

**DRAFT**

**THE REPUBLIC OF SERBIA  
NATIONAL ASSEMBLY**

As laid down by Article 99, par. 1(7) of the Constitution of the Republic of Serbia, Article 9 of the Law on Emergency Situations (“Official Gazette of RS”, No. 111/09) and Article 109 of the Rules of Procedure of the National Assembly (“Official Gazette of RS”, No. 52/10 and 13/11),

the National Assembly of the Republic of Serbia, at its second ordinary session held on 17<sup>th</sup> November 2011, passed the following

**NATIONAL  
STRATEGY FOR DISASTER RISK REDUCTION AND  
PROTECTION AND RESCUE  
IN EMERGENCIES**

**Belgrade**

**Introduction**

Emergency situations, caused by natural hazards or human activities, daily claim many human lives and in various ways destroy and degrade the environment, causing extensive damage and losses. The disaster risk exists in every society since the disasters impede sustainable development of the society as a whole, and their occurrence in one region may cause damage in another region and vice versa.

The South-Eastern Europe region is increasingly threatened by various kinds of natural hazards (floods, droughts, extreme high temperatures, earthquakes, landslides, storms and heavy rains, etc.), technological accidents, the effects of hazardous substances and other risks. Global climate changes also contribute to environmental degradation, having adverse impacts on human health, survival of numerous natural species and cultural heritage.

The combination of these factors requires a comprehensive National Strategy for disaster risk reduction (DRR) and protection and rescue in the Republic of Serbia, which comprises systems of prevention, mitigation, protection and rescue, and recovery. The National Strategy presented here fully meets this requirement.

The basis for the adoption of the National Strategy is contained in the Law on Emergency Situations (“Official Gazette of the RS” No.111/09) (hereinafter the Law) which defines the establishment of an integrated protection and rescue system. In addition to the legislative framework, the basis for drafting a National Strategy is also to be found in other national and international documents such as: the amended National Program for Integration of Serbia into the European Union, National Sustainable Development Strategy, Development Strategy of the Ministry of the Interior 2011-2016, Millennium Development Goals defined by the members of the United Nations and the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. Apart from the mentioned, the EU Internal Security Strategy and the EU Strategy for Supporting Disaster Risk Reduction in Developing Countries were also taken into account when drafting the Strategy

The purpose of the National Strategy for disaster risk reduction and protection and rescue in emergency situations is to protect life, health and property of citizens, the environment and cultural heritage of Serbia. The National Strategy defines and determines the national coordinating mechanisms and program guidelines for reducing disasters caused by natural hazards and the risks of accidents, protection, response and recovery.

The Strategy shall ensure meeting of the recommendations of the European Union for development of the national security systems: the establishment of institutional, organizational and personnel requirements for implementing protection in emergency situations; providing well-trained personnel; establishment and training of the existing fire and rescue units in all places to perform new tasks (repeated below in the paragraph); development of the ability to respond in the event of a disaster in the most efficient manner, including the elimination of consequences of disasters caused by terrorist attack; providing material assistance to support implementation of the Strategy; training of fire and rescue units of the MoI, fire units in companies and fire brigades of volunteer fire associations, civil protection units (specialized and general-purpose units); training of citizens to act in emergency situations, etc.

By virtue of its Council Decision 2007/779/E3, the European Union established a Civil Protection Mechanism of the EC (hereinafter referred to as: the Mechanism). The Mechanism is aimed at facilitating cooperation in civil protection emergency assistance interventions, when preparedness of the country affected by a disaster is not sufficient for an adequate response due to insufficiently available resources. As Article 10 of the Decision foresees that the Mechanism should be open for participation of future member countries,

and in view of the fact that the process of accession of the Republic of Serbia to the European Union has started, one of the priorities of the National Strategy is the accession of the Republic of Serbia to the Mechanism.

Global politics in the field of DRR and national efforts for the prevention and elimination of effects of emergency situations are especially needed and productive at the regional level. Also, the Strategy envisages the possibility of effective regional cooperation, considering the fact that the need for joint responses to challenges is becoming more evident.

The principles underlying the integrated system of protection and recovery are: the right to protection, solidarity, transparency, preventive care, responsibility, gradual approach in the use of forces and resources as well as active policy of equal opportunities.

## **SITUATION IN THE AREA OF EMERGENCIES**

Disasters represent a challenge that shows when, to what extent and in what way the society is ready to respond. Disasters can be avoided. There are ways to reduce risks and to limit impacts of disasters, to enhance resilience of a society to disasters. The Republic of Serbia is ready to accede to effective disaster risk reduction but the current level of organization and training of the integrated protection and recovery system is much lower than the assessed needs and objective possibilities available to the state. These facts were confirmed and recognized at the international conference "National policy dialogue on disaster risk reduction in Serbia", held in October 2010. Recommendations from this meeting were taken into account when drafting the Strategy.

The field of disaster management is comprehensively regulated by the Law, while certain areas that may have an impact on the environment and the safety of citizens are regulated by separate laws.

The Article 1 of the Law regulates the following: activities during and proclamation of the state of emergency; disaster management; the system of protection and rescue of people, material and cultural assets and the environment from natural hazards, technical and technological disasters - accidents and disasters, consequences of terrorism, war and other major disasters (hereinafter referred to as disasters caused by natural hazards and other disaster); the competences of state authorities, autonomous provinces, local self-governments and the participation of the Serbian police and army forces in protection and rescue; rights and duties of citizens, businesses, other legal entities and entrepreneurs in connection with emergency situations; organization and activities of civil protection related to protection, rescue and relief of the consequences of disasters caused by natural hazards and other disasters; financing; inspection and supervision; international cooperation and other issues of importance for the organization and functioning of the protection and rescue system.

The Law is consistent with the generally accepted rules of international law and ratified international treaties.

The Government of the Republic of Serbia is responsible for all aspects of disaster management. On behalf of the Government, the responsibility for planning and implementing preventive measures, preparedness, response to emergencies and recovery thereof, is transferred to the joint activities of the public administration bodies, the specialized agencies, autonomous provinces and local self-governments. Responsibilities of each of the previously mentioned entities are specified in Articles 9 – 15 of the Law.

Intensive cooperation between international entities and the Ministry of Interior has been established primarily through sharing of experiences, emphasising the best practices, various forms of education, courses and trainings, developing neighbourhood programs, donation programs and similar. The scope of the training conducted so far may not adequately meet all the requirements of an integrated management system and management and control in emergency situations. The training system should be expanded, modernized and improved by creating a plan and programme for further development of the acquired knowledge. Implementation of capacity building training shall reduce insufficient training of personnel engaged in the emergency response and for the development and implementation of preventive and mitigation measures, reconstruction and recovery. Also, encouraging non-governmental, non-profit organizations and citizens to acquire education related to action before, during and after emergency situations contributes to the further development and improvement of an integrated protection and rescue system.

In order to develop an integrated protection and rescue system, in addition to the previously mentioned, greater technical innovations and equipment is needed, as well as the improvement of the infrastructure, information and technological systems accompanied by the application of modern technology and standards of the European Union.

In the Republic of Serbia there is no single number that citizens can call in a case of emergency, each emergency service has its own emergency number and a dispatch centre (92 the police, 93 - fire-fighters, 94 - ambulance), whose coordination is inefficient. Moreover, the system for identification / location of the caller is not functional (which impedes the rapid response of the emergency services) and the database for tracking all risks, events, emergencies and disasters has not been properly developed.

The introduction of a universal system, "number 112 for emergency calls" in Serbia will provide a coordinated, rapid and efficient intervention and assistance in emergency events, emergency situations and disasters, in full compliance with the standards and practices existing in the European Union. "Number 112 for emergency calls" is a system that includes developed operational procedures, technical equipment, increased operational readiness and trained staff in accordance with the European standards. Moreover, a database

of all events, hazards, disasters and crises shall be established. The system for notification, early warning and alert in the Republic of Serbia shall be improved and decision-making process and task allocation and execution shall be coordinated.

The Government of the Republic of Serbia has established a Budgetary fund for emergency situations in order to provide additional funding for the preparation, implementation and development of programmes, projects and other activities in the field of disaster management. It is possible to fund projects that go beyond the regular allocation of resources, which contribute to the improvement of the integrated protection and rescue system.

The conducted analysis that included an outline of the state and evaluation helped in creating a document (Annex) in which the following shortcomings of the existing protection and rescue system have been identified:

### **1. Institutional organization**

- Lack of conditions for the consistent application of regulations
- Inadequate organization and implementation of preventive measures
- Lack of specialized cadastres
- Lack of a comprehensive risk maps
- Uneven distribution of capacities of the emergency response services in the RS
- Lack of 112 system
- Lack of methodology for hazardous waste management

### **2. Material - technical**

- Unsatisfactory level of road and other infrastructure
- Outdated, unreliable equipment, facilities and vehicles of the emergency response services
- Inadequate funding of the protection and rescue system maintenance
- Lack of specialized vehicles and equipment for responding to chemical accidents in road, rail and river transport
- Insufficient number of mobile eco-toxicological units

### **3. Cooperation, coordination and availability of information**

- Insufficient coordination between protection and rescue system entities in emergency situations
- Lack of cooperation between scientific and research institutions and direct beneficiaries of researches
- Insufficient cooperation with NGOs and private sector
- The need to improve international cooperation

### **4. Human resources and capacity building**

- Inadequate professional qualification and technological discipline of the available human resources
- Lack of specialized personnel
- Insufficient training of professional personnel
- Unpreparedness and a low level of the local self-government capacity
- An underdeveloped culture of prevention

## **VISION AND MISSION**

The National Strategy represents a clearly defined vision which, in the process of changes, is intended to provide motivation in undertaking actions in right direction, while the mentioned mission directs the strategic development and provides an action timeframe.

