

**AIR POLLUTION AND ITS ANALYSIS IN NAVOI CITY DURING 2020–2021*****Toshturdiyev Nurbek Nurali ugli****National University of Uzbekistan named after Mirzo Ulugbek**Faculty of Physics, Department of Hydrometeorology**3rd year student**Phone: +998 88 910 42 46**Email: nurbektoshturdiyev86@gmail.com*

Abstract: This scientific article presents information on air pollution and its analysis in Navoi city based on observations conducted in 2020–2021. It also includes data on the average values of meteorological parameters recorded during the observation years and analyzes their impact on air pollution levels.

Keywords: Navoi city, atmosphere, air pollutants, nitrogen oxides, sulfur dioxide, carbon monoxide, precipitation, wind, fog.

In today's globalized world, the scope of environmental issues associated with human development is expanding rapidly. While industrialization, urbanization, and technological advancements contribute to socio-economic prosperity, they also give rise to acute environmental problems, particularly atmospheric air pollution. From this perspective, studying and evaluating air quality indicators in highly industrialized regions, including Navoi city, has become a pressing scientific priority.

Navoi city is not only a major industrial center in Uzbekistan, but also one of the largest in Central Asia. The mining-metallurgical, chemical, construction materials, and energy industries located here play a significant role in the region's economic development. However, this progress comes at a considerable environmental cost — thousands of tons of industrial emissions are released into the atmosphere annually, leading to an increase in air pollution levels.

This article provides a scientific analysis of the state of air pollution in Navoi city during 2020–2021, identifying the main sources of pollutants, their composition, and their harmful consequences. The objective is to assess changes in air quality based on statistical and environmental monitoring data, identify existing ecological risks, and develop recommendations to eliminate them. These analyses are crucial for protecting the air, maintaining environmental sustainability, and ensuring the ecological health of the population. As highlighted in our previous studies, Navoi has a sharply continental climate with very low levels of precipitation, and winds vary in strength and direction. These meteorological parameters can contribute to the stagnation and spread of air pollutants for prolonged periods. Below are the average annual values of the meteorological parameters observed in Navoi city for the years 2020 and 2021.

Table 1.**Meteorological parameters observed in 2020–2021**

Average Annual Values	Long-Term Indicators	Year 2020	Year 2021

Number of days with precipitation	65	42	37
Average wind speed (m/s)	2,3	3,2	3,0
Frequency of wind speed 0–1 m/s, %	44,3	46,9	15,3
Frequency of fog in cold months (%)	7,1	3	1

As can be seen from the table data, the recorded values during the observation years were significantly lower compared to the long-term average values. The amount of precipitation has shown a decreasing trend year by year. This contributes to the longer persistence of air pollutants and particulate matter in the region. For a more in-depth analysis, it is necessary to examine the monthly distribution of meteorological parameters recorded during these years.

Table 2.
Meteorological characteristics of the city for the year 2020.

№	Meteorological Parameters	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
1.	Number of days with precipitation	7	8	3	5	6	1	0	0	1	0	1	7
2.	Frequency of foggy days (%)	1	0	0	0	0	0	0	0	0	0	1	1
3.	Wind speed 0–1 m/s	17	15	15	12	13	7	18	14	18	17	14	12
4.	Percentage of calm (windless) days (%)	32	10	18	10	23	16	20	26	36	28	35	68
		13	4	8	4	9	7	8	10	16	11	11	27

Table 3.
Meteorological characteristics of the city for the year 2021.

