

## STRATEGIC APPROACHES TO THE DISASTERS PREVENTION SYSTEM AND THE OPTIMIZATION OF DECISION MAKING IN RUSSIA

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### Abstract

They are considered strategic analysis and approaches to the raising of the safety level in complex systems in Russia. This paper pays attention the disasters prevention system and the optimization of decision making process in the contingences. This paper present a case study, concerning safety situation in the transportation sphere in Russia

**Keywords:** optimization, decision-making, emergency, prevention, mitigation, disasters

### Introduction

With the background of obvious successes in the sphere of safety in Russia during last decade certain negative tendencies are, nevertheless, evident that, if not checked, could adversely affect all the efforts aimed at the raising of the general safety level in the basic branches of the economy, in fact, the state of art in the safety activities of the whole society (The State Report of the Ministry, 2002).

The difficulties connected with the transition of the Soviet socio-economic system to the free market principles and the emergence of new conditions in Russia's national economy have resulted, *inter alia*, in important and all-pervading societal changes, including the safety sphere in general and the decision making in the emergences, in particular. In the course of the rapid "perestroika" an essential and considerable re-distribution of the state properties to the benefit of private companies and entrepreneurs have been taking place with appropriate acquisition of property rights (on large industrial complexes, especially). As a by-product, they have produced a considerable impact on the situation in the safety sphere. The general aim of the safety activities remains, of course, in essence the same, but particular emphases have significantly shifted.

Available information and data facilitate the identification of these negative trends and of various obstacles and means of their timely overcoming.

### The safety situation in Russia

Societal processes in Russia, extremely complicated as they now are, express themselves, directly or otherwise, in that they in many aspects negatively affect the state of safety of technological, societal and environmental systems. Partly, at least, this may be explained by the reluctance of new owners of industrial and other enterprises to allocate large investments into activities, like safety or labor protection, that do not yield "immediate" returns. Another reason might be the necessity of managers and operating personnel to "play according to new rules" (not always socially justified, fair or far-sighted), established by new proprietors. Rapid ageing (physical and moral) of technological processes and equipment, practically in all the branches

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of the economy, accompanied by the reduction of investments in the basic capital and technological innovations, may also be an important factor.

In the existing and still further complicating socio-economic conditions the **optimization** of the management practices and decision-making, in particular in the extreme situations, together with the disasters **prevention** approach and mitigation of negative consequences, have now become decisive methodological tasks, the solution of which could greatly improve the general safety situation in the country.

The realization of this strategic approach might be seen, first, in the modernization of the regulative and legislative systems, dealing with the safety problems, second, in the promotion of modern managerial methods and practices, and, third, in the centralization of governmental agencies dealing with the safety problems under the “umbrella” of a single super-agency (the ministry of emergencies) as main state instruments for both, the realization of the adopted strategic policies and the solution of tactical tasks in the safety sphere. Organization of comprehensive programs, formulation of approaches to resolve appearing problems and particular decisions in the frames of the accepted strategies, connected largely with emergency situations of a local character and significance became a second important function of this ministry.

From the end of 1980s the Russian government undertook several active measures to modernize, partly create anew, the legislative and managerial bases of the activities directed, in the first place, at the prevention of large catastrophes (in particular, of the Chernobyl type and scale) and industrial accidents. The modernization of the existing administrative and legal systems has since been acquiring speed, though it should be admitted, that these activities proceed with certain delays and overcoming various obstacles, of socio-economic character in particular.

Only in mid-90s two basic and comprehensive laws dealing with safety problems had been worked out and then approved by the “Duma” (one of the two houses of the Russian Federal Parliament) and signed by the President:

- “The protection of the population and territories against the emergences of the natural and technological character” (November 1994);
- “The emergency situations, rescue services and the status of the members of salvation teams” (June 1995).