Vision - Developed, comprehensive, efficient and effective system to reduce the risks and effects of disasters caused by natural hazards and other disasters by integrated disaster management in the Republic of Serbia, which contributes to the increased safety and sustainable development in the region.

Mission - Creating conditions for building a society resilient to disasters by developing an integrated and efficient protection and rescue system in the Republic of Serbia by 2016.

## **STRATEGIC AREAS**

Disaster risk reduction requires a strong institutional base, which can be achieved through capacity building, good governance, promotion of appropriate program policies and legislation; facilitated flow of information and effective coordination mechanisms. The National Strategy will provide an efficient and effective protection and rescue system through the following strategic areas, which are consistent with the Hyogo Framework for Action.

Within the strategic areas, the strategic goals have been defined and shall be elaborated in details in the Action Plan.

### **STRATEGIC AREA 1.**

#### **ENSURE THAT DISASTER RISK REDUCTION BECOMES A NATIONAL AND LOCAL PRIORITY WITH STRONG INSTITUTIONAL BASIS FOR IMPLEMENTATION**

Political understanding and support are the key factors needed for the permanent improvement of protection and rescue system and implementation of DRR measures at all levels and in all segments of society. It is necessary to achieve an overall social consensus that includes both the integration of DRR into development policies and plans, and provision

of resources (human and financial) required for implementation of these plans and programmes and the establishment of an integrated protection and rescue system. Effective DRR requires a strong institutional basis which provides further capacity building, improvement and promotion of appropriate systems, development programs and legal solutions, facilitates the flow of information and provides effective mechanisms for dialogue and coordination.

- The DRR policy generally accepted by all stakeholders
- Established sustainable financing of an integrated protection and rescue system
- The objectives of this Strategy involved in development programmes and other programme-planning documents of the AP and local self-governments
- Provided an adequate regulatory framework of an integrated system of protection and rescue in compliance with international regulations
- Established National Platform on disaster risk reduction as a national mechanism for disaster management.
- Improved functional cooperation of protection and rescue system entities at the national and local level

## **STRATEGIC AREA 2**

### **IDENTIFY, ASSESS AND MONITOR DISASTER RISKS AND ENHANCE EARLY WARNING.**

The basis for DRR and promotion of a culture of resilience to disasters consists in being aware of the risks and the physical, social, economic and environmental threats faced by individual communities and a society as a whole, and the ways in which those risks and vulnerabilities change in short and long term, as well acting in accordance with that knowledge.

The existing and identified shortcomings stress the need for better mapping and capacity building for risk analysis, by promoting an integrated vulnerability and capacity assessment, as well as the improvement of the early warning system in order to develop strategies and measures aimed at DRR, which contribute to the strengthening of resilience and which are appropriate to local conditions. The expanded research capacities and the use of research results will help to overcome the identified deficiencies.

- The adopted standards and methodologies of evaluation and identification of risks of disasters caused by natural hazards and other disasters in line with EU recommendations
- A 112 system established within the Sector for Emergency Management of the Ministry of Interior, through the reorganization of systems for monitoring, early warning, alert, notification and through the formation of the organized and integrated databases
- Improved hydro-meteorological system for early warning and alert

### **STRATEGIC AREA 3.**

#### **USE KNOWLEDGE, INNOVATION AND EDUCATION TO BUILD A CULTURE OF SAFETY AND RESILIENCE AT ALL LEVELS**

The consequences of disasters can be reduced substantially if people are well and adequately informed about the risks they may face and about possible options and measures they can take to reduce vulnerability and better prepare themselves.

Public awareness of all the features of the integrated protection and rescue system and measures for DRR can be improved by timely dissemination of information about hazards and risks of disasters. The education system and media have a crucial role. Children, in particular, can also be made aware of the aspects of an integrated system of protection and rescue by including disaster risk reduction into formal and non-formal education. Implementation of professional training and training of all stakeholders of an integrated system of protection and rescue will empower both the authorities and citizens to protect themselves and become more resilient to disasters. In particular, emphasis will be made on the training of all participants in the integrated rescue and protection system, so that the staff could provide adequate assistance and protection for children, elderly people and people with disabilities in risk situations, natural and other disasters. Timely public awareness through the media about the disaster risks should encourage the behaviour directed at risk reduction.

- Information on disaster risks, as well as the preventive options available to all, especially citizens in high risk areas and categories of population especially vulnerable to risk – children, elderly and people with disabilities
- The contents and topics related to the protection and rescue and disaster risk reduction introduced in the national curricula at all education levels
- Developed National and regional training centres for disaster management and other training agencies and professional capacity building of entities of an integrated protection and rescue system
- Developed capacities of an integrated protection and rescue system at the national and local levels
- Established a functional connection between scientific research organizations and the key stakeholders in an integrated protection and rescue system
- Developed collaboration with the media in promoting disaster risk reduction policies and reporting before, during and after emergencies
- Raising awareness and developing the culture of safety of citizens in terms of protection, rescue and disaster risk reduction

### **STRATEGIC AREA 4.**

#### **REDUCE THE UNDERLYING RISK FACTORS**

Disaster risks related to the change of social, economic, and environmental and land use conditions, as well as impacts of risks associated with geological events, weather, water, climate variability and climate changes are the subject of sustainable development planning, and the development and implementation of appropriate strategies, sectoral programmes and



other planning-programming documents, and represent important issues in post-disaster period.

- Improved methods for prognostic assessment and socio-economic analysis of multiple risks
- Risk assessments included in the decision-making processes at national and local level
- Developed urban and technical construction conditions that provide disaster resilience of buildings based on assessment of social, economic and environmental impacts.
- Disaster risk assessments integrated in urban and spatial plans and management plans in disaster-prone settlements, especially in overpopulated areas and areas with a rapid urbanization in progress.

### **STRATEGIC AREA 5.**

#### **STRENGTHEN DISASTER PREPAREDNESS FOR EFFECTIVE RESPONSE AT ALL LEVELS**

At the time of disaster, it is possible to significantly reduce the consequences and losses if the competent authorities, individuals and local communities in areas affected by the hazards are well trained, equipped and ready to react.

Preparedness may include various types of activities, such as making contingency and preparedness plans, stockpiling of equipment and supplies, organization of emergency services, 'stand-by' arrangements, preparation of mail notifications and information management procedures, defining coordination mechanisms, training and joint drills and exercises of units and population.

Effective protection and rescue plans also help in coping with small and medium scale disasters that in certain communities frequently occur. The support that will enable communities to help themselves in case of emergencies and financial support for the implementation of activities aimed at post-disaster recovery and reconstruction without creating macro-economic and budgetary problems are of vital importance for sustainable development and poverty reduction.

- Established the improved, efficient coordination and operational cooperation of all state and non-state entities (the Serbian Red Cross, NGOs, private sector), of an integrated protection and rescue system aimed at disaster risk reduction
- Improved regional and international coordination and operational cooperation through monitoring, information exchange and joint training of units of an integrated protection and rescue system

### **IMPLEMENTATION OF THE NATIONAL STRATEGY**

The National Strategy shall be implemented through the Action Plan that will be made within six months from the date of adoption of the National Strategy. The Action Plan will define the detailed implementation of strategic activities, as well as implementers, performance indicators, timeframe for implementation and the necessary financial resources.

The Republic Headquarters for Disaster Management, operating as a National Platform for disaster risk reduction, shall monitor and coordinate the implementation of the National Strategy.

**Monitoring** of the implementation will be conducted at regular intervals, quarterly and annually, in accordance with the elements of the Action Plan. The system for monitoring the implementation of the Strategy shall include: defined activities and objectives, implementers, with the appointment of persons responsible for monitoring and reporting, resources, indicators, risks and timelines.

Persons responsible for the implementation monitoring will continuously monitor the execution of individual activities. The report on the achieved results or highlighting problems that occurred is to be submitted to the Republic Headquarters for Disaster Management, which shall submit to the Government of the Republic of Serbia the consolidated semi-annual reports in the form of annual reports.

With the aim of establishing a unified and formal system of reporting, the Republic Headquarters for Disaster Management shall standardize reporting procedures and forms of these reports. The plan is to also establish a non-formal reporting by working meetings of the implementers during which the implementation of activities and areas that need improvement shall be discussed.

**Assessment** is a systematic and objective monitoring of the results and progress achieved in the implementation of the Strategy.

The assessment shall be conducted regularly, every six months, using a variety of data sources including semi-annual reports as the main source of data, based on the indicators defined by the Action Plan. Internal information shall be systematically compared with external sources of information, such as interviews, polls, etc. Depending on the indicator type, the implementation and effects of planned and realized activities shall be assessed, as well as institutional and legislative changes.

Based on the submitted annual report, the Republic Headquarters for Disaster Management shall evaluate the extent of the implementation. If necessary, the Republic Headquarters for Disaster Management will propose corrective actions to improve implementation and the Strategy sustainability.

Upon completion of the period envisaged for the implementation of the Strategy, the final evaluation shall be made, which will include the analysis of implementation, recommendations, conclusions, lessons learned and best practices in terms of the Strategy implementation.

