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# Information support for safety insurance of road transport of dangerous goods

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**Abstract.** In this article, the methods of system analysis are used to establish the presence of two open systems, one of which is intended for the carriage of dangerous goods by road and the other – for liquidation of consequences of accidents. It is established that in the case of a car accident with dangerous goods, part of the information necessary to make a decision on the elimination of the consequences of the accident is not available to the second system because only the first system that carries out the transportation has access to it. The integration of these systems on the basis of new information and communication technologies ensures the emergence of the developed system, eliminates the identified drawback and creates conditions for information support management.

## 1. Introduction

An accident with dangerous goods can be characterized by a number of features: the location of the emergency; the type of damaging factors and consequences that threaten the life and health of people and pose a threat to the economy and the environment [1, 2].

An even more dangerous emergency occurs in a car accident with dangerous goods [3]. Firstly, such an emergency is characterized by uncertainty of the location of occurrence due to the movement of dangerous goods in time and space. Based on this, it should be expected that an emergency can occur both in places of large concentrations of people and vehicles and in completely deserted places during long-distance transportation [4].

Secondly, the peculiarity of this type of emergency is the threat of chain development of the accident with the release of damaging factors abroad the place of occurrence as a result of the release of a dangerous substance into the surrounding space or the spread of fire due to the ignition of combustible substances, etc. Taking all of the above into consideration, the scale of this emergency can reach up to the regional level.

The purpose of the article is to build a system of information support for the management of transportation of dangerous goods by road that would include existing systems based on new information and communication technologies [5–7].

## 2. Theoretical analysis

In accordance with the existing practice in the Russian Federation of transportation of dangerous goods by road transport, the transport company is obliged to: obtain a permit for the transportation of



dangerous goods; prepare the vehicle for transportation; teach the driver the rules of transportation and actions in case of emergency. At the same time, a system of dispatching services on duty (DSD) designed to eliminate emergencies including accidents with dangerous goods exists.

The decision to eliminate the consequences of a car accident with dangerous goods is based on information about the characteristics and quantity of the cargo, the location and time of the accident, weather conditions in the area of the accident. Analysis of the composition and sources of information allows to decompose it by time and location of its origin.

First component of information is regular information which is generated at the stage of preparation of dangerous goods for shipment, i.e. before the onset of the emergency. Its content is determined by the requirements of the guidance documents and is formed in the process of obtaining a transport company permit for the transport of dangerous goods and registration of accompanying documents.

The second component of the information is the operational information which is transmitted directly from the scene of the accident by the driver, if he is able to do it, or an eyewitness.

The third component is the calculated part. It is obtained in the process of evaluation calculations of the possible consequences of the accident to decide on the composition of forces and means to eliminate the damaging factors of the accident.

In the conditions of an emergency [8], the time factor in the vast majority of cases is crucial in making management decisions. Inconsistency and incompleteness, as well as sometimes a complete lack of information in the first minutes of emergency does not allow one to quickly make the required decision, appropriate to the circumstances. The main problem faced by the decision maker (DM) is the lack or complete lack of reliable information.

One of the possible ways to improve the level of safety of dangerous goods transportation by road is to create a software and hardware complex that would provide constant monitoring and notification of emergencies in real time. We define constant monitoring as the continuous monitoring of the movement of a vehicle with dangerous goods, monitoring the state of the "vehicle-cargo" system.

Constant monitoring [9, 10] would allow to assess the operational situation on the roads as well as the risks of possible emergencies on the road sections. This, in turn, will lead to the appropriate level of combat readiness of emergency services headquarters, to which certain sections of the roads would be assigned.

