



NOVOSIBIRSK STATE UNIVERSITY OF ARCHITECTURE
AND CIVIL ENGINEERING (SIBSTRIN)

Environmental impact assessment of the reconstructed MSW landfill with the Kuybyshev.

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The purpose and objectives of the study

Purpose:

The purpose of the master's thesis is to prevent possible environmental degradation under the influence of the planned reconstruction of the landfill and to ensure the environmental stability of the area of the object's location during its operation.

Objectives:

- calculation of the level of air pollution;
- calculation of the level of pollution of surface and groundwater, land resources;
- calculation of the level of environmental pollution during storage of production and consumption waste;
- recommendations on the organization of industrial environmental monitoring (EMP).

The personal contribution of the author is to perform numerical calculations using the PC "ECOLOG"

GENERAL INFORMATION ABOUT DESIGNATED OBJECT

The projected facility is located 7 km north-east of the city of Kuibyshev Novosibirsk Region and 1.5 km from the Chumakov highway on the right bank of the Patrushevsky channel. The reconstructed landfill is an environmental protection facility and is designed to dispose of municipal solid waste generated in the city of Kuibyshev.



GENERAL INFORMATION ABOUT DESIGNATED OBJECT

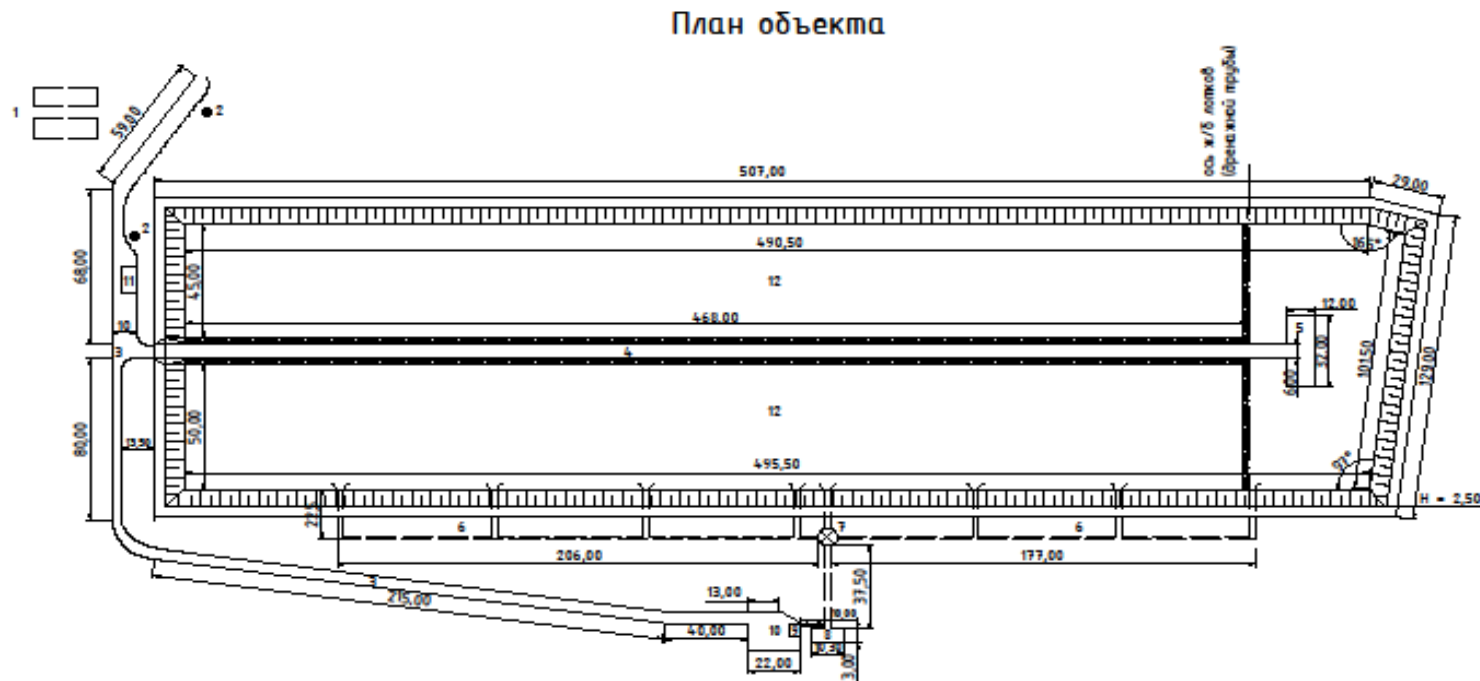
The entire territory of the landfill is divided into 3 zones:

- storage area MSW;
- economic zone;
- driveway.



