



## **Analysis of sanitary protection zones location in the city area of Tomsk**

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### **Abstract**

Currently, it is prohibited to place large industrial enterprises on the territory of urban and rural settlements, such production is carried out outside the city. The paper deals with the historical aspects of industrial enterprises and the design of their sanitary protection zones. Using the rules of land use and development, a geof ormation analysis of the location of industrial enterprises was carried out. In accordance with regulatory documents, sanitary protection zones are allocated. A number of factors of violation of urban space are noted and possible measures for its restoration are proposed. In the context of the rapid development of infrastructure, the planning and construction of settlements should provide for the creation of favorable conditions for the life and health of the population through comprehensive improvement.

*Key words:* Industrial enterprises, residential zones, sanitary protection zones, environmental safety;

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### **1. Introduction**

The city-forming factor of most Russian cities is industrial activity. Previously and historically, no particular significance was attached to the location of industrial facilities. The rapid development of urban space and urbanization, changes in approaches to planning and development of urban and rural areas provides for the creation of favorable conditions for the life of the population, with the reduction of the adverse impact of hazards.

The industrial zone of the city is intended for the location of industrial enterprises: factories, workshops, enterprises of the fuel and energy cycle, utilities, scientific facilities that train personnel, and other non-production facilities that are engaged in servicing material and non-material production.

The residential area has recreational, public and business zones, parts of the transport and engineering infrastructure, and other facilities that do not have a negative impact on the human environment.

An integral part of industrial enterprises is the presence of a sanitary protection zone - a regulatory element of environmental design, which is installed at facilities that are a source of chemical, physical, biological impact on the environment and humans [4].

In this paper, we consider industrial enterprises and their sanitary protection zones, applying geoinformation analysis and taking into account the rules of land use and development.

## 2. Definition of the sanitary protection zone

According to Federal Law No. 52 "on sanitary and epidemiological welfare of the population", sanitary protection zones are established around objects that are sources of negative impact on the environment and the population, in order to reduce chemical, biological, physical, and environmental impacts. [1]

The production ipso facto is inextricably linked to the negative impact on the environment. As a result of the technological process, waste of various hazard classes is formed.

Pollutants, that are specific to production, are escaped into the atmosphere, and thus contamination of soil cover, groundwater, as well as biota occurs.

To minimize the negative impact on the components of the natural environment, a sanitary protection zone is designed to separate the residential area from the industrial one. It assumes the presence of barriers in the form of distance, fences, green spaces that contribute to the localization of harmful factors.

According to SanPiN 2.2.1/2.1.1.1200–03 it is planned to restrict the population's residence near the territory of the SPZ of enterprises, but due to the previously formed structure of the city, this requirement is not always feasible, and the territory of residential development may belong to the regulatory SPZ.

In cases where experimental tests have proved that the negative impact on the residential area is minimal, it is possible to reduce the size of the sanitary protection zone.

Depending on the sanitary classification, standard indicators of sanitary protection zones (SPZ) for prevention are established: class I-1000 m; class II – 500 m; class III-300 m; class IV-100 m; class V-50 m [3].

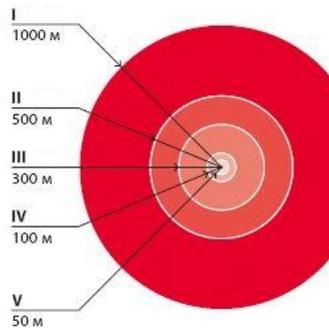


Fig.1 Design and installation of SPZs is performed depending on the hazard class of the enterprise

## 3. Structure of an industrial complex in Tomsk

Urban spatial planning in the Soviet times, when the development of industrial production prevailed over the efficiency and safety of urban development, is characterized by the lack of a clear planned city structure and is typical for the city of Tomsk.

During the Great Patriotic War, a number of industrial enterprises were evacuated to Tomsk and located in the central historical part of the city, surrounded by residential buildings and socio-cultural facilities.

