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Pollutant Standards for Mining Enterprises

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POLLUTANT STANDARDS FOR MINING ENTERPRISES

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Abstract: The article provides environmental regulation of emissions and discharges of pollutants to the environment by establishing standards for maximum permissible emissions and maximum permissible discharges. Also, the formation and disposal of production and consumption waste by establishing standards for maximum permissible waste. The ecological regulation of pollutants of enterprises for the extraction and processing of nonmetallic rocks is considered. The procedure for the implementation of environmental regulatory projects is outlined and calculation methods for determining pollutants, specific indicators, formation rates and waste disposal limits are given. The materials of the article can be used by engineering and technical specialists of enterprises for the extraction and processing of nonmetallic rocks, design and environmental organizations involved in the development of environmental regulatory projects.

Key words: environment, pollutants, sources of emissions, sources of discharges, industrial waste, environmental regulation, quota, surface concentration, disposal limit.

1.INTRODUCTION

Along with the intensification of the use of natural resources, the pollution of the environment with industrial waste has rapidly increased. Pollution increased at a disproportionately high rate also because at the first stages of scientific and technological progress in the field of industrial production, imperfect technologies were used. Mass release of harmful substances and compounds into the atmosphere, hydrosphere and soil-vegetation cover, has become dangerous, which can cause irreversible environmental changes.

Therefore, the protection of the environment from pollution by emissions, discharges and wastes of national economic enterprises is the most urgent task of global importance.

One of the leading areas of environmental protection work is a detailed study of sources and processes of environmental pollution and environmental regulation of emissions and discharges of pollutants and waste generation.

Enterprises for the extraction and processing of nonmetallic rocks are one of the major sources of environmental pollution. The main sources of pollution of which are quarries for the extraction of nonmetallic rocks, as well as factories and enterprises for the processing of these rocks. In addition, in many cases, the extraction of rocks is carried out by blasting the rock mass. As a result, bulky quantities of pollutants are released into the environment. Therefore, the environmental regulation of pollutants and the development of environmental regulatory projects for pollutants, as well as the formation and disposal of production waste from enterprises for the extraction and processing of nonmetallic rocks is a very urgent issue. To solve these problems, it is necessary to carefully study the technological processes of production, the types of techniques and technological equipment used, as well as the existing methods for calculating pollutants and methods for developing regulatory environmental projects.

In addition, for the environmental regulation of pollutants and the development of environmental regulatory projects of pollutants, as well as the formation and disposal of production waste from enterprises for the extraction and processing of nonmetallic rocks, methods and guidelines are used, approved by both higher organizations and the bodies of the State Committee for Ecology of the Republic of Uzbekistan [1].

Environmental regulation and methods for calculating pollutants of enterprises for the extraction and processing of nonmetallic rocks. The enterprises for the extraction and processing of nonmetallic rocks include quarries for the extraction of crushed stone, sand, bentonite and loess soils, marble, granite, limestone, etc., as well as factories and enterprises for the processing of these nonmetallic rocks.

Calculation methods for determining emissions (emissions) of pollutants into the atmosphere. According to the instruction [2], open pits are considered as single sources of emissions uniformly distributed over the area from road transport, excavation and loading and drilling and blasting operations.

1. Emissions during the formation of rock dumps and face cleaning. The volume of inorganic dust emission during the formation of waste rock dumps by a bulldozer according to [2] is determined by the formula:

$$M = q * t * 3600/106, \text{ t / year} \quad (1)$$

where: M - the total amount of emitted pollutants;

q - specific indicator of dust emission; g / sec

t - bulldozer operation time, hour / year

2. Emissions from mining and loading operations. When operating an excavator, loading crane or loader, dust is emitted mainly when material is loaded onto dump trucks. Dust release objects can be described by the equation:

$$Q_2 = P_1 * P_2 * P_3 * P_4 * G * 10^6/3600, \text{ g/s} \quad (2)$$

where: P_1 - the fraction of the dust fraction in the rock, determined by washing and sieving the average sample with the release of dust fractions with a size of 0-200 microns;

P_2 - the fraction of flying dust with a particle size of 0-50 microns passing into an aerosol, in relation to all dust in the material (it is assumed that all of the flying dust passes into an aerosol). The P_2 value is specified by sampling dusty air at the boundaries of a dusty object at a wind speed of 2 m / s blowing in the direction of the sampling point;

P_3 - coefficient taking into account the wind speed in the excavator operation area. taken in accordance with table 1.4.26 [2];

P_4 - coefficient taking into account the moisture content of the material, is taken in accordance with table 1.4.16 [2];

G - the amount of rock processed by the excavator, t / h.