Thus, the regulative and legislative foundation for the safety activities and protection of the population against the emergences has been laid and begun gradually to expand with the help of the President’s ukases and appropriate governmental decisions. Regional authorities and various governmental agencies dealing with safety problems also participated in this work, issuing various documents of normative and regulative character (circulars, instructions, particular regulations, etc.) (Vorobiev, 2000).

### **The national system of disasters prevention and mitigation of negative consequences in Russia**

The main result of all these organizational and managerial activities on the federal and regional levels has been the emergence of a comprehensive and specialized national **system** of the regulative and legal character – “The system of the prevention of natural and technological disasters and mitigation of their consequences”. The sphere of its application is wide – practically on all the levels of the safety activities, from national and regional, to local (municipal), and even particular (large) industrial complexes and plants, as well as engineering installations of various kinds.

Among the main directions of the activities in the frames of this system can be mentioned:



- Organizational decisions in the context of this system as a main national managerial instrument (8 laws);
- The measures directed at the perspective and aggregate planning with the aim to prevent emergency situations and increase the effectiveness of the safety activities on various levels;
- The improvement of the safety situation in important socio-economic and other processes, as well as the prevention of natural and technological disasters and various contingences (11 laws);
- The guidance of administrative activities on various levels, organization and modernization of firefighting, rescue and auxiliary services, instructions of appropriate teams members, accumulation of reserves and equipment as an integral part of the system's functioning and control over the population's readiness for the contingences (32 laws);
- The modernization of the communication and information networks and of the information distribution systems as an important part of the prevention of the emergences (3 laws)
- The expert assessment, monitoring of the work of various equipment and control over the realization of measures directed at the protection of the population of various regions in case of emergences and disasters (17 laws);
- Prognoses and assessment of probable negative socio-economic consequences of natural and technological disasters (4 laws);
- International cooperation and humanitarian assistance to the victims of disasters in foreign countries (one law) (Vorobiev, 2000).

This list makes it possible to estimate the importance of the whole system and the scale of its activities.

### **A case study: safety situation in the transportation sphere in Russia**

To illustrate and assess the scale, state and results of the research and practical safety activities in a particular branch of the national economy, and also to work out recommendations based on the practical experience, it is expedient to analyze the safety situation in the transportation sphere, as a most important sector of the economy.

Transport in general possesses practically all the specific features inherent in the safety activities. To stress the importance for Russia of the daily safe transportation of huge volumes of various goods (including dangerous materials) and millions of passengers and the connected difficulties, it is necessary to take into account, first, the territorial largeness of the country with unique lengths of railway and other transportation lines and, second, often harsh climatic conditions which greatly complicate the functioning of numerous and various transport systems.

It is, thus, comprehensible that the number of large accidents and other disasters, as statistical and other data confirm, has been lately, at least in some systems, generally on the increase due to the mentioned and some other, including socio-political, difficulties. Consequently, the necessity arises to take and realize urgent and comprehensive political and administrative decisions to minimize the possibilities of contingences. This, in turn, presupposes: first, the necessity of the re-assessment of the safety situation in particular branches of the economy, in this case transportation, and of general attitude to safety issues; second, necessity of considerable investments increase into the safety activities, third, perspective and far-reaching political and organizational decisions; and forth, the development and introduction on a wide scale of advanced managerial and organizational methods and instruments directed at the **prevention** of accidents or emergency situations. It means, in fact, if not the exclusion, then, at least, minimization of accidents, as one of the main purposes of research and everyday activities. The prevention principle in the transport sphere should be applied, in the first place, in the maritime and air transportation systems, taking into account technological specifics of



their employment, of environmental conditions, often lack of time necessary for organization of rapid relief and evacuation measures, when needed.

Safe transportation activities in Russia require not only the changes in the accepted approaches, but in too many a case radical reconsiderations of the measures already in wide use. For example, changes in the methods of the risk analysis and assessment in the rapidly alternating conditions (socio-political, economic and technological, in the first place), necessity to take into consideration of new factors, in particular, the effects of the innovative technologies, their rapid introduction and use, and also the interests of new participants and their role in the development of modern and complex transportation systems (like bullet-trains or supersonic planes). Speaking in general, a reconstruction of the whole transportation branch is now needed. Several measures have already been suggested, among them the creation of privately-owned private organizations dealing with the separate activities, like construction, or exploitation and maintenance of railways and other systems, etc.

