

Organisation of technological safety of production on military industrial complex

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Abstract

The urgency of the major scientific problem of the research and development of scientific-methodical, information-analytical and software for monitoring and managing technogenic risks for electronic industry enterprises (EIE) is solved in the dissertation work, the goal and tasks of the research are determined, the main theoretical and practical results of the thesis are presented. The conceptual and terminological apparatus for monitoring and managing technogenic risks for EIE is formulated.

Keywords: model, method, technogenic safety, monitoring, electronic industry.

The analysis of problems, methods and means of ensuring technogenic safety of production at the enterprises of the electronic industry is carried out. Specific features of ensuring the safety of production processes and their results on EIE. The main of them include the following:

- the main investments in the electronic industry were made in the middle of the last century, while the safety of production processes and their results is largely determined by the depreciation of equipment;
- high concentration of personnel in production facilities EIE leads to a large number of casualties in accidents and incidents;
- the development of production technology with its constant intensification, as well as the presence of a large number of intermediate products, the properties of which have not been sufficiently studied;
- widespread use of harmful chemicals, hazardous production facilities, harmful and dangerous production factors, vehicles;
- EIE location, mainly in areas with a high degree of urbanization of the population, and the impact of accidents is either limited by boundaries, or locally manifested outside these enterprises without escalating into anthropogenic disasters;
- statistics on incidents and accidents are almost inaccessible for the synthesis of data and the dissemination of best practices in combating them, since most EIE are related to the defense industry complex.

The analysis of the main tasks and business processes of EIE, which are most susceptible to technogenic disturbances and technogenic emergencies (Figure 1) was carried out.

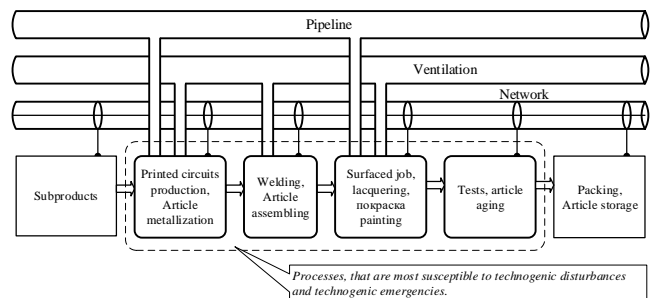


Fig. 1: Business processes of EIE, which are most susceptible to technogenic disturbances and technogenic emergencies

The activity of enterprises in the electronic industry related to ensuring technogenic safety has been analyzed, and the expediency of managing risks in the sphere of industrial safety, labor safety, fire and environmental safety of these enterprises is justified. [4, 5]

The classification of man-caused risks has been carried out and the analysis of the processes of monitoring and managing technogenic risks has been carried out. Information on the main methods of qualitative and quantitative risk assessment for EIE is summarized.

Based on the results of the analysis, the methods most focused on solving problems of identification, analysis and assessment of technogenic risks for EIE are defined: preliminary hazard analysis; analysis of the type and consequences of failures; criticality analysis of failures; risk analysis based on tree failure; risk analysis based on the event tree; risk assessment and analysis based on risk matrices.

A well-founded conclusion is made that the management of technogenic risks on EIE is realized under conditions of non-stochastic uncertainty, due to: incomplete information on the functioning of individual elements and subsystems, as well as the

complexity of assessing the probabilities (opportunities) of manifestation of technogenic risks; fuzzy descriptions of the states of objects, as well as input and output data, conditions of their functioning; limitation of resources for the assessment (identification, analysis and evaluation) of technogenic risks; expert nature of information on man-made risks. Therefore, to take into account non-stochastic uncertainty, it is justified to introduce vagueness into the description of technogenic risks, as well as the use for their evaluation of methods and models based on the theory of fuzzy sets, relations, fuzzy computations and fuzzy logic.

The analysis of information systems for monitoring and managing technogenic risks for EIE, including information systems, providing the collection of primary data on production processes, as well as information systems, for automation of enterprise management processes in general.

