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## Environmental safety systems in breadbaking efficiency analysis

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**Abstract.** The results of publications on the level of environmental safety of bakery production are summarized. The production potential of the baking industry is characterized. The components of ensuring environmental and technosphere safety of baking enterprises in the city of Orenburg are highlighted. It is concluded that the wide introduction of the best available technologies is the main way to enhance environmental and technosphere safety of the bakeries of the Russian Federation.

### 1. Introduction

Since bakery products in the Russian Federation are most staple, traditional, affordable, everyday foods, improving their nutritional value and quality, developing health-promoting functional and enriched products contributes to the implementation of the most important state concept of healthy nutrition of the country's population [1, 2].

There are about 18 thousand enterprises in the baking industry in the Russian Federation, half of which are small, and the other half are large and medium-sized enterprises.

One of the features of the baking industry is the concentration of production capacities at large enterprises and, at the same time, the presence of a large number of small enterprises of various forms of ownership [3].

The segmentation of the bakery industry is as follows: large bakeries deliver about 71% of the total volume; bakeries in supermarkets –14% (there is a tendency to increase to 20% by 2018); small bakeries contribute 12% (with a growth trend to 16% by 2018) and the rest account for 3% [4].

The Russian bakery industry still has a production potential that is sufficient to fully satisfy the demand of the population.

With a total production volume of about 7 million tons / year, there is a steady downward trend of 1-1.5%. The budget of all levels annually receives 27-30 billion rubles tax deductions.

However, a number of problems that need to be addressed have accumulated in baking industry [5]. For example, they do not use new design and technological developments of import-substituting orientation, which results in a significant reduction in energy consumption and an improvement in the parameters of technological processes [5].



The author [6] suggests possible directions for the development of the baking industry and increasing the competitiveness of baking enterprises based on an analysis of their activities.

However, no generalizing works on the declared topic have been published yet.

## **2. Analytical part**

Flour milling and bread baking are fire-hazardous and explosive industries, due to the flammable properties of the substances used, the nature of the processes, the conditions for the occurrence and spread of the fire.

Grain and flour – the main types of raw materials at baked goods factory – are highly flammable. Therefore, the main task is to increase the environmental and technosphere safety of the baking industry by timely removal of flour dust from the workshops [7].

The industrial safety of bakery products (grain storage, flour milling, cereals, animal feed, baking, etc.) containing hazardous production facilities for storing and processing plant materials, depends a lot on the operating conditions and the technical condition of the transport and technological equipment.

This is especially important for equipment with an expired service life, which is still in large numbers operated at enterprises established in the 90s or during the Soviet period. Such equipment is not only physically and morally outdated, but often does not fully comply with current industrial safety requirements.

Modernizing this equipment is slow and cost-intensive, and it is not allowed by Rostekhnadzor standards to expose equipment with an expired service life without performing work to extend its safe use period [8].

When examining outdated equipment, there are the following difficult issues [8]:

- lack of information on the equipment use history (i.e. replacements and repairs carried out, accidents involving objects of expertise occurred, consequences and results of the elimination of accidents, regular and preventive maintenance);
- non-compliance with Rostekhnadzor requirements, or lack of operational documentation (revision or restoration of documentation is necessary);
- the general technical condition of the equipment is not always satisfactory (due to the lack of quality regular maintenance);
- the equipment does not fully comply with applicable Federal norms and rules of industrial safety, including installing safety devices on the equipment, which requires a certain amount of time and money;
- defects discovered during the examination with technical diagnostics of equipment, without removal of which a conclusion about the industrial safety of the equipment and the possibility of increasing the period of its safe operation cannot be made [8].

In [9], the composition of raw materials and wastewater pollution of enterprises of bread and baking pasta industry was studied and the results of the development of an effective effluents treatment technology that meet the requirements of wastewater intake into the city's sewage system, taking into account the productivity of the enterprise, the production process, the existing sewage system and specifics of the region.

The main requirement for technological processes is to fully ensure environmental safety. This can be achieved by using the best available technologies, i.e. production technologies characterized by the achieved level of modern science and technology and the best combination of criteria for achieving environmental protection goals, provided that they are technically feasible.

The best available technologies are the most advanced and effective stage in the development of production activities and methods of operating facilities that indicate the practical value of specific technologies for creating a base with the aim of determining emission limit values designed to eliminate or, if it is practically impossible to achieve, reduce emissions and influence the environment [10, p. 5].