3. Dust emissions from road transport operations. The movement of vehicles in the quarry causes the emission of dust, as well as gases from internal combustion engines; dust is emitted as a result of the interaction of the wheels with the roadbed and blowing off the material loaded into the car body from the surface.

The total amount of dust emitted by vehicles can be characterized by the following equation:

$$q = C_1 * C_2 * C_3 * N * a_1 * q_1/3600 + C_4 * C_5 * C_6 * F_0 * n * q_2, \text{ g/s} \quad (3)$$

where: C_1 - coefficient taking into account the average carrying capacity of a vehicle unit and taken in accordance with Table 1 [2];

C_2 is a coefficient that takes into account the average speed of movement of transport in a quarry and is taken in accordance with Table 1 [2];

Average transportation speed is determined by the formula;

$$V = N * a / N, \text{ km / h}$$

C_3 - coefficient taking into account the condition of roads and taken in accordance with Table 1 [2];

C_4 - coefficient taking into account the surface profile of the material on the platform and determined as the ratio F_{Fact} F_0

where: F_{Fact} - the actual surface of the material on the platform;

F_0 - the average platform area. The C_4 value ranges from 1.3 to 1.6 depending on the size of the material and the degree of filling the platform;

C_5 is a coefficient that takes into account the blowing speed of the material, which is defined as the geometric sum of the wind speed and the reverse sector of the average vehicle speed.

C_6 - coefficient taking into account the moisture content of the surface layer of the material, equal to $C_6 = K_5$ equation (3) and taken in accordance with table 1.4.16 [2];

N - the number of walkers (there and back) of all transport per hour;

a_1 - average length of one pass within the quarry, km

$C_1 = C_2 = C_3 = 1$, taken equal to 1450

q_1 - dust emission per unit of the actual surface of the material on the platform, g / m^2 * s;

n - the number of cars in the quarry.

4. Release of pollutants during drilling operations. Calculation of the volume of air pollution during drilling of wells and bore holes according to [2] is carried out according to the formula:

$$Q_6 = n * Z * (1-\eta) / 3600, \text{ g / s} \quad (4)$$

where: n - the number of simultaneously operating drilling rigs;

Z - the amount of dust emitted during drilling with one rig, g / h;

η - efficiency of the dust cleaning system, in fractions.

5. Release of pollutants during blasting operations. Blasting operations are accompanied by massive dust emission. The high power of dust emission causes short-term pollution of the atmosphere, hundreds of times higher than the MPC. To calculate one-time dust emissions during blasting operations, according to [2], you can use the equation:

$$Q_в = a_1 * a_2 * a_3 * a_4 * D * 10^6, g \quad (5)$$

where: a_1 - the amount of material lifted into the air during the explosion of 1 kg of explosives (4-6 t / kg);

a_2 - the proportion of flying dust with a particle size of 0-50 microns passing into the aerosol, in relation to the exploded rock mass (on average 2 * 10-5);

a_3 - coefficient taking into account the wind speed in the explosion zone ($Q_3 = P_3$),

a_4 - coefficient taking into account the effect of water cut in wells and pre-wetting the bottom

D - the magnitude of the explosive charge, kg.

Since the duration of dust emission during blasting operations is short (within 10 minutes), this pollution should be taken into account, mainly when calculating the burst emissions of the enterprise.

6. Emission of pollutants during welding. Calculations of emissions of pollutants during welding were carried out according to [2] according to the formula:

$$M = q * B * 10^{-6}, t / year \quad (6)$$

where: q - specific emissions of pollutants, g / kg.

B - the number of electrodes used, t / year.

7. Emission of pollutants from the fuel and lubricants warehouse. The amount of hydrocarbons emitted into the atmosphere per year from one reservoir or group of reservoirs is determined by summing up the losses of petroleum products, calculated based on the "Norms of natural loss of oil and petroleum products when receiving, dispensing and storing in tanks" [2].

$$P = (n_1 + n_2): 2 * Q * 10^{-3}, t \quad (7)$$

where, n_1 - the rate of natural loss of petroleum products when receiving, dispensing and storing in the autumn-winter period;

n_2 - the rate of natural loss of petroleum products when receiving, dispensing and storing in the spring-summer period;

Q - the amount of oil products that entered the tanks during the year, t

Table 1. Coefficient Value K_s

Total area of the enterprise, ha				
1	10	100	500	1000
0.0015	0.001	0.0005	0.0002	0.00015

