UDC 614.87
https://doi.org/10.23947/2541-9129-2019-3-2-5

# INTEGRAL INDICATOR OF INDUSTRIAL SAFETY OF HAZARDOUS PRODUCTION FACILITIES OF FERROUS AND NON-FERROUS METALS PROCESSING IN THE ROSTOV REGION

***Zhokhov R.V., Korotkiy A. A.***
Don State Technical University, Rostov-on-Don, Russian Federation

RomikZ@bk.ru
korot@novoch.ru

The article considers application of an integral indicator of industrial safety in relation to hazardous production facilities (HPF) of ferrous and nonferrous metals processing in the Rostov region. The integral indicator is determined on the basis of individual indicators used to assess the probability of potential negative consequences of non-compliance with the requirements in the field of industrial safety.

**Keywords:** hazardous production facility, foundry, metal, industrial safety

УДК 614.87
https://doi.org/10.23947/2541-9129-2019-3-2-5

# ИНТЕГРАЛЬНЫЙ ПОКАЗАТЕЛЬ ПРОМЫШЛЕННОЙ БЕЗОПАСНОСТИ ОПО ПЕРЕРАБОТКИ ЧЕРНЫХ И ЦВЕТНЫХ МЕТАЛЛОВ В РОСТОВСКОЙ ОБЛАСТИ

***Жохов Р. В., Короткий А. А.***
Донской государственный, технический университет, Ростов-на-Дону, Российская Федерация
RomikZ@bk.ru
korot@novoch.ru

Рассматривается применение интегрального показателя промышленной безопасности применительно к опасным производственным объектам (ОПО) переработки черных и цветных металлов в Ростовской области. Интегральный показатель определяется на основе отдельных показателей, используемых для оценки вероятности возникновения потенциальных негативных последствий несоблюдения требований в области промышленной безопасности.

**Ключевые слова:** Опасный производственный объект, литейный цех, металл, промышленная безопасность.

**Introduction.** Foundry in mass production is an integral part of the technological process and belongs to the category of processing of ferrous and non-ferrous metals. Maintaining a high level of industrial safety can prevent or minimize the consequences of an accident. An integral indicator allows assessing the probability of potential negative consequences of non-compliance with industrial safety requirements. It is formed from factors that are evaluated in points by selecting values on a linguistic (nominal) scale. The degree of influence of individual factors on the level of industrial safety is taken into account by means of weight coefficients.

**Determination of external factors.** All external factors can be divided into three groups:

1. Man-made factors, including the presence of hazardous facilities or the movement of hazardous substances in the area of HPF. In foundries, these factors are necessary for the production process.

2. Anthropogenic factors that depend directly on the location of HPF in the region relative to human settlements. Most foundries in the Rostov region are located within the city limits, but are localized in industrial districts. The location of residential buildings, places of mass events and transport passenger facilities is within acceptable limits, but it affects the overall indicator of industrial safety negatively.

3. Natural factors (wind load, the possibility of earthquakes, fire danger, the possibility of volcanic eruptions) that depend directly on the region and for the Rostov region are optimal.

**General characteristics of the enterprise.** On the territory of the Rostov region, legal entities are the main owners of industrial production, which includes foundries. The presence of a compulsory insurance contract and a license in the field of industrial safety is strictly controlled for such enterprises. Compliance with all the requirements necessary for them significantly reduces the probability of potential negative consequences. The area of the territory and location of the foundry facilities must comply with both the technological process and industrial safety standards.

**Technical and technological characteristics of HPF.** The characteristic of HPF is formed depending on the following parameters:

1. The age of the object and the deprecation of both production assets and buildings and structures. Foundry production in the Rostov region started in the 1920s and has been modernized to the present day. The wear parameter is determined by the arithmetic mean of the years of commissioning, which corresponds averagely to the 1980-th year.

2. Quantitative characteristics of explosive, combustible and toxic substances, technical devices both tested and modernized.

3. Availability of technical solutions aimed at prevention of accidents and prevention of depressurization of equipment and pipelines. The presence of automatic control system, locks, alarms and other safety means. Hazardous production facilities of the Rostov region are equipped with all the above mentioned solutions and systems.

**Staff.** The level of training and competence of the staff is directly related to HPF safety. One of the main causes of emergencies is the human factor. The following conditions allow minimizing the influence of the human factor:

• sufficient number of certified industrial safety personnel for the last 5 years;

• a system for the training of personnel in case of emergency, the presence of special stands, training sessions and drills that significantly improve staff preparedness;

• compliance with the procedure for admission of personnel to independent work;

• availability of a system of professional training (advanced training) of personnel;

• provision of personal protective equipment for personnel;

• availability of local emergency alarm system.

Enterprise of the Rostov region observe these conditions, which is supported by the relevant materials in the reports of Rostekhnadzor.

**Units.** All HPF of the Rostov region with foundries include medical service, fire protection facilities, emergency rescue teams and organize non-professional emergency teams of the employees. Training sessions and training alarms allow them to control the degree of preparedness of these formations.