GENERAL INFORMATION ABOUT DESIGNATED OBJECT

The main structure of the landfill is the storage area. The site for storage of MSW covers an area of 75085 m². The storage area has dimensions of 500x107 m. The storage height of the MSW is 2 m. Storage is carried out in one tier with intermediate insulation layers.



Экспликация.

- | | |
|--|--|
| 1 - пожарные резервуары | 7 - канализационный колодец |
| 2 - колодцы для отбора проб воды | 8 - резервуар-накопитель фильтра и стоков |
| 3 - автомобильная дорога с гравийным покрытием | 9 - площадка для мойки контейнеров |
| 4 - автомобильная дорога с ж/б покрытием | 10 - приемный резервуар с грязеотстойником |
| 5 - площадка для разбора автомобилей | 11 - дезинфицирующая ванна |
| 6 - дренажные трубы | 12 - котлан для складирования ТКО |

GENERAL INFORMATION ABOUT DESIGNATED OBJECT

In the economic zone of 3010 m² located:

- a single-storey building of the administrative building combined with a checkpoint;
- covered parking;
- transformer substation;



GENERAL INFORMATION ABOUT DESIGNATED OBJECT

Name	Requisites
Business name	Landfill MSW, Kuibyshev
Type of ownership	Municipal
Enterprise location	Novosibirsk region, Kuibyshev district, Kuibyshev
Landfill life	7,7 years
The total accumulation of waste for the entire period of operation of the landfill	116,909 thousand m ³
The number of employees	12 people
Landfill operation mode	interchangeable
Land area	7,50 hectares

PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

Climatic characteristics

Name of the indicator	The value of the indicator
1. Climatic characteristic	
Place refers to the reconstruction of IB climatic regions and is characterized by the following data:	
- prevailing winds are south-westerly direction	30 %
- average wind speed	6,5 m/s
- normative wind load	38 kgf/m2
- calculated air temperature:	
The coldest days –	
security 0,98	44°C
security 0,92	42°C
The coldest five days -	
security 0,98	42°C
security 0,92	39°C
- the average temperature of the coldest period	26°C
- period duration with average daily $<0^{\circ}$	179 days
- amount of precipitation liquid and mixed:	
Per year	361 mm
Daily maximum	73 mm
- normative depth of freezing	2,2 m
- regulatory snow load	100 kgf/m2
- area seismicity	6 points