**REPORTING:** The Republic Headquarters for Disaster Management shall annually prepare and publish reports on the implementation of the Strategy, the extent of the implementation of goals and activities, problems and challenges. The report during the implementation of the Strategy will be an integral part of the Progress Report on the Republic Headquarters for Disaster Management to be submitted to the Government. The Report on the Implementation of the Strategy will be made public.

## **FINANCING**

Implementation of the National Strategy shall be performed with financial resources from the budget, Budgetary fund for emergencies and other funds in accordance with the Law.

### **Donations and joint projects**

Within cooperation with international partners, it is possible to plan donations and joint projects aimed at supporting the implementation of the Strategy objectives and activities of the Action Plan.

## **VII. FINAL PART**

This Strategy shall be published in the “Official Gazette of the Republic of Serbia”.

RS No. 51

In Belgrade, 17<sup>th</sup> November 2011

**NATIONAL ASSEMBLY OF THE REPUBLIC OF SERBIA**

**PRESIDENT**  
Prof. Slavica Djukic – Dejanovic, Ph.D.

## THE AREA OF EMERGENCIES IN THE REPUBLIC OF SERBIA

Commitment to Disaster Risk Reduction by state authorities is essential for improvement in this area. The United Nations and European Union have been supporting developing countries in accepting the concept of DRR and implementing the National Strategy and Action Plan for a Safer World, in the framework of which a DRR programme policy has been developed.

A Government Working Group composed of representatives of the government authorities deliberated on emergency issues using the following parameters: legal and strategic framework, organization and management, resources, training and cooperation.

### **Legal and strategic framework**

The area of emergency protection and rescue has been regulated by a number of laws and bylaws.

Besides the regulations related to actions in a specific situation that may be considered as an emergency from the point of view of pooling protection and rescue resources, such as protection from fire, flood, chemical accident etc, the common legal framework is also to be found in the **Law on Emergency Situations** (“Official Gazette of RS”, No. 111/09), defining emergency management and other elements required for the operation of the protection and rescue system. These elements refer first of all to a precisely defined field of application (natural disasters and other larger accidents, technical accidents, protection and rescue from the impacts of terrorist attacks and so on); defined leading actors in the case of an emergency, decision-makers and all other stakeholders who may be relevant not only in the case of emergency response but also for taking more preventive measures and enhancing the resistance of a society to an emergency, such as non-government organizations, scientific institutions etc.

The above-mentioned Law, together with the **Law on Fire Protection** (“Official Gazette of RS”, No. 111/09), introduced also by the Ministry of Interior, have been harmonized with the EU regulations and with the Hyogo Framework for Action, a UN programme document, and provide a basis for the establishment of an integrated system of emergency management. In order to ensure a consistent enforcement of the adopted legislation it is necessary to pass the relevant bylaws the enactment of which is in progress.

Besides the above-mentioned regulations, providing a basis for the establishment of an integrated emergency management system, regulations that are not primarily regulating emergencies also refer to specific issues related to this field.

The **Law on Health Protection** (“Official Gazette of RS”, No. 107/05, 72/09 – other law, 88/10 and 99/10) establishes a health care system and the organization of a health care institution, including care for public health. In accordance with the law, a health care institution shall organize and implement measures in the case of natural and other disasters and emergencies. Also, by virtue of this law, the Public Health Institute, established at a Republic level, shall take special measures in the case of natural and other disasters and shall implement them in cooperation with other institutions.

In the context of public health functions of the public health institutes, other health care institutions and other stakeholders in the field of health care, the **Law on Public Health** (“Official Gazette of RS”, No. 72/09) introduces an area of public interest. A special chapter of the Law is related to public health in the case of natural and other disasters and emergencies. The Public Health Institute should plan and draft emergency response action plans in the case of natural and other disasters and emergencies in the territory they are responsible for. The Public Health Institute shall take timely action in the case of natural and other disasters and emergencies by putting forward measures aimed at reducing the harmful effects on human health in cooperation with the authorities of the Republic, Province and local government units.

The National Assembly enacted a **Law on Transport of Dangerous Goods** (“Official Gazette of RS”, No. 88/10) and together with the new rulebooks, it will constitute legal regulations in the area of transport of dangerous goods.

Transport of dangerous goods in the Republic of Serbia has also been regulated by the respective international conventions, ratified by Serbia. The following international conventions in the field of transport of dangerous goods apply: the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), Regulation concerning the International Carriage of Dangerous Goods by Rail (RID) – Appendix C to the Convention concerning International Carriage by Rail (COTIF) - Annex 18 of the Convention on International Civil Aviation (Safe Transport of Dangerous Goods by Air); Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO Doc 9284 AN;905); the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN). The traffic system and traffic safety have been legally regulated, so that all aspects of traffic are within the limits of an organized system.

Also, a Draft Law on Explosive Substances and a Draft Law on Incendiary Liquids and Gases are in the procedure of enactment.

The Law on Water (“Off. Gazette of RS”, No. 30/10) defines the area of protection from the harmful influence of water, implemented in Serbia for more than one century.

According to the provisions of the Law on Water, flood defense is divided according to the classification of waterways in two categories. Public water management companies organize flood defense for first order waters that primarily include large waterways with developed protection systems and defense organization. Second order water flood defense, which include mostly torrential waters, is entirely the responsibility of the municipalities. An average municipality in Serbia has around fifteen second order waterways. Some of those waterways were in the past provided by protection facilities, but the majority of them are not provided.

According to the Law on Water, the operational annual plan for torrential flood defense for second order waterways is drafted by the municipalities.

By virtue of the provisions on the Law on Meteorological and Hydrological Activity (“Off. Gazette of RS”, No. 88/10), namely its Article 16, inter alia, the Republic Hydrometeorological Institute shall issue information, early warnings and alerts on meteorological and hydrological natural disasters and catastrophes, as well as on trans-boundary effects on air pollution in the case of accidents, and shall submit them to the competent emergency management service and to the interested authorities and organizations; it shall produce and periodically update vulnerability maps and maps of risks from meteorological natural disasters, shall take part in the drafting of flood vulnerability maps on the basis of the relevant methodology and shall within its t.o.r. draft a vulnerability assessment for the Republic of Serbia and submit it to the Ministry in charge of protection and rescue activities. As laid down by Article 24, the Republic Hydrometeorological Institute is exclusively responsible for drafting and issuing extraordinary meteorological and hydrological information and warnings before, during and after meteorological and hydrological natural disasters, catastrophes and nuclear accidents.

Besides the above-mentioned Law, some meteorological and hydrological tasks, responsibilities and functions, which are within the area of responsibility of the Republic Hydrometeorological Institute, are regulated by other laws. Ratification of international treaties ensures direct implementation of international commitments in the field of meteorology and hydrology, meteorological provision of international air traffic and inland waterway traffic, monitoring and climate and climate change research, as well as commitments related to early warning about natural disasters. In accordance with the Convention of the World Meteorological Organization, the Republic Hydrometeorological Institute performs the functions of a national meteorological, climate and hydrological centre within permanent international hydrometeorological operational systems and programmes.

The Law on the Republic Seismological Institute (“Off. Gazette of RS”, No. 71/94) prescribes the responsibilities of the Republic Seismological Institute. Detailed monitoring of seismic activity in the territory of the Republic of Serbia and borderline areas is performed in order to inform the public about the main earthquake parameters and to assess their impacts with the view to taking timely and necessary measures of assistance to the affected population. The data about regional and distant earthquakes are required for international data exchange with other seismological organizations.

In the territory of the Republic of Serbia a regime of concurrent operation of the two parallel systems of telemetric acquisition has been established (in Belgrade and on Divcibare), enabling for constant and continuous operation of an automatic site and for information about earthquakes even in the cases when one of these systems ceases to operate. The National Seismological Network of the Republic of Serbia (18 stations) ensures 24-hour observation regime and the use of a virtual seismological network consisting of the stations from the European region (about 30 stations).

Apart from the seismological network in the territory of the Republic of Serbia, there is a partially installed strong earthquake network, including our biggest dams: Djerdap, Bajina Basta, Gruza, Barje, Prvonek, Rovni and Selova, which is in the phase of construction. With the data from these stations the acceleration level is established, i.e. the intensity of the earthquake effects on crucial facilities, immediately after an earthquake strikes.

The Institute forwards the information about the earthquake to the users and makes it accessible via Internet. The Institute forwards an SMS to all the users and makes it available via Internet within 5-10 minutes after the earthquake episode; it provides updated information about the site and intensity of the earthquake within 10-20 minutes.

Immediately after a strong earthquake, technical services of the Institute visit the area affected by the earthquake and collect the data about manifestations of the earthquake on the facilities and the soil. On the basis of segregated data about the types of damage caused and their spatial distribution (the European Macroseismic Scale is used), isoseist charts are drafted, which outline degrees of intensity in the area.

By virtue of the Law on Ionizing Radiation Protection and Nuclear Safety (“Off. Gazette of RS”, No. 36/09), the Government established the Agency for Ionizing Radiation Protection and Nuclear Safety of the Republic of Serbia, as an independent regulatory organization, in order to provide the conditions for a high quality and efficient implementation of ionizing radiation protection measures and nuclear safety measures in the performance of radiation and nuclear activities. This law and the respective bylaws define the role and tasks of the Agency in the field of radiation protection and nuclear safety in the territory of Serbia.

The Agency provides the conditions for the implementation of international conventions in the field of radiation protection and nuclear safety and security, ratified by the Republic of Serbia. The role of the Agency for Ionizing Radiation Protection and Nuclear Safety of Serbia, in the cases of nuclear or radiation accidents, is defined on the basis on the Law on the Ionizing Radiation Protection and on Nuclear Safety, the Law on Emergency Situations, relevant bylaws and international conventions.