The limiting areas for the disposal of waste of different toxicity classes are assigned based on the condition of equality of the potential hazard of the placed masses of waste of individual groups that differ in toxicity:

$$w_1 / d_1 = w_2 / d_2 = w_3 / d_3 = w_4 / d_4 \quad (8)$$

and determined by the formulas:

$$w_1 = S_1 * d_1$$

$$w_2 = S_1 * d_2$$

$$w_3 = S_1 * d_3 \quad (9)$$

$$w_4 = S_1 * d_4$$

where, w_1 - w_4 are the limiting areas of the placed masses of waste of 1, 2, 3 and 4 classes of toxicity / hazard, m^2;

d_1 - d_4 - the average values of the relative toxicity indicators (MPC, concentrations of aqueous extracts), which determine the separation of waste into 1, 2, 3 and 4 toxicity / hazard classes (set according to Table 2).

Table 2. Indicator d_i Value

Waste toxicity classes			
1	2	3	4

0.006	0.034	0.340	0.620

According to [1], the generation and disposal of municipal waste is not standardized.

Control over compliance with environmental standards for the generation and disposal of waste at the enterprise should be carried out directly at the places of generation and disposal of waste by instrumental measurement or calculated determination of the amount of waste.

If, according to the results of the analysis, the normative formation of the corresponding waste does not exceed the agreed values, then the mode of waste generation at the enterprise corresponds to the normative indicator.

2.RESEARCH RESULTS.

According to the stated calculation methodology and procedures for the implementation of the standard, the draft MPE standards for the Jom marble deposit were developed [12,13]. Here are some results from the developed project.

The main production activities of the Jom deposit are the extraction of marble blocks and quarrystone for the production of marble slabs and decorative marble crushed stone and sand.

The structure of the enterprise includes quarries leading the extraction of nonmetallic rocks, a stone sawing shop for cutting marble blocks and producing decorative marble slabs, a crushing and sorting shop, as well as a welding station and a fuel and lubricants warehouse that ensure the operation of the main technological processes.

The production activity of the enterprise is carried out in two areas: East and West.

According to the data obtained as a result of the environmental survey of the facility, as well as in accordance with the project, 23 sources of pollutant emission will operate on the territory of the Jom field of Samarkandmarmar JSC.

Sources of emissions of pollutants into the atmospheric air at the enterprise are: quarries for the extraction of marble blocks and rubble stone (source of emissions No. 1,2 of the area type); welding station (fugitive emissions source No. 3); fuel and lubricants warehouse (fugitive emissions source No. 4); DSU (fugitive emissions source No.5).

The parameters of the sources of emissions of pollutants into the atmosphere are given in Section 2.

There are no sources of emissions equipped with PGOU.

During the operation of the Jom field of Samarkandmarmar JSC, 4 types of pollutants will enter the air from all 5 stationary sources of emissions. The total amount of emissions will be 2.886707 t/year, of which gaseous and liquid substances will be 0.0012477 t/year, solids - 2.8854545 t/year. Consequently, the main part of the emissions from the Jom field of Samarkandmarmar JSC is inorganic dust.

Emissions of pollutants during blasting operations (salvo emissions) will amount to 0.260806 t / year. The total emissions of pollutants (exhaust toxic gases) during the operation of mining machines and technological equipment will amount to 2.552 tons / year.

The calculation of the fields of surface concentrations of harmful substances was carried out using a computer using the "VARSA-RADUGA" program. The results of the inventory and quotas for pollutants were used as initial information. According to the results of the calculations of the fields of dispersion of emissions of pollutants in the atmosphere, no excess of surface concentrations outside the industrial site was found for the considered pollutants. Therefore, there is no need to carry out environmental protection measures aimed at reducing emissions of pollutants.

The list of pollutants emitted into the atmosphere is presented in section 5.

The salvo emissions are presented in section 2.

Based on the detailed analysis of the mass and structure of emissions, pollutants given in the project, as well as taking into account the current level of pollution, it is proposed:

1. Establish the normative status of maximum permissible emissions of pollutants into the atmosphere in total by substances in accordance with the data contained in section 3.

2. In the event of significant changes in the parameters of pollutant emissions (change in technology; reconstruction of an enterprise not envisaged by this project, etc.), the established parameters of emissions lose their regulatory status, and the standardization work is immediately carried out again.