Nowadays industrial enterprises outside of Tomsk are located depending on meteorological conditions: the most harmful enterprises are located to the north of the residential part of the city. However, some enterprises of hazard class II-IV are located in the immediate vicinity of the residential area as before.

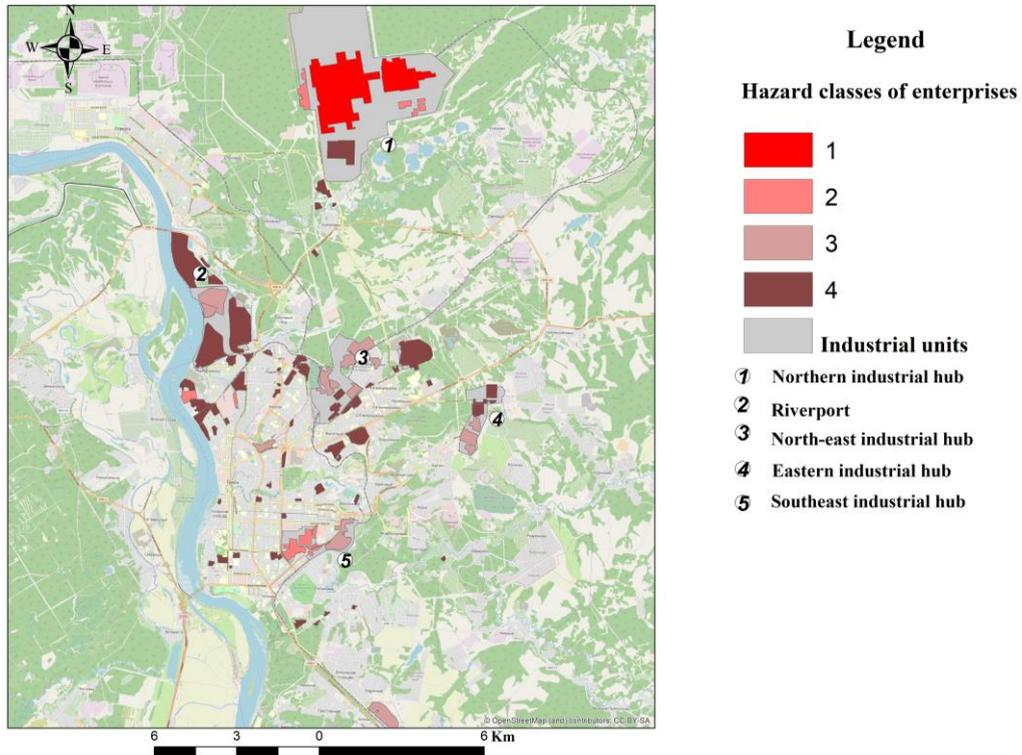


Fig. 2 Map of the location of industrial enterprises in Tomsk by hazard class

#### 4. Geoinformation analysis of the study area

While studying the issue, authors referred to source materials such as the Urban Planning Atlas of the city of Tomsk, territorial and functional zoning, data on the location of industrial enterprises and their established sanitary protection zones [3]. Statistical and mathematical processing of the results was carried out in the software packages Statistica 10.0 and Excel 2016. Spatial data analysis was performed in the geographic information system ArcGIS 10.5.

According to the rules of land use and development in the city of Tomsk, the analysis of the location of industrial enterprises in the city was carried out. The following territorial zones are [2]:

- P-1 zone of industrial and communal facilities of hazard class I
- P-2 zone of industrial and municipal facilities of hazard class II
- P-3 zone of industrial and municipal facilities of hazard class III
- P-4 Zone of industrial and communal facilities of hazard classes IV-V
- Coolant the Zone of public and residential purpose
- O-1 business, public and commercial Zone