**Organization of production supervision.** Production supervision is an integral part of industrial safety. The main conditions of its implementation:

• availability of a plan of measures to ensure industrial safety;

• at least one inspection per year with corrective actions;

• availability of proposals to improve the quality of industrial safety;

• appointment of responsible employees and systematization of information on the organization and implementation of production supervision.

All these points are executed according to the regulations on production supervision on observance of requirements of industrial safety on dangerous production facilities developed individually for each HPF (foundry shop) according to the following documents:

1. Federal law no. 116-FZ of 21.07.1997 "On industrial safety of hazardous production facilities".

2. "Rules of organization and implementation of production supervision over compliance with the requirements of industrial safety at a hazardous production facility". Approved by the decree of the Gov-

ernment of the Russian Federation of 10.03.1999, no. 263, amended by resolutions of the Government of the Russian Federation of 01.02.2005 no. 49, of 21.06.2013 no. 526, 30.07.2014, no. 726).

3. "Procedure for technical investigation of the causes of accidents, incidents and cases of loss of industrial explosives at the facilities supervised by the Federal Service for Environmental, Technological and Atomic Supervision". Approved by order of Rostekhnadzor of 19.08.2011 no. 480, amended by order of Rostekhnadzor of 25.12.2014 no. 609.

**Rostekhnadzor inspections.** Rostekhnadzor inspections are conducted in accordance with the plan of scheduled inspections by the Federal Service for Environmental, Technological and Nuclear Supervision. The identified violations are eliminated, and the requirements are fulfilled in time and in full, which is confirmed by the lack of suspension of the activities of the HPF.

**Industrial safety expert review.** Expert reviews are carried out in accordance with article 13 of Federal law "On industrial safety of hazardous production facilities" of 21.07.1997 no 116-FZ amended on 29.07.2018. Information from the Register of expert opinions on industrial safety are freely available on the website of the Federal Service for Environmental, Technological and Nuclear Supervision http://sevkav.gosnadzor.ru.

**Material and financial resources.** Availability of material and financial resources for localization and elimination of consequences of accidents is confirmed by the corresponding orders issued at the enterprises of the Rostov region, which include HPF (foundries).

**Fire hazard of the facility.** The presence of hand fire extinguishing means and automatic fire alarm systems are mandatory. They are formed according to the specifics and equipment of the foundry.

**Prevention of outside interference.** For HPF, the availability of technical means of protection and unarmed security is a prerequisite for reducing the impact of the human factor on technological processes, a condition for limiting access and the terrorist threat.

**Accidents and injuries.** According to the annual reports on the activities of the Federal Service for Environmental, Technological and Nuclear Supervision at metallurgical and coke and by-product process facilities, which include HPF (foundries), the Rostov region is not included in the distribution statistics of accidents and emergencies [1].

**Calculation of accident risk.** The calculation is carried out individually for a HPF (foundry) on the following parameters:

- value of tangible risk;
- material damage for the maximum possible accident;
- humanitarian risk indicator;
- frequency of occurrence of the maximum possible accident;
- number of deaths and injuries among workers and other persons for the maximum possible accident.

**Conclusion.** The result of the application of the technique is to obtain a risk-oriented integrated indicator of industrial safety, which characterizes the level of accident risk on the HPF, equal to an average of 2.69 on a 3-point scale [2].

The results show that the state of industrial safety of hazardous production facilities (foundries) of the Rostov region can be generally characterized as "excellent". Nevertheless, it is worth paying attention to the prevention of violations of the technological process and increasing the level of production supervision, the main causes of accidents and emergencies in other regions of the Russian Federation.

**References**

1. Godovoy otchet o deyatel’nosti federal’noy sluzhby po ekologicheskomu, tekhnologicheskomu i atomnomu andzoru. [Annual report on the activities of the Federal Service for Environmental, Technological and Nuclear Supervision.] Federal’naya sluzhba po ekologicheskomu, tekhnologicheskomu i

atomnomu andzoru. [Federal Service for Environmental, Technological and Nuclear Supervision.] Available at: http://www.gosnadzor.ru/public/annual_reports/ (accessed: 11.04.2019) (in Russian).

2. Kal'kulyator integral'nogo pokazatelya promyshlennoy bezopasnosti. [Calculator of the industrial safety integrated indicator.] Gruppa kompaniy "Promyshlennaya bezopasnost'" [Group of companies "Industrial safety".] Available at: https://www.safety.ru/danger-analyse/ (accessed: 11.04.2019) (in Russian).

***Autors:***

***Zhokhov Roman Valerevich,***
*postgraduate student "Operation of transport systems and logistics", Don State Technical University, (1, Gagarin sq., Rostov-on-Don, 344000, Russia),*
RomikZ@bk.ru

***Korotkiy Anatoliy Arkadyevich,***
*head of the Department "Operation of transport systems and logistics", Don State Technical University, (1, Gagarin sq., Rostov-on-Don, 344000, Russia), doctor of techn. sciences,*
korot@novoch.ru