

## Analysis of objects food industry dangers and estimation of risks origin on them emergency situations

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**Abstract.** *The development of science and technology in general increases the safety of human life, but along with this leads to a set of new dangers, a significant increase of the risks of injury and death. The main causes of injury or death among production staff and the population living near industrial plants is possible explosions and fires and their consequences - the destruction and damage of buildings and structures, machinery and equipment, damage of communication lines, power lines and communication structures.*

*At present the probability of extraordinary technogenic situations in Ukraine is a steady upward trend. This is primarily due to deterioration of public danger in general and in particular of the working environment, due to the obsolescence of fixed assets, poor work discipline and insufficient skills of engineer specialists.*

*Technical disasters (emergency situations) in the food industry, such as emissions of hazardous chemicals, explosions, fires, etc. are the main causes of economic losses and deterioration of ecological environment.*

**Keywords:** *safety, safe, work, environment, conditions.*

### INTRODUCTION

In recent years there has been widespread acknowledgement of the significance of managerial and organizational failures in the causation of accidents. Assess the contribution of safety management in achieving the ultimate goal of creating a safe working environment at the present stage of development of management theory and practice relevant forces and means there is enough challenge. The activities and processes involved in managing safety have come under increasing scrutiny via the development of approaches for safety management and safety culture assessment.

It is known that the process control system and safety management as an organizational and technical basis of this process is influenced by many factors. Quantify this impact can only with the system parameters. These indicators comprehensively describe functioning safety management system and criteria concerning the level of efficiency of operation.

### RESEARCH METHODS

A comparison of quantitative and qualitative methods of hazard analysis objects of food industry and risks of accidents on them (emergency situations).

Was analyzed the law of Ukraine:

1. About objects of increased risk. About the objects of high danger. Law of Ukraine № 2245-III, 18.01. 2001.
2. About basic principles of state supervision (control) in the field of economic activity. Law of Ukraine № 877-V, of 05.04.2007.
3. On approval, "Methods of risks and their acceptable levels for declaring security of high risk". Order of the Ministry of Labor and Social Policy of Ukraine № 637 from 04.12. , 2002.

### RESULTS AND DISCUSSION

Therefore, the issue of analysis and risk assessment of emergency situations on the enterprises of food industry, depending on the specific operation, their practical application in developing documentation that defines the limits of danger of the objects to make informed decisions for its reduction, prevention of emergencies and timely responses as they occur today is important.

Analysis of the conditions and factors that determine the degree of risk on enterprises of the food industry, found that the most prone to accidents and emergencies, with the emergence of explosions and fires, it is on which the process can be created by increasing the level of dust (indoors or devices, connected associated with the storage and preparation of flour, sugar and raw materials), gassed (in bakeries halls flue outlets, boiler), explosion-hazard in connection with the use of gas as fuel, aerosols, ammonia compressors in refrigeration, as well as equipment that operate under pressure, including boilers and exchangers. These industries include companies that specialize in working with grain and products of his processing and production of bread and bakery products.

Expertise of project documentation on security of such explosive objects identified common errors and difficulties associated with the calculation of explosive processes that determine the mass release of hazardous substances, weight substances that are involved in the explosions, description criteria of destruction and otherwise.

Overall assessment of the risk of accidents in the food industry includes the organization and execution of the following tasks:

Identify and justify the purpose and objectives of the risk of origin analysis of emergency situations;

Analysis of the specific technological requirements of the enterprise;

Identify possible sources of danger;

Definition of the events that can cause emergency situations;

- Identify possible striking factors that occur during emergency situations;

Assessment of the likelihood of accidents;

Development and exploration of possible scenarios of possible emergency situations;

Forecast the likely magnitude and consequences of emergency situations in various scenarios;

Calculation of the risk of accidents and a decision on its admissibility;

Identify measures to reduce the risks of accidents in case of exceeding the acceptable level;

Development of statements regarding enterprise security;

Development of measures to prevent accidents on the enterprise.

In the main activities of the secure functionality of the enterprises food industry should be considered: administrative, organizational, engineering, regime-restrictive measures, identification of relevant facilities, development of emergency response plans, management of replacement manufacturing equipment and compliance technological requirements, review and audit of the functioning of the company.

For analysis and assessment risk of emergency situations at the enterprise origins, it can be stated that this step is extremely important link in the security management function of production. It is searching unaccounted hazards determined the probability of their occurrence, evaluated possible magnitude and consequences

Calculations of risk of origin of emergency situations and his analysis are subsoil for development of measures on safety of functioning of enterprise.

The conducted analysis of existent methods of estimation of risk of origin of emergency situations allows drawing conclusion that in different sources a term "risk" is explained on different.

So in [1], the "risk - the probability of a negative event that can happen at a certain time or under certain circumstances at the hazardous site and (or) outside it". This definition makes a probabilistic assessment of an emergency at the plant for a period of time and has the form:

$$P(A) = Q(A) \quad (1)$$

where  $P(A)$  - risk event  $A$ ;  $Q(A)$  - the probability of the event  $A$ .