Section 1. Total emissions of pollutants into the atmosphere

Names of contaminants	The amount of pollutants emitted from	including		Of those received for cleaning			Total emitted into the atmosphere, t / year	Specific emissions	
		thrown away without purification, t / year	goes for cleaning, t / year	emitted into the atmosphere, t / year	Caught and neutralized			value	dimension
					actually, t / year	of which is			

	sources, t / year					utilized, t / year			
1	2	3	4	five	6	7	8	nine	ten
Total:	2.886707	2.886707	0	0	0	0	2.886707	0.19	kg / t of marble block and rubble
including solid :	2.8854595	2.8854595	0	0	0	0	2.8854595	0.19	kg / t of marble block and rubble
inorganic dust	2.8854595	2.8854595	0	0	0	0	2.8854595	0.19	kg / t of marble block and rubble
gaseous and liquid:	0.0012477	0.0012477	0	0	0	0	0.0012477	0.00014	kg / t of marble block and rubble
hydrocarbons iron (III) oxide manganese (IV) oxide	0.0005 0.000402 0.0003457	0.0005 0.000402 0.0003457	0 0 0	0 0 0	0 0 0	0 0 0	0.0005 0.000402 0.0003457	0.00009 0.00003 0.00002	kg/t of marble block and rubble

Section 2. List of pollutants

Pollutant name	PDK or OUV mg / cubic met er	Hazard Class	Established quota (in shares of maximum concentration limit)	Maximum concentration in fractions of PD K- outside the industrial site	Compliance with the established quota (+/-)	Percentage of contribution to emissions	Total emitted to the atmosphere t/year
1	2	3	4	5	6	7	8
Inorganic dust Iron (III) oxide Manganese (IV) oxide Hydrocarbo ns	0.500000 0.200000 0.005000 1.000000	3 3 2 4	0.33 0.33 0.25 0.50	0.2373 less than 0.01 0.04 less than 0.01	+ + + +	99.96 0.01 0.01 0.02	2.8854595 0.000402 0.0003457 0.0005
Total for the enterprise						100.00	2.886707

Section 3. Total standards for emissions of pollutants into the atmosphere

Name of substance	Emissions of pollutants				Excessive emission	
	Existing provision		P D V			
	g/s	t/g	g/s	t/g	g/s	t/g
1	2	3	4	5	6	7
Inorganic dust	0.81056	2.8854595	0.81056	2.8854595	-	-
Iron (III) oxide	0.0002198	0.000402	0.0002198	0.000402	-	-
Manganese (IV) oxide	0.000189	0.0003457	0.000189	0.0003457	-	-
Hydrocarbons	0.000015	0.0005	0.000015	0.0005	-	-
Total for the enterprise	0.8109838	2.886707	0.8109838	2.886707	-	-

3.CONCLUSION

The protection of the environment from pollution by emissions, discharges and wastes of national economic enterprises is an urgent task. One of the progressive directions for solving these problems is a detailed study of sources and processes of environmental pollution and environmental regulation of emissions and discharges of pollutants and waste generation.

Environmental regulation of pollutant emissions is to ensure compliance with air quality criteria. The regulation of emissions of pollutants into the atmosphere is established based on the results of calculations of their surface concentrations outside the industrial site with further identification of the compliance of the results obtained with the established standards for each pollutant.

Rationing of discharges of pollutants into the environment is carried out by establishing MPD (maximum permissible discharges) of these substances with wastewater into water bodies or onto the terrain.

Waste generation is regulated in accordance with the technological features of the main and auxiliary production.

When developing environmental regulatory projects, an environmental analysis of existing and newly created sources of emissions, discharges and waste generation is first carried out, and the degree of their impact on the environment is assessed.

On the basis of the inventory, drafts of environmental standards for pollutants are being developed, and environmental standards for the formation and limits of production waste disposal are established.

In enterprises for the extraction and processing of nonmetallic rocks, the main sources of pollution are quarries for the extraction of nonmetallic rocks and factories for processing these rocks. When calculating, open pits are considered as single sources of emissions uniformly distributed over the area from road transport, excavation-loading and drilling and blasting operations.

Based on the results of the study, a draft MPE standard for the Jom marble deposit was developed. As a result of the environmental analysis of the facility, 23 sources of emission of pollutants, 5 unorganized sources of emissions of harmful substances were identified, of which 2 are unorganized sources of areal type. In total, the above-mentioned sources of the deposit emit 2.886707 t / year of pollutants into the atmosphere.

The main source of air pollution will be DSS, emissions of which will amount to 65.37% of the total emissions from stationary sources. In terms of ingredients, most of the emissions are inorganic dust - 2.8854595 t / year (99.96%). Emissions for other ingredients do not exceed 0.04%.

On the basis of the inventory of sources of emissions of pollutants into the atmosphere, a draft MPE standard was developed. The calculation of ground-level concentrations of pollutants was performed using the "Rainbow" program. Measures have been developed to help maintain the amount of emissions at the current level.

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