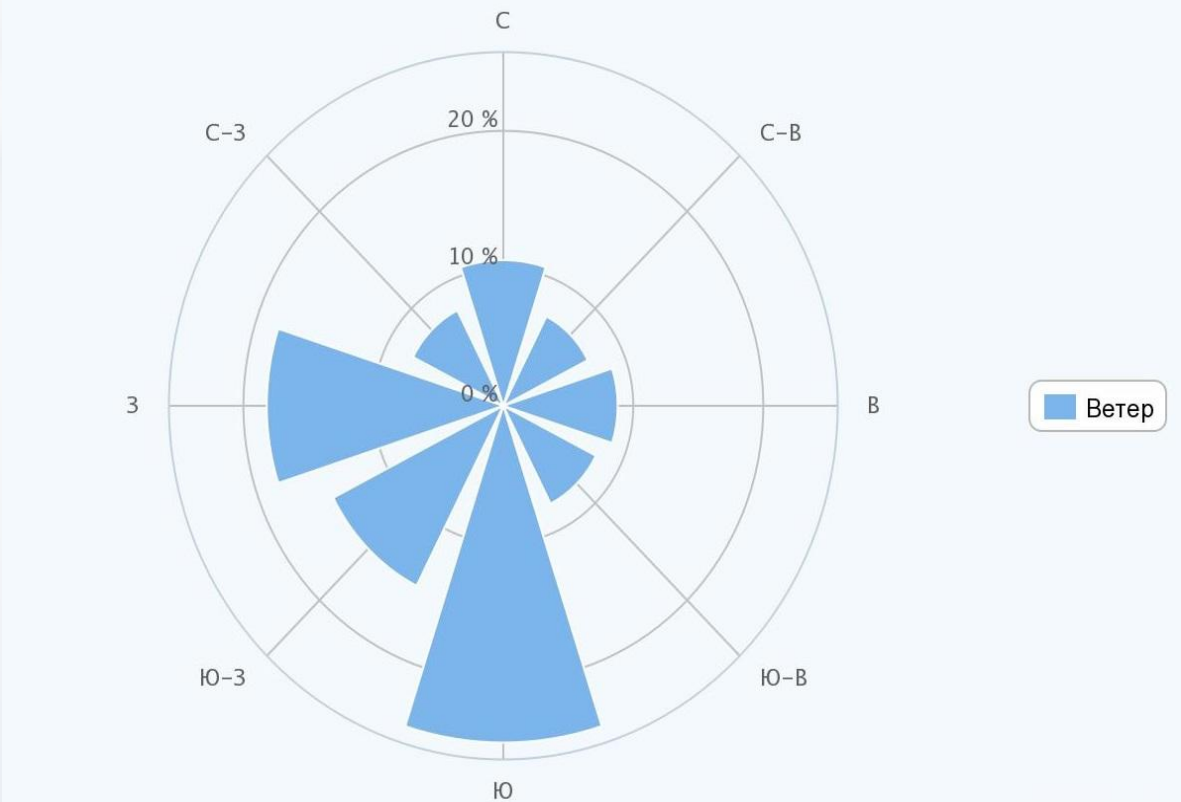
PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

The average annual wind speed is 6.5 m/s, the maximum wind speed reaches 25-35 m/s, the winds have a south-west dominant direction.

The highest average monthly wind speeds are observed in spring.

The average repeatability of wind directions (%) (wind rose) is presented in the table.

	N	NE	E	SE	S	SW	W	NW
%	10,6	7,3	8,8	8	24,5	14,7	18,2	7,8



PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

The source of air pollution during the reconstruction and operation of the landfill are:

- Working special equipment.
 - Welding unit.
 - Harmful substances released during the application of paint coatings.
- The list of pollutants emitted into the atmosphere, their codes, MPC m.r., the hazard class, and the mass of emissions are given in the table.

The name of the substance	Code list	MPC m.r мг/м³	Hazard Class	Emissions (MPC)		Concentration at the boundary of the SPZ	
				г/сек	т/год	мг/м³	Shares MPC
Nitrogen dioxide	0301	0,085	2	0,0696	0,5501	0,017	0,2
Sulfurous anhydride	0330	0,500	3	0,0234	0,2023	0,01	0,02
Soot	0328	0,150	3	0,0100	0,0680	0,003	0,02
Lead	0184	0,001	1	0,0002	0,0010	0,00004	0,04
Carbon oxide	0337	5,000	4	0,1934	1,3788	0,05	0,01
Hydrocarbons limit	2754	1,000	4	0,0242	0,1475	0	0
Benzapyrene	0703	c.c.1*10 ⁻⁸	1	1,9E-07	1,1E-6	0	0
Inorganic dust, SiO ₂ 70-20%	2908	0,300	3	0,0968	0,7866	0,024	0,08
Suspended substances	2902	0,50	3	0,0015	0,0120	0,025	0,05
Total				0,4191	3,146		

PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

The following calculations were made of total emissions of pollutants into the atmosphere, which are carried out during the year:

- during the operation of the bulldozer at the site on the basis of a tractor, on a caterpillar track with a capacity of 100 hp car category - 4. Calculation of total emissions of pollutants from the bulldozer.

The name of the substance	Emissions		
	Maximum, г/с		annual, т/год
	summer	winter	
Carbon oxide	0,0215	0,0262	0,2910
Hydrocarbons limit C ₁₂ -C ₁₅	0,0072	0,0085	0,0911
Nitrogen dioxide	0,0412	0,0412	0,4712
Sulfurous anhydride	0,0032	0,0038	0,0404
Soot	0,0045	0,0068	0,0656
Бенз/а/пирен	6,7E-08	8,1E-08	9,0E-07
Total	0,0775	0,0865	0,9592

PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

When working excavator in a warehouse of soil.

