Coordination of special technical conditions for civil defense and protection in emergencies in Russia

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Abstract The article contains the results of research work to identify the shortcomings of the regulatory framework of Russia and the impossibility of agreeing special technical conditions that are not included as a type in the main document regulating the procedure for agreeing special technical conditions. An algorithm was developed to solve this problem, including proposals for amending the existing order of the ministry of construction. In addition, a method was developed for calculating warning zones for local warning systems at hazardous production facilities of hazard classes 1 and 2. Currently, the regulated values of this zone for such objects have not been established. The method refers to the method of calculating the radii of zones of damaging factors that can be implemented in various emergency situations.

1. Introduction
Technosphere safety is a very large area of knowledge and research that includes fire safety, industrial safety, emergency protection, environmental safety and labor protection. Many different articles are devoted to fire safety. Topics relate to fire retardant coatings, fire fighting, fire resistance of structures, and fire alarms. [1-7] Also often considered issues of modeling, management decisions in an accident, calculations of strength and reliability. [8-11].

The topic under consideration, that is, protection in emergency situations, is covered in the works with less frequency. [12] In this regard, it is worth noting that there are few theoretical sources for this study. This indicates a certain level of scientific novelty of this study.

The paper examines the existing system of legal regulations in the field of civil defense and protection in emergency situations, as well as construction, searches for its shortcomings, as well as developing proposals for improving the system.

2. Methods
System analysis is briefly described below.
The section on civil defense and emergency protection measures for capital construction projects includes a wide range of issues: providing warning to management personnel, notifying employees of the enterprise, notifying the population of nearby settlements, building bomb shelters, zoning territories, creating emergency formations to carry out civil defense activities, and emergency relief - rescue formations, conducting exercises and more. [13-14]

According to Federal Law N 116-FL, hazardous production facilities are enterprises / workshops / sites, as well as other production facilities in which combustible, flammable, toxic substances are obtained, used, processed, formed, stored, transported, destroyed, explosive and other substances specified in the annex of this law. [15] There are 4 hazard classes of objects. The study examined objects of extremely high and high danger, that is, classes 1 and 2. The fact is that for these objects the
normative value of the length of the warning zone for local warning systems has not been established. These values are established only for nuclear, radiation hazardous, chemically hazardous facilities and hydraulic structures. [16]

In this regard, according to Federal Law N 384-FL, the creation of special technical conditions is required. [17] But according to the Order of Department of development N 248, the deviations considered above do not fit into any type of special technical conditions contained in the Order. [18] Consequently, the order of development and coordination of such special technical conditions is not defined, and the Ministry of Construction and the Ministry of Emergency Situations are not authorized to coordinate this document.

To solve this problem, a draft amendment to the Order of the Ministry of Construction No. 248 / pr was developed, as well as an explanatory note to it. This project was sent as an appeal to the Department of licensing activities and control in the Ministry of Construction of Russia. In accordance with the established procedure for the consideration of citizens' appeals, the response to the appeal came within 30 days from the date of registration of the submitted application. The answer was unsatisfactory and did not give an answer to the question in the appeal. In this direction, the study is not yet completed.

The second part of the research work concerned the development of methods for determining the radii for zones of local warning systems. The method of determining the action of horns and the zones that they cover exists. [19] But there is no methodology for determining the radius of the zone in which it is necessary to conduct an alert.

It was accepted that for each specific hazardous production facility it is advisable to determine the radii of zones of damaging factors. Among all the scenarios, one should take the most severe in consequence, and take this radius as the minimum radius of the warning zone.