Information systems that collect primary data on production processes are usually classified as a Manufacturing Data Collection (MDC) system or a Supervisory Control and Data Acquisition (SCADA) system. A distinctive feature of such information systems is the ability to collect data directly from objects that have their own interfaces for data transmission, as well as from objects not equipped with such interfaces. [1-3]

The integration of equipment or several production sites into a single network of the technological process level is realized within the framework of technological processes automated control systems (ACS TP), which are developed taking into account the needs of a specific end customer: its infrastructure, process features, needs and capabilities. Often, software and hardware systems (platforms) are used to develop automated process control systems, including a set of libraries for docking with production equipment, sensors, sensors using exchange protocols, which have a modular scalable structure and provide the ability to customize for the needs of the customer. The information in the process control system can be received both from SCADA / MDC-systems, and from separate sensors / sensors. ACS TP is the "lower level" on which a complex system for ensuring technogenic security can be built.

Both the initial data on production processes and aggregated information are necessary information support for risk management processes at various levels of enterprise management. Automation of enterprise management processes in general is carried out using information systems of ERP (Enterprise Resource Planning), MES (Manufacturing Execution System), EAM (Enterprise Asset Management), BI (Business intelligence) and others.

The technogenic safety of EIE reflects the following peculiarities that arise in the complex automation of the processes of transmission, transformation and generalization of information in a single information space:

- a large amount of primary data, and, as a consequence, problems with efficient access to them, communication channels and storage systems, difficulties in administering integration processes;
- different (insufficient or excessive) granularity of primary data;
- necessity to support a large number of industrial protocols for access to data from equipment of various manufacturing companies;
- the possibility of distortion of the loss of the value of information as a result of its generalization to solve the tasks of risk management.

- not taking into account anthropogenic factors that significantly affect the technogenic safety of the whole enterprise.

The results of the conducted studies made it possible to define the concept of man-caused risk for EIE [4-5]. Technogenic risk for EIE is a combination of opportunities for the emergence and development of technogenic emergencies and their negative consequences for the enterprise and the environment, including as a result of man-made disruptions, as well as the potential for the occurrence of man-made disruptions and their direct consequences for the enterprise:

$$TR = \left(\bigoplus_{i=1}^N (P_{TH_i} * C_{TH_i}) \right) \oplus \left(\bigoplus_{j=1}^M (P_{TAC_j} * C_{TAC_j}) \right),$$

Where: TR – is the indicator of man-caused risk for EIE; P_{TH_i}, C_{TH_i} - the possibility and degree of consequences (damage) of the i-th technogenic violation, $i = 1, \dots, N$; P_{TAC_j}, C_{TAC_j} - possibility of occurrence and development and degree of consequences (damage) of an emergency situation of the j-th technogenic emergency situation, $j = 1, \dots, M$; "*" - an operation for assessing the combination of the possibility of anthropogenic disturbance (technogenic emergency) and its consequences, selected depending on the nature of the man-made disturbance (technogenic emergency) and types of variables; $(P_{TH_i} * C_{TH_i})$ - risk indicator of the i-th technogenic violation; $(P_{TAC_j} * C_{TAC_j})$ - risk indicator of the j-th technogenic emergency; $\bigoplus_{i=1}^N, \bigoplus_{j=1}^M, \oplus$ - operations of aggregation of risks of technogenic violations and technogenic emergency situations.

Conclusion.

The analysis of the basic business processes of the enterprises of the electronic industry, which are most susceptible to technogenic violations and technogenic emergency situations, is performed. For each of these processes, man-caused disruptions and technogenic emergency situations are characterized by sources, negative events and consequences from negative events.

The pragmatic problem of research consisting in maintenance of technogenic safety of manufacture at the enterprises of electronic branch is grounded, which means the state of security of production personnel, technical systems, production facilities of these enterprises and the environment from both technogenic disturbances and technogenic emergency situations in the course of production processes and by their results.

The analysis of the activity of enterprises of the electronic industry related to the provision of man-caused safety, including the provision of industrial safety, labor safety, fire and environmental safety was carried out.

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