An excavator based on the MTZ-80 tractor with an engine power of 55 kW (75 hp) operates in the soil stock. Machine category - 3. Calculation of total emissions of pollutants from the excavator (table on the slide).

During the period of work in internal combustion engines, 86.39 tons (107.98 m³) of diesel fuel and 1.64 tons (2.062 m³) of gasoline will be burned.

The name of the substance	Emissions		
	Maximum, г/с		annual, т/год
	summer	winter	
Carbon oxide	0,0166	0,0184	0,0113
Hydrocarbons limit C ₁₂ -C ₁₅	0,0039	0,0044	0,0027
Nitrogen dioxide	0,0182	0,0182	0,0118
Sulfurous anhydride	0,0017	0,0020	0,0012
Soot	0,0021	0,0030	0,0017
Benzapyrene	5,1E-08	5,7E-08	3,5E-08
Total	0,0424	0,0460	0,0286

PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

During welding, atmospheric air is polluted by welding fume. Manual arc welding is performed using E-42 type electrodes. Gas cutting time 209,6 hours. Total emissions from welding and gas cutting are shown in the table on the slide.

Code	Name	Excluding gas purification		In view of the gas cleaning	
		g / sec	t / year	g / sec	t / year
0123	Iron oxide	0.0202500	0.019858	0.0202500	0.019858
0143	Manganese and its compounds	0.0003056	0.000722	0.0003056	0.000722
0203	Chromium (VI) oxide	0.0000560	0.000702	0.0000560	0.000702
0301	Nitrogen (IV) oxide (Nitrogen dioxide)	0.0108333	0.008189	0.0108333	0.008189
0337	Carbon oxide	0.0137500	0.010394	0.0137500	0.010394
0342	Gaseous fluorides	0.0000004	0.000005	0.0000004	0.000005
0344	Fluorides poorly soluble	0.0000587	0.000736	0.0000587	0.000736

PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

When applying paintwork

During the period of reconstruction, paints and varnishes will be used:

- enamel PF-115– 0.0559 t;
- varnish BT-577- 0,014 t;
- enamel HV-124 - 0.194 tons;
- solvent R-4 - 0,0185 tons

The total emissions of harmful substances into the atmosphere emitted during the application of paint coatings are shown in the table on the slide.

Code	Name	Excluding gas purification		In view of the gas cleaning	
		g / sec	t / year	g / sec	t / year
1401	Propan-2-one (Acetone)	0.0180556	0.018464	0.0180556	0.018464
1210	Butyl acetate	0.0083333	0.008522	0.0083333	0.008522
0621	Toluene	0.0430556	0.044029	0.0430556	0.044029
0616	Xylene (mixture of isomers)	0.0251125	0.017854	0.0251125	0.017854
2752	White-Spirit	0.0186375	0.016494	0.0186375	0.016494
2902	Suspended substances	0.0202778	0.053439	0.0202778	0.053439

PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

Calculation of dispersion.

The calculation of the dispersion of harmful substances in the atmosphere during the period of reconstruction and operation was carried out according to the Ecologist program. The calculation results are tabulated.

The name of the impurity	MPC, mg/m ³	The emissions		Concentrations at the boundary of the SPZ	
		g / sec	t / year	mg/m ³	Shares MPC
301 Nitrogen oxides	0,085	0,0696	0,5501	0,017	0,2
328 Soot	0,15	0,0100	0,0680	0,003	0,02
330 Sulfur dioxide	0,5	0,0234	0,2023	0,01	0,02
337 Carbon monoxide	5	0,1934	1,3788	0,05	0,01
184 Lead	0,001	0,00002	0,0010	0,00004	0,04
2754 Hydrocarbon fumes	1	0,0242	0,1475	0	0
703 Benzapyrene	1*10 ⁻⁴	1,9E-07	1,1E-06	0	0
2908 Dust inorganic content SiO ₂ 70-20%	0,300	0,0968	0,7866	0,024	0,08
2908 Suspended substances	0,5	0,0015	0,0120	0,025	0,05
TOTAL:		0,4191	3,146		

PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

Based on the results of calculations of maximum surface concentrations of harmful substances emitted into the atmosphere, it follows that air pollution with harmful substances from the MSW landfill at the border of the sanitary protection zone is expected to be less than 0.15 maximum one-time maximum permissible concentration (estimated safe level of exposure). Therefore, the actual emissions of harmful substances are proposed as standards for maximum allowable emissions (MPE) given in the table on the slide.

