IV Всероссийская (национальная) научная конференция с международным участием: «Наука, технологии, общество: Экологический инжиниринг в интересах устойчивого развития территорий» (НТО-IV-2023) при поддержке Краевого фонда науки

10 (2023)

УДК 502.5

EDN LBMVMD

Влияние отходов теплоэлектростанций на биосферу Жетысуского региона

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Аннотация. В статье рассматривается глобальная проблема, которая связана с загрязнением биосферы, вызванным тепловыми электростанциями, которое приводит к очевидным экологическим проблемам. Ухудшается здоровья населения и повышается риск преждевременной смерти проживающих вблизи тепловых электростанций, а также деградации биоты. Научная новизна заключается в изучении экологических нагрузок систем отопления, вентиляции и горячего водоснабжения жилых домов и объектов на биосферу области Жетісу. Задачами исследования является детальный анализ всех видов воздействия на окружающую среду, оценка возможных последствий для окружающей и социально-экономической среды, разработка природоохранных мероприятий.
В результате определено, что фильтрация сточных вод из золоотвала практически отсутствует. То есть, миграция ЗА с подземными водами невозможна. Миграция золошлаковых отходов под воздействием ветра в данном случае также незначительна.

Ключевые слова: сбросы, отходы, тепловые электростанции, золоотвалы, предельно-допустимая концентрация, загрязнение.

Impact of waste heat power plants on the biosphere of the Zhetysu region

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Abstract. The article deals with a global problem that is associated with the pollution of the biosphere caused by thermal power plants, which leads to obvious environmental problems. The health of the population is deteriorating and the risk of premature death of those living near thermal power plants, as well as the degradation of biota, is increasing. The scientific novelty lies in the study of the environmental loads of heating, ventilation and hot water supply systems of residential buildings and facilities on the biosphere of the Zhetysu region. The objectives of the study are a detailed analysis of all types of environmental impacts, assessment of possible consequences for the environment and socio-economic environment, development of environmental protection measures. As a result, it was determined that there is practically no filtration of wastewater from the ash dump. That is, migration for groundwater is impossible. The migration of ash and slag waste under the influence of wind is also insignificant in this case.

Keywords: discharges, waste, thermal power plants, ash dumps, maximum permissible concentration, pollution.

1. Introduction

The city of Taldykorgan is the center of the Zhetysu region, located in its central part, the territory is 1 thousand square kilometers.

One of the city's backbone enterprises is Kainar AKB LLP, a manufacturer of batteries, which accounts for 22% of all industrial production. A new plant for the production of maintenance-free flooded batteries using a lead-calcium alloy was built on the base. The technological process at this enterprise is based on the world's advanced technologies.

Temirbeton LLP, a manufacturer of reinforced concrete supports for the construction of power lines, has a solid production base.

TC Metacon LLP is the only manufacturer in Kazakhstan of hot-dip galvanized products for the needs of power grid construction, as well as metal poles for power lines.

The Baskuat boiler house is designed to cover the heat loads of heating, ventilation and hot water supply systems of residential buildings and infrastructure facilities and to serve existing consumers - the Southern, South-Eastern and Central districts and prospective consumers - the South-Western residential area of Taldykorgan.

The main activity of the boiler house "Baskuat" is the generation of thermal power for heat supply systems, hot water supply of residential, public and industrial buildings in Taldykorgan and the supply of steam to consumers.

The central boiler house "Baskuat" was built and put into operation in 1980. The Baskuat boiler house generates up to 85% of the total production of thermal energy for the city.

The nearest residential area is located at a distance of 730 m in the south-eastern direction from the boiler house "Baskuat" (branch No. 3 of the Zarya warehouse) and in the north-western direction at a distance of 1300 m (5 microdistrict).

The following emission sources are located on the territory of industrial site No. 1:

- Hot water boiler ENChM-60-2 with a capacity of 60 Gcal/h (4 pcs, 2 of them are reserved) and steam boilers KE-14S with a capacity of 16 Gcal hour (25 tons of steam/h) (3 pcs, 1 of which is a backup). The fuel for the boilers is coal from the Semipalatinsk basin of the Karazhyra deposit. Fuel oil is used to ignite boilers and maintain the coal flame;
- Ignition of boilers and maintenance of the coal burning flame;
- Coal warehouse;
- Coal warehouse formations and open coal storage surface;
- Above bunker gallery, crushing plants;
- Fuel oil receiving tank;

- Cargo pumps;
- Oil trap;
- Electric welding station;
- Gas cutting station;
- Electric welding station;
- Gas cutting station [1].