Environmental safety of an enterprise is understood as a high degree of safety of personnel and the technosphere within the territory, natural and artificial ecosystems, and the population in the adjacent territory [11].

The terms “environmental safety” and “technosphere safety” are related and interdependent through the safety of the population and technosphere objects.

According to the authors of the study guide [12, p. 8], the environmental safety of enterprises and industries implies the combined states, processes and actions of enterprises and industries that ensure the ecological balance in the environment and do not cause vital damage (or the threat of such damage) to nature and man.

Based on the analysis of statistical data, the directions of development of the Russian baking industry and the level of its impact on the ecological environment (EE) were determined in [13].

Based on statistical data on industries in the Russian Federation, and taking into account that the baking industry accounts for no more than 10% in the food industry output, the contribution to the pollution of the EE by the baking enterprises was calculated. It amounted to no more than 0.07%, respectively, for emissions and waste, and no more than 0.018% for discharges of contaminated wastewater.

In principle, due to the small amount of waste generated at the enterprises of the baking industry, they can be attributed to industries with low-waste technologies [13].

An assessment of the impact of bakeries in Orenburg on the EE using the environmental criterion (EC) was carried out in [14].

The EC share of solid waste in the baking enterprises is 3.3–3.5%, and sewage pollution accounts for 20–40%. Air emissions have the most significant impact - 54-70%.

It was revealed that the baking process (60.65% of the hazard category of pollutants), which occurs simultaneously with gas and heat emissions, is the main anthropogenic factor that affects EE [14] in the work of bakeries.

The article [15] examines the competitiveness of bakeries in Orenburg and identifies the best facilities for introducing an environmental management system, as well as suggests measures to reduce the environmental risk of bakery production.

The subject of environmental management is the management of modern production, ensuring the coordination of high production efficiency with the rational use of natural resources, the effective protection of the ecological environment and the natural surroundings [16].

Moreover, the concept of “environmental management” is part of the concept of “environmental safety”, and the environmental management system is included in the environmental safety system as a whole at the level of the subsystem of management decisions [17].

It is significant for the baking enterprises, which are, in general, not extremely dangerous from the point of view of environmental impact, to determine the stages of production that use the maximum amount of raw materials and energy that have a negative impact on nature. Challenges requiring resolution are methods of saving resources and ways to reduce the harmful effects of production processes [15].

Using the main provisions of management theory and the recommendations of ISO 14004, the components of ensuring the environmental and technosphere safety of baking industry enterprises were identified, for example:

- assessment of the negative impact of certain stages of production, with the identification of the most dangerous ones. Such work allows the most efficient use of enterprise resources, limiting the impact on particularly problematic areas;
- establishment of emergency forecasts. Using mathematical models of technological stages, it is possible to make forecasts of critical loads and emergency situations and develop measures to eliminate them even before they appear [15].

Based on the study, and taking into account the industry-specific features of environmental pollution, there is an intention to prepare a system for assessing the performance of environmental activities and its results. There is also a need for an environmental monitoring system.

These developments end with specific methodological materials for calculating limits for waste disposal, maximum permissible emissions and discharges of pollutants used to calculate the maximum admissible discharge (MAD) of the industry, instrumental control of various factors, on the territory of the enterprise, and on the borders of its sanitary protection zone.

Innovations in this area are aimed at creating a methodology for a systematic and structured solution to environmental problems, moving away from spontaneous actions and, ultimately, strengthening the economy of bakeries [18].

Thus, according to the authors, the main way to increase the degree of environmental safety of the bakeries of the Russian Federation is the widespread introduction of the best available technologies.

One of the central problems is the development of theoretical and methodological foundations for ensuring environmental and technosphere safety at the enterprises of the baking industry.

### 3. Conclusion

The results of the main publications on the level of environmental safety of the baking industry have been reviewed, and its production potential has been characterized.

Attention is focused on the adjacency and interdependence of the concepts of “environmental safety” and “technosphere security” through the protection of the population and territories.

The emphasis is placed on the components of ensuring environmental and technosphere safety of baking enterprises in the city of Orenburg.

It is emphasized that the best available technology acceptance is a promising way to increase the degree of environmental and technosphere safety in the baking industry of the Russian Federation.

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