As laid down by the Law on Forests (“Off. Gazette of RS”, No. 30/10) the owners and users of forests shall endorse their commitment to take forest protection measures, to protect forest and forest land from degradation and erosion, to implement forest management plans, as well as to perform other measures prescribed by this law and the respective transposition regulations. Also, the Law on Forests prescribes that the owners and users of forests shall ensure the safeguarding of forests from destruction and other illegal acts.

In line with the so far practice, the forest user shall take part in extinguishing a fire also on the fire-affected areas in the possession of an owner, with all its available human and technical resources, in view of the fact that the boundary between private and state estate has not been clearly delineated on site, which is why a fire is easily and quickly spread to the surrounding forested area.

It often happens that an owner, for both justifiable reasons (lives far from his estate) and for subjective reasons (does not wish to participate), does not take part in putting out the fire, and thus this is left to the users’ services in cooperation with firemen and rescue units.

The Law on Environmental Protection (“Off. Gazette of RS”, No. 135/04, 36/09, 36/09 – other law, 72/09 – other law and 43/11 – US) and its transposition regulations regulate the area of protection from chemical accidents occurring in Seveso facilities; it implements the provisions of the EU directive related to protection from big chemical accidents (Seveso II Directive). These legal acts set the criteria for determination whether a facility may rank as Seveso or not; in other words, they define the types and boundary quantities of dangerous substances that may be held at the site of a Seveso facility. These legal acts also stipulate the responsibilities of a Seveso facility to elaborate a safety report and an accident protection plan, i.e. to produce an accident prevention policy. The goal of drafting the above documents is to foresee and take in advance all safety and protection measures and chemical accident prevention measures and to limit the effects of the accident on human life and health and the environment. An operator at the Seveso facility shall exchange information and adjust the Accident Protection Plan with that passed by the relevant authority of the local government unit.

The Ministry in charge for environmental protection tasks gives its approval of the submitted security reports and accident protection plans for all Seveso facilities in the territory of the Republic of Serbia. An operator at a Seveso facility shall occasionally review



the safety report and accident protection plan and, as appropriate, update them in the legally prescribed deadline. Also, an operator shall ensure that the safety report and the list of dangerous substances kept at a Seveso facility are available for the public. Protection and rescue regulations are related to information dissemination in the case of a chemical accident or an immediate threat from a chemical accident that may have trans-boundary effects, as well as potential mutual assistance.

Besides the Law on Environmental Protection and the Law on Emergency Situations, this subject matter is also regulated by the following documents:

The Law on Transport of Dangerous Goods (“Off. Gazette of RS”, No. 88/2010) regulates the responsibilities of the state authorities and specialized organizations in the transport of dangerous goods, the conditions and manner of transport, procedures in the case of an extraordinary event – accident in the transport of dangerous goods and oversight in the implementation of this law. The Law shall establish an Authority for Transport of Dangerous Goods, as an administration body within the ministry in charge of traffic.

The Law on Explosive Substances, Incendiary Liquids and Gases (“Off. Gazette of RS”, No. 44/77, 45/85, 18/89, and “Off. Gazette of RS”, No. 53/93 – other law, 67/93 – other law, 48/94 – other law and 101/05 – other law). The routes of transport of dangerous goods by rail are operationally monitored 24 hours a day. This way of monitoring has been defined by internal rail regulations.

## **Strategies**

In October 2009 the National Assembly passed a Decision on the Adoption of the Strategy of the National Security of the Republic of Serbia, which lays the foundations for drafting strategic documents in all areas of social life and for the operation of the state authorities and institutions, for the purpose of preserving and protecting citizen safety.

The Strategy of Scientific and Technological Development of the Republic of Serbia for 2010-2015 was adopted by the Serbian Government in February 2010; it defines seven priority areas of research, among which the area of environmental protection and climate change.

The Government passed a Strategy of Development of Railway, Road, Water, Air and Intermodal Transport in the Republic of Serbia for 2008-2015, which examines the situation in these areas of transport, establishes the infrastructure and transport development design, defines long-term and short-term objectives of transport system development and the action plan for its implementation. The improvement of the transport infrastructure is related, inter alia, to moving transit routes away from the urban areas, especially when transporting dangerous goods.

At the moment there is no comprehensive National Strategy of Environmental Monitoring in the Republic of Serbia. In the reports of the European Commission this issue has been raised many times. Significant progress has been made by merging the tasks of air quality and water quality monitoring from the phase of sampling to the phase of reporting at the Environmental Protection Agency of the Ministry of Environment, Mining and Spatial Planning.

### **Republic Hydrometeorological Institute**

In line with its legal responsibilities, the Republic Hydrometeorological Institute, with its unique hydrometeorological early warning system integrated in the National Protection and Rescue System of the Republic of Serbia and in European and world hydro-meteorological systems and programmes, through continuous 24-hour operation of the organizational units included in the early warning and alert system provides timely and reliable meteorological, climate and hydrological information, forecasts and alerts.

The early warning hydro-meteorological system consists of:

- state meteorological and hydrological observation system,
- computer and telecommunication system,
- analytical-forecasting system.

For the purpose of systematic monitoring and study of the state and changes in weather, climate and water, detection, prediction and early warning about meteorological and hydrological hazards and disasters, and finally, for the purpose of detection of climate change in Serbia, the meteorological and hydrological observation system of the Republic of Serbia has been established (hereinafter referred to as: state meteorological and hydrological observation system), as an integral part of the European and global observation systems.

The national meteorological and hydrological observation system consists of:

- state networks of meteorological stations,
- state network of hydrological stations and
- state network of laboratories.

Within the early warning system in the territory of the Republic of Serbia there are 36 main meteorological stations and five localized hydrological stations. These stations are permanently operated by state officers. These stations, in accordance with the accepted international commitments, are also a part of the world, European and regional meteorological and hydrological reporting observation network.

The Hydrometeorological Telecommunication System is responsible for exchange of all meteorological and hydrological data and products, as well as for international information exchange about all natural disasters, technological and nuclear accidents.

By virtue of the Law on Ministries (“Official Gazette of RS”, No. 16/11) and a Government’s Decision, the Hail Defense Sector of the Republic Hydrometeorological Institute was taken over by the Emergency Management Sector of the Ministry of Interior, while, in accordance with the provisions of this Law, the Environmental Protection Sector was transferred to the Environmental Protection Agency.

### **Organization, management and procedures**

The Ministry of Interior, through its Emergency Management Sector, organizes and performs activities with the view to protection of citizen lives, health and assets, preserving the conditions necessary for life and preparation for overcoming the new situations of natural and other disasters, technical-technological accidents and other hazards resulting from natural and human-made catastrophes (emergencies).

The Emergency Management Sector was set up by re-organizing the parts of the state authorities, namely by joining the functions of the employees and assets of the Protection and Rescue Sector of the Ministry of Interior and those of the Emergency Management Directorate of the Ministry of Defense, together with the parts of organizational units of the Ministry of Environment, Mining and Spatial Planning dealing with tasks of risk management and chemical accident response; thus a unique emergency management unit was established in order to produce optimum results in their area of responsibility.

In accordance with the Law on Emergency Situations, the protection and rescue units consisting of emergency management staffs, civil protection units, firemen-rescue units, Serbian Army and other entities dealing with protection and rescue or that are equipped and trained for emergency response shall be in charge for this kind of response.

A professional firemen-rescue service in the Republic of Serbia is made of local firemen and rescue units, which are a part of the Emergency Management Sector of the Ministry of Interior of the Republic of Serbia.

As a part of the Emergency Management Sector regional specialist teams have been established. There are five regional teams for operation and rescue on water, established in the following cities: Belgrade, Novi Sad, Nis, Kraljevo and Bor-Zajecar, and five teams for rescue from ruins, distributed in the following cities: Belgrade, Novi Sad, Nis, Kraljevo and Valjevo. The teams consist of members of the Emergency Management Sector, who have undergone special training due to specific nature of the tasks performed. Also, for these teams there is a special equipment.

In the case of declaring an emergency caused by natural and other disasters, parts of the Serbian Army may be on alert and be used upon command of the Chief of General Staff of the Serbian Army or a competent commander, based on a special approval of the President of the Republic.

In the case of an emergency, health institutions have been organized and operate on three levels: primary, secondary and tertiary. Depending on the site of emergency, the level of disease, injury or trauma, i.e. on the degree of impairment of vital functions, emergency medical assistance shall be provided on three levels:

First level: pre-hospital emergency medical assistance shall be provided in four organizational forms:

- as a part of regular activity of the ambulance work of the local health care centre, i.e. through its regular teams,
- through an organizational unit of the emergency department, which is a part of the service of the general health ward of the local health care unit
- by a special service of the ambulance of the local health care centre or another health care institution
- by special health institutions (institutes).

Second level: hospitalization in a general hospital

Hospitals, depending on the size, human resources and other conditions, shall take in patients in the case of emergencies in an affected area. Bigger medical centres and hospitals, especially in the middle of a district, shall provide emergency medical assistance to the traumatized persons through their centres. In order to efficiently account for the traumatized people, hospitals shall provide appropriate premises, with constant presence of the required number of medical staff and the possibility to use optimum diagnostics.

Each hospital must have a work plan in the case of mass accidents, which is occasionally reviewed and verified in practice (during exercise) in order to check its effectiveness.