The object of the oil industry was modeled with certain parameters. The tank farm included 6 storage tanks for light oil products with a volume of 10,000 m3. Regarding this park, various emergency situations were modeled: the explosion of the fuel-air (FA) mixture, the fire of the strait, flare burning, fire-flash and others. Calculations were made, according to which the most dangerous scenario for this enterprise was the explosion of the air-fuel mixture. Below is the method of calculating the parameters of damaging factors. [20]
a) Effective energy storage, Joule, combustible mixture is determined by the following formula:

$$E = M_g \cdot q_g \cdot \min(c_g \leq c_{st}, c_g > c_{st}),$$

or

$$E = M_g \cdot q_g \cdot \frac{c_{st}}{c_g} \cdot \min(c_g \leq c_{st}),$$

where $M_g$ is the mass of combustible material contained in the cloud of fuel assembly, kg; $q_g$ is the specific heat of gas combustion, J / kg; $c_g$ is the concentration of combustible material in the FA cloud, kg/m$^3$; $c_{st}$ is the stoichiometric concentration of a substance in a mixture with air, kg / m$^3$.

To calculate the parameters of the air shock wave at a given distance $R$, m, from the center of the cloud when the fuel assembly cloud detonates, the corresponding dimensionless distance is preliminarily determined by the following formula:

$$R_x = R / \left(\frac{E}{P_0}\right)^{1/3},$$

where $P_0$ is atmospheric pressure, Pa.

Next, the dimensionless pressure $P_{x1}$ is calculated. In the case of detonation of a cloud of a gas fuel assembly, the calculation is made according to the following formulas:

$$\ln(P_{x1}) = -1,124 - 1,66 \cdot \ln(R_x) + 0,26 \cdot (\ln(R_x))^2,$$
The dimensionless pressure $P_{x2}$ is determined by the ratio (true if $R_x > 0.34$, otherwise $R_x$ is assumed to be 0.34):

$$P_{x2} = \left(\frac{V}{C_0}\right)^2 \cdot \left((\sigma - 1)/\sigma\right) \cdot \left(\frac{0.83}{R_x} - \frac{0.14}{R_x^2}\right). \quad (5)$$

The final value of $P_x$ is selected from the condition:

$$P_x = \min(P_{x1}; P_{x2}), \quad (6)$$

After determining the dimensionless pressure value, the corresponding dimensional value is calculated, Pa:

$$\Delta P = P_x \cdot P_0. \quad (7)$$

For an overpressure value of $\Delta P$ equal to 5 kPa, the value of $R$ will be equal to 281 m. The maximum value of $\Delta P$ reaches when the value of $R$ is 15 m and equals 651 kPa.

The results of the calculations were used to construct a diagram reflecting the change in pressure developed by the air shock wave from the distance from the center of the cloud of the fuel-air mixture. (fig. 1)

![Graph of the pressure values of the distance from the center](image)

**Figure 1.** A graph of the pressure values of the distance from the center

The radius shown in fig. 2 is the smallest permissible boundary for covering the SALW alert zone. Since the regulatory values of the alert radii are not defined for the hazard class 1 and 2 hazard classes, the calculation gives the right to reasonably set the missing parameter, which will be spelled out in the special technical conditions and then used in the project documentation on SALW.
3. Results
In the process of writing research work, the existing system for developing and approving special technical conditions in the Russian Federation was analyzed. Its shortcomings were identified, the options for the development and approval of a civil defense and emergency response system as part of technical specifications of another type were studied. Due to the imperfection of the legislation, this was not possible.

The methodology for calculating alert zones for local alert systems was also formulated and applied, which is currently not defined. This is a Heading 2

4. Conclusions
The work carried out is devoted to several sections of security. The results were obtained in terms of regulatory regulation: proposals were made to amend the existing documents of the Ministry of Construction of Russia. The project was sent to the Office for consideration.

The results were obtained in the field of technical regulation.

Since the special technical conditions are a regulatory document that takes into account the characteristics of a particular object for which they are developed, it is advisable to apply the developed methodology to justify the values of warning zones. Under such conditions, the provisions of Federal Law 384-FL are complied with, which currently cannot be observed in respect of civil defense and emergency situations due to the imperfection of the current regulatory system.

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[15] Federal law N 116-FL "About industrial safety of dangerous industrial facility"

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