

# Status, problems and prospects of protection of surface waters from sewage pollution in Kazakhstan

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## *Description of the sewage system in the Republic of Kazakhstan*

Centralized sewage system covers the urban population in average for 62%, where 84% are major cities and 10% are urban settlements.

86 of the existing municipal sewage treatment plants one third is in poor technical condition. In 39 cities and towns settlements there are no treatment facilities at all, which means that discharge of sewage waters is carried out without purification. Untreated sewage is discharged directly into the fields of filtration, as in Taraz, in storages – like in Kokshetau, Kyzylorda, Uralsk, Petropavlovsk, Kostanay, on the terrain surrounding areas. A considerable amount of waste water from industrial enterprises (up to 24% in some cities) goes directly to municipal treatment facilities that are not designed for treatment of industrial wastewater. In recent years, detergents of foreign origin began to dominate in the composition of domestic wastewaters, these detergents are difficult to clean and have a long period of lasting of harmful effects on the environment and, therefore, contaminate water sources significantly (Table 1).

Table 1 – Assessment of the current level of sanitation and wastewater treatment in 19 cities of Kazakhstan

№	Cities	Volume of waste water, mln. m <sup>3</sup> /year			Volume of turnover waters of enterprises, mln. m <sup>3</sup> /year	Characteristics and capacity of purification facilities, thous. m <sup>3</sup> /day		Date of putting into service, year
		total	Sewage collector	Surface sources		mechanical	biological	
1.	Almaty	241,4	237,36	4,04	86,10	+	640	1980
2.	Astana	35,8	36,2	0,6	23,2	+	135,9	1973
3.	Aktau	17,05	16,53	0,87	14,8	+	73,2	1971
4.	Aktobe	15,56	2,11	13,45	95,53	+	103,24	1981
5.	Arkalyk	9,66	5,43	4,165	3,13	15,0	-	1973
6.	Atyrau	29,0	11,56	17,44	89,03	35,0	-	1979
7.	Zhambyl	38,56	36,26	2,30	819,30	140,0	-	1974
8.	Zhezkazgan	191,22	23,68	167,64	925,7	+	44,0	1967
9.	Karaganda	129,21	89,76	39,45	250,08	+	233,0	1982
10.	Kyzylorda	21,24	10,41	10,83	9,56	36,0	-	1976
11.	Kokshetau	26,18	11,12	15,06	89,31	+	32,0	1990
12.	Костанай	25,89	25,17	0,72	908,21	-	35,0	1980
13.	Pavlodar	58,09	55,5	2,59	964,54	+	170,0	1988

14.	Petropavlovsk	35,68	25,9	9,78	344,75	32,0	-	1986
15.	Semey	88,51	47,3	41,21	15,27	94,4	-	1977
16.	Taldykorgan	32,12	16,06	16,06	8,41	+	36,0	1976
17.	Oral	31,80	27,10	4,70	16,34	+	23,0	1970
18.	Oskemen	191,84	17,06	174,78	323,92	+	150,3	1980
19.	Shymkent	74,08	70,0	4,08	558,83	+	197,0	1986

Many existing treatment facilities have run down their operational resources and need to be repaired. Other work with real overload, which leads to a mismatch of wastewater treatment technology to the design data. In Taldykorgan, Atyrau, Pavlodar, Oskemen and Semey existing treatment facilities are overstretched by 1.5-2 times.

Out of 1040 industrial enterprises located on the territory of 19 regional centers, only 531 companies have local treatment facilities, usually of mechanical (settling) or mechanical and chemical (settling - chemical treatment) wastewater treatment. On the remaining 509 enterprises local treatment systems are still being designed or being built or are just not provided. Consequently, the industrial wastewaters of these enterprises are discharged directly into the city sewer.

As we can see from the Table 1, total volume of wastewater in 19 cities of regional centers of Kazakhstan is 2970,8 mln. m<sup>3</sup>/year, where 2264,4 mln. m<sup>3</sup> /year is taken directly by the water removal network.

As can be seen from Table 1 only 13 out of 19 regional centers of Kazakhstan have facilities of mechanical and biological treatment and in 6 cities there are only installations for mechanical purification.

In almost all the cities except Almaty and Astana, existing wastewater treatment plants of mechanical and biological treatment are ineffective due to high congestion and low technical level of structures.

It should be noted that the treated urban waste water is directed to the field of filtration and irrigation, to a low relief areas or special collectors.

The Republic of Kazakhstan has 540 sewage ponds. Table 2 presents data on the largest wastewater storages of Kazakhstan.