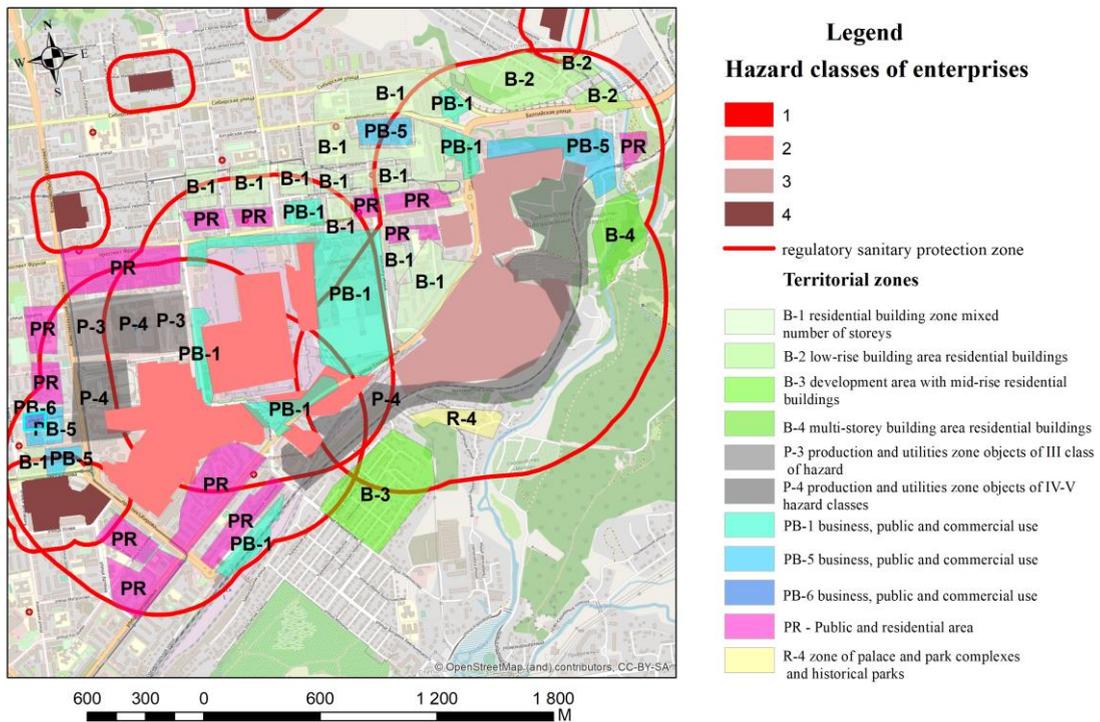


Fig.3 Location of borders of sanitary protection zones in the South-Eastern industrial hub

The existing planning structure shows that along with industrial zones, the city has zones of development of multi-story buildings that fall within the regulatory SPZ. The most striking example is the territory of the GRES-2 enterprise. However, at the time of the introduction of SPZ regulations, some enterprises were already surrounded by various types of development, so the SPZ border in such cases coincides with the enterprise border based on calculations of dispersion of pollutants.

In addition, there are enterprises located in the limits of the city that have now lost their production value, but as capital construction objects and the nearby territory they are subjects to be restructured.

## 5. Conclusion

Thus, today issues, related to the location of enterprises near residential areas and their regulatory SPZs, require a detailed comprehensive analysis of the components for the natural environment in order to identify effective and safe use of the urban area, with an assessment of its urban planning and architectural and constructional value. This assessment should be the basis for further sustainable development of the locality.

Properly conducted territorial planning of the city is the key to a comfortable residence for the population and a favorable environmental situation.

Due to the historical development and the increase in the boundaries of the city territory, this fact is currently not observed for the territory of Tomsk, and, as a result, today industrial zones are adjacent to residential areas, that violates the connectivity of urban areas and has a negative impact on the environment.

Based on the results of the research, the following recommendations were proposed to improve the quality of the urban environment

- to increase green areas;
- to establish sanitary protection zones for industrial facilities and to enter borders in the Unified State Register of Legal Entities;
- to review and change territories of prospective development within the boundaries of the SPZ;
- to revise the SPZ and urban planning regulations regarding restrictions on the use of the territory, taking into account the SPZ;
- to draw the boundaries of the SPZ on the territorial planning scheme of the Tomsk region.

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