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Scenario analysis of management processes in the prevention and the elimination of consequences of man-made disasters

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Abstract

The article represents the analysis of using the possibilities of the scenario analysis methods and modelling in the process of solving the planning and management problems of measures to ensure the man-made safety of a wide range of potentially dangerous production and infrastructure facilities.

The classification of emergency situations (ES) on potentially dangerous objects is given in terms of the readiness degree of the management system and technical services to eliminate the consequences of emergencies.

The main stages and technology of formation of scenarios for the development of man-made disasters and emergencies are considered. The processes of modelling and synthesis of alternative scenarios for the development of ES are proposed to be implemented using the theory of functional sign graphs. An example of practical use of the scenario analysis methodology in the process of solving the problem of management the consequences of emergencies in a land production facility (building) is given.

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Keywords: man-made safety; potentially dangerous object; emergency situation; planning; management; scenario analysis; simulation modelling; sign graphs; production facility

1. Introduction

The main features of the management processes of the prevention and elimination of the consequences of man-made disasters are that an emergency situation (emergencies) occurs and develops unexpectedly, suddenly. At the

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same time, countermeasures (measures to counteract the development of emergencies and eliminate its consequences) must be taken immediately and be as effective as possible. Therefore, new tasks arise before the control system, which are complicated by a powerful flow of incoming initial information. This information has to be studied and analyzed operatively.

The principal features of the processes of planning and managing the elimination of the consequences of man-made disasters and emergencies are [1, 2].

- partial predictability of serious problems and opportunities for their solution;
- partial predictability of the centers of the origin and development of emergencies;
- weak predictability of the scale and timing of emergencies;
- unpredictability of adverse events and situations caused by the appearance and character of emergencies (the presence of strategic surprises).

These conditions dictate the need to use planning and management methods based on foresight of problems, situations and events, making flexible emergency solutions that are oriented to the external environment of the system (the natural environment, the life support conditions of the population and the personnel of enterprises and organizations, the socio-political environment, etc.).

2. Scenario analysis of the management of disaster prevention and elimination of ES

Planning and management processes in emergency situations are closely related to the advanced scenario analysis and forecasting of alternative ways of their development. Consider the methodology of the analysis of man-made safety of a wide range of potentially dangerous objects, such as production, transport, energy, infrastructural facilities, industrial buildings, etc. For brevity we shall call them the complex technical objects (CTO).

The emergency situation at the CTO is defined as an unfavorable combination of factors and events that threaten the lives of people, which violate the conditions of their normal life.

An emergency situation is defined as the unintended program or state regulation of the CTO, their components and elements (production, energy, transport, equipment, technological processes, production facilities, maintenance personnel, etc.)

The analysis made it possible to develop a classification of ES in the CTO in order to solve a set of problems under consideration in terms of the readiness of the control system and technical services of the protected objects to eliminate the consequences of the occurrence of emergencies (Fig. 1)[1,3].

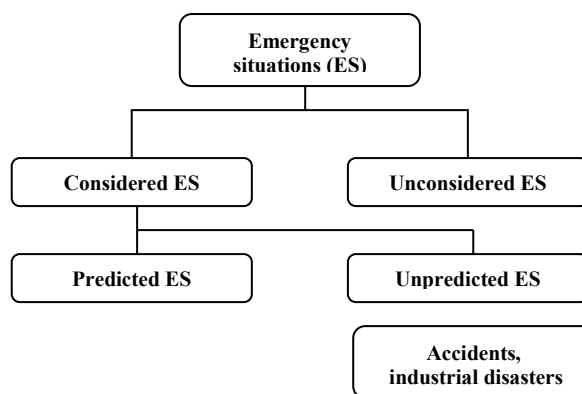


Fig. 1. Classification of emergency situations

Accidents, industrial disasters or other serious emergencies are defined as situations that result in the total or partial destruction of the CTO or its individual parts, as well as the threat of deterioration in the health or death of service personnel.

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