Production	№ emission source and name	Name of pollutants	Mass emission (MPE)	
			g / sec	t / year
1	2	3	4	5
landfill	Vehicles and road equipment	Nitrogen dioxide	0,0277724	0,016316
		Nitrogen oxide	0,0045130	0,002651
		Carbon oxide	0,2512383	0,113232
		Sulfur dioxide	0,0045308	0,002266
		soot	0,0127206	0,005250
		Hydrocarbons	0,0383044	0,016388
	Equipment for loading and unloading	Inorganic dust	0,011058	0,052588
	Welding machine	Iron oxide	0,0202500	0,019858
		Manganese and its compounds	0,0003056	0,000722
		Gaseous fluorides	0,0000004	0,000005
		Fluorides poorly soluble	0,0000587	0,000736
		Chrome oxide	0,0000560	0,000702
		Nitrogen dioxide	0,0108333	0,008189
		Carbon oxide	0,013750	0,010394

PROTECTION OF ATMOSPHERIC AIR FROM POLLUTION

Production	№ emission source and name	Name of pollutants	Mass emission (MPE)	
			g / sec	t / year
1	2	3	4	5
landfill	Working machinery	Nitrogen dioxide	0,008036	0,004876
		Nitrogen oxide	0,001306	0,000792
		Carbon oxide	0,076967	0,035002
		Sulfur dioxide	0,0013503	0,000705
		soot	0,003753	0,001489
		Hydrocarbons	0,010387	0,004535
		including:		
		Gasoline	0,002333	0,001323
		Kerosene	0,008053	0,003212
	Polygon maps	Methane	4,771599	52,088694
		Toluene	0,065196	0,711706
		Ammonia	0,048063	0,524672
		Xylol	0,039948	0,436085
		Carbon oxide	0,022724	0,248068
		Nitrogen dioxide	0,010009	0,109260
		Formaldehyde	0,008657	0,094500
		ethylbenzene	0,008567	0,093517
		Sulfur dioxide	0,006313	0,068913
		Sulfur	0,002344	0,025587
	Paintwork	Xylol	0,0251125	0,017854
		White Spirit	0,0186375	0,016494
		Acetone	0,0180556	0,018464
		Butyl acetate	0,0083333	0,008522
		Toluene	0,0430556	0,044029
		Suspended substances	0,0202778	0,053439

PROTECTION OF SURFACE AND UNDERGROUND WATER FROM POLLUTION AND DRAINAGE

To ensure the safe operation of the landfill and reduce its impact on groundwater, the project provides for the installation of a waterproofing layer made of a geomembrane produced by Tekhpolymer Group of Companies. An example of geomembrane laying at the TKO test site.



PROTECTION AND RATIONAL USE OF LAND RESOURCES

Pollutants, including heavy metals (lead, zinc, cadmium, mercury, etc.) listed in the table, accumulate in the soil and contribute to the gradual change of its chemical composition, disruption of plant activity and living organisms. To assess the impact of the landfill on the soil it is necessary to organize monitoring of the chemical composition of the soil.

Source of soil contamination	Загрязняющие вещества почвы (грунта)
Landfill solid municipal waste	Arsenic [As], cadmium [Cd], mercury [Hg], lead [Pb], zinc [Zn], benzo (a) pyrene [C20H12], cobalt [Co], nickel [Ni], molybdenum [Mo], copper [Cu], antimony [Sb], chromium [Cr], barium [Ba], vanadium [V], tungsten [W], manganese [Mn], strontium [Sr], oil products, volatile organohalogen compounds, polycyclic aromatic hydrocarbons, phenols and chlorophenols, organic acids, polychlorinated biphenyls, etc.