Analyzing this interpretation of the term "risk" can be argued that it does not provide quantitative assessment to determine possible losses due to occurrence of event  $A$ .

In [2, 3, 4] the term "risk" is interpreted as follows: "the risk of an accident - a measure of dangerous, which describes the potential for accidents at hazardous production facilities and the severity of its consequences." Then to the magnitude of risk (P) of the expression:

$$P(A) = Q(A) * \gamma(A) \quad (2)$$

where P (A) - risk event A; Q (A) - the probability of event A;  $\gamma$  (A) - the probability value of the possible consequences of an event A.

Thus Q (A) numerically expresses the extent possible occurrence of event A, the probability value of the possible consequences of  $\gamma$  (A) depends not only on expected losses, but also on the degree of stability of the object, i.e.

$$\gamma(A) = S(A) * Z(A) \quad (3)$$

where  $\gamma$  (A) - the probability value of the possible consequences of an event A; S (A) - the resistance of an object to event A; Z (A) - conditional loss of event A.

Thus we have a model to determine the risk:

$$P(A) = Q(A) * S(A) * Z(A) \quad (4)$$

P (A) - risk event A;

Q (A) - the probability of event A; S (A) - the resistance of an object to event A; Z (A) - conditional loss of event A.

However, its practical application in a particular case requires additional studies, such as determining criteria, the essence of which lies in the combination of hazards that may occur under certain conditions and cause of accidents on the appropriate object. In this case, the probability of complex hazards will be determined as the product of the probabilities of joint events and possible losses as a result of thorough research for eliminated areas.

For the analysis of risk objects food industry and risk of accidents they are commonly used as a quantitative and qualitative methods of analysis. Thus the most common methods of qualitative analysis is to analyze the types, effects and criticality of failures, which is very effective for analyzing hazards technological requirements of different enterprises, as well as the method of types of failures and their consequences.

To quantify the probability of occurrence of accidents in the food industry use methods which are based on modeling of random events and the development of possible emergency situations.

To estimate the losses that can be caused by negative events using deterministic methods.

Integrated use of the above methods can calculate the value of the risk of accidents at the sites of the food industry with a sufficiently high level of reliability.

The most common methods of quantitative risk assessment of emergency situations at the sites of the food industry are logical - probabilistic and statistical methods of processing information about the accident technological equipment of the undertaking.

Statistical methods are used with minimal assumptions, but they require large amounts of statistical information.

Calculation of the risk of accidents may also be using the theory - the probabilistic method used to estimate frequency or probability of events with severe consequences in the absence of statistical information.

Qualitative method "tree of events" is used to construct the logical structure of the possible scenarios of adverse events and estimate their probabilities of occurrence. Using this method, we can determine ways of accidents that make the largest contribution to the risk due to their high probability or major consequences.

The method "Tree of Failure" is that originally considered some dangerous event, which is defined as the main and associated with numerous basic events and logical operators over them. Thus, if each of the identified individual adverse events characterized by probability  $Q_i$ , then the probability of critical events  $Q_k$  will look like:

$$Q_k = 1 - \prod_{i=1}^n (1 - Q_i) \quad (5)$$

Analysis of the risk of accidents in the food industry is to ensure the organization and implementation of risk management, development and grounding precautions.

As a precautionary safety measures that should be implemented in the enterprise may be the replacement of hazardous materials and substances used in the technological process on a less threatening, reducing inventories of hazardous substances and materials, ensuring safe spatial indices between departments of enterprise application systems for early detection emergency situations; compliance with established norms, standards and technical regulations; timely development, approval and adoption of plans eliminate accidents (accidents) the identification of high-risk and their declaration if necessary.

### CONCLUSIONS

Thus the analysis of the risk of accidents in the food industry, the development and implementation of measures to prevent them requires considerable effort and cost, which is the reason for the decline of profitability on a certain time, but early resolution of these issues can eliminate existing contradictions and ensure effective operation of the enterprise and its further development.

Integrated application of risk assessment of emergency situations in the food industry can develop and justify effective measures to improve the safety of their operation.

### REFERENCES

- [1] Alexander Fekete (2012), Safety and security target levels: Opportunities and challenges for risk management and risk communication. *International Journal of Disaster Risk Reduction*. Volume 2. Pp. 67-76.
- [2] Hivrich O., Volodchenkova N. (2012) Modeling spatio-temporal development (evolution) risk of destruction of hazardous industrial facilities in emergencies. *Food industry*. № 13. Pp.140-145.
- [3] Marvin Rausand, Ingrid Bouwer Utne (2009). Product safety – Principles and practices in a life cycle perspective. *Safety Science*, Vo 47, Issue 7, Pp. 939-947.
- [4] F.K. Crawley. Optimizing the Life Cycle Safety, Health and Environment Impact of New Projects (2004) *Process Safety and Environmental Protection*, Vol. 82, Is. 6, Pp. 438-445

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