A hospital is informed about the nature of an accident, the number of injured persons, the time of arrival by communicating with the emergency medical services. If the number of injured is below 50 (the number which creates an extraordinary situation in a hospital), it is necessary to set up a triage centre and rooms for providing minimum emergency assistance and to employ all reserve staff. In such a situation all selective surgeries are cancelled.

If the envisaged number of injured persons is 50, all regular hospital activities are minimized. Patients whose health condition is not critical are discharged.

### **Third level: specialized help at health care centres in which there are trauma centres and skin burn centres, clinics and institutes**

Patients that cannot be accounted for at the level of primary health protection and general hospital and health care, are treated in the tertiary medical institutions (clinics, institutes).

The Institute for Trauma and Orthopedic Surgery (with 45 specialist doctors) at the Serbian Clinical Centre, with its institutes and responsibilities (for treating patients with cardiac problems, psychologically traumatized, with skin burns etc) should take the role of a state trauma centre. Also, trauma centres should be established in central towns of the regions (Novi Sad, Nis, Kragujevac).

In a majority of health institutions there are emergency protection plans. These plans are mostly outdated and are not regularly updated and thus do not always respond to a situation on site. Few institutions have procedures for keeping and using incendiary and explosive substances. The procedure related to fire protection is more organized and in most cases is appropriate to actual needs.

Based on the tasks of the Poisoning Control Centre, in the situation of accounting for the poisoned or poison exposed citizens due to a chemical accident or a potential terrorist chemical warfare, the Government has appointed a national poisoning control centre with the Military Medical Academy. This is the second most important legal entity in the field of health care and social protection, of special importance for defense of the Republic.

The National Poisoning Control Centre is an institution providing medical services of prevention and therapy of acute poisoning, detection of chemical substances in biological material, water, soil and air, training in clinical toxicology and toxicological chemistry and scientific research in the field of toxicology and pharmacology.

### **Resources**

In the protection and rescue system, resources include trained protection and rescue human resources and material and technical resources required for response; both are equally important and essential for efficient operation of the system.

Nevertheless, having analyzed the present condition, it has been identified that the existing human resources and equipment of the prevention and operational services are not satisfactory.

At the Ministry of Interior, Sector for Emergency Management, there are 72.5% filled vacancies, which is why the rest of vacancies need to be occupied in order to perform the tasks in a more satisfactory manner and within prescribed deadlines. At the moment there are 2.950 work posts occupied by firemen-rescue staff. This figure is below the European

standards, which prescribe that per every 1,000 citizens there should be one firemen-rescue man, while our situation is 0.41 per every 1,000 people. The number of staff should be increased according to the number of interventions and the territory they protect, with respect to the number of population (estimates show that the existing figure should be raised by 1,500). It is worth mentioning that there is a lack of technical positions, especially engineers (mechanical engineers, electrical engineers specialized in industrial energy, architects, civil engineers) at the Preventive Protection Directorate. As regards floods, when recruiting new staff priority should be given to hydrological engineers who have the knowledge and skills to prepare preventive protection measures and response to floods. Activities are in progress related to the implementation of the Agreement on seconding the employees and transferring material assets, movable property and real-estate and archives of the Emergency Directorate of the Ministry of Defense.

The Ministry of Defense and the Serbian Army do not develop special capacities for protection and rescue tasks but, when required, support civilian authorities and protection and rescue providers. In performing the tasks of protection and rescue, capacities of logistical support, air forces, engineering teams and ABCD (atomic-biological-chemical defense) units of the Ministry of Defense and Serbian Army may be used.

After a standstill in the international exchange due to the sanctions imposed by the international community, and the resulting economic recession, Serbia started the transition process, in other words, the process of return to the international market, inflow of foreign investments, using the position of a transition country, organizing international sports and cultural events and in general strengthening international cooperation in all areas, which is why the existing material and technical resources became insufficient for the newly arisen requirements. For this reason it is essential to improve the equipment of the protection and rescue units, first of all of firemen-rescue teams, and thus contribute to the safety of lives and property in the Republic as much as possible.

The existing equipment and vehicles, especially those required for technical interventions with dangerous substances (cutting, rescuing, protection of respiratory system, detectors of air pollution, protection equipment for work with dangerous substances, human and equipment decontamination devices, remediants etc) do not satisfy the requirements for efficient action in the territory of Serbia. Namely, the Directorate for Firemen and Rescue Units has only three fire vehicles that may adequately respond to a chemical accident. Besides, the existing equipment required for technical interventions in traffic is outdated and unreliable, although some parts have been acquired over the last five years. Due to such condition of fire vehicles and fire protection equipment, arrival on the site from the moment of call is 11 minutes on average, which is far below the European standards (five-seven minutes), and the duration of the intervention is therefore longer, especially in fire extinguishing interventions, where average time for putting out the fire is 60 minutes, resulting in larger damages and often injuries and the loss of lives.

Acquisition of fire protection techniques, devices, equipment and personal protection kits introduced some changes. The equipment needs replacing in all the units except for those in the cities: Belgrade, Novi Sad and Kragujevac, which have new personal protection kits.

The Ministry of Defense and the Serbian Army keep operational records, containing data on the equipment and assets that may be used in the case when Serbian Army is deployed for the operations of support of civilian authorities in countering unarmed threats.

In 2007-2009 period, the Republic Hydrometeorological Service of RS installed, in its regional units, 28 automatic meteorological stations and 20 automatic rain gauges in the territory of Belgrade, so that its meteorological station network now satisfies the requirements prescribed by the World Meteorological Organization (WMO).

The Republic Hydrometeorological Service performs activities and measures from the Action Plan for the Implementation of the 2009-2017 National Strategy of Sustainable Development, with the view to improving the hydro-meteorological information system.

Due to its geographical position the Republic of Serbia, with its corridor 10, has the busiest traffic in this part of Europe. What is expected is the increase of river navigation and transport of various materials by river, among which dangerous substances. At the moment only the fire protection-rescue team in Belgrade has a fire protection ship, while other ports have no such form of protection. Increasing the safety at these corridors remains a priority, so it is essential to procure additional technical equipment and the equipment for water chemical accidents for the key fire protection-rescue units, and to provide further specialist training for the members of these units. The Environmental Protection Agency possesses a ship-laboratory "Argus", which may become a technical support to these units with the view to identifying the degree and type of accidental pollution and to its monitoring.

The Environmental Protection Agency of the Ministry of Environment, Mining and Spatial Planning began in 2007 the establishment of the automatic air quality monitoring system in Serbia. Owing to a donation of the European Union, 28 fixed automatic air quality monitoring stations were installed in the area of the Republic. At the moment the Agency has 40 AAQMS that are operational, while other entities have around 15 AAQMS whose data are also submitted to the Agency, but not in real time. Data from most AAQMS may be tracked in real time on the websites of the Agency, the Public Health Centre of the City of Belgrade and the Public Health Centre of Pancevo. The same will be possible on the website of the Provincial Secretariat for Environmental Protection and Sustainable Development.

The Environmental Protection Agency permanently works on development of components of the environmental information system, especially through IPA 2008 Project of establishment of the national EIONET network in the Republic of Serbia, through the implementation of which a network of institutions for environmental data monitoring, collection and processing will be established at the national level.

The Ministry of Education and Science has financed scientific projects under which direct or indirect research was performed related to improvement of the system of protection and rescue of human lives and property.

### **Funding considerations**

The protection and rescue system is financed from the budget of the Republic of Serbia, budget of the provincial units and that of the local government units, budget of the Emergency Fund and other sources. In accordance with the Law on the Budgetary System (“Official Gazette of RS”, No. 54/09, 73/10 and 101/10), in the budget of the Republic of Serbia there are funds for permanent budgetary reserve, shown in the appropriations for budgetary reserve. Permanent budgetary reserve is used for funding the expenses of the Republic of Serbia in removing the consequences of emergencies such as earthquake, flood, drought, fires, landslides, snow drifts, hail, animal and plant diseases, environmental accidents and other natural disasters, i.e. other emergencies that may affect human life and health or cause a large damage. Permanent budgetary reserve amounts to maximum 0.5% of the total proceeds and income gained by the sale of non-financial property in a financial year. The Government shall pass a Decision on the Use of Permanent Reserve Funds, following a proposal by a minister in charge of finance.

From the moment of declaring an emergency and passing a decision on the use of the permanent reserve funds by the Government, the Treasury Directorate shall promptly make a transfer of funds from the budget of the Republic of Serbia.

### **Training**

Besides the well built infrastructure and the necessary equipment, it is essential to permanently build the capacity of human resources, in terms of training and education.

The National Emergency Training Centre was established with the Ministry of Interior, Sector for Emergency Management. The Centre trains and educates members of professional and voluntary firemen and rescue teams, as well as citizens who take part in civilian protection. International citizens may also be trained at the national and regional protection and rescue training centres, in accordance with the applicable regulations, and against an appropriate fee, determined by bilateral or multilateral agreements.

Since 2006, the US Agency for International Aid (USAID), in the framework of its Emergency Planning and Response Programmes, has provided technical and material help to the Sector for Emergency Management, in order to enable the Sector to continue providing high quality training to its members, as well as to all the members of the local emergency management staffs. At the moment 80 municipalities in the Republic are taking part in programme activities during which they undergo several month training and qualify for certification.