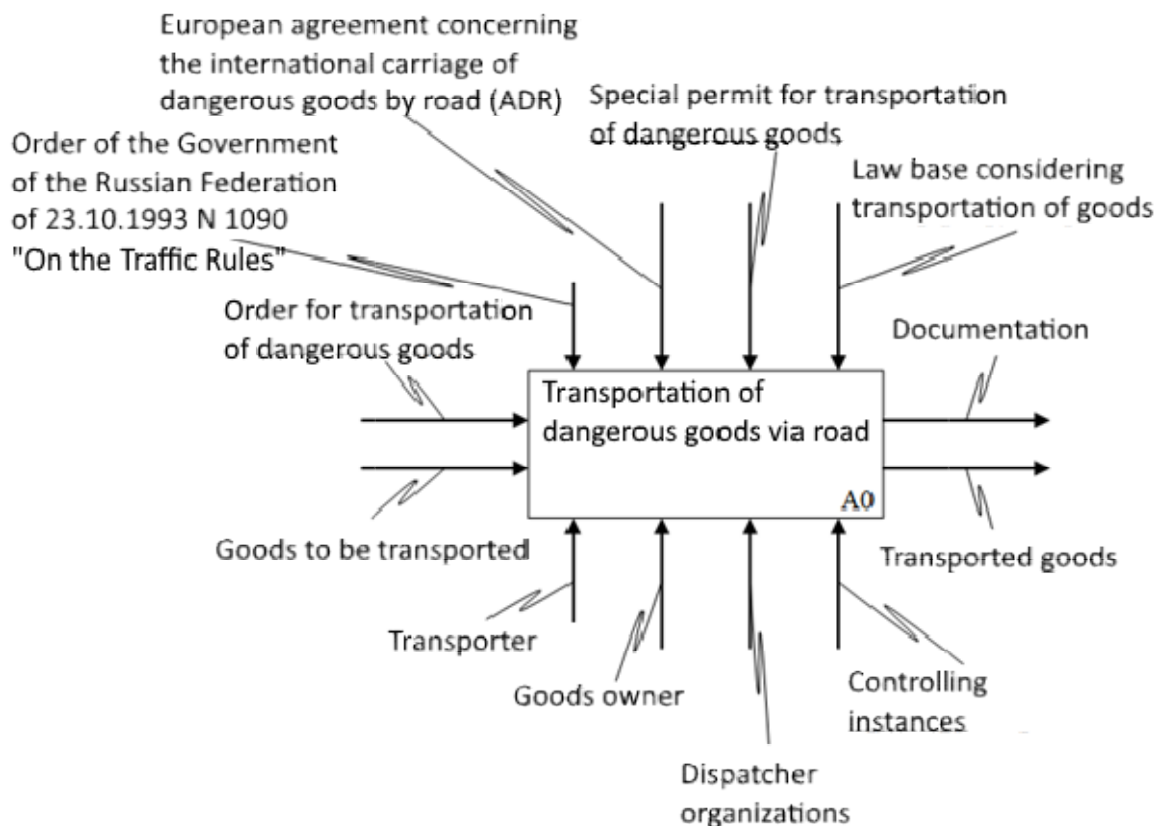
Any management is provided with information and analytical support [11], which include regulations, supporting documentation, reports, statistical data, etc. General control scheme of road transport of dangerous goods is represented in figure 1 as the IDEF0 functional model.

Organization of road transport can be divided into 5 main stages:

1. Preparation for transportation;
2. Development and coordination of transportation route;
3. Collection and registration of accompanying documentation;
4. Additional actions: cargo insurance, escort organization, etc.;
5. Delivery of the cargo.

The stage of preparation for transportation includes the following actions: the main parameters of the cargo being prepared for transportation (hazard class, quantity, dimensions, identification of the cargo according to the UN list) are established, the tank and the vehicle are selected and checked for their technical condition and the availability of the necessary safety equipment is checked. All information obtained at the stage of registration of the permit for the carriage of dangerous goods and filling in the accompanying documents is held by the dispatcher of the transport company and is not available to the person making the decision to eliminate the consequences of a car accident with dangerous goods. Elimination of this deficiency can be realized at introduction of system of electronic document flow taking into account differentiation of information access levels.

After the confirmation of the route and schedule of delivery of the goods, the next stage is carried out: the registration of the transport and accompanying documentation. At this stage, the most important thing in terms of obtaining operational information for emergency services in case of emergency are the following documents: bill of lading, waybill and the route of transportation of dangerous goods.



**Figure 1.** Functional model of organization of road transport of dangerous goods.

These documents contain information that can be used in information systems that provide control and monitoring of the safety of transportation of dangerous goods. Based on the analysis of these documents, a list of operational information is compiled.

Currently, there are no effective mechanisms for automatic transmission of operational information [12, 13] contained in the accompanying documents from the carriers to the dispatching services on duty. Information about the cargo and the location of the emergency can be transmitted by eyewitnesses or the driver, if he is not injured after the emergency. Thus, at present there is no communication system between a moving vehicle (truck) with dangerous goods and EMERCOM dispatching services on duty (DSD).

### 3. Practical realization

To implement the information transfer it is necessary to create a multi-level network system based on information and communication technologies [14]. Such a system is a Web-compatible integrated tool for access to search, collection and analysis of information that allows to process heterogeneous sets of text and graphic information more quickly. This system is called an electronic document management system (EDMS). A number of scientific publications have proved the improvement of management efficiency through the use of EDMS [15, 16].


In order to organize monitoring and security, the implementation of the EDMS in accordance with the proposed classification should be focused on supporting the management of the organization and the accumulation of information, as well as providing additional support for joint work. This in turn will ensure the performance of work by the staff of duty services even if they are geographically separated and the preservation of the results of this work. A web portal provides entering of information, control and provision [17] of it through the Internet networks on the communication channels protected from various types of attacks [18, 19].

The Web portal built according to the scheme of three-level architecture provides the necessary mode of differentiation of access to data, as well as the authority to fill and edit them using the application server. According to the set access policy, the application server provides a specific user interface for each category of users. In this case, the data entered by one category of users can be accessed by another in accordance with access rights.

#### 4. Conclusion

The proposed information support system for the management of the transport of dangerous goods by road developed on the basis of a systematic approach to the use of existing information based on the requirements of the guidance documents and the use of new information and communication technologies to ensure the transfer of information from the moving vehicle to the duty services.

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