

Problems of defining sanitary protection zones for existing water supply and water disposal enterprises

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Abstract. The paper considers the first codification of enterprises according to hazard classes and the development of a classification showing the negative impact of enterprises on people. To protect people from production facilities negative impact sanitary protection zones (SPZ) are established for such enterprises. This paper describes how approaches to hazard classes of enterprises have changed over time. The procedure for establishing sanitary protection zones which is in force today is also described. This procedure can be applied to the establishment of the size of a sanitary protection zone for all types of enterprises, including water supply and wastewater disposal facilities. The researchers further examine issues arising from the establishment of sanitary protection zones of existing enterprises and objects of water supply and wastewater disposal located in historical building developments, concentrating on those locations where reconstruction or modernization is planned. It is specially stressed that reconstruction of sewage waste-disposal plants often causes considerable difficulties as the formal expert examination requires to provide a layout of an officially approved sanitary protection zone which is not possible in most cases because there are houses already located within the regulatory zone of these plants.

1. Introduction

Since the beginning of the last century, the protection of the population from the negative impact of production facilities began to be implemented in the form of the organization of sanitary protection zones (SPZ) of enterprises [1]. The first classification of enterprises in relation to their SPZ identified three types of construction objects. They were objects with zones of 2000 and of 250 meters, as well as those enterprises which can officially operate in residential areas. Further research conducted in 1932-1939 made it possible to produce a new classification of industrial enterprises, which included six types of construction objects, that is objects with sanitary protection zones of 2000, 1000, 500, 300, 100 and 0 meters. The sanitary classification, developed later, included 259 types of various production facilities. The list of production facilities is constantly revised, expanded and supplemented [2]. Constantly updated normative and sanitary documents are also taken into account [3-6].

2. Problem specification

At present, Document [6] is the main one in force. It enumerates 525 enterprises, production facilities and other construction objects with five different classes of danger (I, II, III, IV, V). Their SPZ size is, respectively, 1000, 500, 300, 100 and 50 metres. For construction objects that are not included in the sanitary classification, the size of their SPZ is set individually in each separate case. For this purpose,



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the corresponding calculations are carried out: the project of the SPZ is developed, measurements on border of the SPZ for a certain settlement are carried out. Further on, the Chief state sanitary doctor of the Russian Federation or his deputies approve the established size of the SPZ.

It should be noted that the mechanism for establishing the hazard class of enterprises, industries and other construction objects and the size of SPZ width is not defined in SanPiN (that is in Sanitary Norms and Regulations) [6]. Criteria for establishing the size of the SPZ "...depending on the capacity, operating conditions, nature and quantity of toxic and odorous substances released into the environment, noise, vibration and other harmful physical factors" do not have quantitative characteristics and therefore cannot be used practically to establish the hazard class of specific enterprises, and, consequently, the size of their SPZ width [7-9].

To properly define a hazard class of a certain enterprises is important not only at the design stage, but also at the preliminary stage, when the site is being yet selected, as the subsequent design, construction (reconstruction) of the enterprise may be useless because of the inability to organize the SPZ with the required size [9]. The same problem arises when a project of reconstruction of the construction object located in the historical development is being launched. The reconstruction project can not be validated by the formal expert examination until the sanitary protection zone of the objects under limitations is approved. Thus, the importance of sanitary classification of industries, enterprises and production facilities is obvious, despite the fact that the class of a particular enterprise and the size of its SPZ, with proper justification, can be changed and specified. Therefore, the establishment of quantitative criteria for the hazard class of enterprises and the size of their SPZ is relevant not only for enterprises which are not included in the sanitary classification, but also for enterprises and industries that are included in this classification.

3. Methodology

Previously, various methods were used to define a hazard class of enterprises. Primarily methods consist in using different quantitative criteria (capacity, emissions), taking into account the maximum permissible concentrations of the components of these emissions [10-12]. Therefore, to assess the danger of enterprises according to their discharge volume it is important to compare the discharge with reference concentrations of the components of these emissions. These reference concentrations take into account the health status of the population and are now widely used to assess the impact of environmental pollution [9, 13, 14].