In cooperation with other services and international organizations, the human resource potential of the Republic Seismological Institute is continuously growing through various types of training, courses and workshops. Also, the Republic Seismological Institute, with the view to creating conditions for better safety of the Serbian citizens and their property in the case of earthquake, organized lectures in reporting centres on the understanding of the main field information about earthquakes.

State officers of the Republic Hydrometeorological Institute regularly participate in the training courses and workshops with the view to capacity building in the following areas:

- early warning systems, telecommunication systems of meteorological data control, processing and archiving, organized by the World Meteorological Organization;
- use of satellite and radar products in detection and forecast of atmospheric hazards, organized by the European Agency for the Exploitation of Meteorological Satellites (EUMETSAT) and European Network of national meteorological services;
- use and development of the latest numerical models for use in weather prediction (very-short-range, short-range, medium-range and seasonal) of atmospheric hazards, organized by The European Centre for Medium-Range Weather Forecasts (ECMWF).

### **Cooperation**

The Ministry of Interior, together with the heads of the Protection and Rescue Services of the Republic of Albania, Federation of Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Republic of Slovenia, Republic of Croatia and Republic of Montenegro, made a decision on the establishment of a network of specialized regional emergency centres in southeastern Europe, in order to use and further improve the existing capacities of the states in the system of emergency prevention and response.

According to the Law on Emergency Situations, action in emergency situations is a common activity of the relevant authorities and representatives of the local government, with the aim to respond as soon as possible.

However, there is an evident lack of cooperation among the scientific institutions and direct users of the research results, such as small and medium enterprises and industry, as well as other institutions of state importance.

In the framework of the Convention on Trans-boundary Effects of Industrial Accidents, the Republic of Serbia cooperates with the UN Economic Commission for Europe (UNECE).

The Environmental Protection Agency, since its establishment in 2004 has been actively cooperating with the European Environment Agency – EEA in the framework of the

European Information and Observation Network – EIONET. The responsibility of the Republic of Serbia is to collect and submit data on the state of the environment to EEA has been fulfilled to a considerable degree, especially in the field of air quality, surface and ground water quality, protected natural areas. As regards cooperation with national institutions performing monitoring of specific mediums of environment, considerable progress was made in the period 2004-2010 resulting in an increased volume of priority data reporting from 9% in 2003 to 75% in 2009.

The mobile toxicological-chemical team of the National Poisoning Control Centre, in accounting for the poisoned cooperates with the services taking part in the post-accident restoration activities.

The Republic Hydrometeorological Institute takes part in the programmes which provide the main component and scientific and technical support to the national hydrometeorological system of early warning about atmospheric and hydrological events, climate extremes and disasters, accidental radiation and chemical transboundary pollution of air and water, as well as a contribution to the disaster and climate change mitigation measures at the national, regional and global level. Besides, agreements on technical cooperation with national hydrometeorological services of Germany, France, Hungary, Montenegro, the former Yugoslav Republic of Macedonia and the Federation of Bosnia and Herzegovina, while an agreement with other interested national services of the SEE countries is about to be reached.

The Republic Seismological Institute, as a member of the European-Mediterranean Seismological Centre (EMSC), has a mandate from the European Council to issue seismic warnings in the framework of the Open Partial Agreement (OPA) related to prevention, protection and organization of assistance from big natural and technical disasters. The Institute is also a member of the Observatories and Research Facilities for the European Seismology (ORFEUS), whose goal is to coordinate and promote European seismology. The Institute has been active in the projects of these organizations. The Institutes exchanges, in real time, registered data with all the neighbouring countries on the basis of agreements signed with Montenegro, Federation of BiH, the former Yugoslav Republic of Macedonia, Albania, Croatia and Austria.

## THE STATE OF NATURAL DISASTERS AND OTHER HAZARDS

Active policy of disaster risk reduction and efficient emergency response may considerably reduce the number of victims and material damage.

The territory of Serbia is 88,361km<sup>2</sup>, with 6.164 settlements and the population of 7,498 according to the 2002 census. In this territory, over the last seven years there were 175,083 different events, including 134,686 fires, 13,620 technical interventions (rescue of people in traffic and other technical accidents, interventions and remedial action after an

accident involving hazardous substances, and other accidents). Data point at an increase in interventions (Table 1). It is worth mentioning that the activities of firemen-rescue teams are in 77% cases focused on extinguishing fires and removing the consequences of explosions, and in 20.5% cases activities are aimed at rescuing citizens and their property in other interventions.

**Table 1**

Nature of event	2002	2003	2004	2005	2006	2007	2008	2009
Fire	14.841	19.271	15.061	14.670	17.847	28.546	24.450	21.545
Explosion	25	42	36	32	39	35	43	44
Technical interventions	877	990	1.144	1.214	1.318	1.640	1.515	1.706
Technical interventions with hazardous substances	43	71	64	80	78	60	89	84
Technical interventions in transport	411	510	608	638	709	819	742	784
On duty activities	696	732	799	1.052	980	1.179	1.290	1.458
Water extraction	574	317	704	820	909	395	244	606
Services	1.652	916	777	1.003	1.188	870	915	562
Scene investigations	215	239	268	345	385	356	386	568
Interactions	23	29	24	46	28	64	34	
False reports	382	402	385	390	379	523	483	417
Other interventions	270	383	364	436	591	549	534	595
<b>Total</b>	<b>20.009</b>	<b>23.902</b>	<b>20.234</b>	<b>20.726</b>	<b>24.451</b>	<b>35.036</b>	<b>30.725</b>	<b>28.391</b>

Increased urbanization, on the one hand, and insufficient control over the implementation of construction regulations are the reasons for higher vulnerability of the society to earthquake effects.

There are no special cadastres with data on fresh water sources, water intake, artificial and natural lakes, areas with dangerous waste (especially agricultural land). There are however certain prerequisites for drafting those cadastres, in the form of plans and maps with relevant scales.

In drafting risk maps, the competent institutions of the Republic of Serbia may use graphic platforms of the Republic Geodetic Institute, such as the digital orthophoto of Serbia and maps of Serbia drawn to a scale of 1:300,000.

According to the INSPIRE Directive (Directive 2007/2EC), it is necessary to implement and present in the national geo-portal (in charge of the Republic Geodetic Institute) the zones of natural risks, as one of the topics of national infrastructure of the geospatial data. The zones of natural risk, in terms of the INSPIRE Directive, include “hazardous areas defined as such according to natural hazards (all atmospheric, hydrological,

seismological, volcanic and flame phenomena, which, due to their location, gravity and frequency have potential serious impacts on the society), such as floods, landslides and ravines, avalanche, forest fires, earthquakes, volcanic eruptions”. Data on the zones of natural risk must be provided in electronic form, should be inter-operational and harmonized with international standards in order to be published on the national geo-portal.

In the framework of the IGIS project implementation, initiated by the Republic Geodetic Institute in November 2010 and lasting for three years, a geo-portal will be established for use by the state authorities. The geo-portal will ensure risk data presentation, the use of satellite photos and exchanges of other data required for emergency response.

For the purpose of precise spatial positioning of natural disasters and other hazards GPS devices may be used in the system of Active Geodetic Reference Basis of Serbia (AGROS), established and maintained by the Republic Geodetic Institute.

### **Natural disasters**

In the period 1900-1940, every ten years there were around 100 natural disasters, in 1960-1970 this figure amounted to 650, and in 1980-1990 up to 2000 disasters in a decade, while in the 1990-2000 decade the number of disasters rose to 2800. There is a rising trend of emergencies and hazards, which has been constantly increasing, and thus over the last couple of years economic expenses have tripled.

In its “Study on Economic Benefits of RHMS of Serbia”, the World Bank Study Group, 2005, Belgrade, Serbia, time dependent economic sectors in the Republic of Serbia i.e. the share of these sectors in the gross national income (without value added tax), have been identified, and the respective damage has been reported and estimated. The share of time dependent economic sectors in the gross national income of the Republic of Serbia, without the Autonomous Region of Kosovo and Metohija, as per constant prices from 2002, without value added tax, ranged from 42% to 43.8% in the period 2000-2004. Already in 2005 the share of time dependent sectors in the gross national income of the Republic of Serbia reached 47.18%. The study of the World Bank included only 49% of time dependent sectors and did not include damages caused by forest fires. However, in the course of 2007, there were 258 registered forest fires. 33,000 ha of growth were consumed by fires, out of which 16,000 hectares was forested land. Forest fires caused a damage estimated at around 40 million EUR. Only for reparation purposes 24 million EUR are required. Indirect damage has not been estimated.

Table 2 shows damages estimated in time dependent sectors in the Republic of Serbia. It is evident that the Serbian economy has suffered great losses in terms of material assets, but that atmospheric hazards are also to blame for loss of human lives.

Table 2. Estimated damages in time dependent sectors

Sector/weather hazards	Mean annual economic losses in millions of RSD	Mean annual losses of human lives
Agriculture/floods	3,100 – 8,500	A couple – a dozen
Water management/floods	Around 1,960	-----
Agriculture/hail, heavy precipitation, strong wind	Around 7,316	A couple – a dozen, from lightning strikes

Agriculture/drought, frost	Around 40	No losses
Production of energy (heat)/extremely low air temperature	Around 716	A couple – to a dozen
Maintenance of roads/snow, ice conditions, icing	Around 3,500	-----
Human losses on regional and local roads, caused by adverse weather, range from 105 to 131	Human losses on regional and local roads, caused by adverse weather, range from 105 to 131	Human losses on regional and local roads, caused by adverse weather, range from 105 to 131
TOTAL	16,648 to 48,572	From several to 160

The generation, scope and duration of natural hazards cannot be predicted in most cases, but for certain phenomena, on the basis of experience, statistical data and modeling methods, they can be foreseen, taking into consideration the site of occurrence.