The values of emission standards are the basis for making decisions on the need to carry out technical measures in order to reduce the negative impact of economic and other activities on the environment and public health.

On the basis of calculations, for each stationary source of emissions and the enterprise as a whole, standards for maximum permissible emissions and discharges, as well as standards for the disposal of production and consumption waste, are established based on the goals of achieving environmental quality standards at the border of the sanitary protection zone and in nearby residential areas.

For the period until the completion of the implementation of technical measures to reduce the level of pollutant emissions in order to ensure the achievement of environmental quality standards, the standard volumes of emissions are gradually established by calculation - limits on emissions into the environment [2].

The purpose of this work is to study the environmental load of the heating industry of the Zhtysu region.

Objectives of the study. Detailed analysis of all types of environmental impact, assessment of possible consequences for the environment and socio-economic environment, development of environmental protection measures

2. Research methods

This research work was carried out on the basis of the "Methodology for determining the standards of emissions into the environment. Minister of Environmental Protection of the Republic of Kazakhstan dated April 16, 2012 No. 110-Order" 1. The methodology for determining the standards of emissions into the environment (hereinafter referred to as the methodology) has been developed in accordance with subparagraph 29) of Article 17 and paragraph 4 of Article 28 of the Environmental Code of the Republic of Kazakhstan dated January 9, 2007 and establishes methods for determining the standards of emissions into the environment [3].

The calculation determines the standards for emissions into various media, including the maximum permissible emissions of pollutants into the atmosphere from stationary sources, the standards for the storage of pollutants in water bodies, reliefs, filtration zones, storage, production and consumption of wastewater.

The object of the study is 3 large thermal power plants:

1. JSC "AlES CHPP 3";
2. Tekeli Energy Complex LLP;
3. KGP on REM "Taldykorganteploservis" Boiler house "Baskuat.

3. Research results

The inventory was carried out in the following order:

- get acquainted with the location of emission sources at the enterprise and put them on the plan (scheme) of the area;

- Analysis of survey results and filling out inventory forms.

The emission inventory was carried out by theoretical and computational methods (using specific emission standards in accordance with existing methods). The study showed that the company has one production site. According to the characteristics of the technological equipment, the amount of harmful substances was determined by the computational and theoretical method [4].

The hazard category of the facility was calculated for each substance and for the enterprise as a whole, depending on the mass and species composition of the substances emitted according to the formula:

$$\text{Hazard category of the object} = \left[\frac{M_i}{MPC_{s.s.}}\right]^{ai}$$

Mi is the mass of emissions of the i-th type, t/year

MPCs.s. is the average daily maximum permissible concentration, mg/m^3

ai is a dimensionless coefficient that allows to correlate the degree of harmfulness of the i-th substance with the degree of harmfulness of sulfur dioxide [5].

4. Conclusion

Based on the analysis of the calculations, it can be seen that the surface concentrations created by own emissions at the boundary of the standard SPZ and in the residential zone do

not exceed 1 MPC. Exceedances, taking into account the background, were detected only in the calculated rectangle for iron oxide - 2.5180 MPC, inorganic dust 20-70% - 5.2922 MPC and for dust reduced to MPC 0.5 - 3.1753MPC, but since on the territory of the SPZ and in the residential zone, the pollution zone of 1 MPC is not reached.

Agrochemical analysis of soil samples carried out in 2021 showed a high content of humus in the surface horizons of the soils of the SPZ - 5.3-5.7%, in the background soils - 4.5-3.7%. The concentration of carbonates in the soil does not exceed 10-11%, which gives grounds to classify them as carbonate. The content of total nitrogen in the upper horizons of the studied soils ranges from 0.02 to 0.023 %. In the group composition of humus of dark chestnut carbonate soils, humic acids are even less than in humus there are few humus chernozems. Here they are 15-24%, sulfonic acids - 23-30%. The ratio of humic acid concentration to sulfonic acid concentration is 0.6-0.8. This suggests that these soils have less favorable physical and chemical properties, and, consequently, less natural fertility than low-humus chernozems.