№	Meteorological Parameters	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
1.	Number of days with precipitation	6	6	12	1	3	1	0	0	0	4	1	3
2.	Frequency of foggy days (%)	0	0	1	1	0	0	0	0	0	0	0	1
3.	Wind speed 0–1 m/s	19	21	23	21	26	25	15	24	19	19	21	17
4.	Percentage of calm (windless) days (%)	29	24	12	10	20	19	14	20	15	23	21	35
		11	10	5	4	8	9	6	8	6	9	9	14

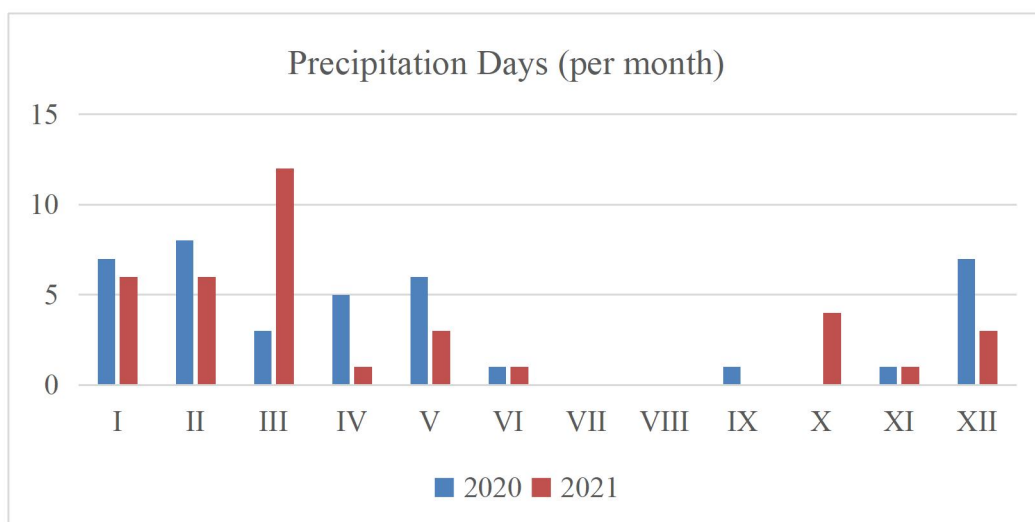


Figure 1. Monthly distribution of days with precipitation in Navoi city during 2020–2021.

According to the data and the graph, the number of days with recorded precipitation in 2021 was lower compared to 2020. Only in March and October was the opposite trend observed. As mentioned above, the amount of precipitation also has an impact on air pollution levels in the atmosphere.

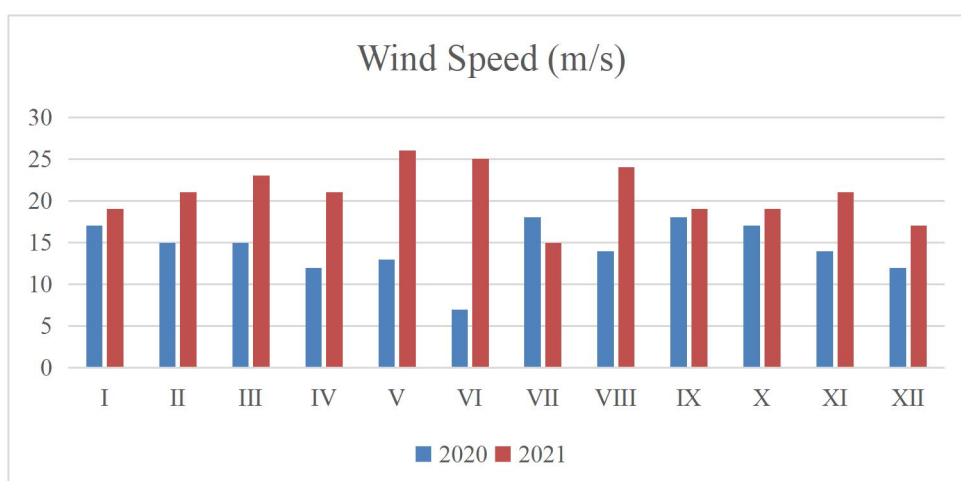


Figure 2. Monthly distribution of wind speed in Navoi city during 2020-2021.

One of the meteorological factors affecting air pollution is wind. Wind speed and direction have a significant impact on the dispersion of pollutants and contamination levels in urban areas. Comparing wind speed variations in Navoi city during 2020-2021, the wind speeds recorded in 2021 were higher than those in 2020. This, in turn, greatly influences the spread of dust particles in the air.

