ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 12 , December 2020

Monitoring of the Environmental Quality of the Navoi Region

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ABSTRACT: The article deals with atmospheric air pollution monitoring by hazardous chemical substances of industrial enterprises in Navoi city.

KEY WORDS: atmospheric air, emissions, local pollution, pollution sources, measurement, reagents, maximum permissible concentrations, maximum permissible emissions, monitoring.

I.INTRODUCTION

In the conditions of a constantly deteriorating environmental situation, the environmental impact degree on the population health and quality life increases accordingly. The population health of the country in general and the region in particular is an important factor in human capital development and growth in labor productivity, which in turn directly affect the economic development of the country and the region [1-3].

Research work on the forecast and monitoring of pollutants emissions from industrial production in order to reduce the negative impact on the environment is an important task facing modern industrial enterprises. One of the ways to solve the emission reduction problem at the local level is the constant research, modeling and forecasting of emission concentration values using a monitoring system, which is an integral part of industrial process control. In the manufacturing industry, modeling and technological processes optimization in the modern scientific and technological progress can increase productivity by reducing energy consumption and improving product quality through the widespread use of modern technologies. At the same time, the search for optimal solutions for technological processes in order to reduce the harmful impact on the environment is one of the main directions of technical development focused on increasing productivity, improving product quality, reducing costs, facilitating working conditions and protecting the environment. An important area of monitoring research is the environment quality assessment [4, 5].

The total pollutants contribution introduced by each element is determined by calculation using the coefficients obtained using the methodology described in [6-8]. For different coefficients values, the database was verified and those for which the smallest discrepancy between the initial and predicted concentration values was obtained were selected. A similar practice of using the coefficients is found in works [9-12], in which each parameter influence on the pollution degree was estimated, and the results obtained were used to make pollution forecast. After normalization, the data is presented in an easy-to-use form. The normalization result is a data model that is easy to maintain and free from data ambiguity and repetition. In this case, all measurements are located on some segment [a, b], which is normalized to [0,1], and the value $x \in [a,b]$ is calculated by the formula:

$$X_1 = x - a/b, \quad \text{где } X_1 \in [0,1].$$

These standards establish a methodology for calculating the harmful substances concentration in the atmospheric air contained in the enterprises emissions. The norms must be observed in the enterprises design, as well as in the emissions regulation into the reconstructed and operating enterprises atmosphere [13].

The danger degree of atmospheric air pollution is characterized by the highest calculated concentration value corresponding to unfavorable meteorological conditions, including dangerous wind speed. The standards do not apply to the concentrations calculation at long (more than 100 km) distances from emission sources [13-17].

Depending on the H height of the emission source mouth of harmful substances above the ground level, the specified source belongs to one of the following four classes: a) high sources, H=50 m; b) medium height source, H = 10 ... 50 m; c) low sources, H = 2 ... 10 m; d) ground sources, H £ 2 m.

For all the specified classes sources in the calculation formulas, the length (height) is expressed in meters, time - in seconds, the harmful substances mass - in grams, their concentration in the atmospheric air - in milligrams per cubic meter, the concentration at the outlet from the source - in grams per cubic meter.

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With the simultaneous joint presence in the atmospheric air of several (n) substances possessing, in accordance with the list approved by the Ministry of Health of the Republic of Uzbekistan, the harmful effect summation, for each group of these substances of unidirectional harmful action, the dimensionless total concentration q is calculated, or the concentration values n of harmful substances possessing the harmful action summation are conventionally reduced to the concentration value from one of them [18]. Dimensionless concentration q is determined by the formula [19]:

$$q = \frac{c_1}{MPC_1} + \frac{c_2}{MPC_2} + \cdots + \frac{c_n}{MPC_n} \quad (1)$$

where $c_1, c_2, ..., c_n$ (mg/m^3) - calculated concentrations of harmful substances in the atmospheric air at the same point in the area; $MPC_1, MPC_2, ... MPC_n$ (mg/m^3) - corresponding maximum one-time maximum permissible concentrations of harmful substances in the atmospheric air.