Holes were drilled to assess the possible level of soil contamination in the areas adjacent to the ash dump. When choosing the location of the control pits, possible migration routes of pollutants from the ash dump to the soils of adjacent territories were taken into account. Theoretically, there are two such methods. The first is the transfer of contaminants from contaminated groundwater associated with the filtration of wastewater from the ash removal zone. The second is the air transportation of ash and slag waste from the ash dump to the surface of the soil cover of the territories adjacent to the ash dump.

As noted above, there is practically no filtration of wastewater from the ash dump. That is, the migration of pollutants with groundwater is impossible. In this case, the migration of ash and slag waste under the influence of wind is also insignificant, since the method of operation of the ash dump does not create sufficient prerequisites for this. This is evidenced by direct measurements of the degree of air pollution, which showed a low content of dust in the air. Consequently, even at the initial stage of research, it seemed unlikely that the ash dump could be a source of contamination of the soil cover of adjacent territories.

3. The results of the analysis of the samples also indicate that for the water of the settling pond there was an excess of the maximum permissible concentrations of CP and KB for seven elements: phosphates (2014), fluorine (for the entire observation period, except for 2014-2016), manganese (in 2011-2015), lead (in 2004 and in 2011-2012), nickel and cadmium (in 2011),

iron (II) (in 2013). In 2016, there were no exceedances of pollutant concentrations above the standards at all. Although, in this case, the comparison with the MPC of CP and KB is conditional, since the settling pond is a technological reservoir and the quality of water in it is determined by the needs and capabilities of production.

In general, the studies of previous years and 2016 showed that the results of the analysis of process water samples, combined with the results of spectral and chemical analyses of ash and slag waste, revealed a stable association of chemical elements, the concentration of which must be controlled when studying the state of groundwater in the area of the tailings collector. Such elements primarily include fluorine and lead. Manganese, copper, nickel, cadmium, and zinc can all pose certain hazards.

When calculating the limits for waste storage, the decreasing coefficient of the KV, which assesses the impact of the ash dump on the state of groundwater, for the entire 19-year period of the study, was assumed to be equal to one, which once again emphasizes the absence of the impact of the ash dump on the state of groundwater. This, in turn, allows us to assume with a reasonable degree of probability that the situation will not change in the period 2017-2026, and to apply a CV equal to one to the calculation of waste disposal standards.

References

1. Bryukhan A.F. Inzhenerno-ekologicheskie issledovanie dlya stroitel'stvo teplovykh elektorstvennykh stantsii [Engineering and ecological research for the construction of thermal power plants] / A.F. Bryukhan, F.F. Bryukhan, A.D. Potapov // Publishing House of the Association of Construction Universities. – Moscow: Cop, 2010. – 233 p.
2. Noskov A.S. Impact of TPP on the environment and ways to reduce the damage / A.S. Noskov, M.A. Savinkina, L.Y. Anishchenko // Institute of Catalysis of the Siberian Branch of the USSR Academy of Sciences, Institute of Solid State Chemistry and Processing of Mineral Raw Materials of the Siberian Branch of the USSR Academy of Sciences, State Public Scientific and Technical Library of the Siberian Branch of the USSR Academy of Sciences. – Novosibirsk. Ed. SPNTB SB AN SSSR, Cop. 1990. – 145p.
3. On approval of the Methodology for determining Emission Standards in the environment / Order of the Minister of Ecology, Geology and Natural Resources of the Republic of Kazakhstan dated March 10, 2021 No. 63. Registered with the Ministry of Justice of the

Republic of Kazakhstan on March 11. – 2021. – No. 22317. https://adilet.zan.kz/rus/docs/V2100022317

4. Ershov V.V. Radioactive elements in Kuzbass coals / V.V. Ershov, S.I. Arbuzov, L.P. Rikhvanov, A.A. Potseluev // Environmental problems of the coal mining industry in the region during the transition to sustainable development: Int. Sci.-Prakt. Conf. T.2. Kemerovo: Kuzbassvuzizdat, Cop. – 1999. – 89 p.
5. Romanov S.M. The relevance of radiation monitoring in coal mines and mines / S.M. Romanov, A.A. Shilov, O.N. Guryanova // Occupational safety in industry. Cop. – 2009. – 38 p.