Table 2 – Information about loading of wastewater ponds

№	Cities	Capacity, mln. m <sup>3</sup>		Marks, m	
		designed	actual	actual	фактическое
1.	Almaty	1000	860	622,0	620,5
2.	Astana	63	44	347,2	346,2
3.	Aktobe	40,4	8	-	-
4.	Atyrau	16	8	-	-
5.	Arkalyk	68,7	38,5	-	-
6.	Kyzylorda	5	4,8	-	-
7.	Kokshetau	15	60	240	239,4
8.	Kostanay	97	101	184,8	184,2
9.	Petropavlovsk	35	35	102	102
10.	Oral	43,5	24,3	51,0	49,8

11.	Shymkent	25,8	11,4	-	-
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As can be seen from Table 2 wastewater ponds in Kyzylorda, Kostanay, Petropavlovsk are filled up to the design level. In general, the technical condition of almost all sewage ponds is quite low. There is no systematic geotechnical and hydro-chemical control. Due to the overloading of the Sorbulak sewage pond, as of September 1995 biochemically treated wastewater of Almaty began to be discharged to the Ili river through the right bank spillway channel. In the cities Zhambyl, Zhezkazgan, Karaganda, Semey, Taldykorgan, Oskemen after purification waste water is discharged to the fields of filtration, lower terrain places or surface sources without complying with the rules of sanitation of water discharge. It should be noted that in none of these cities neutralization of sewage sludge is carried out. As a rule, they are directed to the fields of filtration or special collectors.

Thus, this mismanaged and uncontrolled practice of water supply and waste water treatment leads to the pollution of natural water of the human environment as a whole.

Certain rural areas have some compact sewage treatment units, but they either do not work or work ineffectively. Most often sewage waters in rural areas are also sent to the wastewater ponds or to the filtration fields.

Agro-industrial complexes such as poultry farms, fattening complexes of cattle, pigs, sheep have sedimentation ponds or filtration fields.

The level of re-circulating water supply in industrial plants is very low, the percentage of water recycling industrial enterprises in regions ranges from 10% to 40%.

There are large losses of water in the extraction, refining, transportation and utilization. Loss of water is caused by the low quality of the equipment, low exploitation level, mismanagement and lack of control. In general, total losses to the total volume of under consumption in the Republic of Kazakhstan are about 20%.

The sewage problem in the country is very serious today. Many regional centres do not have facilities for full biological treatment, the available facilities of mechanical and biological treatment are overloaded and inexpertly exploited, which leads to the situation when treated wastewater in most cases do not meet the sanitary requirements. Neutralization and disposal of sewage sludge is not carried out. There is a very low percentage of usage of wastewater for irrigation, it is not used for technical water supply industry at all.

Rain wastewater is discharged directly into waterways or terrain. All the above mentioned factors lead to the pollution of natural waters. Simple ways to water treatment (clarification and disinfection) do not provide the required quality of drinking water, which affects the health of the population.

Lack of appropriate technology, equipment, material supplies and financial funding complicates the introduction of modern techniques for improvement of

quality of water, disposal of sewage and waste deposits.

There is contamination of ground and subsurface waters. Anthropogenic source of groundwater pollution are almost all settlements of Kazakhstan. Among the most common known the most dangerous is nitrate contamination.

It is known that a safe dose of nitrates per 1 kg of weight is 5 mg, the maximum allowable concentration of nitrates in drinking water is 45 mg/l. Meanwhile, in the drinking water of many districts average annual dose of nitrates per 1 kg of weight exceeds this limit by 3-5 times, and MPC by 1,2-1,7 times. In this connection, there is a need take serious measures and solutions that would contribute to the normalization of the environmental situation. Within each settlement there are areas where the pollution of groundwater is more intense than in other places. For example: household water along the edge of the villages, cattle complexes, fields of filtration, landfills, storage of fertilizers. But at the same time, thanks to the considerable power and flow of underground stream certain locations with increased intensity of inputs merge into hot spots that are characterized by sufficient homogeneousness.

There is a simplified point of view that nitrate contamination is the result of some irrational use of fertilizers. However, nitrogen balance in the soil indicates that, in essence, it is a consequence of the effect of the whole complex of factors of intensive farming. In addition, another source of nitrates in groundwater are compost heaps, manure storage, fermented feed livestock farms and filtration fields.

Drainage system as an integral part of the housing and communal services requires speedy modernization and construction of new facilities, both in urban and rural settlements. In this regard, the search and implementation of innovative technologies is a challenge that requires an immediate solution.

Government of the Republic of Kazakhstan approved and enacted the program of modernization of housing up to 2020 and the program "Akbulak" for 2011 - 2020, which provide the planning, development and long-term financing of the sector of housing and communal services.

However, today it is required to develop a system of rationing wastewater discharges into water bodies, taking into account the use of best available technologies of their purification, capacity of treatment facilities and the ecological condition of wastewater receivers, including ponds.

It is also necessary to develop a program of gradual transition of the Republic of Kazakhstan to the new principles of protection of water bodies from pollution by sewage waters, as a result of which some proposals on changes and amendments to the Water Code and other normative acts of water legislation of the Republic of Kazakhstan can be made.

We think that the harmonization of water legislation with the legislation of EU and the Customs Union will increase the investment potential of Kazakhstan and will create conditions for the development of domestic production of water purification equipment.