In these conditions the **systems approach** to the solution of general and particular problems of the transportation safety not only confirms its validity, but in fact has become at present an organic component of the whole process of the branch reconstruction efforts, which include also the modernization of the auxiliary systems and their effective and reliable functioning.

### **Advanced technologies and their role in increasing transportation safety and reliability**

In the existing conditions in the country a growing number of complex problems, connected with the transport safety, could be successfully resolved only by means of introduction of advanced methods and means, in particular, information and communication technologies, into everyday practices. Modern managerial systems, decision support systems (DSS), and reliable communication networks guaranteeing correct transmission and understanding of the messages' contents on all the levels of the decision-making should be mentioned first.

**Informatization** in the transportation activities, like in all other branches of the national economy, opens new and wide possibilities for the practically immediate transmission of large volumes of various information and data, thus, securing the optimization of the decision-making and prevention of contingences of various kinds.

Recent collision of the Russian and American planes in the "clear" sky over the Switzerland with the loss of lives could serve as an example of the tragic consequences of operators' and pilots' mistakes, connected with the modern equipment improper use, however insignificant they might appear on the first sight. Linguistic misunderstanding between the pilot and operator or the collision between the international and national legal norms concerning the behavior of pilots in unusual situations may explain strange decisions in the seemingly simple situations. The paradox of this particular catastrophe is that it **in principle** should not have taken place!

Among important methods securing higher safety in the transportation sphere (and not only there!), the **optimization** of the decision-making processes, in the emergencies in particular, should named as the second. A special importance this method acquires for the choice of managing and operating personnel for the work where probabilities of extraordinary situations are very high and additional specific personal qualities, beside professional knowledge, are needed of the personnel: psychological stability and reliability, abilities for making rapid and rational decisions, especially when data necessary for taking them either insufficient or often absent, getting consultations or advise from outside is impossible. They often may become decisive factors in preventing large accidents or disasters.

The processes of wide automation and closely connected with it the **computerization** of the management practices proceed, unfortunately, with insufficient speed, accompanied by the unavailability of modern information systems, easing the decision making in contingences.



Although, it should be in fairness, added, that, for example, the use of the virtual reality (VR) technologies had been taking place first in the transportation sphere for the training of the personnel indulged in specific types of work (pilots, navigators, operators, etc). As the experience has already demonstrated, the VR-technologies could be effectively employed now for the improvement of the professional knowledge and qualification of managers and operating staff, or members of the rescue, firefighting or auxiliary teams (Britkov, 2002).

Prevention of the emergencies and accidents of any origin has become in Russia one of the most important directions in scientific activities oriented at the resolution of the problems connected at the safety situation in general. As a principle, the emergency situations prevention, should, to a greater degree, be applied to the *recurring* accidents and catastrophes, so characteristic of the transportation activities, usually forestalling or accompanying accidents with increasing rate of their rapid transformation into disasters. Thorough analysis of particular accidents makes it possible to develop specific algorithms for such events and higher efficiency of rescue, evacuation or other rescue methods.

Detection of the *systemic defects* should not be limited by normative considerations as a basis for the investigations of various transportation and other accidents. The emphasis should rather be made on the identification of all *possible and probable* causes and consequences of the disasters of the systems of particular type or class. This approach makes it possible to develop a number of appropriate scenarios, actually working *hypotheses* describing the process of the accident origin's causes or their transformations into disasters. In the course of the accident investigations the most appropriate and realistic ones might be chosen, placing at the analysts' disposal a unique instrument helping to raise not only the effectiveness of a particular investigated system, but also to promote the general safety level of complex technological, societal and other systems. A number of methods to connect general scenarios with the real circumstances of a particular accident have already been developed now that could promote the raising of safety of the systems of a particular *species* and make necessary changes in all the systems of this particular class.

