Planning of elimination of emergency consequences

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Abstract

Introduction. The volume of useful information in the planning of elimination of emergency consequences process is reasonable to assess with calculatory problems and mathematical models.

Materials and methods. The expert survey method is used to calculate quantitative values of probability and to determine the optimal solution before the information in condition is received.

Results. It is determined that the quality of the solution of elimination emergency consequences depends primarily on the number of factors that are taken into account in particular circumstances of the situation; on the level of information readiness of control bodies to take decision to eliminate emergency consequences as soon as possible and to consider several options for achieving reasonableness and concreteness of a particular decision.

The ratio between volume of useful information collected and processed during operation planning which is required for identifying optimal solution is calculated. This ratio allows to construct a graph of probability of identifying a solution in existing environment and probability value of identifying optimal solution before information in P*condition is obtained.

This graph also shows the ratio volume of useful information collected and processed during operation planning and necessary volume of information for identifying optimal solution.

Conclusion. The results of this research can be used for improving control bodies decisions to ensure safe working conditions for employees of food industry.

Introduction

The qualitative and operational work of control bodies during the planning of elimination of emergency consequences significantly depends on the completeness and usefulness of the information that will be used for management decisions. In order to control bodies could react timely and adequately to changes in environment and make reasonable decisions and develop plans, the process of obtaining necessary information during informational support must be continuous.

Completeness and usefulness of information is a the main objective of the phase of identifying the decision of planning of elimination of emergency consequences, this decision must fully meet the requirements of the existing situation and depend on completeness and usefulness of information collected and processed by the control bodies during its definition.

Some scientists in there works on planning of elimination of emergency consequences [1, 2, 3] paid enough attention to investigation of completeness and usefulness of information. But, proposed methods do not fully take into account wide introduction of new automation devices and this significantly affects the process of obtaining and processing of information.

In the article the method of assessing volume of useful information during the process of planning of elimination of emergency consequences, based on application of calculatory problems and mathematical models is proposed. From the functional point of view, the system of analytical data processing and mathematical modeling is closely connected with the subsystem of system analysis and making proposals. During the process of designing elements for decision making support in emergency situations the universal approach is used, that allows to bringing together both subsystems from viewpoint of the used software-tools and methodological support. In this connection we could claim that the system of analytical data processing and mathematical modeling, analysis and presentation of information and analytical materials fully solve all tasks during emergency situations.

Materials and methods

The developed method of assessing volume of useful information in the planning of elimination of emergency consequences, based on application of calculatory problems and mathematical models is used. During the process of designing elements for decision making support in emergency situations the universal approach is used, that allows to bringing together both subsystems from viewpoint of the used software-tools and methodological support. System of analytical data processing and mathematical modeling, analysis and presentation of information and analytical materials fully solve all tasks during emergency situations.

Currently to solution of similar problems, especially when analyzing large data volumes, it is impossible without the use of new information technologies, such as OLAP (online analytical processing) and Data Mining (data mining methods), which significantly increase the efficiency and effectiveness of the analytical information processing, that's why implementation of elements of support of control bodies decision in emergency situations is based on development of support data warehousing (Data Warehouse), and also on use of OLAP technology and Data Mining.

The method of survey experts was used to calculate the quantitative value of probability for identifying the optimal solution before information in (P*) condition is received. It is the practice to express [3] the probability of identifying optimal solution

before information is received during planning of elimination of emergency consequences as $P^* = 0,46$ according to experts. Certainly, the level of training of control bodies that make a decision, practical experience in performing duties of the position, psychological stability etc. influence greatly on this value.

Results and discussion

To make a decision of planning of elimination of emergency consequences is a creative and responsible task. The essence of this task from the perspective of cybernetics, can be defined as conversion of information in quantitative components, parameters of information control, and a creative side of identifying decision, can by defined as production of complete information cadastre and its assessment.

To solve this task control bodies need required volume of useful information, and the correctness of conclusions in assessment of a situation, timeliness and validity of the decision planning of elimination of emergency consequences will depend on this information. That is, the volume of useful information is a function of completeness and usefulness of information used by control bodies.

$$R_i = f(Q_i, C_i) \quad (1)$$

R_i - volume of useful information;
Q_i - completeness of information;
C_i - usefulness of information for control bodies during planning of elimination of emergency consequences.

According to equation 1 volume of useful information can be expressed in terms of increase in probability of achieving a goal. If before information is obtained this probability is (P^*), i.e., the decision could be defined as rational or irrational, and after information is obtained it has become – P, so volume of useful information can be defined as:

$$R_i = log_2(P/P^*), \text{ where } 0 < P^* < 0,5 \quad (2)$$

If before information is obtained the decision can be determined by one of two variants of $P^* = 0,5$, then after obtaining certain volume of useful information a variety of options appear, part of these options lead to a goal and others don't lead. Probability of achieving a goal after obtaining information can be equal P*, more or less than P* and it depends on relative fraction of one or other variants. In other words obtained information in some volume can be useful, neutral or harmful (misinformation).

We can state that the best solution in the existing environment must include information about all the factors which affect this solution.

