monitoring program covers 5 major pollutants: dust (suspended solids), carbon monoxide (carbon monoxide), nitrogen dioxide, sulfur dioxide, nitrogen oxide. Information obtained from 63*

*stationary observation posts makes it possible to judge the average level of air pollution in the republic as a whole and to calculate the air pollution index, which gives an integral characteristic of the level of air pollution for the city over the year. Results:* data analysis shows that for the period studied, a higher degree of air pollution index was observed only in Angren: in 2014 - 5.12, in 2016 - 5.32, in 2017 - 5.30. **Conclusions:** *despite the reduction in gross emissions of pollutants, it is not accompanied by stabilization and, moreover, improvement in the quality of atmospheric air.*

**Key words:** *air, air pollution, air pollution index.*