The reduced concentration with is calculated by the formula

$$c = c_1 + c_2\frac{MPC_1}{MPC_2} + \cdots + \frac{MPC_1}{MPC_n} \quad (2)$$

where c_1 - concentration of the substance to which the reduction is carried out; MPC_1 - its MPC; c_2 ... c_n and MPC_2 ..... MPC_n - concentration and MPC of other substances included in the considered summation group [20-22].

MPC - maximum permissible concentration of a pollutant in the atmospheric air - a concentration that does not have a direct or indirect adverse effect on the present or future generation throughout life, does not reduce a person's working capacity, does not worsen his health and sanitary living conditions. MPC values are given in mg/m^3.

$MPC_{м.р.}$– the maximum permissible maximum one-time concentration of a chemical substance in the air of populated areas, mg/m^3. This concentration, when inhaled for 20-30 minutes, should not cause reflex reactions in the human body.

MPCc.c.– maximum permissible average daily concentration of a chemical in the air of populated areas, mg/m^3. This concentration should not have a direct or indirect harmful effect on a person if inhaled indefinitely (years).

Three air quality indicators are used as mandatory statistical characteristics of air pollution: air pollution index – API, standard index – SI and the highest repeatability of exceeding MPC – HR [23].

API is a comprehensive air pollution index that takes into account several impurities. The integrated API is calculated using a special formula that takes into account the average annual concentration of the pollutant, its average daily maximum allowable concentration and a coefficient that depends on the pollutant harmfulness degree [24].

The API measures the chronic, long-term air pollution level. SI is the standard index, the highest measured single impurity concentration divided by the MPC. It is determined from the observation data at a post for one impurity, or at all territory posts under consideration for all impurities for a month or a year. Characterizes the short-term pollution degree.

HR is the highest repeatability (in percent) of exceeding the maximum one-time MPC according to the observation data for one impurity at all territory stations for a month or a year.

In accordance with the existing assessment methods, four levels of atmospheric pollution are distinguished:

1. Low at API from 0 to 4, SI<1, HR < 10 %;
2. Increased at API from 5 to 6, SI<5 , HR from 10 to20 %;
3. High at API from 7 to 13, SI from 5 to 10, HR from 20 to 50%;
4. Very high with API equal to or greater than 14, SI>10, HR>50% [24].

When monitoring the dynamics of atmospheric air pollution levels in Navoi city for 2017, it was found that the main share of the harmful impurities influence is made up nitrogen dioxide and oxide, ammonia and phenol, which exceed by 0.13 in fractions of maximum permissible concentrations (MPC) than during the past of the year.

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Dynamics of air pollution levels in Navoi city in 2017					
№	Name of pollutants	*In shares of MPC*			
		For the current year		For the corresponding period last year	
		MPCс.с.	MPCм.р	MPCс.с	MPCм.р
1	Dust	0,7	1,4	0,7	1,4
2	Sulphur dioxide	0,06	0,02	0,03	0,02
3	Carbon monoxide	0,3	1	0,3	0,8
4	Nitrogen dioxide	1,25	0,1	1,25	1,3
5	Nitric oxide	0,8	0,2	0,7	0,3
6	Ozone	0,2	0,2	0,2	0,3
7	Phenol	0,7	0,8	0,7	0,8
8	Ammonia	0,75	0,6	0,75	0,5
	API г.Навои	**4,76**		**4,63**	

The table shows that the integrated air pollution index, taking into account several impurities, calculated using a special formula, taking into account the average annual pollutant concentration in Navoi city, was 4.77, which corresponds to the increased content of atmospheric air pollution with harmful substances.

Thus, we can conclude that the main share of harmful substances falls on the mining, chemical and transport industries, and in recent years the share of emissions from the construction industry has doubled. The air pollution problem solution in recent years has become more and more urgent, which requires the consistent implementation of organizational and economic measures to prevent environmental pollution.

Reducing emissions from the chemical industry can be achieved primarily by using new, more advanced devices and equipment, the use of which in the mining, metallurgical and transport industries, the share of which in total emissions will decrease every year. Also, reducing emissions of harmful substances can be achieved by constantly updating road transport with more environmentally friendly transport..

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ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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