4. Discussion

Currently, the procedure for establishing the SPZ is regulated by Resolution [16] (hereinafter the Rules). In determining SPZ for existing enterprises of water supply and water disposal, the main problem is the implementation of Article 5 of the Rules. According to this article, it is not allowed using of the land plots for the following purposes:

a) building residential facilities, educational and medical facilities, open-type sports facilities, recreation and recreation facilities for children, recreational areas and gardening;

b) building construction objects for production and storage of medicines, objects of food industries, wholesale warehouses of food raw materials and food products, complexes of water supply facilities for preparation and storage of drinking water, use of land plots for the purpose of production, storage and processing of agricultural products intended for further use as food products if chemical, physical and (or) biological impact of the object in respect of which the sanitary protection zone is established will lead to violation of the quality and safety of such means, raw materials, water and products in accordance with the requirements established for them.

It means that within the boundaries of the SPZ there should be no land plots for residential development (their presence is determined by the public cadastral map), though it is not prohibited to set up houses unregistered in the cadaster. Of course, this assumption will not pass the sanitary examination. Restrictions of a residential zone location is more accurately reflected in Article 5.1 of

SanPiN [6], which says that "in a sanitary protection zone it is not allowed placing: residential development, including individual houses...".

Despite such a marked difference in the wording "use of land for housing" and "residential development" the Rules even require a list of prohibitions in the SPZ project. The SanPiN [6] also refers to the prohibition of location in the SPZ of such a group as "other territories with parameters of habitat quality under limitations".

The same applies to the placement of "recreation organizations for children" and "playgrounds". For example, the placement of a playground with a swing and a sandpit, etc. within the boundaries of the SPZ is not prohibited by the Rules, though it is prohibited to build such a playground according to the SanPiN requirements [6].

Currently, it is Rospotrebnadzor (**an abbreviation for Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing*) which issues sanitary and epidemiological conclusions on SPZ and Decisions on the SPZ determination. In this case, full-scale measurements are not required.

Resolution [16] does not use the concepts of preliminary, calculated and final (established) SPZ.

According to Resolution [16], SPZs are established on the basis of the Decision. It is not required to have a sanitary-epidemiological conclusion on a preliminary arranged sanitary-protection zone.

The difficulty of establishing SPZs for existing sewage treatment plants in practice consists in the fact that such facilities are often surrounded by suburban (from 2019, garden and horticultural plots), as well as by plots for individual residential development. Let us explain the reason of this difficulty. Wastewater treatment facilities can be drawn in the general lay-out of the settlement together with their approximate SPZ. Yet when garden plots (while obtaining property rights) are fixed on the cadaster map, SPZ are not taken into account as they are not fixed in the cadastral register. Such garden plots, in fact, can be referred to as "the seizure of territory", which can be legalized through the so-called "garden plots Act of Oblivion".

During the development and approval of the SPZ, there might also be cases when wastewater treatment facilities are built within the boundaries of the settlement located in the territory of a national park (specially protected natural area) or in the zone of economic purpose. According to Regulations [17], this territory is intended for activities aimed at ensuring the functioning of the institution and the life of citizens living in the territory of the national park, i.e. the placement of structures is quite possible, but this territory is still a part of the national park (specially protected natural territory), which, in its turn, is recreational and can not be located within the boundaries of the SPZ.

According to Section 13 of Article 26 of the Federal law [18], the owners of buildings, for which estimated (approximate) sanitary protection zones were determined, were required to contact (until October 1, 2019) public authorities, empowered to making decisions on sanitary protection zones. These owners were supposed to make an application for new sanitary protection zones determination or for cessation of existing calculated (approximate) sanitary protection zones. Such applications have to be supported with documents stipulated by regulation on the sanitary-protective zones. It is not required to follow MAC or MPC regulations on the zone boundaries, however, when passing the formal expert examination, inspection authorities require the draft program of measurements to be made in the project papers.