A flood and landslide vulnerability assessment for the Republic of Serbia has been made, and based on available statistics a natural disaster risk map has been drafted (forest fires, floods, landslides and earthquakes).

#### *Existing situation – media monitoring*

The existing air quality monitoring programs, as well as surface and ground water monitoring programs are outdated. It is essential that the Government should adopt the National Environmental Control Program, and then to sign the program of air, water and soil quality monitoring.

### **Earthquakes**

On average, every ten years a powerful earthquake strikes Serbia causing damages to buildings. The Republic Seismological Institute detects the site of earthquake, identifies its magnitude on the basis of which it provides the assumed intensity of the earthquake in its epicentre. Based on the data from the network of strong earthquake, the Republic Seismological Institute provides data for assessment of seismic vulnerability of crucial facilities. According to the number of registered and located earthquakes, seismic activity in 2010 was considerably more intense as opposed to 2009. Mosts earthquakes were located in central Serbia (Kraljevo, Kopaonik) and southern Serbia (Autonomous Region of Kosovo and Metohija). Fewer earthquakes have been located in eastern and southeastern Serbia, while the fewest have been located in the Autonomous Region of Vojvodina.

Interpretation of registered earthquakes allows for: drafting of intensity estimate maps; studying tectonic processes in the epicentre; seismotectonic interpretation of seismological data; calculation of seismic hazard parameters in Serbia, including smaller areas; drafting seismic hazard maps of Serbia, as a baseline for spatial planning and design of seismically resistant facilities; drafting of seismological elements of the Rulebook on Regulations on Construction in Seismic Areas.

### **Torrential floods**

Flood vulnerability assessment of the Republic of Serbia includes only floods on big rivers. Torrential flood vulnerability assessment calls for a more detailed elaboration and has

been made only for several municipalities. In view of the fact that a great number of torrential currents pose a constant threat (14,000-15,000, according to the statistics of old torrential current cadastres) for settlements and critical infrastructure facilities, it is essential to make an updated torrential flood vulnerability assessment. At the Water Management Institute "Jaroslav Cerni" a methodology for classification of torrential currents has been developed and included in the Water Management Information System.

According to the interviews with the majority of municipalities in the Republic of Serbia, as regards emergencies, they have suffered big losses from floods (over 70%). As laid down by the provisions of the Law on Water, flood defense is divided according to the classification of waterways in two categories. Public water management companies organize flood defense for first order waters that primarily include large waterways with developed protection systems and defense organization.

Torrential floods are characteristic for their sudden occurrence and short duration. They belong to the group of predictable phenomena, which occur suddenly and last for a short time, leaving ruins behind them. They occur during and after big storms with high intensity. It has not been identified in which part of the year torrential floods occur. There were examples of floods occurring in winter (November 2007, on the following rivers: Vlasina, Nisava, Jablanica and Pusta) or in spring (May 2010, Trgoviste) and summer (June 1988 on the river Vlasina). The year 2010 was marked by torrential floods causing large damages throughout the Republic. The municipalities of Zajecar, Ljubovija, Loznica, Valjevo, and Osecina suffered great damages by torrential floods, while Trgoviste was devastated by the torrential flooding of the river Pcinja and its tributaries. Traditional manner of protection from this kind of flood is to build a strong system of facilities. If such a system is insufficient or if it is lacking, torrential floods leave behind ruins of bridges, roads, buildings and everything that comes in their way. In view of the high expenses of construction of a passive system of torrential flood defense, the respective works always lag behind the needs, and the only way to reduce damage is to organize timely alerts about possible torrential floods and to remove the people and removable property from the way of the flood. An active defense methodology has been drafted as defense from torrential floods and is intended for municipalities. Unfortunately, this methodology was applied by municipalities that had previously suffered from torrential floods, and it included total coordination with the radar observation service of the Republic Hydrometeorological Institute.

Besides the outfall of rivers and streams, in the case of heavy precipitation, there is also the threat from flooding of settlements due to inadequate maintenance of drainage canals around and inside these settlements.

Corridor 10 is of special interest, as in the past this area was typical for a regular occurrence of torrential floods, slides and landslides, which interrupted railway and road traffic for up to several weeks in a year. For these reasons, the corridor was covered by a multitude of protection facilities and works. Nevertheless, there are still occasional torrential floods which intersect a railroad or road, but naturally much less often than they used to do in the middle of 20<sup>th</sup> century. The need to provide an updated map should be included in planning any activity and establishing numerous specialist maps and cadastres.

For the purpose of monitoring the state and changes in the characteristics of the hydrological waterway regime in Serbia, there are 187 operational hydrological stations within the state network. For use in hydrological prediction and warning, data from over 70

hydrological stations are collected on a daily basis. The respective reports are submitted by radio; at 50 hydrological stations modern digital measuring and accounting equipment has been installed: this equipment allows for directly accessing data by using the GPRS service, while at 20 stations data may be obtained by phone or radio. Bulletins with hydrological data and forecasts, information and alerts about high and small waters and the state of ice are distributed to all the stakeholders in the flood and other extreme hydrological phenomena defense system, as well as to the media. Data are submitted by mail, fax or phone, with daily data update on the web pages of the Republic Hydrometeorological Institute.

The system of general warnings and public information about the potential occurrence of meteorological hazards – Meteoalarm, has been developed in the framework of the network of European National Meteorological Services – EUMETNET, the member of which is the RHMI. Also within the European Flood Alert System (EFAS) there is an operational Hydro-alarm, which also includes the RHMI.

### **Landslides and slides on the slopes and inclined planes**

Considerably raised levels of ground and surface waters caused by heavy precipitation or water saturation with potentially unstable masses cause the occurrence of landslides. In such conditions specific environments that are not able to receive a large quantity of water from rain, snow and waterway, are vulnerable to landslides; these are mostly the environments that contain clay and that are mostly located in lowlands and big river valleys.

The landslides occurring in Serbia are in 70% of cases well-known and studied to a large extent. Slides and landslides occur in around 25% of the territory of Serbia. In Serbia there are 3,137 active or potential landslides. A number of landslides affect housing facilities in human settlements (around 3,727 facilities and around 7,755 inhabitants), while most landslides affect local roads and highways. Landslides in the Republic of Serbia are distributed in the southeastern part of the Pannonian Valley, namely on the northern slopes of Fruska Gora and in the section of Podunavlje between Belgrade and Smederevo.

What is necessary to do in order to define potential hazards, or hazards related to these phenomena is:

- to study phenomena with the biggest masses, or potential energy, and based on this, estimate the potential threats of land sliding and rockfalls. This will be the ground for taking preventive measures in order to reduce the negative effects caused by landslides.
- from the geological-engineering point of view, a dedicated map, in which rock masses were classified, has been drafted and allows for separating the relevant models of terrain (construction of terrain) that are very suitable for defining the land sliding hazards, i.e. for assessing the risk of instability.

Geological models of slopes suitable for large-scale unstable phenomena are typical only of the region of central Serbia. In the Pannonian and Kosovo Basin, as well as in neogenic lake basins of Sumadija, in spite of numerous landslides causing large damage, there are no conditions for the occurrence of unstable phenomena.

Reparation measures include using geological-engineering techniques and methods. Fund raising for landslide reparation measures is the responsibility of the Ministry of Environment, Mining and Spatial Planning.

### **Atmospheric hazards**

Depending on the intensity, duration of direct and indirect impacts, there are two types of hydrometeorological phenomena, unfavourable and hazardous.

Unfavorable hydrometeorological phenomena include hydrometeorological phenomena – events, which by their intensity, duration or time of occurrence do not reach critical values or typical values, but may cause damage to specific, time dependent economic sectors.

Hydrometeorological hazards are hydrometeorological phenomena – events, which by their intensity, duration or time of occurrence pose a threat for human safety and may cause large damage to economic sectors. These phenomena pose a risk when they reach critical or typical values.

#### *1.1. Potentially harmful hydrometeorological phenomena – events in Serbia*

The following potentially harmful hydrometeorological phenomena – events may lead to losses of life, damage to property, disturbance of social and economic activities, or may cause degradation or environment:

- strong/intense weather phenomena: storms and heavy thundering (hail, thundering, lightning strikes, wind shifts, intensive precipitation), precipitation (snow storms, blizzards and snowfalls, wet snow, intensive rain, long-lasting rain, ice rain, ice conditions);
- other events/phenomena and time conditions (strong inversion, cold and hot waves, fog and low cloudiness, UV radiation, fire forests, sudden snow melting, snow drifts);
- air quality (acid rain, radioactive precipitation, urban air pollution...);
- climate phenomena/events (drought, plant diseases..);
- hydrological events/phenomena (floods, torrents, erosion and landslides, low waters...).

### Hail

Hail defense methodology is implemented from 15<sup>th</sup> April to 15<sup>th</sup> October in the area of 7,749,800 hectares, with 5,052,957 ha of arable land.