## Conclusion

A number of appraisals and recommendations, managerial and organizational, are suggested here, which, the authors hope, could be of interest. Among them:

1. Despite the growing attention in Russia to the raising of the safety level of complex technological and other systems, a general trend can be noticed, which, if not checked, could result in further *increase* of **serious** accidents.
2. Existing methods of reactions to various accidents, in transport systems in particular, do not yet correspond to the complication processes in the majority of technological and socio-economic systems. There is a growing need for new methods of the **preventive** (pro-active) character and for more efficient actions in the safety sphere. Modernization in management practices, thorough investigations of serious transport and other accidents, wider employment of the risk analysis and assessment methods could considerably improve the current safety situation and to decrease general accidents rate in the country.
3. Employment of the innovative technologies (information and communication, in the first place) and new concepts and approaches to the modernization practices could guarantee the improvement of safety in majority of the complex systems. The concept of the **integrated** approach to safety would provide favorable conditions for the solution of numerous current and perspective tasks in safety activities (Rezer, 2002).
4. From the methodological point of view the conditions to optimize the investigations of transport accident seem to include the following:



- The broadening of the use of the **systems approach** in the emergency management and accidents investigation practices which have been acquiring a growing societal importance.
- The responsibilities of managers of every rank and level dealing with the safety issues in transportation and other branches should include the organization and realization of activities on various levels, directed at the exclusion of the repetition of accidents of analogous types and kinds. It is useless each time analyze “anew” transportation and other accidents, similar in character and/or origin, employing again and again purely “local”, thus, limited rescue and other salvation and rehabilitation means.
- In Russia the complexity of the accidents *per se* and of the measures directed at the prevention of technological and other disasters and mitigation of their negative consequences increase the significance of the changes in the accepted now approaches to the accidents investigation practices and detection of the “causality” (the whole complex of possible and probable causes) of the accidents.

5. Effective investigations of accidents shall, undoubtedly, facilitate the process of approaching to the “zero” accident rate which has been recently introduced in the nuclear and other high risk industries where effective measures were initiated to exclude not only the accidents of any kind, but also the conditions for the extraordinary situations emergence. If applied to the transportation sphere, it could become one of the most specific features of safety activities in the observable future.

6. A significant phenomenon (repeating with increasing frequency) has been recently detected which concerns the accidents of the airplanes on the runways while preparing to the take-off or immediately after landing. They often result in serious material damages (destruction of airplanes, airport buildings, equipment, etc.). The causes seem to be the incessantly increasing burden on the airport services with the appropriate growing numbers of landing or taking-off planes, both passenger and cargo-carrying.

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### Short Biographies

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### References

The State Report of the Ministry of Emergences for the Year 2001. (2002). Of the State of the Safety on the Territory of the Russian Federation and the Measures against the Emergences of the Natural and Technological Origin. *Problems of safety in the emergences*, vol.4. VINITI, Moscow, Russia.

Vorobiev J. (2000). Basic Factors of the Formulation and Realization of the State Policy for the Lowering of the Risks of the Emergences. In *Business Express*, p. 15. Moscow, Russia.



Vorobiev J. Et al. (1999). Safety and the Sustainable Development – New Paradigms of the Civilization’s Preservation. Report. The 4<sup>th</sup> International Conference on “Ecology and the Development of the North-Western Region of Russia” St-Petersburg.

Britkov V., Sergeev G. (2002.) The Technologies of Virtual Reality. Method of the Optimization of the Safety of Complex Engineering Systems and the Personnel’s Readiness for the Emergences\\ *Problems of safety in the emergences*, vol.3. pp.115-139. VINITI, Moscow, Russia.

Rezer, S. (2002). The Safety Problems in the transport complex in Russia. *Problems of safety in the emergences*, vol.2. pp. 32-44. VINITI, Moscow, Russia.