As for this program of measurements necessary to confirm the size of the SPZ, the center of hygiene and epidemiology requires to include in the program only substances with large calculated concentrations, and the inspection body, in its turn, requires to include all substances which concentration outside the territory of the enterprise exceeded 0.1 percent of the MAC (MPC).

SanPiN [6] establishes SPZs for sources of impact on the environment and human health, for which the levels of pollution created outside the industrial site exceed 0.1 MAC and/or MPC. In Resolution [16] the SPZ is established for sources of chemical, physical, biological impact on the human habitat in case of formation behind contours of objects of the chemical, physical and (or) biological impact exceeding sanitary and epidemiological requirements.

SanPiN [6] does not define a hazard class for sewage treatment plants and other facilities. It is also not possible to determine it indirectly, since enterprises are classified by the size of 50, 100, 300, 500 and 1000 m, while sewage facilities have the size of 15, 20, 30, 100, 150, 200, 300, 400, 500, 1000 meters.

It is not possible to define the class of enterprises during the calculated and objective evidence of reduction in size, i.e., whether the class depends on the size of the established (proven) SPZ.

In most cases, the requirements to take the size of the SPZ from wastewater treatment facilities and pumping stations of industrial sewage, which are not located on the territory of industrial enterprises, are stricter than those for the industries from which the wastewater comes.

The fact that wastewater treatment facilities are often surrounded by garden plots, which SanPiN [19] refers to the places of mass recreation of the population, requires MAC not exceeding 0.8 (according to Paragraph 2.2 of SanPiN [19]). At the same time, it is not required to follow this 0.8-of-MAC-rule at the border of the sanitary zone, though it is required to follow it for a formal expert examination.

The application of Point B of Article 5 of Rules also raises a lot of questions as there is no technique of an assessment, whether chemical, physical and (or) biological influence of the construction object will cause violation of quality and safety of means, raw materials, water and production.

Regulatory documents do specify what MAC / MPC (maximum acceptable concentration / maximum permissible concentrations) are used in the assessment of SPZ, as there might be either maximum one-time or average daily concentrations which are taken into account. This fact may be considered as the absence of the need to consider substances with a specified level (approximately safe level of exposure).

The only existing methodology of calculation of emissions from wastewater disposal enterprises is known as "Guidelines for the calculation of emissions of pollutants into the air from unorganized sources of wastewater aeration stations" [15]. In this methodology, the calculation method defines the emissions from the following fugitive sources of wastewater treatment facilities: receiving chamber, grates of mechanical wastewater treatment, sand catcher, primary strainer chamber, secondary clarifier, aeration tank, sludge compactor, raw sludge tank, sand platform, sludge platform, pre-aerator. Sewage pumping stations are calculated with account of their receiving chamber. There are no such common facilities as bio filters (bulk and disk), sludge dehydration facilities, irrigation and filtration fields, biological ponds, septic tanks.

The existing application of a methodology designed to estimate emissions from oil traps of the oil industry to estimate emissions from oil separators of surface runoff treatment facilities is unjustified.

In water treatment plants, the sources of negative impact are mainly not technological, but auxiliary facilities (processes). For water treatment plants SanPiN [6] does not suggest approximate SPZ. Technological processes that are themselves a chemical source of exposure are as follows: chlorination, ozonation, dry preparation and storage of reagents.

Water and sewage treatment plants often comprise boiler rooms and backup diesel generator sets.

5. Conclusions

Currently, there are many problems connected with determination of sanitary protection zones for existing water supply and waste water disposal facilities. These problems are caused by the fact that at present there isn't any reliable methodology to determine the negative impact on the environment for the whole number of building structures. Another reason for these problems lies in the fact that there are two "basic" documents regulating the procedure for establishing the size of sanitary protection zones which are in force in this country.

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