The operational, methodological developmental activities related to hail defense are performed at the Hail Defense Sector. This is a system consisting of: 13 radar centres, around 1,650 active hail defense launch stations, telecommunication system covering the territory of the Republic of Serbia and the operational-methodological center in Belgrade. Radar centres are responsible for the organization and operation of hail defense in the relevant territories. They are equipped with meteorological radars, which monitor the development of cloud systems. Based on the processing of radar signals, hail hazard caused by cumulonimbus



clouds is assessed and the cloud seeding methodology is automatically carried out with the purpose of hail suppression, prevention and reduction of hail-related damages. Besides, radars may be used for monitoring of all sorts and levels of precipitation. All radar centers have the possibility for three-dimensional presentation of clouds, which is the top technology in the area of radar meteorology. The entire methodology of work at radar centers is supported by information system – radar operation automatic systems, operation command system, data processing and archiving and their distribution to users and to the central data base. The overall operation of the radar centers and in the hail defense system is defined by operating instructions, which are revised every year with regard to new scientific knowledge, progress made in the field of technical equipment and development of new software solutions.

### Drought

Drought as a natural hazard caused by a deficit of precipitation over a longer period of time has numerous negative impacts for the sector of agriculture, water supply, energy, health care, environmental protection and other areas. In the region of the Balkans, Mediterranean and southeastern Europe, more frequent and intense droughts have been reported, and a similar trend is expected in the following decades, due to climate change. The meteorological observation data have shown that in the Republic of Serbia the most intense droughts were reported in the last two decades, mostly in the northeastern, eastern and southern parts of the country.

The Republic Hydrometeorological Institute has, within its area of responsibility as regards agricultural meteorology, established an operational drought monitoring system which ensures continuous monitoring of insufficient or excessive humidity of the soil and production of analyses, forecasts and warnings about the occurrence and intensity of drought in certain regions of Serbia. The Republic Drought Monitoring System is included in the regional drought monitoring system coordinated by the Drought Management Center for Southeastern Europe, seated in Slovenia. A preliminary drought risk assessment has been made for the sector of agriculture, and activities related to elaboration and application of methodologies and recommendations of the European Union as regards natural hazards risks are in progress.

### Disease epidemics

In the case of disease epidemics, following an initiative by the Ministry of Health, joint bodies shall be established, i.e. operational teams for health activities system, planning and coordination, communication and monitoring and evaluation of the situation.

### Technical accidents

A considerable threat is posed by technical-technological accidents in which fires and hazardous substances effects may affect not only the territory of Serbia, but also neighboring countries.

### Fires

A user of forests shall monitor general state of the forests in all sorts of ownership and their vulnerability to natural disasters.

Preventive protection from fires is implemented in accordance with the Law on Forests, which defines the responsibility to draft and implement the prescribed plans of fire protection of forests in all sorts of ownership in the five year-period. The annual fire protection plans defines in detail fire protection services and procedures in the case of a fire (manner of organization of manpower, transport of equipment, reporting to the relevant authorities etc).

The Law on Forests stipulates a ban of setting an open fire in the forests and in the land close to forests, at a distance less than 200 m from the edge of a forest, except at a place that has been intended for that purpose and visibly marked, with due observance of the prescribed measures.

There is also a responsibility to keep forest order, which includes measures taken with the view to preventing disturbances in the forest ecosystems which may be caused by works in using and cultivating forests, especially for the purpose of preventive protection of forests from fires, protection of forests from entomological and fitopathological diseases, protection of young trees, protection of surface layer, protection of the soil from erosion, protection of sources and waterways, pollution protection and so on.

Through the implementation of the above mentioned measured and relevant procedures by the users of forests and hunting areas, or by the owners of forests, and by implementing mandatory forestry and hunting plans the state and management of forests and game will be improved, as well as protection of forests and game from fires and other natural hazards.

Preventive measures taken by the Republic Forestry and Hunting Inspection, in terms of fire protection, are based on the legally prescribed responsibility and the right of an inspector to take these measures in accordance with his/her responsibilities, when and in the case he/she identifies a failure in the observance of the Law and its transposition regulations; these measures include a temporary ban on specific activities, with the view to preventing damages of public interest. Reparation measures in the case of such hazards are related to estimating damages suffered by geodiversity and biodiversity.

Since spring 2008, the Republic Hydrometeorological Institute, with the view to contributing to an organized protection of forests in Serbia has been providing an estimate of forest fire hazards in Serbia, using a Canadian method of determination of the forest fire hazard index "Fire Weather Index (FWI)". This method is based on the estimate of the combustibility of forest fuel depending on the past and present time conditions and provides indicators for the occurrence of forest fires. Information about the real and predicted condition shall be regularly submitted to the competent authorities and laid out on the website [www.meteoalarmrs](http://www.meteoalarmrs) in the form of tables and graphs.

#### Effects of hazardous substances

The existing traffic infrastructure of the Republic of Serbia is used for transport of dangerous goods, with due observance of prescribed regulations.

At the airport "Nikola Tesla" in Belgrade, there is a warehouse for dangerous goods. The warehouse consists of magazines for dangerous cargos that are not radioactive and do not include incendiary liquids; magazines for incendiary liquids, magazines for radioactive

substances, and refrigerators storing dangerous cargos that must be kept at adequate temperatures. The airport “Konstantin Veliki” in Nis has no warehouse for dangerous cargos. Transport of dangerous goods may be carried out only directly to the aircraft by the authorized shipping agencies.

The transport routes of dangerous goods in road traffic have not been defined but at the moment the traffic sign “Prohibited for transport by vehicles carrying dangerous goods” may ban traffic in certain sections of the road. There is no data on average monthly quantities of hazardous cargos that are carried by road and on specific routes, but most vehicles transporting dangerous goods use the corridor 10, while the classes of dangerous goods transported are class 2 (gases), class three (incendiary liquids) and class 8 (erosive substances).

In the railroad traffic, based on the available program for tracking the transport of dangerous goods average monthly quantities of transported dangerous goods are not possible to determine according to directions. Also it is impossible to define routes for transport of dangerous goods on the waterways, as there is no alternative for rivers that are natural corridors.

Many accidents causing environmental pollution were reported during the transport of hazardous substances.

In the case of an accident, depending of the affected area, inside or outside a facility and on the estimated impacts that may caused direct or delayed hazard for human health and environment, the state of environmental emergency is declared and the public is informed about the measures taken. The state of environmental emergency shall be declared by the competent ministry, the autonomous region authority, or the local government authority. For accidents with trans-boundary effects the state of environmental emergency shall be declared by the Government.

In the case of an accident happened during the transport of dangerous goods by rail, the public company “Zeleznice Srbije” observes the emergency regulations prescribed by Guidelines 171 for the transport of dangerous goods in the railroad of Serbia No. 193/10-03 of the Law on Safety in Railroad Traffic (“Off. Gazette of FRY” No. 101/05 – other law) and the respective railway regulations. The public company “Zeleznice Srbije” does not have specialized vehicles or equipment for interventions in such situations. For the purpose of accident response in the case of release of dangerous substance from a railway car, the Emergency Management Sector of the Serbian Ministry of Interior shall be informed.

Preventive protection measures are carried out during the transport of dangerous goods by road and rail through regular inspection oversight of all the competent authorities, all participants in the transport of dangerous goods. Preventive measures also include proper implementation of the regulations, training and education of persons taking part in the transport of dangerous goods.

With the view to adequate response to a chemical accident, the Ministry of Environment, Mining and Spatial Planning has signed contracts with five public health institutes in Serbia (cities: Belgrade, Pancevo, Zajecar, Cuprija and Sabac) with the main goal – to be on alert and to deploy mobile eco-toxicological teams in the case of a chemical accident; the teams will come on the spot and make the necessary measurements of the environmental pollution. The responsibility of the mobile eco-toxicological teams is, upon the call of an authorized environmental inspector, to come to the site of a chemical accident occurred during the transport or on dangerous installations and having potential harmful

impacts on human health and environment, and to perform examination, identification and quantification of pollutants in the main environmental substrata; immediately after the test results have been obtained, an individual report about the accident, including a risk assessment and a proposal for reparation measures, shall be sent to the Ministry of Environment, Mining and Spatial Planning.

At the moment there are two mobile eco-toxicological units in the Republic of Serbia, which are equipped with mobile equipment for accidental environmental pollution measurements. These are the Public Health Institute of the City of Belgrade and the Public Health Institute of Pancevo. The Ministry of Environment, Mining and Spatial Planning is negotiating the procurement of another three mobile eco-toxicological units for Serbian public health institutes through various projects and international donations.

With the view to preventing further spread of accidental pollution, legal entities and individuals shall take, at their expense, immediate measures of reparation according to protection plans. If the polluter responsible for the accident is found out at a later stage, the authority bearing the costs of remediating the impacts of environmental pollution shall make a request for indemnity.

The National Poisoning Control Center has a mobile toxicological chemical team which is activated from the staff of the Center in situation of massive chemical accidents. The main role of the mobile team is to organize medical care for the victims on the site of the chemical accident, where there is a possibility or evidence about lost lives or affected.

#### Chemical accidents

According to the Law on Environmental Protection, in the case of a chemical accident on a Seveso facility, a Seveso operator shall immediately inform the Ministry of Environment, Mining and Spatial Planning, the local government unit and emergency response authorities about the chemical accident in accordance with the regulations related to protection and rescue, namely about: the circumstances of the chemical accident, hazardous substances present, available data for the assessment of the impacts of the accident on humans and environment and about taken emergency measures.

Also, a Seveso operator who witnessed an accident shall inform the competent authorities about the subsequently collected facts which have an influence on the previously identified facts and conclusions; shall take urgent medium-term and long-term measures of reparation of chemical accidents effects, and shall after an analysis of all the aspects of the chemical accident has been made, give recommendations for the future preventive measures.