It is important to know how to calculate the required volume of useful information for obtaining the optimal solution. To identify the optimal solution it is necessary to solve a certain number of calculatory problems and mathematical models, which take in account maximum number of factors (ideally all of them) that will influence performance of tasks of elimination of emergency consequences.

Based on the results of previous studies volume of useful information can be calculated as follows:

$$I = \frac{\sum_{i=1}^{N_1} N_i^{із} \cdot K_i^{із} + \sum_{i=1}^{N_2} N_i^{рз} \cdot K_i^{рз} + \sum_{i=1}^{N_3} N_i^{мм} \cdot K_i^{мм}}{\sum_{i=1}^{M_1} N_i^{із} \cdot K_i^{із} + \sum_{i=1}^{M_2} N_i^{рз} \cdot K_i^{рз} + \sum_{i=1}^{M_3} N_i^{мм} \cdot K_i^{мм}} \quad (3)$$

$N_i^{із}$ - information problems, which control bodies use in process of making decision;

$N_i^{рз}$ - calculatory tasks which the control bodies use in process of making decision;

$N_i^{мм}$ - mathematical models which use controls bodies use in process of making decision

N_1- number of information problems, which can be solved by control bodies in process of making decision depending on volume of useful information;

N_2- number of calculatory problems, which can be solved by control bodies in process of making decision depending on volume of useful information;

N_3- number of mathematical models, which can be solved by control bodies in process of making decision depending on volume of useful information;

M_1- number of information problems, which control bodies must solve in the process of making decision;

M_2- number of calculatory problems, which control bodies must solve in the process of making decision;

M_3- number of mathematical models, which control bodies must solve in the process of making decision;

$K_i^{із}$ - coefficient of comparative importance of information problems;

$K_i^{рз}$ - coefficient of comparative importance of calculatory problems;

$K_i^{мм}$ - coefficient of comparative importance of mathematical models.

But there is no sufficient statistics on control bodies activity in solving control at the stage of planning of elimination of emergency consequences. So, we propose to determine quantitative value P * by expert survey.

The proposed approach to assess the completeness of information supply is not unique, and from a logical point of view is the most suitable for assessing of information support of operation that meets requirements of completeness of information and its usefulness.

The method of experts survey is used to calculate quantitative value of probability of identifying the optimal solution before information *(P*)* is received. We can state [3], that the probability of identifying the optimal solution before information is received during elimination of emergency consequences, according to experts P * = 0,46. Certainly, such factors will have a significant impact on the value as: the level of training of control bodies that make a decision; practical experience in performing the duties of a position, psychological stability, etc.

The most appropriate ways to enhance the probability of identifying the optimal solution before information is received are:

- to increase the level of training of control bodies;
- to improve practical skills in duties of a position;
- improve regulatory framework of elimination of the consequences of emergency situations;

- create database and knowledge data base that would be used in identifying the optimal solution.

According to equation (3) calculated the ratio of volume of useful information, which is collected and processed during the planning of the operation required for making a solution is calculated. The ratio between volume of useful information collected and processed during operation planning which is required for identifying optimal solution is calculated. This ratio allows to construct a graph of probability of identifying a solution in existing environment (P) and probability value of identifying optimal solution before information in P*condition is obtained.

This graph also shows the ratio volume of useful information collected and processed during operation planning and necessary volume of information for identifying optimal solution *(I)* (fig. 1).

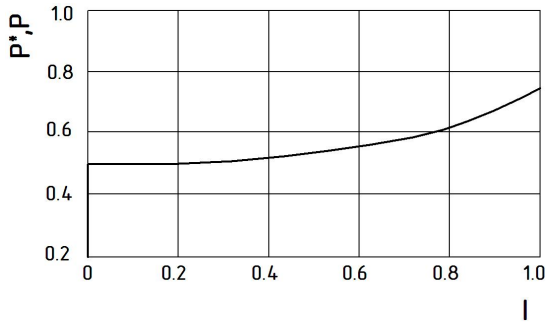

Fig. 1. The ratio of probability of identifying a solution that corresponds the situation to probability of determining the optimal solution before information is received and volume of useful information

The existing control system does not allow to collect centralized information. That is, the analysis shows that there is no possibility to connect informational support of planning of elimination of emergency consequences with the organization of the system of control, besides conditions for forming general principles of information choice and nature of information sources are created. This leads to the selection of the organizational and functional structures, which have the most favorable information characteristics. Currently it is possible to achieve this only in conditions of a rigid centralization of information gathering.

The study of causes and circumstances of elimination of emergency consequences at the food industry enterprises will allow to develop sustainable and effective ways of preventing and reducing occurrence of emergency situations in this field. Thanks to this study it will be possible to determine the directions and recommendations for prevention emergency situations. It is a topical scientific task, related, first of all, to solving industrial problems.

Conclusion

The quality of the solution of elimination emergency consequences depends primarily on the number of factors that are taken into account in particular circumstances of the situation; on the level of information readiness of control bodies to take decision to eliminate emergency consequences as soon as possible and to consider several options for achieving reasonableness and concreteness of a particular decision.

Thus proposed approach allows to establish the ratio between the volume of useful information and probability of identifying solution that corresponds to the situation in received information.

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