Air pollution is characterized by the concentration of pollutants and dust particles present in the atmosphere. The largest contributors to air pollution include dust particles, sulfur dioxide, nitrogen oxides, ammonia, and other gases. Below are the indicators of air pollution in Navoi city for the years 2020-2021:

Table 3.

Characteristics of Air Pollution in the Territory of Navoi City (in mg/m³)

№	Pollutant Gases	Average Values (mg/m ³)		Maximum Values (mg/m ³)		Number of Observations	
		2020	2021	2020	2021	2020	2021
01	Dust	0,10	0,10	0,52	1,1	897	913

02	Sulfur dioxide	0,005	0,007	0,030	0,022	2572	1828
05	Nitrogen dioxide	1	1	3.5	5	897	913
06	Nitric oxide	0,05	0,05	0,11	0,12	2572	1828
07	Ozone	0,04	0,03	0,11	0,09	897	913
10	Phenol	0,011	0,010	0,023	0,027	288	286
19	Ammonia	0,002	0,001	0,006	0,009	879	913

Results of atmospheric monitoring conducted during 2020–2021 indicate that the air quality in Navoi city varied from year to year. Based on data collected at monitoring stations, the concentrations of main pollutant components were assessed: particulate matter (PM), sulfur dioxide (SO₂), nitrogen oxides (NO and NO₂), carbon monoxide (CO), and other gases.

By the end of 2021, the following main changes were observed:

Particulate Matter (PM): In 2021, the concentration of particulate matter significantly increased compared to 2020. This rise is mainly associated with the activities of thermal power plants, increased vehicular traffic, and the uncontrolled release of industrial emissions. High concentrations of particulate matter in the atmosphere pose risks not only environmentally but also to public health.

Sulfur Dioxide (SO₂): The amount of this gas in 2021 exceeded average norms. This indicator is directly related to the operations of the Navoi Mining and Metallurgy Complex and other industrial enterprises, particularly the combustion of coal and other sulfur-containing fuels. SO₂ is an irritant to the respiratory tract, and high atmospheric levels can exacerbate respiratory diseases.

Nitrogen Oxides (NO_x): Nitrogen oxide concentrations showed an upward trend reaching peak values in 2021. This increase is mainly explained by the rise in vehicle numbers, poor fuel quality, and high traffic density. Nitrogen oxides are key contributors to the formation of photochemical smog in the atmosphere.

Other Gases (Carbon Monoxide (CO), Methane (CH₄), Ozone (O₃), etc.): According to monitoring data, concentrations of these gases remained nearly stable between 2020 and 2021. Only their peak values showed some increase in 2021. This stability indicates that their sources remained relatively constant, mainly associated with household emissions, small enterprises, and natural factors.

The observed changes may be influenced by the following factors:

- Increase in industrial production volume, especially in mining and metallurgy sectors;
- Growth in automobile transport, particularly older vehicles operating without ecological control;
- Insufficient filtration in heating systems;
- Dust accumulation from open areas and roads around the city.

These results are of significant scientific and practical importance for regular atmospheric monitoring, early detection of ecological hazards, and implementation of mitigation measures.

In conclusion, analyses of atmospheric air quality in Navoi city during 2020–2021 demonstrate relative changes in concentrations of certain harmful gases. Specifically, particulate matter, sulfur dioxide, and nitrogen oxides increased in 2021 compared to the previous year. These changes are directly related to industrial activities, increased vehicle traffic, and weak environmental control. Concentrations of other pollutants such as carbon monoxide and methane

remained largely unchanged, indicating stable emission sources. Nonetheless, the increase in concentrations of some gases poses ecological risks. Such atmospheric conditions in the city may negatively affect human health in the long term, particularly impacting respiratory and cardiovascular systems. Therefore, based on these data, it is necessary for relevant state authorities and industrial enterprises to strengthen environmental measures, improve monitoring systems, and implement practical actions to reduce pollution sources.

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