ENVIRONMENTAL PROTECTION WHEN STORING WASTE OF PRODUCTION AND CONSUMPTION

In work the following volumes of waste were calculated, which are tabulated:

- Regulatory amount of welding slag (table);
- the standard amount of education household wastewater from workers (table);
- the normative number of waste formation when servicing road-building equipment (table)
- calculations for waste from motor transport (table).
- calculations for construction waste (table).

Regulatory amount of welding slag

Source of waste	Annual consumption of electrodes, т/ год	Удельный норматив образования шлака, т/т	Average waste density, т/м 3	Waste generation standard	
				т	м 3
Welding electrodes	0,4908	0,01	1	0,004908	0,004908

The standard amount of education household wastewater from workers

Normal wastewater formation m3/day at 1 worker	Number of working days	Number of employees, people	The amount of waste, t /year
0,0005	231	12	1,386

ENVIRONMENTAL PROTECTION WHEN STORING WASTE OF PRODUCTION AND CONSUMPTION

The normative number of waste formation when servicing road-building equipment.

№	Type of transport	Number of units of equipment, pcs.	Total time, hour/period	The rate of formation of waste cloth, kg / h	The amount of cleaning cloth, t / period
1	Car crane г/п 10 т	1	1680	0,13	0,2184
2	Excavator, bucket capacity 0,65 m ³	1	1008	0,05	0,0504
3	Bulldozer - 130 л.с.	1	1176	0,09	0,10584
4	Tractor- 100 л.с.	1	336	0,08	0,02688
5	Crawler Crane г/п 16 т	1	168	0,14	0,02352

ENVIRONMENTAL PROTECTION WHEN STORING WASTE OF PRODUCTION AND CONSUMPTION

Calculations for waste from motor transport.

Code	Waste name	Mass [т]
5410020102033	Used motor oils	0.135997
5410020602033	Waste transmission oils	0.008776
5490270101034	Cleaning material contaminated with oils (oil content less than 15%)	0.012131
3513010001995	Unsorted ferrous scrap	0.590971
3531020101013	Unsorted lead scrap	0.023260
1711050213005	Wooden packing (non-returnable containers) made of natural wood	0.561478
5810110801995	Trims and scraps of mixed fabrics	0.000556
1470020101004	Split leather trimming chrome-tanned leather	0.002782
5710190001005	Waste plastics (synthetic) film unpolluted	0.003895
5410021302033	Waste hydraulic oil not containing halogens	0.106389
1871020101005	Unpolluted packaging paper waste	0.010573
5710990001004	Waste plastics mixture solidified heterogeneous	0.005815
3515050001995	Brake pads waste	0.003339

ENVIRONMENTAL PROTECTION WHEN STORING WASTE OF PRODUCTION AND CONSUMPTION

Calculations for construction waste

Waste name	Mass [т/ год]
Cinder welding electrodes	0.044172
Cement waste	2.4912
Steel scrap	0.041375
Brick battle	0.00455
Construction timber waste, incl. from demolition and disassembly of buildings	0.10833
Waste bitumen, asphalt	0.002074
Mastic and putty materials, hardened	0.100752
Old paint hardened and hardened residues in containers	0.008472
Concrete debris	6.29658

PRODUCTION ENVIRONMENTAL MONITORING (TEM)

At operation of the MSW landfill, the organization of monitoring of atmospheric air, as well as soil and flora, is recommended.

Atmospheric air monitoring is recommended at the border of the nearest residential development in order to determine the level of its pollution. Sampling is recommended twice a year: in the warm and cold periods.

Soil condition monitoring includes periodic monitoring of the content of pollutants in soils. Soil samples are sampled once a year (in July).

CONCLUSION

The analysis of the impact of the MSW landfill on the state of the environment suggests that the reconstruction and operation of the MSW landfill in Kuibyshev will not affect the environmental situation in the area, subject to compliance with all environmental and technological solutions provided for in this project.

Compliance with the requirements of environmental legislation and the maintenance of continuous production control and monitoring of the state of natural environments, provide the possibility of safe operation of the projected landfill of municipal solid waste in the city of Kuibyshev. It is necessary to conduct continuous monitoring of pollutant emissions into the atmosphere and monitoring of atmospheric air.

THANK YOU FOR
ATTENTION!