REDUCTION OF ENVIRONMENTAL RISK FROM EMISSIONS INTO THE ATMOSPHERE OF BOILER HOUSES

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Аннотация. В данной статье рассматриваются рекомендации по снижению экологического риска от выбросов отходящих газов котельных, поступающих в атмосферный воздух из организованных источников (дымовых труб).

Abstract. This article discusses recommendations for reducing the environmental risk from emissions of boiler exhaust gases entering the atmospheric air from organized sources (chimneys).

Ключевые слова: экологический риск, котельные, котельные установки, выбросы продуктов сгорания топлива, атмосферный воздух, загрязнение.

Keywords: environmental risk, boiler houses, boiler plants, emissions of fuel combustion products, atmospheric air, pollution.

Emissions from boilers are one of the main sources of environmental pollution. They contain various harmful substances such as nitrogen oxides, sulfur, carbon, and others. These substances can lead to various problems such as climate change, health issues for humans and animals, as well as damage to vegetation. Therefore, comprehensive measures are necessary to minimize the negative impact of boilers on the environment. In this process, it is important to consider both technical and organizational aspects, and also involve government agencies and society to address this problem.

Boiler installations are a complex of devices designed to produce steam or hot water by burning fuel. Boiler houses are mandatory elements of infrastructure, thanks to them, housing organizations, budget organizations and other consumers are provided with hot water and thermal energy, but they have a significant drawback – emissions of fuel combustion products that enter the atmospheric air through chimneys, thereby polluting it. Emissions into the atmosphere from such enterprises become a serious threat to human health and the environment.

Risk assessment is a process aimed at calculating or assessing the risk to a given system as a result of exposure to a given substance, taking into account the characteristics inherent in both the substance and the system itself.

The analysis of the environmental risk from the exhaust gas emissions of boiler houses allows to identify sources. Their risk level exceeds the permissible level. Consideration of the influence on parameters the emission sources, (chimneys) will allow to implement environmental measures.

Risk assessment can be carried out by various methods, such as ‘assessment of non-carcinogenic risk by reference doses’, ‘assessment of the risk of air pollution by average daily concentrations’, ‘assessment of the risk of air pollution by average annual concentrations’, ‘risk assessment by concentration of pollutants in the workplace’ and other methods.

The acceptable total carcinogenic risk is 0.001, and the acceptable total non-carcinogenic risk is 0.02.

Based on the results of calculations made in accordance with the ‘Guidelines for the assessment of occupational hazard to the employees health. Organizational and methodological foundations, principles and evaluation criteria’, the sources of emissions from the boiler house of JSC ‘Cascade-Energo’, the boiler house of LLC ‘Shinoremontnyy zavod’ and the boiler house of CS ‘Vertikos’ do not exceed the level of acceptable total carcinogenic risk, and there are no carcinogenic substances in the emissions of the boiler house ZATO ‘Solnechnyy’.

The total environmental risk of the sources of the boiler house of JSC ‘Cascade-Energo’, the boiler house of CS ‘Vertikos’, the boiler house of LLC ‘Shinoremontnyy zavod’ and the boiler house ZATO ‘Solnechnyy’ exceed the acceptable level for non-carcinogenic substances.

Since the sources of the boiler house of JSC ‘Cascade-Energo’, the boiler house of CS ‘Vertikos’, the boiler house of LLC ‘Shinoremontnyy zavod’ and the boiler house of ZATO ‘Solnechnyy’ have exceeded an acceptable level of risk, an assessment was made for them of the speed effect of the gas-air mixture and the height of the chimney on the level of risk.

As a result of the calculations made, it was found out that with an increase in the height of the pipe of the emission source, it is possible to reduce the total environmental risk or with an increase in the exiting rate of the gas-air mixture from the organized source of emissions (by narrowing the mouth of the chimney). Also, an increase in the rate of exit of the gas-air mixture from the chimney can be obtained due to the introduction of traction devices.

In addition, environmental risk reduction can be achieved by reducing emissions of nitrogen oxides. This can be achieved as a result of the introduction of two-stage fuel combustion, since the formation of these oxides depends on the mode and burning temperature and the device of the combustion process. The oxygen concentration determined by the excess air in the furnace has a great influence nitrogen oxides on the formation.

Nitrogen oxides are mainly formed in the combustion chamber. As a result of the interaction of nitrogen oxides (NO) with atmospheric air, additional oxidation and conversion of nitrogen oxide into more toxic nitrogen dioxide (NO_2) occurs at the exit of the chimney.

Two-stage fuel combustion is the air supply to the burner devices in two stages: at the first stage, a smaller amount of air is supplied, and at the second - more. As a result, gasification of the fuel occurs at the first stage, which occurs when it is incomplete combustion. Gasification is the process of converting the organic part of the fuel into a gaseous by the action of an oxidizer (air), it is associated with a decrease in temperature. At the second stage, afterburning of the formed gases occurs, which leads to a decrease in the nitrogen oxides yield by about two times, as a result, there is a reduction in the environmental risk from emissions into the atmosphere of boiler houses.

Emissions from boilers pose a threat not only to the environment but also to human health, especially those living near such facilities. To solve this problem, a comprehensive approach is necessary, which includes both technical measures (the use of modern technologies and equipment that allow reducing emissions of harmful substances) and organizational measures (control over the fuel combustion process and regular inspection of equipment for compliance with safety and environmental standards). This requires joint efforts from government agencies, companies, and society as a whole. Minimizing the negative impact of boilers on the environment is a complex task that requires a comprehensive approach and the participation of all stakeholders. By taking necessary measures, we can make our lives safer and healthier, and the environment cleaner and more sustainable.

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